Innovative Teaching Models in the System of University Education: Opportunities... pp. 107–119

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THE IMPACT OF LESSON STUDY ON PRE-SERVICE KINDERGARTEN TEACHERS' MATHEMATICS TEACHING ANXIETY

Abstract: In today's society teachers are expected to have adequate knowledge and skills to teach effectively even before graduation. Such expectations can cause anxiety in teachers, especially in inexperienced ones. *Lesson Study* is recognized as an effective tool for providing high-quality learning experiences for future teachers which enables them to learn from engaging in and observing teaching in contrast to traditional pedagogy courses. This study aimed to investigate the effects of Lesson Study on mathematics teaching anxiety of pre-service kindergarten teachers. The quasi-experimental design with two parallel groups was used. The sample consisted of 49 students divided into control (27) and experimental group (22). The students in the experimental group followed an adjusted Lesson Study design, while the control group followed the traditional way of teaching practice. The results showed that there was no significant difference in mathematics teaching anxiety scores between groups. However, there was a significant difference in the findings referring to ability to control the class favoring the experimental group. The findings of the current researchers' study cannot be generalized due to certain limitations (small sample size, quasi-experimental design). The results can be used as support to encourage further investigations of the effects of Lesson Study in teacher education programmes.

Keywords: Teacher education programme, lesson study, pre-service kindergarten teachers, mathematics teaching anxiety.

INTRODUCTION

Schuck (2016) indicates that teacher education is currently facing existential challenges and that it is particularly important to focus attention on primary preservice preparation in mathematics in both content and pedagogy. Teachers are expected to have adequate knowledge and skills to teach effectively in the classroom before graduation and these expectations can cause anxiety in teachers, particularly in inexperienced ones (Peker, 2009a). Research indicates that learning from teacher education programmes has an impact on some teachers'

instructional work (Judson & Sawada, 2001; Murata & Pothen, 2011), but it sometimes takes years to appear in practice. Murata and Pothan (2011) link this to preservice teachers' lack of exposure to pupils and recognize *Lesson Study* as "cohesive professional development tool" for providing high-quality learning experiences for future teachers. Lesson study enables participants to learn from engaging in and observing teaching in contrast to traditional pedagogy courses where usually it is just talked about teaching.

Lesson Study

Lesson Study (LS) has drawn the attention of educators and educational researchers from around the world because of the outstanding achievements of Japanese students in international assessments over the past 20 years (Pjanić, 2014), particularly in Mathematics. It is an established educational investigative method and practice adopted by teacher-led professional development groups in Japan and refers to a set of practices that have been used to improve teaching and learning (Makinae, 2010). Lesson Study is defined as the "systematic investigation of classroom pedagogy conducted collectively by a group of teachers/students, with the aim of improving the quality of teaching and learning" (Tsui and Law, 2007, p. 1294). It involves a group of teachers who meet regularly over some period of time to work on the design, implementation, testing, and improvement of research lessons (Rock & Wilson, 2005). As Lewis & Tsuchida (1998) indicate, research lessons are actual lessons in classroom which are (a) observed by other teachers, (b) carefully planned, usually in collaboration with one or more colleagues, (c) focused on a particular goal/vision of pedagogical practice, (d) recorded for analysis and reflection, and (e) discussed by LS group members, other colleagues or outside educators and researchers.

The majority of the research about LS is focused on in-service teachers, but there are indications that some adapted versions of LS can be effectively used with preservice teachers (Burroughs & Luebeck, 2010; Chassels & Melville, 2009; McMahon & Hines, 2008; Mostofo, 2013). The main idea of LS is to bring together teachers to carry out the process of planning a lesson, teaching the lesson with the LS team observing, and then examining and discussing this lesson during a debriefing session. Based on the group's comments during the debriefing session, the lesson is revised, re-taught and reflected on again before being polished (Tsui & Law, 2007). The main impact of reflection goes beyond improvement of a single lesson. It includes deeper understanding of content knowledge and how students learn, and improved pedagogical skills of teachers. Since the focus is on the research lesson, and not on the teacher, this encourages open and frank discussions about the lessons (Tsui & Law, 2009).

The settings of higher education are usually far removed from the settings where the graduate teachers will eventually work and this can lead toward division between theory and practice (Grossman et al., 2009). For preservice teachers, LS provides opportunities such as: building professional learning communities, broadening their understanding of content knowledge and pedagogy, developing habits of critical and constructive observation, analysis, and improving ability to provide and receive feedback (Chassels & Melville, 2009; Chokshi & Fernandez, 2004; Fadlelmula, 2013; Mostofo, 2013). Collaborative planning, teaching, debriefing, revising and re-teaching increases pre-service teachers' confidence to teach mathematics (Matanluk, Johari & Matanluk, 2013; Villalon, 2016).

Mathematics teaching anxiety

Gardner and Leak (1994, p. 28) conceptualize teaching anxiety as "anxiety experienced in relation to teaching activities that involve preparation and execution of classroom activities". As they state, teaching anxiety is not just speech anxiety, but also involves interactions with the audience (questions from students, immediate negative feedback, class disruption and student evaluation). In this aspect, mathematics teaching anxiety can be defined as preservice teachers' feelings of tension that they experience while teaching mathematical concepts, theories and formulas, or during solving mathematical problems (Peker, 2009). It differs from mathematics anxiety, and is based on individuals' anxiety about their ability to teach mathematics (Fadlelmula, 2013). According to Levine (1993), anxiety for teaching mathematics is not rare among preservice teachers. It may reflect memories of past occurrences of mathematics failure or mathematics anxiety, as well as actual or perceived knowledge deficits in mathematics content or in teaching skills. It can be linked to teachers' content and pedagogical knowledge, mathematics attitudes and self-confidence (Etheridge, 2016; Peker, 2009).

Teaching anxiety has a significant negative impact on teacher effectiveness (Faldelmula, 2013). Possible causes of high levels of teaching anxiety among preservice teachers are: difficulty of teaching content; inadequacy of mathematical content knowledge; low level of interest toward teaching profession; incompetence to teach according to the pupils' developmental stage; lack of self-confidence; inexperience and unfamiliarity with material and students (Akinsola, 2014; Ameen, Guffey & Jackson, 2002; Peker, 2009; Sen, 2009). The possibility of encountering unexpected students' questions also increases teaching anxiety (Ameen et al., 2002; Baştürk & Taştepe, 2015) as well as lesson planning and classroom management (Akinsola, 2014). Baştürk and Taştepe (2015) pointed out that there is an inverse relationship between teaching anxiety and confidence.

Although there are studies that examined the sources and effects of the mathematics teaching anxieties, as well as the relationship between mathematics and mathematics teaching anxiety (Fadlelmula, 2013; Peker & Ertekin, 2011), very few studies have been conducted on investigating effects of different teaching methods and approaches on reducing teaching anxiety. Levine (1993) found that mathematics teaching anxiety decreased after the mathematics methods course that used instructional practices consistent with recommendations of the National Council of Teachers of Mathematics (such as teaching mathematics in student-oriented style). Some researchers investigated the impact of microteaching on mathematics teaching anxiety of preservice teachers (Fadlelmula, 2013; Peker, 2009a; Sen, 2009). They reported significant decrease in preservice teachers teaching anxiety levels from the beginning to the end of the teaching practicum course.

Although implementation of LS contributes to the increase of confidence to teach mathematics (Matanluk et al., 2013; Villalon, 2016), there are no studies that investigate the effects of LS on preservice teachers mathematics teaching anxiety. This lack of literature provided the rationale for our study. The aim of the current researchers' study was to investigate the effects of implementing an adjusted LS on preservice kindergarten teachers anxiety for teaching mathematics.

RESEARCH METHOD

The use of LS with preservice kindergarten teachers (PKT) in this project was the innovation that was used to link the Mathematics Teaching Practicum (MTP) course classroom with field experience teaching. Future kindergarten teachers, who are involved in teaching practice in the course of their studies, often experience anxiety for teaching mathematics and feel a lack of confidence in their teaching competences.

The presented study was conducted at the Faculty of Education in Jagodina, University of Kragujevac, as a part of a larger scale research. Since survey instruments were administered and numerical data were collected, a quantitative method was used in analyzing the data. Data were collected through questionnaires which is a very common technique in educational research (McMillan & Schumacher, 2001). The study used a quasi-experimental design with pre- and post-tests. The convenience sampling procedure was followed. According to McMillan and Schumacher (2001), a convenience sample presents a group of subjects selected on the basis of the accessibility or expediency. In the current researchers' study, participants were enrolled in MTP course at Kindergarten Teachers Education

Programme (year 4). The statistical analyses were conducted using the SPSS 17.0 programme.

Sample

The research sample involved 49 student teachers. The study was conducted during the academic year 2017/2018, and it lasted 20 weeks. All students had successfully finished theoretical Mathematics Teaching Methods (MTM) course at their third year of study. They were divided into a control group (CG) and an experimental group (EG). The CG consisted of 27 students (27 females) and EG consisted of 22 (21 females and 1 male) students. The mean age of the EG was 22,48 years (SD=1,12) and the mean age of CG was 22,39 (SD=0,95).

Instruments

The instrument used was a questionnaire that contained two parts. In the first part, background information about preservice teachers was collected (age and MTM course grades). The second part of the instrument contained a scale for assessing anxiety for teaching mathematics. This scale consisted of 12 items that were adapted and slightly modified from the Teaching Anxiety Scale (TCHAS) developed by Parsons (1973). The TCHAS aims to assess preservice teachers self-reporting of their feelings and tensions while teaching. The items included in our instrument referred to different aspects of teaching: confidence in own teaching competencies; teaching preparation and planning; realization of instructional activities (ability to maintain control of the class, ability to effectively present contents, ability to answer students' questions; speaking in front of the group), and concerns about teaching as a profession (Table 1). The translation of the items from English into Serbian was accomplished by a professional translator, and the original denotation and connotation of items was maintained. The Cronbach's alpha reliability coefficient indicated acceptable reliability (α=0,704). In the instructions of the questionnaire it was indicated that while answering questions, students should take into account and refer only to mathematics lessons.

Table 1. Items adopted from TCHAS scale (Parsons, 1973)

Items code	Items
A1	I feel uncertain about my ability to improvise in the classroom.
A2*	Even if I have trouble answering a student's question, I (would) find it easy to concentrate on questions that follow.
A3	I (would feel) feel anxious (if I were) when I am preparing lessons.
A4	I'm afraid students won't follow my instructions.
A5	I feel anxious about my ability to keep a class under control.
A6*	I'm happier teaching than I thought I'd be.
A7	I'm worried whether I will find teaching a satisfying profession.
A8	I'm afraid I will forget everything that I know when I get in front of a class.
A9*	I feel comfortable when I speak before a group.
A10*	I (would be) am able to decide how to present information in the classroom without a feeling of uncertainty.
A11*	I feel sure I can be a good teacher.
A12*	Good rapport with my students (will be) is one of my strong points.

* Items that were coded and scored reverse.

Procedure

Kindergarten teacher education programme (bachelor's degree) at the Faculty of Education lasts four years. The MTP course is obligatory for all PKT. During this course PKT spent three hours a week in kindergarten observing and teaching lessons. They are guided by their supervisor, a university teacher. Within this period, every PKT must conduct two lessons in an actual classroom.

Student teachers in the CG used a traditional way in MTP course. This means that student teachers individually planned and prepared lessons, and after consulting with their supervisor and final lesson plan corrections, they taught the lesson in an actual classroom in kindergarten. Other student teachers in CG observed the lessons, and participated in debriefing session. All student teachers from the EG were introduced to the LS process at the beginning of the MTP course. The adjusted LS took two phases (Table 2). In the first phase the teams of two or three student teachers were chosen randomly. Each team was assigned to teach a particular mathematics unit. The teams worked cooperatively on lesson

planning. They used team teaching, both to teach the simulation in MTP classroom and revised lesson in an actual classroom. This collaboration in the form of team teaching was used in order to reduce student teachers' stress when being observed by their peers (Mee & Oyao, 2013). In the second phase, every PKT was assigned a new mathematics unit. This time student teachers worked individually on lesson planning. Every student teacher first taught the lesson in simulated environment in an MTP classroom. After a debriefing session, the process of revision was carried out collaboratively. The same student teacher then re-taught the revised lesson in an actual classroom in kindergarten.

Table 2. Phases of LS implementation

	1st phase of LS	2nd phase of LS
Step 1	Collaborative planning	Individual planning
Step 2	Team teaching of the lesson in simulated environment	Individual teaching of the lesson in simulated environment
Step 3	Debriefing session	Debriefing session
Step 4	Revision of the lesson	Revision of the lesson
Step 5	Team re-teaching of the lesson in real classroom	Individual re-teaching of the lesson in real classroom
Step 6	Debriefing session	Debriefing session

During the lesson simulations, in both phases the rest of the PKT in the EG acted as typical kindergarten children. Each student teacher (or team) taught for about 20 minutes in simulated environment. The debriefing session with the whole group followed immediately after both the lesson and simulation. The debriefing session started with the self-reflection of student (or team) who taught the lesson, followed by the rest of the student teachers' comments, questions, and suggestions for revising the lesson. Supervisors guided the discussion and gave their own feedback after the student teachers' reflections. After that the lesson was revised based on the received feedback, and before teaching in real settings in kindergarten, the lesson plan was sent to the supervisors. Lessons in kindergarten were followed by a debriefing session with the whole group of PKT and the instructor's evaluation. All PKT had one week to prepare a lesson simulation as well as an actual classroom lesson. The authors of the research had multiple roles throughout the study, as researchers, supervisors and practitioners.

RESULTS AND DISCUSSION

At the beginning of the research, the two groups were checked for equivalency in their academic achievement in MTM course. The groups were homogenous in terms of their MTM grades (Table 3).

Table 3. Achievement in MTM course.

Group	Mean	SD	Median	Mean Ranks	Sum of Ranks	Shapiro-Wilks test		Mann-Whitney test		
						Statist.	Sig.	U	Z	Sig.
CG	7,50	1,22	7,50	24,04	577,00	0,893	0,016	251,00	-0,294	0,768
EG	7,41	1,30	7,00	22,91	504,00	0,866	0,007			

PKT mathematics teaching anxiety scores were calculated before and after implementation of LS. The analysis of the findings showed that there was no significant difference between teaching anxiety scores of CG and EG in pre-test (Table 4). Also, there was no significant difference in scores on single items. The groups were homogenous in terms of their teaching anxiety level.

Table 4. Anxiety level of CG and EG in pre-test

Items	Group	Mean	SD	Median	Mean Ranks	Sum of Ranks	Shapiro-Wilks test		Mann-Whitney test		
							Statist.	Sig.	U	Z	Sig.
A1	CG	3,20	0,50	3,00	27,44	741,00	0,667	0,000	231,000	-1,574	0,115
	EG	2,91	0,68	3,00	22,00	484,00	0,804	0,001			
A2*	CG	2,64	0,57	3,00	25,57	690,50	0,643	0,000	281,500	-0.342	0,733
	EG	2,73	1,12	2,50	24,30	534,50	0,893	0,021			
A3	CG	3,04	0,73	3,00	26,80	723.50	0,813	0,000	248,500	-1,047	0,295
	EG	2,82	0,79	3,00	22,80	501.50	0,795	0,000			
A4	CG	3,04	0,84	3,00	25,06	651.50	0,848	0,002	271,500	-0,327	0,744
	EG	3,00	0,82	3,00	23,84	524.50	0,745	0,000			
A5	CG	2,88	0,44	3,00	24,46	660.50	0,597	0,000	282,500	-0,367	0,713
	EG	3,00	0,76	3,00	25,66	564.50	0,814	0,001			
A6*	CG	2,68	0,99	3,00	25,33	684.00	0,865	0,003	288,000	-0.190	0,850
	EG	2,73	1,08	3,00	24,59	541.00	0,923	0,086			

A7	CG	2,28	0,89	2,00	24,78	669.00	0,839	0,001	291,000	-0,127	0,899
	EG	2,32	1,71	2,00	25,27	556.00	0,881	0,013			
A8	CG	3,04	0,73	3,00	25,81	671.00	0,801	0,000	252,000	-0,755	0,450
	EG	2,95	1,05	3,00	22,95	505.00	0,909	0,045			
A9*	CG	2,92	0,81	3,00	26,50	689.00	0,859	0,003	234,000	-1,142	0,254
	EG	2,73	0,93	3,00	22,14	487.00	0,884	0,014			
A10*	CG	3,20	0,71	3,00	24,87	646.50	0,820	0,000	276,500	-0,213	0,831
	EG	3,14	0,89	3,00	24,07	529.50	0,866	0,007			
A11*	CG	1,84	0,75	2,00	26,60	691.50	0,805	0,000	231,500	-1.230	0,219
	EG	1,59	067	1,50	22,02	484.50	0,756	0,000			
A12*	CG	1,76	0,66	2,00	23,96	623.00	0,786	0,000	272,000	-0,330	0,741
	EG	1,82	0,59	2,00	25,14	553.00	0,754	0,000			
Total score	CG	32,52	4,22	33,00	26,83	724,50	0,953	0,294	247,500	-1,000	0,318
	EG	31,73/	5,28	30,50	22,75	500,50	0,867	0,007			

* Scores for reverse items are showed in Table 4.

At the end of the semester both groups were given the post-test. The post-test contained the same 12 item scale that was used in the pre-test. The results of CG and EG in post-test are shown in the Table 5.

Table 5. Anxiety level of CG and EG in post-test

Items	Group	Mean	SD	Median	Mean Ranks	Sum of Ranks	Shapiro-Wilks test		Mann-Whitney test		
							Statist.	Sig.	U	Z	Sig.
A1	CG	2,00	0,98	2,00	24,00	624,00	0,821	0,000	273,000	-0,288	0,774
	EG	2,20	1,15	2,00	25,09	552,00	0,774	0,000			
A2*	CG	1,77	0,65	2,00	23,39	631,50	0,783	0,000	253,500	-0,950	0,342
	EG	2,15	1,23	2,00	26,98	593,50	0,815	0,001			
A3	CG	1,73	1,00	1,00	27,67	747,00	0,716	0,000	225,000	-1,669	0,095
	EG	1,35	0,59	1,00	21,73	478,00	0,632	0,000			
A4	CG	1,81	0,80	2,00	26,09	704,50	0,710	0,000	267,500	-0,645	0,519
	EG	1,70	0,92	1,00	23,66	520,50	0,670	0,000			
A5	CG	1,89	0,91	2,00	29,65	800,50	0,671	0,000	171,500	-2,834	0,005
	EG	1,30	0,58	1,00	19,30	424,50	0,583	0,000			

A6*	CG	2,00	0,89	2,00	27,26	736,00	0,848	0,001	236,000	-1,317	0,188
	EG	1,55	0,89	1,00	22,23	489,00	0,679	0,000			
A7	CG	1,65	0,89	1,00	26,09	704,50	0,740	0,000	240,500	-1,070	0,285
	EG	1,45	0,89	1,00	22,45	471,50	0,583	0,000			
A8	CG	1,73	0,83	2,00	27,37	739,00	0,791	0,000	233,000	-1,437	0,151
	EG	1,40	0,76	1,00	22,09	486,00	0,582	0,000			
A9*	CG	2,00	0,94	2,00	26,91	726,50	0,847	0,001	191,500	-1,826	0,068
	EG	1,55	0,76	1,00	20,08	401,50	0,677	0,000			
A10*	CG	2,00	1,02	2,00	27,91	753,50	0,760	0,000	218,500	-1,719	0,086
	EG	1,55	1,00	1,00	21,43	471,50	0,612	0,000			
A11*	CG	1,27	0,45	1,00	26,85	725,00	0,557	0,000	247,000	-1,498	0,134
	EG	1,05	0,22	1,00	22,73	500,00	0,236	0,000			
A12*	CG	1,31	0,55	1,00	25,80	696,50	0,598	0,000	275,500	-0,595	0,552
	EG	1,20	0,52	1,00	24,02	528,50	0,447	0,000			
Total score	CG	21,40	4,83	21,00	28,56	771,00	0,948	0,222	201,000	-1,937	0,053
	EG	18,59	4,92	18,00	20,64	454,00	0,893	0,021			

* Scores for reverse items are showed in Table 5.

There was a decrease between the pre- and post-test total scores in the teaching anxiety level of the participants in the EG and CG. However, the results showed that there was no statistically significant difference regarding teaching anxiety in general between the CG and EG (Table 5). In other words, teaching anxiety levels of the group that practiced LS during MTM course and the group that had traditional teaching experience did not differ significantly.

When comparing scores on single items, we determined that there is statistically significant difference between CG and EG concerning item A5 (*I feel anxious about my ability to keep a class under control*). Preservice teachers in EG showed significantly lower anxiety about their ability of keeping classroom control comparing to preservice teachers in CG (U=171,500, p=0,005). Some empirical findings support the notion that a high level of anxiety among preservice teachers may be related to various negative consequences such as class control problems and classroom disruptions (Ngidi, Sibaya, 2003). Therefore, we might recognize the benefits of LS on preservice teachers' confidence in classroom control ability.

As for the other items, we have not found statistically significant differences between EG and CG. The reason can perhaps be found in the fact that the sample size is small. Also, although preservice teachers participated in LS the whole academic year, the fact that they taught only two complete individual lessons might have also influenced the results of the study.

CONCLUSION

The results obtained have shown that LS has positive impact in some aspects of student teachers' perceptions of their competences in teaching such as the ability to keep control of the lesson. However, the current researchers have not found statistically significant differences in other items and in teaching anxiety total scores between experimental and control group. The findings of our study cannot be generalized since there are some limitations such as a small sample size and quasi-experimental design. However, the value of this study can be recognized in the fact that it contributes a new insight in the area where there is a lack of literature and empirical evidence on the use and effects of LS on teaching anxiety. Also, this is the first time that LS was used in Serbia at any educational level. Hence, the current researchers believe that results of this research can be used as support to encourage some further investigations of the effects of LS in teacher education programmes on teaching anxiety, but also on teaching competencies, teacher efficacy, content and pedagogy knowledge, attitudes toward mathematics, and the similar.

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