LESSON STUDY IN TEACHER EDUCATION:
A TOOL TO ESTABLISH A LEARNING COMMUNITY
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This paper presents a study on the use of lesson study in teacher education. Teacher education in Iceland has been under constant development and the authors of this paper have taken part in developing mathematics teacher education based on recent research on teacher education. The study shows that lesson study can create a learning community where teacher students can develop their professional language and collaborative competence which are considered to be important issues in teacher education. Lesson study also helps teacher students to put focus on pupils learning and content when planning lessons together. Lesson study with teacher students seems to be a good way for them to learn to teach and to develop as professionals.

Key words: lesson study, mathematics teacher education, learning community

INTRODUCTION
Mathematics teacher education in Iceland has been changing and developing during the last decades. From 1971 teacher education for teachers in compulsory school (grades 1-10) has been a three year B. Ed. degree. The structure has varied but teacher students have always specialized in one or two subjects. From 2007 the B. Ed. degree has consisted of 80 ECTS in pedagogy and didactics, 80 ECTS in specialization and 20 ECTS for studies of own choice (Stefnumótun Kennaraháskóla Íslands 2005-2010). In their specialization the mathematics teacher students study mathematics and mathematics education. In some courses they study either mathematics or mathematics education while in others the study is combined. For their teaching practice (12 weeks) the teacher students have a home-school.

The authors of this paper have taught different mathematics education courses for more than 20 years and have taken part in developing the studies in cooperation with colleagues. In choosing a structure and content for our mathematics education courses we have put an emphasis on creating a learning community among the teacher students. We, play an active role in this community as participants in discussions and as group leaders or experts. The teacher students are to be active and bring in their knowledge, views, and thoughts about mathematics education. We have chosen to introduce our students to lesson study (Lewis, 2002) to establish learning

1 In 2011 a five years M. Ed. degree will be required to qualify as compulsory school teacher.

2 European Credit Transfer System – A full academic year of studies is 60 ECTS
communities within the frame of the courses. This is based on the belief that the creation of learning communities in teacher education it gives the students good learning opportunities for developing a professional language and a collaboration competency. Our aim is also to introduce a professional learning strategy to our students they can use in different contexts when they enter the teaching profession.

In this study we explore the effectiveness of using lesson study to develop a learning community within our courses. Our research questions are:

- How does the learning community develop during the lesson study process?
- What characterizes the learning community?

THEORETICAL BACKGROUND

Mathematics teacher education has become an important field of study among researchers in mathematics education during the last 20 years. The increased interest was marked by the publication of the first issue of the Journal of Mathematics Teacher Education in 1998 and the publication of the first International Handbook of Mathematics Teacher Education in 2008 (Krainer & Llinares, 2010). The collaboration of teachers, teacher educators and pupils seems to be a central issue in many of the research studies. Team work, learning communities, networks and design research are often suggested as ways to help teachers to tackle and meet the complexity of teaching mathematics and to support them in their lifelong learning process. (Jaworski, 2005, 2006, 2007; Krainer, 2003; Wood, 2002; Wood & Berry, 2003).

Many researchers have tried to identify a knowledge base for mathematics teaching or important competencies for mathematics teachers. A professional learning competency is considered to be an important factor and teacher students need to learn to create professional learning opportunities during their pre-service teacher education. They also have to learn to collaborate with others and to create learning communities that will support their learning as teachers (Grevholm, 2006; Hiebert, Morris, & Glass, 2003). Teacher students have to realize that they are only starting to create a knowledge base and that they are entering a profession where lifelong learning is essential.

Hiebert, Morris, & Glass (2003) describe learning environments prospective teachers must learn to create in order to sustain their own and other teachers learning. In these environments teacher students need to learn to learn from their teaching in collaboration with others. They mention lesson study is an example of such a learning environment.

According to Darling-Hammond (1998) the best learning environment for teacher students is when the they are given the opportunity to teach, study and reflect in collaboration with others and by looking closely at the pupils and their work and share what they see with others. This requires a close connection to schools and
teaching practices. Teacher students need both opportunities to try out their ideas in practice and knowledge of and support to reflect upon and interpret practice (Darling-Hammond, 1998).

Professional learning communities seem to play an important role in supporting teachers in continuously improving their teaching and sustaining their professional learning. Trends in teachers’ professional development show increased attention to professional learning strategies grounded in classroom practice. (Fernandez, 2002; Loucks-Horsley, Stiles, Mundry, Hewson, & Love, 2010). Professional learning communities where teachers share understandings about the nature of good teaching and work together on planning and improving teaching seem to provide particularly conductive settings for learning to teach (Hammerness, Darling-Hammond, & Bransford, 2005).

Lesson study is often referred to as an example of a professional development strategy that creates a learning environment in which teachers engage in learning with their peers (Lewis & Perry, 2009). It is also a strategy that aims to achieve all of the four outcomes that according to Loucks-Horsley and her colleagues characterise effective professional development. They are; enhancing teachers’ knowledge, enhancing quality teaching, developing leadership capacity, and building professional learning communities (Loucks-Horsley, et al., 2010)

Lesson study is mentioned as an example of a pedagogy for preparing teachers for teaching as a lifelong learning process (Hammerness & Darling-Hammond, 2005). Several research studies report on successful use of lesson study with teacher students (Burroughs & Luebeck, 2010; Tsui & Law, 2007) and teacher educators have shared their experiences of using lesson study with teacher students in journals like NCTM’s Mathematics Teacher.

**The Lesson Study Process**

The main idea of lesson study is that a group of teachers, with support from an expert, develop a teaching plan for one lesson. The structure of the lesson, the role of the teacher and pupils learning are in focus. The lesson study process can be described as a cycle, a process where the group of teachers repeatedly goes through the phases, discussion, goal-setting and planning, research lesson.

In the first phase, the group has to discuss the aim and the content of the lesson. Then the participants explore the content, both what it means to acquire understanding of the it and how it can be approached in teaching. The participants are in control, and make decisions about the process. The participants often deepen their knowledge of the content and possible teaching approaches. They communicate, do research, work together, make decisions, plan teaching, and experience the advantages of participating in a learning community. The research lesson is taught by one of the participants and the other participants are present and take notes. After the lesson, the experience is discussed and an expert joins the group discussions. On that
basis the lesson plan is revised and the lesson taught again for a similar group. The cycle can be repeated several times (Lewis, 2002).

In organizing our courses we have focused on establishing a learning community with our teacher students. A learning community where teacher educators and teacher students share ideas, discuss and work together on planning good teaching. Such an environment gives opportunity to develop professional language and collaborative skills. By engaging in the lesson study process the teacher students take part in creating a learning community where the focus is on the pupils learning of a specific content.

**METHOD**

This research-study focuses on two 10 ECTS courses in mathematics education. The teacher students attend them in their second year and are at the same time attending courses on geometry and number theory. Teaching practice in grades 7-10 is an important part of the mathematics education courses. In the fall they follow the course: *Mathematics teaching and learning in lower secondary school* where they are introduced to mathematics education as a field of study. They learn about lesson study, discuss and study various resources for lesson study ([http://www.lessonresearch.net/](http://www.lessonresearch.net/)). Lesson study is introduced as a tool to use in a professional development. The focus in on how being a part of a learning community gives teachers the supporting environment to develop their teaching collaboratively. In the spring term the teacher students attend the course: *Mathematics teaching and learning for all*. Then they try out the ideas of lesson study. All the students, around 15, work as one lesson study group. They start with discussing the aim and the content of the lesson. They focus on what could be relevant for 8th and 9th grade in their home-school and use the curriculum guide and their own analysis and interest in their considerations. The teacher students plan the lesson in collaboration with their teacher educators and make use of different literature and teaching materials as well as their own experiences. In the making of the lesson plan they use a four-column lesson plan (Matthews, Hlas, & Finken, 2009). The columns are: Steps of the lesson: Learning activities and key questions (1), expected pupils reactions and responses (2), teacher’s response to pupils reactions/things to remember (3) and goals and method(s) of evaluation (4).

Some of the teacher students are distance learners and all students share a digital learning environment (Blackboard). The students on campus work together in class and records of the work in progress are shared with the distance students in Blackboard. The distance students contribute to the process by communicating their ideas, thinking and reflections the same way. Three or four weeks are used for the preparation of the lesson. Then the teaching plan is introduced to the practice-teachers in the home-schools. They can make comments to the lesson plan and share their experiences with the group. Groups are created for teaching and observing research lessons. In each groups there is a teacher educator, practice teachers and teacher students from two home schools if possible. The groups adjust the lesson plan
to the actual situations in the school and make practical decisions regarding the research lesson. All groups teach the lesson two times. After the research lesson there is a short evaluation meeting. When all groups have taught the lesson once the teacher students and teacher educators meet at campus to discuss the experience and make revision of the lesson plan. The reasons for different adjustments of the lesson plan in each home school are also discussed. When the teacher students are back at the university time is taken to discuss the lesson study project and this way of planning and collaborating as a tool for professional growth.

The lesson study process reported on in this study has been conducted with two groups of teacher students in total 30 students. Both groups developed lesson plans around prime numbers. The students were attending a course in number theory and the teaching of numbers and number theory was a topic in the math education course. The overarching aim for the teacher students was to find ways to make the mathematics teaching and learning interesting and fun for the pupils. They also found it challenging to make this particular topic prime numbers interesting and purposeful for their pupils. The first group developed a lesson plan around the question: What use can be made of prime factorization? They developed six different tasks that could be worked on in groups and then discussed in the whole class. The second group developed a game where the pupils were supposed to find out whether a number was a prime number or a composite number and how they could argue for their categorization.

DATA

In this research-study the data was gathered during the school-years, 2008-2010. This study builds on prior studies on teaching teacher students similar courses. There the focus was on how research on mathematics teacher educations has influenced the structure, content and teaching approach in the courses (Gunnarsdóttir, Kristinsdóttir, & Pálsdóttir, 2008; Gunnarsdóttir & Pálsdóttir, 2010). The data in this study consists of two lesson plans, teacher educators’ notes, an interview with two teacher students, audiotapes from planning meetings, correspondence between the teacher students at campus and the distance students, notes from evaluation meetings, a video tape from the evaluation meeting at campus and notes from discussion after the teaching practice period. We also have an audiotape from the oral presentation of the final course assignment where the teacher student presented their ideas about ideal mathematics teaching.

The data was analysed with our goal for using lesson study, to create learning communities, in mind. When reading and listening to the data our attention was drawn to four main themes that are all important in a learning community. The four main themes; professional language, collaboration competence, focus on pupils learning and teacher students elaboration of the content are evident in all our data. The development of a professional language and collaborative competency are often
mentioned as the main goals for establishing learning communities (Hammerness, et al., 2005; Jaworski, 2007). A learning community based on a lesson study process puts focus on pupils learning and mathematical content. We will provide some examples of how these four themes emerge from the data.

**Professional language**

In the beginning of the lesson study process the teacher students found it hard to understand how you could use several weeks to plan one lesson. It took one session to discuss the approach and decide on content. But when they started to work on the content in more details they realized that there were many things to consider and many different ways to go. They felt the need to understand each other’s ideas and they needed to be more precise in their use of language and had to support their arguments by referring to prior readings and common course literature in mathematics education. They also had to refine their shared understanding of concepts from general didactics and mathematics. The discussions became longer and more intense. They were developing their ideas in collaboration and trying to consider the teaching of the content from all points of view. Because of the distance students a part of the dialog was in written format and that demanded a more precise use of professional language. All the teacher students were going to teach the lesson at some point so they felt the need to understand and agree with the lesson plan. Despite of the assumed shared understanding written in the lesson plan the students realized that the lesson turned out differently in the schools when they met after the first round of teaching. The teacher students’ use of professional language developed considerably during the process, they used more professional concepts, their discussions lasted longer and they referred more often to literature connecting theory and practice. In her final assignment Elsa refers to the book *Adding it up* and that she wants to establish communities of learners in her ideal school. When she introduces her idea to her fellow students they elaborate on the idea and discuss it in a professional way with reference to their shared experiences during the lesson study process.

**Collaborative competence**

When using lesson study the challenge is to develop an effective way to teach a certain content or concept with some long term educational goals in mind. This is done in collaboration and participants have to present their ideas, discuss them and take joint responsibility for the planning of the lesson. They have to reason with each other and build on their previous experiences. They come to realize how important it is to collaborate, think and plan together. There are many things to consider when planning a lesson and when it is done in collaboration more details are discussed and from different points of view.

Kristin: It was fun and rewarding to plan this together. We all thought we understood the plan the same way but it turned out differently.
It also encourages and gives the teacher students opportunity to try out things they otherwise would hesitate to do. They experience what to collaborate about in a learning community and what teacher collaboration can mean. The teacher students’ collaborative competence strengthens during the lesson study process. It is evident they have more to discuss and they experience the benefit of having colleagues and common experiences to relate to. They feel it is important for their future development as mathematics teachers to be a part of a learning community and that they themselves have a responsibility in creating such a community. In their final assignment almost all the teacher students see themselves as a part of learning community planning and reflecting on teaching.

**Focus on pupils’ learning**

In the lesson study process the teacher students discuss possible teaching approaches. In choosing an approach they use their knowledge of pupils, their situations and different learning needs. The teacher students try finding an approach that many pupils will find appealing and is at the same time challenging to themselves. In the lesson plan they focus on what the pupils should do but they often fail to anticipate pupils’ responses and how they as teachers should react to them. During the teaching of the lesson there is always at least one teacher student in the role of an observer. The teaching approach is well known to the observers and therefore it does not become the main object of study even though they have an interest in how the teaching develops. Instead the observers focus more on the pupils and their reactions and learning. In the evaluation meeting the teacher students often refer to particular pupils responses and become fascinated of how the different pupils deal with the content. Changes in the lesson plan are based on their analysis of the pupils’ responses. Their main focus is on making the lesson a positive learning experience for the pupils. The teacher students feel that by choosing approaches like games and group work they succeed in creating good conditions for pupils learning. During the preparation of the lesson the teacher students express their ideas on what is important for the pupils’ learning.

Elsa: We need to make use of their interests  
Anna: They have to be able move around,  
Karen: It has to be fun and it should be hands on,  
Berta: Pupils show more interest when they can work together and decide what to do.

When discussing their future teaching the teacher students point out the importance of getting to know the pupils ideas about mathematics and mathematics learning and base their teaching on that knowledge.

**Focus on mathematical content**

The choice of content is influenced by what the teacher students are learning in mathematics courses. They have some prior knowledge of prime numbers, rules for finding prime factors and whether a number is a prime or not and rules for divisibility
of numbers. But there are some shortcomings in their understanding that become obvious during their initial discussions. They make use of each other’s knowledge, make connections and refine their understanding through common discussions. They become more aware of what it means to understand prime numbers and composite numbers.

Tina: The pupils know about prime numbers and ways to find them. They have also worked with divisibility, square roots and composite numbers. We need to discuss with them how to use this when finding out whether a number is a prime number or composite number.

Through the discussion the teacher students also better understand the importance of a good content knowledge for a teacher. They experience that good content knowledge gives you more power and flexibility when designing a lesson process. During the process all the teacher students become better in expressing their knowledge and for many their basic understanding of the content improves a lot. They realize that there are many things to consider if you want to teach this content with understanding.

CONCLUSION

During the lesson study process the teacher students have developed their professional identity. They have realized the complexity of teaching but they have also become more eager and stronger in dealing with the complexity. In the beginning the teacher students focused on the teaching plan as a platform for collaboration. But during the process they realized that they needed to collaborate more closely regarding other aspects of the teaching and the learning of the content. They also felt how rewarding these collaborations were. They felt the need to verbalize their ideas and thinking, ask into others thinking and reflect on that. More and more teacher students became active and they became more able to dwell on things and discuss them in details. Both the distance students and the students on campus became more willing to collaborate and share ideas and they developed a community of learners where everyone had a voice. It was noticeable in the discussions that the teacher students were also ready to take risks and could provide some strong arguments for their ideas. They became more convinced that they could learn a lot from others and by trying out things in collaboration with others.

Trust and openness characterized the learning communities that were established. The fact that it was only a short term commitment and the teacher students had to take part in the project as a part of their study influenced their participation. Because it was not a long term commitment it did not involve much risk for them. It became a positive experience that they can use and learn from when they enter into teaching. But trying to establish a learning community in school can become much more risky because it is more long term and there are other expectations and power structures in place. Because the teacher educators were a part of the learning community the
teacher students did not have to take full responsibility for the process or the outcome of the process, the lesson plan.

The lesson study process is an important venue to connect theory and practice and it also gives the teacher educators an opportunity to enter the practice field more in the role of a partner than an evaluator. The focus was more on making the learning opportunities for the pupils learning better than on the teacher students’ performance. Lesson study has a potential for changing the focus in teaching practice and puts the collaboration between the teacher educators, teacher students and practice teachers in a different context. Many teacher educators are trying to use and develop lesson study with teacher students and here there are many opportunities for further research and development. It is a future challenge to establish learning communities with all three partners, teacher students, teacher educators and practice teachers that could strengthen professional learning communities in schools.

REFERENCES


