

Student Teachers' Views on Relevance and Coherence of Mathematics and Science Teacher Education Programme

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Introduction

Based on evaluation by student teachers, there are several problems that have been identified in teacher education programs; e.g. inadequate time for learning, fragmentation, uninspired teaching methods and superficial curriculum of teacher education besides the discontinuity between theory and practice. In addition, practical issues like lack of training in behavioural problems and in working with parents seem to be challenging areas. (e.g. Brandsford et al. 2000, Davis and Ferguson 1997). Some suggestions have been made to improve teacher education on the grounds of research-based understanding (e.g. Hagger and McIntyre 2000, Anderson and Mitchener 1994). Some generalisations about effective and expert teaching might be useful guidance for student teachers but not to be presented as absolute authority. The other suggestion is to take into consideration preconceptions which student teachers bring with them in educational courses (Fajet et al. 2005, Hagger and McIntyre 2000, 490). The potential of the classroom and experienced teachers have also been noticed; how to help student teachers to learn from expertise in the practice of experienced teachers or develop in-service teacher education programmes in order to help teachers to reflect on their work and access constructivist learning and teaching (Hagger and McIntyre 2000, Anderson and Mitchener 1994).

To overcome the challenges described above, it is also important to understand student teachers' reasons for becoming teachers and their orientation toward the studies. Besides, the preconceptions of teaching and learning have been noticed to be a good starting point for teacher education. (Younger et al. 2004, Haritos 2004) Diversity within student teachers has been paid attention in different frameworks like ethnicity, social class and gender besides personal life experiences which all influence student teachers' preconceptions (e.g. Richardson and Watt 2005, O'Brien and Schillaci 2002, Guyton et al. 1996). On one hand, student teachers seem to assign great importance to their personal

characteristics and less importance to pedagogical training as teacher (Fajet et al. 2005). On the other hand, there is also evidence that student teachers think that they learn teaching within university context, from observation and through doing (Younger et al. 2004). Furthermore, the reasons for becoming a teacher and motivation to teach vary between different areas of education.

It is stressed that teacher education courses should be provided in a way that student teachers could reflect upon their own preconceptions and would understand the meaning of teacher education (Haritos 2004, Younger et al. 2004). There are several ways to address the need for integrating personal views with the perspectives of pedagogical issues and professional development e.g. through completing journals, doing reflection exercises and a variety of classroom experiences (Haritos 2004, Trotman and Kerr 2001). However, integrating educational research in teacher education seems to be demanding as well. Teachers, especially more experienced ones, seem not to value educational research as they are concerned about the practicality, contextuality, credibility and accessibility of academic research (Ratcliffe et al. 2005, Gore and Gitlin 2004).

In this research, we will focus on Finnish secondary teacher education in mathematics and science especially from student teachers' point of view. The objective of research-based teacher education has been to educate pedagogically thinking teachers who are able to think reflectively over their teaching. In Finnish secondary teacher education, there are several partners involved in teacher education: several university subject departments to be responsible for subject studies and Department of Applied Sciences of Education with university training schools to take care of pedagogical (educational) studies. In the case of mathematics and science teacher education, student teachers take a master degree in faculty of mathematics and natural sciences (300 ECTS) which includes

subject studies in mathematics or science as their major (120 ECTS), minor subject studies in another school subject (60 ECTS) and a pedagogical studies module for subject teachers (60 ECTS) organised by the Department of Applied Sciences of Education and University Training Schools.

As the studies in teacher education programme are to be completed in several departments and students may complete pedagogical studies flexibly in different phases during their studies, it is a challenge to overcome issues related to coordination needed in different units and to support students in their studies. Student teachers' experience of fragmentation of studies has been one problem besides the orientation toward studies. In this research, the status of disciplines is also central. Based on our experiences as teacher educators in pedagogical studies, we have noticed that way of thinking in mathematical and natural sciences as disciplines is very different from that educational sciences; student teachers have difficulties understanding the idea of educational studies and educational knowledge after studying many years in subject department. (see Kosunen and Mikkola 2002)

In the paper, the focus is on evaluation of the study programme, especially the pedagogical studies module for becoming teachers. As discussed above, several challenges have been noticed generally in teacher education and there are also specific issues due to the structure of secondary teacher education in University of Helsinki. Developmental actions have taken place to overcome the problems in co-operation between the partners and the evaluation of the programme is a good starting point. In this paper, the focus is on student teachers' views on the relevance and coherence of mathematics and science teacher education programme in University of Helsinki. The aim of the research is to examine the student teachers' views especially on pedagogical studies and find the possible reasons behind the views concerning the pedagogical studies module within the teacher education programme.

The study explores the following questions; 1) what kind of views do student teachers have on the relevance and coherence of the pedagogical studies module in mathematics and science teacher education programme? 2) what might be the reasons for those views based on the starting points of student teachers?

To understand these experiences, a few mathematics and science student teachers were interviewed.

Methods

Participants

The data used in this research consists of interviews with mathematics and science student teachers for secondary school. We asked ten student teachers who were participating in pedagogical studies (60 ECTS) to take a part in semi-structured interviews which took place in the autumn 2004 as a part of evaluation of the programme. The interviews took place in a connection with a seminar for developing mathematics and science teacher education programme which all interviewees participated voluntarily as student members. There were no particular reasons for participating in the seminar but their own interest in developing the studies they were evolved. As the pedagogical studies module may be completed flexibly during the studies, the backgrounds of these student teachers varied according to progress in their studies in overall (2nd year up to last year of studies) besides age (20-40 years) and gender (5 men and 5 women) as well. All student teachers were taking at least some pedagogical courses during the semester 2004-2005. All together, in the pedagogical studies there were 70 student teachers with mathematics, chemistry or physics as

their major subject. Our aim was to ensure that we are able to acquire different ways to perceive pedagogical studies.

Procedure and data analysis

Participants were asked to take part in semi-structured interviews which were recorded. The correspondence author interviewed student teachers. The interviewer was not responsible for educating these student teachers within pedagogical studies. The participants were told that they could tell about their views on studies confidentially and anonymously. Four specific themes were discussed during the interview: 1) why did they apply in and started pedagogical studies and what kind of expectations they have? 2) how did students describe their pedagogical studies and piece the studies together? 3) the relevance of pedagogical studies to professional development, and 4) how the students have experienced the pedagogical studies?

The research is engaged in the qualitative research approach (e.g. Denzin and Lincoln 2000). The data was analysed following the principles of the analytic induction starting with four themes of semi-structured interview described above; motivational issues and expectations in pedagogical studies, views on the coherence of teacher education, the relevance of the teacher education programme and experiences in studies (c.f. Patton 2002). The reduced expressions were built on the original expressions and the original categories were gradually specified. For example, study arrangements and practical issues were quite highly emphasised as well as the role of student teacher in relation to teacher educators and other student teachers. In the end of the analysis, the main categories were built on the sub-categories and the results of the research are based on them. The types of the students were built on main categories as a preliminary result to be further examined later. These three different types of students emerged while examining a profile of each participant in relation to the main categories that were found. Table 1 provides an example of the analysed clause. It is good to notice that the data was analysed partly by both authors. An initial categorising of four randomly selected interviews was independently made by both researchers and then discussed. At the end of the analysis process, the categorising of the data and the conclusions of coding were agreed by both researchers.

Table 1. An example of abstraction of one analysis unit

Original expression	Reduced expression	Sub-category	Main category
"So, I think that we have been punished because... although, I don't think that any of us would absence in purpose... that they wouldn't have a good reason for doing that... that we are all adults so, so we know what is the idea for example in subject didactics and thing like that... so I think that nobody, that nobody wouldn't have absences from courses only because of tiredness or something like that."	I think that we have been punished for no reason when absenting the course. We are adults so we wouldn't absence for no reason.	Interrelation between student teachers and teacher educators	Student teacher's role in pedagogical studies

Results

Firstly, we will focus on the student teacher's views on the relevance and coherence of the pedagogical studies within the teacher education programme by describing the main categories which emerged from the research data. In the end of the data analysis, there were two main categories found more than initially were stated. One of the categories which emerged during the analysis process was 'educational research and theoretical approach in pedagogical studies' and the other was 'student teacher's role as a learner in the pedagogical studies'. Secondly, we will describe three different

kinds of characters as a preliminary result which can be found among the student teachers. These descriptions of different types of student teachers are based on the main categories of the data. Categorising the types of student teachers might help us to understand the way the students view their pedagogical studies but still need further research.

Student teachers' views on pedagogical studies

There were six themes that were emphasised by student teachers related to the teacher education programme; 1) orientation and backgrounds of a student teacher; 2) educational research and knowledge as a part of the studies; 3) the relevance of pedagogical studies for becoming teachers; 4) the coherence of the teacher education programme; 5) study arrangements and practical issues and 6) the student teacher's role in educational studies. In this paper, we will describe the features that were overwhelming or central in order to have a holistic view on the student teacher's conceptions. Despite the variation within the views on the pedagogical studies according to emphasised matters, there were common characteristics within the views.

Orientation and motivational backgrounds

Student teachers paid attention to their former studies in psychology and their experience as a substitute teacher in school as a starting point for pedagogical studies. The pedagogical studies were thought to be especially important for those who had no teaching experience. Besides these two themes, the preconceptions of pedagogical studies seemed to be quite strong and could be characterised on the one hand by attributes like inflexible, exhausting and pointless and on the other hand as practical and fragmented.

Coherence of pedagogical studies

The student teachers emphasised the importance of practical training in a classroom and practical issues that had been discussed in teacher training schools as they understood the meaning of these things. Besides practical training, courses on subject didactics (concentrated in mathematics and science education) seemed to be relevant for becoming teachers. However, student teachers found difficult to understand the meaning of general educational and theoretical parts of their studies. Student teachers compared educational studies with their view on mathematics or science as disciplines. The students thought that educational studies were not so intellectually challenging. In a way, educational field was not a real discipline for student teachers as educational knowledge seems to be somebody's opinions and not as exact as knowledge in mathematical sciences.

Educational research

Student teachers did not perceive the connection between theoretical studies and practical issues. The fragmentation of different parts of pedagogical studies seemed to be a problem as the student teachers did not find practice in a classroom to be based on theoretical ones or otherwise. One part of the pedagogical studies is to complete an educational scholarly thesis (bachelor level) which is one of the special characteristics of Finnish teacher education. Thus, some of the student teachers found it difficult to understand the meaning of educational research and felt this part of their studies quite irrelevant for themselves as becoming teachers. However, some students found it interesting as it was something different than they had experienced before. The idea of the reflective practitioner, one the main objectives of the programme, was still quite unfamiliar for student teachers.

Relevance and the meaning of pedagogical studies and new knowledge

The students expected to get new knowledge and to have the feeling that issues discussed in educational courses were something they haven't thought beforehand. The relevance of the studies was evaluated in relation to work experience as a teacher; those who were more experienced had more specific goals and expectations for studies besides that teaching practice were not so crucial for them. Inexperienced ones found it difficult to set goals for their studies and valued teaching practice highly.

Interrelation between peers and teacher educators

They stressed the importance of co-operation with other students and some of them even thought that for the first time during their university studies, they have had an opportunity to get to know other students. The importance of discussions with peers was emphasised. Besides the co-operation with other students, the interrelation between student teachers and their teacher educators seemed to be central. The role of student teacher was not always as independent and self-regulated as the students wanted it to be. Thus, they expected teacher educators to be role models of some kind and to get guidance on their way to teacher profession. After studying many years in subject departments with no compulsory attendance, educational studies seem to be inflexible as study arrangements and group activities mean quite intensive guidance and rules for attendance.

Three different types of student teachers viewing on the pedagogical studies

Besides the main categories and central themes described above, we extracted three different types of students according to commitment to become a teacher, their views on relevance and meaning of pedagogical studies for themselves as becoming teachers and their conceptions of the idea of the reflective practitioner. The result of the student types is preliminary. These three types of student teachers are characterised based on the themes above which emerged during the analysis and the idea is to understand the reasons behind the student teacher's views on pedagogical studies.

Will I ever become a teacher? What is the point of educational studies?

The first type of student teacher is a person who is not committed to or only slightly interested in the teacher profession as well as doubted the relevance of the teacher education programme and educational studies. This type of student is not sure if a career as a teacher were the right choice and he/she want to make decisions after completing the education programme. This kind of student seems to think that participating in the pedagogical studies is the choice while figuring out what he/she wants to really do. As the student is not sure of becoming a teacher, he/she finds pedagogical studies personally irrelevant. Still, the student teacher might find pedagogical studies interesting e.g. because of social interrelations.

The idea of the reflective practitioner and the role of educational research in teacher education are not relevant issues in pedagogical studies for this type of student teacher. It seems to be a problematic situation when the student is made to reflect on his/herself as a becoming teacher within the educational framework. This type of student doesn't see his/herself as a reflective practitioner as reflection and self-evaluation are not the real tools for the development process and he/she might even feel reflective activities intrusive.

I want to become a teacher, but what is the relevance of educational studies?

The second type of student teacher is the one who is convinced of becoming a teacher but still doesn't find pedagogical studies relevant in the development process. This type of student teacher is quite committed to the idea of becoming a teacher and might even think that he/she is already a teacher, especially those who are working while completing the pedagogical studies. The student focuses on those issues in pedagogical studies that seem to be relevant in order to have new, practical information about teaching. Even if the student is committed to the teacher profession, he/she might have difficulty in understanding the meaning of educational studies despite the practicalities and recipes for good practices. The basic idea among these students is that the real development as a teacher takes place in classrooms by experience, after the teacher education programme.

Despite the real interest in the teacher profession, the student finds it hard to commit to reflective activities and self-assessment. Those who expect teacher educators to represent expertise in educational studies are not as comfortable with the reflective approach as those who evaluate the more independent role of the student. It is challenging to evaluate oneself and have the critical approach in the teaching process.

I want to become a teacher and develop myself within the educational studies

The third type of student teacher is the one who is committed to the teacher profession and find pedagogical studies including issues of educational research relevant for professional development. Just like the second type, the third type of student teacher is sure of becoming a teacher and is quite aware of his/her needs and goals for pedagogical studies. The difference between the second and the third type is in the meaning of pedagogical studies in professional development. The third type of student understands the relevance of educational studies including the research-based approach. The idea of completing an educational study of one own is relevant part of studies as well as reflective activities and the critical approach in teaching action.

Even if the student understands the idea of educational studies and theoretical approach, practicalities are still highly evaluated. This type of student finds practical issues to be important but also expects to find the connections between the theoretical approach and practice. Only then, practical issues have something to do with professional development. The student emphasises the active role of the student in learning and understanding new things in pedagogical studies. However, the student thinks that the role of teacher educators should be varying according to issues and situations dealt in courses.

Discussion

In this research, we have focused on student teachers' views on the coherence and relevance of pedagogical studies within mathematics and science teacher education programme. As student teachers' conceptions of teaching and teacher education as well as their reasons for becoming teachers affect teacher education, teacher educators should be aware of this starting point and take it into consideration when implementing the programme (e.g. Haritos 2004, Trotman and Kerr 2001). The results of educational research focused on this issue vary and there are several suggestions to improve teacher education in order to enhance student teachers' professional development and support student teachers to

achieve their goals as to become a good teacher (Younger et al. 2004, Davies and Ferguson 1997). In order to understand better the way student teachers experience their pedagogical studies, we have focused on exploring student teachers' views and especially, tried to find out the reasons for those views. The views should be taken into consideration while implementing the study programme; the idea of the research is to evaluate the way the programme is carried out and to consider what could be done in future.

According to the interviews of student teachers, six main themes related to pedagogical studies were emphasised. Some categories supported the results of former educational studies like experience of fragmentation when coherence and the meaning of pedagogical studies are not clearly internalised (e.g. Younger et al. 2004, Kosunen and Mikkola 2002, Brandsford et al. 2000). We want to focus on a few themes that arisen and which seem to be special characters for Finnish teacher education. The student teacher's emphasised the problematic role of educational research and research-based approach in the teacher education programme (c.f. Gore and Gitlin 2004). Firstly, they were not familiarised with educational discourse and knowledge to understand the nature of education as a discipline. As the student teachers studied mathematics or science for several years in subject departments, they actually defined educational research as an opposite to exact and clear discipline, as 'somebody's opinions' (c.f. Ratcliffe et al. 2005). Secondly, even if completing a scholarly thesis in education should be a central part of the Finnish teacher education programme, student teachers found it irrelevant for becoming a good teacher. However, recipes and teaching practice alone wouldn't be enough because many students lack the reasoning and theoretical basis.

The other category stressed by student teachers was interrelations between student teachers and teacher educators besides interrelations among student teachers. Some student teachers thought that they were missing the academic way of studying but they still wanted to have instruction and guidance. Discussions and co-operation with other student teachers were highly valued. At the same time, the meaning of educational knowledge and added value of contents that had been discussed were not clearly internalised. It seems to be controversial in a way, especially as student teachers experienced attendance and inflexible study arrangements as problems in the teacher education programme.

The other issue of this research was to understand the reasons of student teachers' views. We have formed three types of student teachers according to commitment to become a teacher, views on relevance and meaning of pedagogical studies for themselves as becoming teachers and their conceptions of the reflective practitioner. Especially those student teachers who are not well committed to the idea of becoming a teacher are a challenge for teacher educators (c.f. O'Brien and Schillaci 2002). Even if these unmotivated student teachers are encouraged and supported in their educational studies, they find it difficult to understand the meaning of contents in teacher education or build up the connection between their personal views and professional perspectives. On the basis of these three preliminary types of student teachers, it is possible to understand better the variety of views and experiences that student teachers have.

Even if teacher education has been a focus of educational research widely, it is important to examine different teacher education programmes with special characteristics. In this research, the evaluation is focused on Finnish secondary teacher education, especially on the pedagogical studies in mathematics and science. On the basis of the results, it is possible for teacher educators to develop the implementation of the programme in a way that the objectives and the special

value of the educational studies could be more easily achieved. Finnish teacher education is supposed to be research-based at all levels concluding the idea of the highly valued role of educational research and the idea of a teacher as a reflective practitioner. It would also be interesting to examine the relationship between views on educational studies and subject discipline. It would also be of great interest and importance to compare the views and experiences which teacher educators and student teachers have in pedagogical studies. The results of this paper will uncover the aspects that should be considered carefully while designing the interviews of teacher educators as a part of evaluation process in future.

References

- Anderson, R. and Mitchener, C. (1994), 'Research on Science Teacher Education' in: Gabel, D. (ed.), *Handbook on Science Teaching and Learning*, New York, Macmillan, 3-44.
- Bransford, J., Brown, A. and Cocking, R. (eds) (2000), *How People Learn: Brain, Mind, Experience, and School*, Washington, D.C., National Academy Press.
- Davies, R. and Ferguson, J. (1997), 'Teachers' Views of the Role of Initial Teacher Education in Developing their Professionalism' in: *Journal of Education for Teaching*, 23 (1), 39-56.
- Denzin, N. and Lincoln, Y. (2000), 'Introduction. The Discipline and Practice of Qualitative Research' in: Denzin, N. and Lincoln, J. (eds.), *Handbook of Qualitative Research*, Thousand Oaks, Sage Publications, 1-28.
- Fajet, W., Bello, M., Leftwich, S., Mesler, J. and Shaver, A. (2005), 'Pre-service teachers' perceptions in beginning education classes' in: *Teaching and Teacher Education*, 21, 717-727.
- Gore, J. and Gitlin, A. (2004), '(Re)Visioning the academic-teacher divide: power and knowledge in the educational community' in: *Teachers and Teaching: theory and practice*, 10 (1), 35-58.
- Guyton, E., Saxton, R. and Wesche, M. (1996), 'Experiences of diverse student in teacher education' in: *Teaching and Teacher Education*, 12 (6), 643-652.
- Hagger, H. and McIntyre, D. (2000), 'What Can Research Tell us about Teacher Education?' in: *Oxford Review of Education*, 26 (3-4), 483-494.
- Haritos, C. (2004), 'Understanding teaching through the minds of teacher candidates: a curious blend of realism and idealism' in: *Teaching and Teacher Education*, 20, 637-654.
- Kosunen, T. and Mikkola, A. (2002), 'Building of Teaching: how objectives and reality meet in Finnish teacher education' in: *European Journal of Teacher Education*, 25 (2-3), 135-150.
- O'Brien, L. and Schillaci, M. (2002), 'Why Do I Want to Teach, Anyway? Utilizing autobiography in teacher education' in: *Teaching Education*, 13 (1), 25-40.
- Patton, M. Q. (2002), *Qualitative Research & Evaluation Methods* (3rd edition), Thousand Oaks, Sage Publications.
- Ratcliffe, M., Bartholomew, H., Hames, V., Hind, A., Leach, J., Millar, R., and Osborne, J. (2005), 'Evidence-based practice in science education: the researcher-uses interface' in: *Research papers in Education*, 20 (2), 169-186.
- Richardson, P. and Watt, H. (2005), 'I've decided to become a teacher': influence on career change' in: *Teaching and Teacher Education*, 21, 475-489.
- Trotman, J. and Kerr, T. (2001), 'Making the Personal Professional: pre-service teacher education and personal histories' in: *Teachers and Teaching: theory and practice*, 7 (2), 157-171.
- Younger, M., Brindley, S., Pedder, D. and Hagger, H. (2004), 'Starting points: student teachers' reasons for becoming teachers and their preconceptions of what this will mean' in: *European Journal of Teacher Education*, 27 (3), 245-264.

