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Bujang Rahman

University of Lampung, bujang.suropati@gmail.com

Abdurrahman Abdurrahman

University of Lampung, abeunila@gmail.com

Budi Kadaryanto

University of Lampung, kadaryanto@yahoo.com

Nurlaksana Eko Rusminto

University of Lampung, nurlaksanaeko.fkipunila@gmail.com

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Teacher-Based Scaffolding for Teachers' Professional Development in Indonesia

Bujang Rahman
Abdurrahman Abdurrahman
Budi Kadaryanto
Nurlaksana Eko Rusminto
University of Lampung, Indonesia

Abstract: Improvement of teachers' content knowledge has long been regarded as a priority in Indonesian school systems, and has been the goal for many teacher professional development programs. In this paper we report the evaluation of a professional development program to improve content knowledge for 147 Indonesian teachers. The teachers were divided into three experimental groups, and each group was treated to one of the three professional development models frequently used in developing countries. The results showed that all three models led to improvement in the teachers' content knowledge; however, the teacher-based scaffolding model proved to be the most effective. In our account of why this program of teacher-based scaffolding was successful, we compared it with other studies.

Introduction

Research on teacher quality improvement from professional development (PD) programs has gained considerable interest among researchers from various parts of the world, including Indonesia (e.g. Kennedy, 2005; Postholm, 2012; Santoro, et al., 2012; Widodo and Riandi 2013). Teachers' PD in Indonesia, including various teacher certification programs and other forms of training conducted by local governments or appointed training institutions, have been implemented for over a decade, but are not yet considered to be effective in increasing teacher competence. World Bank research results have confirmed the weakness of Indonesian teacher competence, especially in subject content knowledge (CK) (Chang et al., 2014). Teachers' knowledge of content and practices prescribed and embedded in teacher professional standards have gained increasing attention in Indonesia from policy makers and schooling systems (Santoro, et.al, 2012).

The result of the national competence test (*Ujian Kompetensi*) for teachers in Indonesia in 2014 indicated that teachers still had serious problems with CK. Teachers are expected to score at least 70 in these competency tests, which is the minimum score of CK for teachers as stipulated by BPSDM Kemendikbud [National Board for Human Resource Development as part of the Ministry of Education and Culture] (Kemendikbud, 2015; Prihono, 2014); however, the average score was only 42. Therefore, teachers might have skills to teach their CK to students, but the fact that they have a restricted content mastery is bound to affect students' ability to master the content. Therefore, there was a strong rationale for educational researchers and practitioners to formulate programs to assist teachers to improve their CK (Ball, et.al, 2008; Baumert et al., 2010; Houseal, et al., 2014; Duschl, et.al., 2007).

In this paper, we review PD programs that have been implemented to improve teachers' CK, and then describe how we designed, implemented and evaluated a PD program to improve teachers' CK in Indonesia. Several researchers have noted that a PD should be based on the professionals' real conditions, needs and hopes (Boud & Hager 2012; Chval, et.al, 2008; Grant, 2002; Hattie, 2012; Lee, 2005). We assumed that scaffolding would be an effective strategy for improving teachers' CK because some researchers have found it can assist teachers to perform their tasks at a higher level of competence (Darling-Hammond & Youngs, 2002). Moreover, other researchers have found that, with suitable facilitation, scaffolding enables teachers as PD participants to solve a problem, carry out a project assignment, and achieve a goal (Engin; 2014; Reiser; 2004; Smit et al.; 2013; Wood, Bruner & Ross, 1976). In addition, we surmised, when teachers are active, involved learners in their PD they are more likely to be responsible, motivated, and successful (Vacca, 2008).

In the remainder of this paper, we commence with a review of literature on PD programs for teachers. We follow this with an account of our research; and, finally, we propose a prototype PD program for improving teachers' CK in developing countries.

Literature on PD, Scaffolding, and Teachers' Needs

Several researchers have addressed the issue of teachers' PD programs. For example, Kennedy (2005) analysed several models of continuing PD in terms of their underpinning influences, expectations, and possibilities, guided by five key questions: (1) whether the focus was on individual or (2) collective development (3) to what extent the PD was used as a form of accountability, (4) in what capacity the PD supported professional autonomy, and (5) whether the PD facilitated transformative practice. We return to this study below.

Engin (2014) studied scaffolding in PD for pre-service trainees. Engin argued that good teaching skills could be attained through negotiation of the conventions and expectations by the trainer and trainee. This approach entailed scaffolding during the planning, preparation and teaching practice, including the development of CK. Engin's scaffolding model comprised three steps facilitated by the teacher/mentor: modelling, demonstrations, and building frameworks. Engin noted that teacher and learner needed to fully understand their roles for successful scaffolding and that effective communication was also critical (c.f. Reiser; 2004; Wood, Bruner & Ross, 1976).

Smit et al.'s (2013) model of scaffolding was delivered in a training program, with three objectives: diagnosis, responsiveness, and handover to independence. In the diagnosis step, scaffolding required explicit attention from both parties to identify strengths and weaknesses of the ongoing learning. This diagnosis activity was essential for the foundations of further stages of scaffolding. In the responsiveness stage, it was very important to have two-way communication strategy to assist the development of ideas and experience exchanges among the participants. Done well, the responsive stage led to the participants' independence because they had many opportunities to share ideas. Smit et al (2013) considered the handover to independence step was the ultimate aim of scaffolding.

Several researchers have noted the importance of participants' motivation in PD programs. For example, Sinclair (2008) found that once teachers were well motivated and enthusiastic, their commitment to the teaching profession improved. However, Lee (2005) claimed that teachers' participation in the program's decision-making was very influential in the success of the program. Grant (2002) asserted that it was necessary to initiate a PD program by first conducting a needs assessment. Both Lee and Grant advocated involving

teachers in the design of a PD program. We took from Lee and Grant that participation in the design of their PD would be especially important for Indonesian teachers because in the past they had had restricted decision-making in their training programs. Furthermore, in addition to considering teachers' knowledge and professionalism, we should endeavour for their PD to have appropriate levels of challenge and support.

Method

Subjects

The Indonesian education system involves over 3 million teachers in about 250,000 schools (BPSDM Kemendikbud, 2015). While schools are government funded, the wealthier areas are better resourced; therefore, teachers' wages can vary according to the location and wealth of the region. Over the last decade, the Indonesian government has recognised that teacher quality is an important consideration in raising student performance and has set minimum standards for teachers. However, as mentioned above, the majority of Indonesian teachers did not meet these standards, especially those in rural and remote regions (Chang et al., 2014).

Based on the national results of the competency test conducted for teachers in 2014, the average scores of the selected teachers' subject-content knowledge was 41.67 for mathematics, 44.08 for Bahasa Indonesia, and 36.16 for English (Prihono, 2014; BPSDM Kemendikbud, 2015). Using purposive sampling techniques, we chose for our sample only teachers who had scored below the standard value. For the purpose of our research, we assumed that all math teachers in the sample had similar content knowledge, and likewise for Bahasa Indonesia and English teachers. From the analysis of the competency test results, we categorised teachers whose score was below the accepted standards into three subject groupings: 49 mathematics teachers, 51 Bahasa Indonesia teachers, and 47 English language teachers. Thus 147 seven teachers participated in this study from senior high schools in which their students obtained a lower national examination score. All teachers in the study had a minimum of five years' teaching experience and were working in senior high schools in Sumatera Island, Indonesia. The mathematics teachers were given treatments with the training model [Regular Training (RT)] (Kennedy, 2005), the second group (Bahasa Indonesia teachers) received the standard scaffolding treatments (Smit et al., 2013), and the third group (English teachers) was given treatment in the TBS model. All teachers were given a pre-test and post-test. Further description about each treatment will be given below.

Data Collection

The PD program for the 147 teachers was conducted in 10 working days. The data for the teachers' competence on content mastery were collected from a pre-test and post-test with a multiple-choice test of national exam questions that were used in a nationally senior high school test. This test was based on the CK in senior students' test instruments. The material for the subjects tested in the national exam is elaborated in table 1

No	Subject	Competence
1	Math	Using mathematical logic in solving the problem
		Solving the problems related to the rank rules, roots and logarithms, simple algebraic functions, quadratic functions, exponential functions and graphs, composition and inverse functions, systems of linear equations, and quadratic inequalities equations, equation of circle and tangent, polynomials, rest algorithms and division theorem, linear program, matrices and determinants, vector, geometry transformation and its composition, sequence and series, and able to use them in problem solving.
		Determining the position, distance and the measurement of angle which involving points, lines, and areas in space.
		Using the comparison, functions, equations, identities and trigonometric formulas in solving the problem.
		Understanding the concept of limits, derivatives and integrals of algebra functions and trigonometry functions, and able to apply these in solving the problem.
2	Reading	Processing, presenting and interpreting the data, and able to understand the rules of the enumeration, permutations, combinations, occurrence opportunities and able to apply these in solving the problem.
		Understanding the content and parts of paragraph in non-literature article text, editorials, reports, scientific papers, speech text, biographical, as well as various forms and types of non-text paragraphs; understanding literary texts form the old poetry, new poetry, saga / classical Malay literature, short stories, novels, and plays.
		Writing Expressing thoughts, ideas, opinions, feelings, and information on various types and forms of paragraphs, speech text, official letters, and scientific works by considering the suitability of content with context, equivalence, cohesion, sentences accuracy, language use, diction, sentence structure, and spelling; expressing thoughts and ideas in the form of poetry, short stories, novels, plays, criticism, essays, and reviews.
3	Listening	Understanding the meaning of interpersonal and transactional oral discourse formally or informally in the daily life context, especially in the form of short functional text, recount, news items, reports, narrative, descriptive and reviews.
		Reading Understanding the meaning of written discourse formally or informally in the daily life context, in the form of short functional text, recount, news items, reports, analytical exposition, hortatory exposition, explanation, discussion and review.
		Writing Expressing meaning in writing formally or informally in the daily life context, in the form of short functional text or essay in the form of recount, narrative, procedure, and descriptive report.

Table 1 Content Coverage for Indonesian National Examination 2012-2013 for Senior High School.

Since the instruments used in the pre-test and post-test of the PD program were taken from a national exam test, it was assumed that the instruments were valid. The reliability of the instrument was calculated using Pearson-Product Moment Correlation Coefficient (r).

The result of the Cronbach Alpha was 0.75 on average. All test parts had a Cronbach Alpha of more than 0.70, which implied that the score was highly correlated and the items were reliable. The training was conducted by three experts who had been nationally certified as facilitators for teacher PD programs in Indonesia. Based on the facilitators' record of accomplishment, and their certificate of eligibility, it was assumed that the facilitators were competent for each subject (Fraenkel, & Wallen, 2008).

Data Analysis

The respective UN test (National Standard Test for Math, Bahasa Indonesia, and English) result was analysed to generate pre-instruction and post-instruction profiles of the participants' CK in the training. Analyses of pre-profiles and post-profiles for each group of teachers were compared to assess changes in teachers' CK. Data collected were analysed using the statistical package for social sciences (SPSS) software (version 15.0). The raw data were summarized using mean (M) and standard deviation (SD). The difference between two means was calculated using t-test and ANOVA, and the significance level was set at alpha 0.05.

Result and Discussion

As indicated above, each group of teachers was given PD under different conditions and treatments. The first group received the regular training models (RT), and the facilitator in this group conducted every phase of the training according to what has been identified by Kennedy (2005), who described the classroom training in five steps;

- (1) understanding how to become a learning group
- (2) discovering needs
- (3) choosing and using methods and materials
- (4) evaluating the impact and results of the intervention
- (5) planning/field-testing participatory learning activities.

In the second group, regular scaffolding (RS) was applied by adapting the whole-class scaffolding activities as practised by Smit et al. (2013), with its three characteristics, namely the diagnosis, responsiveness, and handover to independence. In the diagnostic phase, the facilitator of this group performed the analysis related to what parts of the CK the teachers needed to address based on the response and feedback of the participants. In addition, the participants were asked to fill out the teacher reflection questionnaire that contained some diagnosing-promoting questions to analyse the weaknesses of teachers' CK. From the diagnostic phase, the profile of the participants' needs to be scaffolded was attained. In the responsive phase, the intervention was done in the form of providing a wide variety of learning support, such as concept and mind maps, visual scaffolding, and explanations (Alibali, 2006). Learning support for the second group was presented in the worksheet to each participant, focused on learning objectives to be achieved. In the handover to independence phase, the facilitator gave problems with different contexts, but without the learning support. The scaffolding steps for group two in TBS model are summarised in table 2.

Steps	Description
Orientation and induction	In the orientation phase, the class is organized to determine the needs of teachers in PD, especially in the mastery of teaching materials so that mentors will consider which strategy is best applied. This may lead to a harmonious relationship between the experts with the trainees. In the induction phase, the expert should explain in brief about the preconceptions built by the teachers as this could promote participant roles and attitudes that must be built by the teachers in order to obtain optimum results, as well as to foster motivation, self-confidence, self-reliance, professionalism (Engin, 2014).
Identify key concepts and focus group discussions for understanding	The atmosphere of the TBS activity should be set up as of enabling them to take part well in the program based on their own needs. Only key concepts and core ideas will be addressed in this phase before they are involved in the group discussion phase. Further, experts in this phase helped teachers to identify key concepts for each material for the focused group discussion to achieve the essential key concepts to form a concept map (Chiou, 2008).
Group facilitation and peer mentoring	Group mentors as facilitators were briefly trained to act as facilitators to enable the researcher to monitor and control all the groups, by having a group visit one another, asking probing questions and dropping words of encouragement when and where necessary; interacting directly with teachers who are exhibiting some major behavioural problems that used to take place in the a line workshop, such as sleeping, chatting, roaming, and general restlessness. This led teachers to aid other learners' knowledge construction (Gibbons, 2006; Staarman & Mercer, 2010).
Assessment and feedback extending	Following completion of the scaffolding process, the groups were assessed on the program objectives. Feedback was provided by the teachers, peers, and the researcher. Reasoning, group activities, prior CK, and independent learning ability were measured. This assisted learners/participants to be aware of their strengths and weaknesses and later identify learning deficiencies (Copland, 2010).

Table 2. Modified Scaffolding Steps and Description

As indicated in Table 2, the scaffolding theories and practices mentioned in our literature review section (Engin, 2014; Kennedy, 2005; Smit et al., 2013), were used as a guide to the scaffolding training.

In the third group, TBS was initiated by two phases: orientation and induction. In the orientation phase, a needs analysis was conducted to examine what parts of the CK of teachers were in need of improvement. In the induction phase, the facilitator briefly explained about the preconceptions built by the teachers. This phase included fostering motivation, self-confidence, self-reliance, and explanation of the program to be carried out; the facilitator also identified key concepts and focus group discussions for understanding. At this stage, the facilitator assisted the participants to identify the main concepts of the materials taken in each group to discuss the mind maps.

In the next phase, group facilitation and peer mentoring activities were employed. Group facilitation took the form of focused group discussion (FGD). The facilitator attended every FGD to analyse and respond to the difficulties encountered by the participants. In addition, the facilitator provided worksheets that assisted their learning process. The next step in the TBS model was the assessment and feedback extension. Here the results of the FGD were discussed by the facilitator and teachers to construct FGD conclusions. The facilitator's intention at that stage was if the assessment showed good results in terms of teachers' CK mastery, the teachers would be given problems in different contexts without any learning support; if the assessments did not show significant progress, the participants were to return to their FGD group and review their work until the appropriate mastery learning was achieved.

Having finished their treatments, each group of participants was tested again with a post-test instrument. As can be seen in Table 3, the pre-test and post-test data for the three experimental groups indicated that there was a significant increase of teachers' content mastery after the treatments. This significance can be seen from the t-Test analysis with its p value < 0.05.

Class	Pre		Post		Gain	t-cal	t-crit	Remark
	M	SD	M	SD				
RT*	43.27	11.16	54.90	9.40	11.63	-6.78	1.67	significant
RS**	32.92	13.75	57.35	16.51	24.43	-9.97	1.67	significant
TBS***	19.41	7.88	47.56	7.79	28.15	-16.16	1.68	significant

*Regular training

**Regular scaffolding

***Teacher-based scaffolding

Table 3 Comparison of Pre- and Post-test about Content Knowledge Achievement

Table 3 shows that the mean of the pre-test for 49 teachers who were involved in the mathematics group was 43.27, with the standard of deviation (SD) 11.16. The intervention in this typical Indonesian training models for PD (RT) resulted in a score gain of 11.63, with a mean of 54.90 and an SD of 9.40 (Effect size = 1.04).

In the RS model (51 Bahasa Indonesia teachers), the mean score gained was 24.43 in CK rising from a pre-test mean of 32.92, and an SD of 3.75 and a post-test mean of 57.35 and an SD of 16.51 (Effect size = 1.48). The effect size value of English teachers' CK in the RS model was even higher than the RT model, indicating that the RS model was better in fulfilling the teachers' needs. This result could be due to the presence of the need analysis in the RS model, which ensured that the scaffolding targeted teachers' specific needs and content they needed to master. In addition, the RS model facilitated the engagement of each participant of the group in his/her learning of the content material. Thus, the TBS model that was applied to 47 English teachers showed better results than the other two, as indicated by the gain difference. For this group the score increased in teachers' CK of 28.15 pre-test mean score of 19.41 and an SD of 7.88 to a post-test mean of 47.56, SD 7.79 (Effect size = 3.57).

It is understood that the three groups were from a different subject areas; however, they had been selected at the school level to handle classes in preparation for the National Test (UN), and certain criteria had to be met. They had to teach similar content coverage and level of difficulty of the test across the nation. It is suggested that further studies in which the treatments are given to mixed subject groups would make for an interesting comparison with this one, and would shed more light on the effectiveness of TBS in comparison with the other two approaches. Since each group was not statistically matched, some caution is required in considering and drawing conclusions from these results.

We contend that the TBS had a higher score gain than the other two because it allowed the participants to be more actively involved in the process of problem solving and decision making through the several phases of the PD program. The TBS model was designed to provide more space for the participants to discuss and exchange information with fellow participants. In addition, the TBS model provided scaffolding support that facilitated the peer-mentoring learning work within the FGD groups.

Table 3 showed that the treatment in each group increased teachers' CK, but the effect size for the TBS treatment was the greatest. This difference in effect size was best captured in the ANOVA test, as shown in Table 4, which indicates that the TBS group attained the lowest pre-test of the three.

Source of variation	SS	df	MS	F	P-value	F crit
Between groups	5091.035	2	2545.517	10.25344882	0.000	3.058928001
Within groups	35749.39	144	248.2596			
Total	40840.42	146				

Sinclair, C. (2008).

Table 4. ANOVA for the Gain Comparison within Groups.

As a training or learning model that has been long developed and applied, the RT model had a significant gain of teachers' performance on content mastery. However, this type of training has some drawbacks. Firstly, Kennedy (2005) argued this training is good to the extent of *what* knowledge is acquired, not *how* the knowledge is acquired. Through this model, teachers' creativity cannot grow optimally because the trainer controls in a rigid way and restricts the participants to being more passive – as the objects, not the subjects, of the training. In addition, because this model omits the needs analysis it can be less focused, less creative, and with less classroom networking. Kelly and Williamson (2002) confirmed that PD activities characterized by external presenters/experts delivering their 'expertise' in the form of decontextualized generic strategies to classroom teachers could result in teachers disconnecting from their daily work.

In the second group (Bahasa Indonesian), regular scaffolding (RS) also increased teachers' content knowledge. However, this model lacked some of the characteristics needed to fit the circumstances of teachers in a developing country. In this kind of training model, the scaffolding is typically conducted in a classical or conventional way, that is, for the whole class at once, thereby disallowing smaller group scaffolding. Therefore, RS is not so appropriate for Indonesian teachers' conditions. Sari (2012) indicated that Indonesian teacher trainings did not allow the trainees to prepare themselves adequately for global challenges in the twenty first century. Sari went on to assert that teachers' PD should be set up through a program that accommodates teacher's needs and characteristics.

A key element of the TBS training program for the third group was the needs analysis process, which enabled the facilitator to identify the participants' strengths and weaknesses and adjust his/her language to the participants' level of understanding. The TBS also involved peer mentoring in which participants actively shared knowledge and concepts within groups. Subsequently, the results of the peer mentoring enabled group consensus. In addition, in the final stage, the facilitator and the teachers discussed each group's improvement and the feedback session was extended beyond the facilitator to the teachers, and then on to the other teachers in the program. In this study, TBS extended the regular scaffolding in three ways: teachers' needs were assessed to guide the facilitator; there was group facilitation and peer mentoring; and there was assessment and feedback extension.

Implications for Teachers' PD Programs

In the past decade, the Indonesian government has stipulated some endeavours for the improvement of teachers' professionalism throughout the nation. Law Number 20 Year 2003 on the National Education System confirmed that teaching was a professional occupation and thereby teachers had to first attain a qualification. Indonesian teachers' competence based on this law was to be indicated by their level of CK, personality, social, and professional competence. Those four competences were expected to be mastered and displayed by teachers as the requirement for their effectiveness in classroom teaching. In addition, teachers were expected to be competent in displaying appropriate behaviour, and acting as a role model for their learners and the community (Lingard, 2005).

Teachers' low scores in mastery of CK meant that the PD for teachers needed to be improved. Until 2003, PD programs had mostly been administered in a 'top down' way in that teachers had little access to the program design. Since then, the government has assigned the local government at the provincial level to organize training and PD programs for teachers under the authority of the Board of Education Quality Assurance (LPMP). This board is responsible for ensuring the quality of teachers in the provincial level and it has carried out PD programs for teachers so far. However, the role of this institution in promoting teachers professionalism still needs to be optimized because regular training programs conducted by this LPMP institution have been trapped in routine and regular activities (Rosadi, 2015).

As mentioned above, several researchers have found that PD programs are more effective when the participants are involved in designing and delivering a program that fits their needs (i.e. Chval, et.al, 2008; Boud, & Hager 2012; Hattie, 2012). Their CK is believed to be able to help teachers attain the maximum benefits of a professional training they have (i.e. Nesbit, and Adesope, 2006; Loughran, et al., 2012; Kleickmann, et al., 2012; Vaidya, 2014). In the TBS model developed in the current research, teachers' needs and involvement were put at the front. Thus, teachers were encouraged to reflect on their strengths and weaknesses and choose strategies to overcome the latter.

Conclusion

In this paper, we have reported on an important aspect of curriculum development for Indonesia. We organised and evaluated the testing of three models of PD: the so-called regular training, regular scaffolding, and the TBS model, finding that all three developed teachers' CK significantly, but we found that the TBS model attained the highest gain.

It may surprise readers in developed countries that teachers' competence in CK is such a big issue in developing countries. Unfortunately, many teachers in Indonesia did not begin with adequate training/education and their limited access to books, computers, and internet connections continue to restrict them from enriching their CK. We commend the Indonesian Government for its recent initiatives to upgrade teacher quality. In addition, we recommend they both implement and conduct further research on PD programs for teachers that incorporate the TBS approach.

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