

Indonesian lesson study in practice: case study of Indonesian mathematics and science teacher education project

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This paper presents a case study of the experiences under the Indonesian Mathematics and Science Teacher Education Project (IMSTEP) concerning in-service teacher training through the practice of lesson study collaboratively conducted by schools and universities. The purpose of the case study is two-fold: first, to examine the changes in teaching practices through the introduction of lesson study under IMSTEP; and, second, to uncover the challenges faced in implementing lesson study under IMSTEP. The results of the analysis revealed that the lessons underwent three changes: (1) a change in the academic base of the lessons, brought about by close liaison between university faculty members; (2) a change in the structure of the lesson by the introduction of experiments or manual activities and discussions; and (3) a change in the reactions of students during the lesson. However, two insights emerged during the IMSTEP case study as tasks to be addressed in order to further develop the practice of lesson study. First, the participants of the collaborative lesson study were likely to have a narrowed interest in probing the learning processes of the students, in comparison with focusing on teaching methodologies more generally. The limited interests of both the university faculty members and the targeted teachers in the learning processes of students can be shown in the following three ways: the dominance of interests in teaching models, the lack of attention to detail in the learning processes of students and the lack of questioning the reasons for the mistakes and misconceptions of students. The second insight was the necessity to involve the entire school in lesson study.

Introduction

It has often been claimed that the professional development of teachers requires them to observe and reflect on their practice in lessons with each other (Barth, 1990;

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Leithwood, 1992; Joyce & Showers, 2002). This implies that teachers can continuously learn from opening their own practices and observing practices of their colleagues, and this learning can be reflected in their own lessons (Inagaki, 1986; Ito, 1990; Ito, 1992; Ose & Sato, 2000; Ose & Sato, 2003). Although the aforementioned authors' argument is primarily based upon cases in developed countries, their argument can also be applied to developing countries.

Regarding in-service training programmes in other developing countries, Dalin (1994) compares cases from Columbia, Ethiopia and Bangladesh, and discusses the importance of addressing classroom practices in a collegial atmosphere. Harvey (1999) focuses on cases in South Africa that pertain to in-service training programmes for primary science teachers. The research reveals that teachers who invited colleagues to observe their lessons made substantial changes in their teaching methodologies, as compared with teachers who did not have such opportunities. Furthermore, Indoshi (2003) indicates the problematic situation faced by novice teachers in Kenya, where the professional development of teachers has deteriorated due to lack of practice-oriented training in schools, which is supposed to be provided by senior mentors. All these studies demonstrate the importance of in-service teacher training, with special emphasis on practices in classrooms and collaboration with other teachers, in order to promote the professional development of teachers.

In Indonesia too, which is the focus of this study, there is a necessity for continuous professional development programmes (World Bank, 2005). However, in-service training programmes in the country are seldom capable of addressing the realities faced by teachers in classrooms (Joni, 2000). In-service training programmes tend to be delivered as lecture and there are few impacts of training in real classroom situations (Japan International Cooperation Agency [JICA], 2003). Therefore, there is a strong necessity that more in-service training for teachers in Indonesia should be based on real teaching practices in the classroom through collaboration with other teachers.

The Government of Indonesia and the JICA have intervened in an attempt to address this challenge by collaboratively working on a project titled 'JICA Technical Cooperation Project for Development of Science and Mathematics Teaching for Primary and Secondary Education in Indonesia' since 1998. This paper will refer to the project as the 'Indonesian Mathematics and Science Teacher Education Project' (IMSTEP). The recipient institutes—the Indonesian University of Education in Bandung, the State University of Yogyakarta and the State University of Malang—are all located on the island of Java. Under the framework of technical cooperation, JICA dispatched experts with education-related backgrounds, particularly in science and mathematics, for the project.

In order to address teachers' practices in classrooms, in 2001 IMSTEP introduced 'lesson study' as a part of in-service teacher training. Lesson study is a method of case analysis of lesson practice for professional development of teachers. It is based on reflection by teachers, including collegial teachers or people from external sources such as university faculty members, on facts observed in concrete practices of lessons (Baba & Kojima, 2003; Fernandez & Yoshida, 2004; Inagaki, 1986; Inagaki & Sato, 1996; Sato, 1996; Stigler & Hiebert, 1999). While activities that are similar to lesson

study are referred to by various names, such as 'action research' (Noffke, 1995), 'coaching' (Joyce & Showers, 2002) or 'clinical supervision' (Stiggins & Duke, 1988), all of these are consistent in that a teacher was to have his/her lesson open to observation by others and reflects on his/her practice of teaching with the observers. The present study uses 'lesson study' as an umbrella term for activities pertaining to the activities for professional development of teachers by opening their lessons to others for observation and reflection.

This paper presents a case study of the experiences encountered under IMSTEP, concerning in-service teacher training through lesson study collaboratively conducted by schools and universities. The purpose of the case study is two-fold: first, to examine the changes in teaching practices through the introduction of lesson study under IMSTEP; and, second, to uncover the challenges faced in implementing lesson study under IMSTEP.

Lesson study under IMSTEP

The following sections will provide a detailed explanation of lesson study under IMSTEP. Lesson study under IMSTEP was conducted collaboratively by both school teachers and university faculty members: they jointly developed lesson plans, implemented these plans in the classroom and reflected on the lessons afterwards. This type of lesson study under IMSTEP will be defined as 'collaborative lesson study' in this research. The collaborative lesson study targeted both junior and senior high schools. The universities, except Bandung, chose two junior and two senior high schools as partners; Bandung selected three junior high schools. Therefore, the total number of such partner schools was 13. Bandung dealt with grade one, Yogyakarta was in charge of grade two and Malang managed grade three at both the lower and upper levels of secondary education.

The collaborative lesson study 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 the collaborative lesson study. 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 school teachers. The group spent the entire day generating consensus on which topics to cover through the collaborative lesson study. They utilised parallel sessions, held according to their subjects, to consult with colleagues. In these sessions, they discussed the teaching methodologies to be used and the approximate time schedules during the semester. The detailed decisions on the lesson plan were fundamentally the responsibility of each teacher, and were not discussed within 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, another targeted teachers in a given/ other schools joined in the observation of lessons. Usually, the procedure followed for

an open lesson was as follows: a lesson began with an introduction, and then checked the knowledge of the students on the topic. The teacher assigned tasks to the students, who worked in small groups. The targeted teachers used group work in every observed lesson. The number of students in a group varied depending on the situation in the classroom. In many cases, the number of students in a group ranged between four and six. There were 45–50 students in a class. The group work mainly involved physical tasks and internal discussions. The physical tasks, which included experiments and measurement-taking, often involved solving problems in worksheets 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.

Subsequently, the third stage, the reflection session, was conducted almost immediately after the observation of the open lesson. In the reflection session, the teachers and the observers shared views and comments. The length of the discussions varied from 30 to 90 minutes, depending on the availability of time. The observers made comments and provided input to the teachers to enable them to conduct better lessons in the future.

During the semester, a team of two to three teachers from targeted schools and at least two university faculty members for each subject at each educational level for collaborative lesson study repeated this entire cycle to ensure that all the decided topics were covered in the semester. The number of lessons and reflection sessions varied according to each departmental agreement on the number of topics, which varied between two and three. In general, collaborative lesson study was conducted at least once a week for one teacher.

In promoting collaborative lesson study, the universities involved in this project also attempted to introduce constructivist teaching and learning approaches to the targeted teachers. Conventional approaches to learning emphasise the transmission of knowledge and skills from teacher to students based on reading and lecturing (Collins *et al.*, 1995). Collins *et al.* (1995) list broadcast radio, television, videotapes or films as possible additional medias; yet it is unrealistic to expect such technology in the classrooms of developing countries. In most cases, including Indonesia, teachers are largely dependent 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, inquiry or brainstorming (Collins *et al.*, 1995; Fraser, 1995). Within this project, the universities incorporated a constructivist approach to learning into collaborative lesson study in an attempt to foster the learning of mathematics and science at both the lower and upper secondary levels. In more concrete terms, the teachers and faculty members jointly attempted to introduce more activities or experiments, small group activities, presentations and discourses.

Method

This paper will employ the methodology of the case study as an analytical method (Creswell, 1998; Cohen *et al.*, 2000). That is, it will provide an in-depth description

and interpretation of IMSTEP's lesson study sessions. The study is based on observations and interviews collected over a period of 18 months, between October 2003 and March 2005. Both the interviews were conducted in the Indonesian language and translated and recorded in English. During observation, the lessons were conducted in the Indonesian language and translated and analysed in English or Japanese, depending on the availability of translators.

During this period, the authors observed a series of lesson study sessions, and their reflection sessions in seven lower and six upper secondary educational levels. The frequency of the authors' participation in the lesson study sessions 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, the authors took notes and those notes were utilised in the analysis. The total number of observed lessons was 53, and observations were made at least twice per school, although in some cases the authors observed more than two sessions per school. In addition, the study employed interviews and focus group discussions as a means to collect data. The subjects of the focus group discussions comprised 14 teachers and 34 faculty members, all of whom are working on collaborative lesson study for science and mathematics under IMSTEP. The focus group discussions were conducted between May and June 2004. Each discussion lasted 90–150 minutes, and the number of participants varied from two to six people. In each discussion, the participants were from the same schools and departments of a university. While the questions asked were not structured, each question targeted the experiences of collaborative lesson study. The authors moderated the discussion and the results were transcribed each time.

Analysis

Issues in lesson study under IMSTEP will be analysed in this section. The analysis of the issues arising during the introduction of lesson study under IMSTEP will provide an insight into the probable changes required in Indonesian teachers, students and their lessons, as well as the difficulties most likely to arise in promoting lesson study. By so doing, this section attempts to uncover the lessons learned to overcome such anticipated obstacles.

Changes brought about by collaborative lesson study

As mentioned earlier, the cycle of collaborative lesson study involves a planning session, an open lesson and a reflection session. According to the results of the observations, the impact of collaborative lesson study on the 'planning' and 'conducting' of lesson was huge. This section will provide analysis regarding planning and conducting activities. The focus of the analysis will be to examine the ways in which collaborative lesson study has impacted on the lessons thus far.

Firstly, as a result of greater collaboration with university faculty members, the teachers were able to use specific academic resources in the preparatory activities.

Technical support for the targeted teachers by the university began at the workshop at the beginning of a semester, as stated earlier. From time to time, teachers were able to get access to academic material while preparing lessons by working with university faculty members to design the structure of the lesson as well as carry out preparatory experiments or activities. In addition, teachers often prepared worksheets for students with technical support from university faculty members. This made it possible for teachers to academically explore the topics in advance and to utilise the university as an academic and educational resource. In an interview with the authors, a university faculty member said:

it used to be so difficult to make a contact and work with schools before we started this collaborative lesson study. We were required take permission from various authorities. However, because of this project, it has become extremely easy to work with schools. Now, teachers just telephone us and we consult each other.

Moreover, according to the conclusions that emerged during a focus group discussion with teachers, the style of the lesson has changed a great deal from the conventional approach. Before this collaborative lesson study began, teachers employed only the lecturing method. One teacher told the authors that before joining in the lesson study she used to find teaching extremely exhausting. This was because she was required to demonstrate perfectly her knowledge of the topics she taught only through the means of a lecture. As described earlier, in collaborative lesson study, emphasis was laid on manual activities, learning in small groups and discussions. Figure 1 shows students learning in small groups and utilising teaching materials in their groups. This is a picture of a mathematics lesson for the third grade at upper secondary level, where students physically examined the positions of points or lines using the models, produced by the students themselves, as the mediating artefacts. In the science lessons, experiments served as activities for students, although it was not necessarily always possible to conduct the experiments in every lesson because of the dearth of opportunities for using laboratories or chemicals.

Moreover, collaborative lesson study under IMSTEP utilised small groups in every case, while Harvey (1999) discusses the difficulty in using small group activities in every lesson. Teachers who participated in collaborative lesson study said that they appreciated the impact of introducing small group activities on the promotion and activation of students' interest and participation in learning. From the beginning of collaborative lesson study, it was agreed across the three universities in both mathematics and science to allocate time for small group activities, such as shared teaching strategies, in collaborative lesson study. Thus, it appears to have become one of the inevitably built-in and necessary elements in conducting a lesson, a habit of teaching, at least within collaborative lesson study. Additionally, collaborative lesson study sometimes finished only with students' conducting experiments or activities and could not cover sharing the results through discussion with the whole class in one period. In such a case, the next lesson began with a presentation of the observations or experiments by the students of each group. In such a situation, students were requested to directly form their groups again from the beginning of the lesson. Thus,



Figure 1. Small group activities utilising materials in a mathematics open lesson

the small group should be viewed as a key unit of learning in collaborative lesson study.

Furthermore, there was an increase in student participation during the lessons. Both university lecturers and teachers frequently mentioned this aspect and its impact on the learning styles of students. Conventional methodologies rely predominantly on the speech of teachers. However, in the lessons of collaborative lesson study, students were expected to carry out experiments, activities, measurements and discussions. Changes in their behaviour during the lesson period were also considered to be an important aspect by teachers. Almost all the teachers and university faculty members interviewed about collaborative lesson study said that the attention span of students had increased and that they participated more actively during lessons. A university faculty member also stated in the interview that, during her student days, it was inconceivable for a student to stand up in class and ask the teacher or the other students a question. However, after introducing these new teaching methods through collaborative lesson study, students were no longer passive, but showed an eagerness to learn, according to her.

According to the target teachers of the class shown in Figure 1, generally both students and teachers perceived three-dimensional space to be among the most difficult topics to teach and to learn. When the authors observed the lesson, however, the

students became extremely absorbed in learning with their peers in small groups, by using their hand-made three-dimensional models out of straws or wood. The lesson continued for approximately 100 minutes, beginning at 6:15 a.m. because the students could not wait for the start time, which was 6:30 a.m. Most of the students concentrated on activities and discussions within groups and with the entire class. Although the students spoke with each other, they had already developed the attitude of listening carefully to others. The teacher observed the activities of the students and intervened only when the groups required support. The teacher guided one of the authors of this paper to observe for a while the lessons in the next classroom, where a mathematical lesson for the same grade regarding the same topic, three-dimensional space, was in progress. As one of the authors observed, the teacher teaching that class behaved in a sharply different manner. She stood in front of the class, explaining three-dimensional space using only chalk and the blackboard. The students quietly took notes on what she drew on the blackboard. The teacher involved in collaborative lesson study said 'this is exactly what I did before the collaborative lesson started'. All other teachers participating in collaborative lesson study made similar remarks about the changes in their teaching methodologies and the changes in the participation of students in lesson activities. It should be noted that the increase in the participation of students in lesson activities has the potential to deepen their learning on topics. Sato and Sato (2003) introduced the example of rapid improvement in academic achievement by increasing the participation of students in lesson activities. Yet, it is necessary to further probe whether such participation causes a direct improvement in their academic achievement in the context of IMSTEP.

Challenges and tasks

This section is a discussion on the challenges in implementing collaborative lessons from the perspectives of the authors of this paper. These are challenges related to collaborative lesson study concerning two major points: (1) the limited interests of both university faculty members and targeted teachers in learning processes of students, and (2) the insufficient development of collegiality in given schools due to the lack of involvement of the entire schools in the collaborative lesson study. In this section, these matters will be discussed in detail.

The limited interests of both the university faculty members and the targeted teachers in the learning processes of students can be shown through three aspects: the dominance of interests in teaching models, the lack of attention to detail in the learning processes of students and the lack of questioning the reasons for the mistakes and misconceptions of students. It should first be noted that, during the reflection sessions, the comments made by both the teachers and the university faculty members tended to be with reference only to teaching methodology. Most of the comments made by the university staff concerned ways of displaying equipment to students and formulating their worksheets, or whether the observed lesson had followed the teaching models. It is necessary, however, to reflect on the relationship between the students' learning and the teaching methodology. The necessity of

discussing the ways in which a particular teaching methodology promoted the learning activities of students is larger than discussing whether the practice was executed as explained in the theories.

Furthermore, both the teachers and the university faculty members seldom reviewed their lessons from the perspective of students and their learning. They tended to place stress only on ways of making students understand the perspective of the teachers. Specific comments made by students were seldom reviewed and the development or transition of the learning processes of students was hardly discussed during the reflection session. Furthermore, the ways for teachers to link the particular behaviours of either student with each other as the contexts generated in the lessons were seldom discussed; neither were the backgrounds of the individual students discussed often. This was partly because the teachers' and faculty members' interest appeared to lie in ways of investigating their teaching skills solely from their own perspectives.

Among the important characteristics of a professionally developed teacher is the capacity to accommodate multiple viewpoints in lessons as well as the ability to make linkages between the behaviours or comments of the students in the ill-structured situation of the teaching learning process in classrooms (Sato *et al.*, 1990; Akita & Iwakawa, 1994). These capacities are significant, and their development through collaborative lesson study is necessary. However, the reflection sessions lacked discussions from multiple viewpoints; only the viewpoints of teachers were aired. The targeted teachers and university faculty members tended to reflect on lessons from the teaching perspective, rather than the learning perspective in specific contexts. Due to this, the participants lacked the opportunity to further develop a capacity to link the behaviours or comments of the students with each other. Such reflective discussions were necessary in collaborative lesson study, since it would enable the participants to view things in teaching/learning processes from various perspectives.

In the second place, such a lack of attention to the learning processes of students and the tendency of the observations to focus on teaching methodologies correlated with the observers' lack of attention to the details of learning processes of students during the observation. For example, one of the authors, while observing a biology lesson being conducted for the second grade at the lower secondary level, noticed that the university faculty members tended to sit at the far end of the classroom for observation; furthermore, teachers observing the lessons of their peers also tended to sit with the faculty members. This implied that they could see only the teacher and the backs of the students, and that it was difficult for them to view the faces of the students to gauge their reactions or responses. In addition, it was also observed that certain faculty members left the classrooms to chat with other colleagues. Although the authors laid emphasis on observing ways in which students learn, certain university faculty members did not pay close attention to the teaching/learning process.

After seeing such tendencies in observation of lessons, some Japanese experts commented that university faculty members, in particular, tended to view lessons as an accumulation of teaching steps. That is, while observing the lessons, university faculty members did not show an interest in continuously observing the activities in the classroom, although they understood the theories of the teaching models. Rather,

it held the major interest of the university faculty members was to inspect whether or not the targeted teacher followed the order of the steps in teaching models. In other words, while observing the lessons, the university faculty members appeared to summarise them according to the important steps in the theories.

However, the reality of the classroom does not reflect the theory, and students often develop their own ways of learning the lessons, regardless of theories. Such learning is expressed through subtle facial expressions, slight utterances in lowered voices or unexpected small actions (Inagaki & Sato, 1996). In order to observe such small reactions and responses, it is necessary for observers to watch the students carefully. However, few university faculty members conducted such detailed observations.

For example, in one lesson, the topic for the entire lesson was light and the class was divided into two to perform two activities. One was to experiment inside the laboratory, using lights of candles. The other was an outdoor activity, utilising solar light to burn black carbon paper with a lens. Several groups of four to five members were formed to conduct these activities. It was a cloudy day, so it was difficult to burn the black carbon paper using sunlight. Most of the students outside were discouraged, while students inside managed to concentrate on conducting their experiments. However, two groups stayed outdoors and waited for stronger sunlight. After waiting for 20 minutes, the sunlight suddenly became stronger and they could sharpen the focus on the carbon paper, managing to burn it. This may appear to be a trivial event in the lesson; however, it indicated the students' patience and eagerness, and revealed that their interest in the topic should be counted as very strong. It might provide some opportunities to discuss in the reflection session why those students kept their concentration while others did not. However, there were no faculty members around and none of them could later discuss the students' involvement in the activities. It is extremely necessary to carefully observe the students' involvement in the activities and to reflect on the types of factors to promote or constrain it; such reflection helps teachers expand the viewpoints on the teaching/learning process.

In the third place, both the lesson and the reflection sessions lacked discussions on the question of why students make mistakes or harbour misconceptions. Due to this, the participants were unable to benefit from the reflection sessions. It is also important to expand the teachers' viewpoints and to deepen their understanding of the students' thinking patterns with regard to topics or to problem-solving through reflection (Ose & Sato, 2000; Ose & Sato, 2003; Sato & Sato, 2003). The targeted teachers and university faculty members usually ended up checking whether students' answers were correct or incorrect. In few of the lessons and reflection sessions did the teachers and university faculty members seek to uncover the logic underlying the mistakes.

For example, during a mathematics lesson for the first grade at the lower secondary educational level, the teacher got the students to write their calculations on a white board in front of the classroom. A student was asked to write one line and to hand the calculation over to the next student. At each line, the teacher had the rest of the students examine whether or not the calculation was correct. When the students made a mistake, the teacher did not provide the correct answer; instead, she provided clues and told the students to continue the calculation until they obtained the correct answer.

This effort is meaningful because errors are indicators of what students can learn, and not an indication of failure, as Stevenson and Stigler (1992) point out. However, the focus should also be on the reason for their making such mistakes. While it is certainly important to clarify the students' mistakes, it is more important to uncover the structure of and reasons for the mistakes and to identify why they are made. Students make mistakes when they deduce that their ideas are correct (Sato & Sato, 2003). It becomes crucial, therefore, to make such students understand the reason why their ideas are incorrect. For this purpose, steps to enrich the exploration, both within the open lesson and the reflection session, of the reasons why students make mistakes and the types of logic that they apply are necessary. As mentioned earlier, one of the important aspects of the professional development of teachers is to expand their perspectives on the teaching/learning process. The exploration of the reasons for students' making mistakes and the logic underlying these mistakes greatly helps teachers expand their views and understand the teaching/learning process.

So far, there has been an in-depth investigation on the important characteristics of the first challenge to collaborative lesson study, experienced in running IMSTEP. The second challenge to the collaborative lesson study deals with the necessity to develop collegiality (Grimmet & Crehan, 1992; Hargreaves, 1994) at the targeted schools. The targeted teachers could not yet develop a collegial relationship with other teachers in the schools by opening their lessons for observation and reflection by each other. Thus, the impacts of collaborative lesson study did not cover the entire school. Even though there have been various changes in teaching through collaborative lesson study, its impact remains confined to the science and mathematics teachers in the schools. This limited impact, coupled with the absence of attention from the school management, has made it difficult for the programme to influence teachers of other subjects.

It should be noted, however, that some principals have shown an interest in aiding the dissemination of this programme to the entire school (Saito, 2004). For example, one school decided to conduct lesson study twice a month: one, an internal lesson study to involve teachers within the school regardless of their subjects; and the other, lesson and reflection sessions open to the public. Additionally, in two targeted schools at the upper secondary level in Malang, the targeted teachers began to share their experiences of collaborative lesson study and opening their lessons for observation and reflection by other teachers.

Nonetheless, on average the teachers remained disconnected from each other in terms of influencing changes in the lesson through collaborative lesson study. If the teachers of a school are indifferent to reforms to change their lessons, it will be difficult for the mathematics and science teachers participating in the programme to share their efforts with others. Therefore, the next challenge for the collaborative lesson study programme is to involve the rest of the teachers and to extend its impact to the entire school.

This situation raises some radical questions regarding the mandate of collaborative lesson study. Collaborative lesson study is considered successful in enhancing the professional development of individual targeted teachers, and in promoting joint research between university faculty members and targeted teachers. Nevertheless,

collaborative lesson study still remains confined to satisfying the academic interests of university faculty members and the professional interests of a limited number of teachers in schools. This implies that there is a necessity to increase contributions made by collaborative lesson study for the purpose of helping in the professional development of teachers in the entire school. Further action should be taken, therefore, to promote the development of collegiality beyond the boundaries of individual subjects to the entire schools.

Conclusion

This paper discusses the issues involved in practicing lesson study using IMSTEP experiences. The results of the analysis revealed three changes brought about in the lessons: (1) a change in the academic basis of lessons by closely working with university faculty members, (2) a change in the structure of the lesson by the introduction of experiments or manual activities and discussions, and (3) a change in the reactions of students during the lesson.

However, two insights emerged during the IMSTEP case study as tasks to be addressed in order to further develop the practice of lesson study. Firstly, the participants of the collaborative lesson study were likely to have a confined interest in probing the learning processes of the students, in comparison with teaching methodologies. The limited interests of both the university faculty members and the targeted teachers in the learning processes of students can be shown in the following three ways: the dominance of interests in teaching models, the lack of attention to detail in the learning processes of students and the lack of questioning the reasons for the mistakes and misconceptions of students. The second insight was the necessity to involve the entire school in lesson study.

From the experience of the Indonesian case discussed, it can be stated that the modification of teaching methodologies through collaborative lesson study under IMSTEP was relatively easy and smooth. The observation of open lessons stimulated this process, and the strong interest of the teachers in changing their lessons helped in implementing these methodological changes well. Furthermore, the positive reactions and responses of the students motivated and encouraged teachers to keep employing a constructivist approach in their lessons.

However, both the teachers and the university faculty members must pay more attention to the learning processes of students, based on evidence from the lessons conducted, in order to develop their professional capacities. The teachers still seem to conceive of lessons only from the perspective of teaching models. In other words, they are deeply concerned about how to appropriately apply teaching theories outside the classroom to the real classroom situation, and rarely attempt to develop their own theories and insights by examining their own cases. While they are certainly expanding the repertoires of teaching methodologies, it is necessary to refine these repertoires by including their concrete cases and experiences.

There are some points to be considered for further research. First, it is necessary to examine the findings using quantitative analysis: there should be an analysis of both

the cognitive and affective changes observed in the students since these are performance indicators of collaborative lesson study.

Furthermore, ways of disseminating collaborative lesson study to the entire school should be explored. The present segmented situation has to be changed; furthermore, the steps to be taken to encourage collegiality among teachers in the entire school through collaborative lesson study need to be determined. Future discussion should include a focus on ways of modifying the structure of the project and its implementation regarding both teachers and university faculty members, as well as any other related educational personnel.

Acknowledgements

The authors appreciate the permission granted by the Japan International Cooperation Agency to publish this article. However, the ideas and opinions expressed in this paper do not necessarily reflect the official viewpoint of Japan International Cooperation Agency. Furthermore, the authors are grateful to Yuko Ogino and Akiko Fujii Kurata for their technical comments and suggestions.

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