

PhD Education in Educational Sciences in Finland: Systematic Development of the Programs

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Abstract: PhD education in the educational sciences, teaching and supervision, studies and quality control in Finland are described in the context of science and mathematics education research. First, the aim and basic processes of the PhD studies are briefly introduced with the focus on educational sciences. Second, the development of the studies is outlined. Third, some important recent decisions and practices considering the PhD education are presented and discussed. During the years 1995 ... 2013, a national network-type graduate school system, financed by the Ministry of Education, was developed and operated. In the beginning of year 2014, the national resources for organising PhD education are allocated to the university level PhD schools and programs.

An Overview of PhD Studies in Finland

There is a long tradition of PhD/doctoral education in the educational sciences in Finnish universities with its origins in the 18th century. However, the formal “training” of PhDs in the educational sciences started in the 1950s (Husso, 2005). The general aim of the PhD studies has always been to provide students with an in-depth knowledge of the field of research and the capability to produce novel scientific knowledge independently. PhD studies are in charge of the faculties of Finnish universities (Ministry of Education, 2000).

Since the 1950s, students have had the option of applying for PhD/doctoral studies in educational sciences after the relevant second-cycle degree by writing a research and study plan. The application have been and is accepted by the faculty council based on its evaluation by the main supervisor, or nowadays, by a PhD selection committee. In Finland, funding for studies is not required: some students are working in PhD student positions, some on research projects, some in PhD programs and others have a scholarship. However, most of the students are part-time students. A student has one main supervisor (a professor of a faculty) and another supervisor. The main supervisor is responsible for supporting the planning of the PhD studies. A personal study plan is devised for each student.

Nowadays, the studies take approximately four years of full-time study to complete. The studies consist of one year (60 credit points) of “formal” studies and conducting the PhD research project, which demonstrates independent and critical thinking. The project should be published as a PhD thesis. The formal studies consist of studies in research methodology, philosophy, studies in the discipline and academic writing courses. In addition, students participate in a research seminar and conferences abroad. A more detailed description of the science education research program is offered below.

Before the public examination of the PhD thesis, the faculty nominates two pre-evaluators who evaluate the PhD thesis manuscript. In their evaluation, the pre-evaluators write a recommendation to the faculty. Based on this recommendation, the faculty might authorize printing of the PhD thesis manuscript. For the public examination, the faculty nominates a chairman, custos (typically the main supervisor), and an opponent, or in some cases, two opponents. The public examination begins with an introductory lecture (lectio praecursoria) of at most 20 minutes given by the candidate. In the lecture, the candidate will introduce his or her dissertation and the research methods used. After the introductory lecture,

the opponent will make a short statement about the scientific status and significance of the dissertation and other general issues. In the actual examination, the opponent will discuss the dissertation, commencing with its title and proceeding to the methods, sources and conclusions. The candidate will respond to the comments made, defending his or her choices, conclusions and results. Finally, the opponent makes a statement and announces that he or she will propose to the faculty that the dissertation be accepted. Based on the recommendation of the opponent, the faculty accepts and the thesis. The grading scale is 7 point scale. The grade is recommended by the grading committee, consisting of the opponent and one faculty member.

The Graduate School System during the Years 1995–2013

The first network-type graduate school system was established in Finland in 1995 through a coordinated effort of Finnish universities, which was financed by the Ministry of Education. The money was allocated for salaries, conference travelling and activities, such as common courses. The graduate school system was established in order to shorten study time, and to increase national and international cooperation. In addition to full-time students, there were also typically part-time students, financed by other scholarships or by students' personal money, participating in the research training offered by the particular graduate school. In 2007, there were altogether 119 graduate schools with 1,500 postgraduate positions in Finland. Traditional PhD education was organised in parallel with graduate schools (Ministry of Education, 2006).

The *Finnish Graduate School of Mathematics, Physics and Chemistry Education* (1995–2011) was established in 1995. The school was established by five universities and their 18 departments. The partner departments included both subject departments, such as physics, and teacher education departments/educational departments; therefore, students were able to obtain their degree either in the mathematics and science faculties or in the faculty of education. Typically, one of the supervisors would have specialised in mathematics, physics or chemistry and the other in education. Consequently, the school was interdisciplinary. In the beginning, the goal set by the school was to deal with the development of mathematics, physics and chemistry teaching in schools and the competence of mathematics and science teachers to teach these subjects. In 1995, there were four full-time students, with the number increasing to 10 by the beginning of 1998. At the same time, the number of member universities increased to seven and the number of member departments to 23. The number of part-time students studying in the graduate school varied from 55 to 75 (Lavonen & Strömdahl, 2008).

The *Finnish Graduate School of Mathematics, Physics and Chemistry Education* was aiming to bring together the researches of mathematics, physics and chemistry education in Finland to form a pool of supervisors for training experts in these fields in the graduate school, while providing a broad scientific education. The educational environment was comprised of research groups with international profiles and international research contacts. In practice, two times a year the graduate school organised one-week common courses. The topics of the courses were, for example, writing scientific text, research methodology and the philosophical basis of educational research. Because the students' projects were interdisciplinary, the supervision was challenging with the need to focus on problems where both deep subject and pedagogical knowledge were required. Supervision was provided on a local basis as well as within the network of supervisors working in the partner institutes. In Finland, since the inception of the graduate school system, nearly 100 PhD theses in mathematics, physics and chemistry education research have been published; among these, 40 were completed within the graduate school by full-time students.

Establishing University-Level PhD Schools and Programs in 2014

In 2012, the Ministry of Education decided to close the Finnish network-type graduate school system and allocate resources directly to the universities and their faculties. The University of Helsinki decided to establish four PhD schools with the aim of improving PhD education and enhancing its international visibility. The research fields of the four schools do not follow faculty or campus structures, but schools comprise PhD/doctoral programs that are closely related in terms of their scientific foundation. From the beginning of year 2014, altogether 32 PhD programs started to operate under these four PhD schools. At the same time all 4800 PhD students at the University of Helsinki were transferred to the PhD programs and 200 new PhD student positions were filled. In future the PhD programs are responsible for teaching and supervision to PhD students. Approximately half of all PhD students have a full paid PhD student position or a position at a research project. Another half of the PhD students are studying as part time students.

Immediately after closing the *Finnish Graduate School of Mathematics, Physics and Chemistry Education*, researchers in science education at the departments of teacher education, physics, chemistry and biology, started to plan a new type of program for PhD education in science education research. However, an independent program was not accepted by the university but PhD education in science education research was accepted as a sub program to the *Doctoral Programme of School, Education, Society and Culture (SEDUCE)*¹. The aim of the multidisciplinary SEDUCE is to provide PhD candidates with an in-depth knowledge on research-based teaching and learning.

The following paragraphs will briefly describe how the science education research community at the University of Helsinki will organise a PhD education as a part of the SEDUCE. The aim for PhD studies in science education research is similar to the graduate school period: *to provide PhD candidates with an in-depth knowledge of science education research and the capability to produce novel scientific knowledge independently*. The PhD education brings together the researches of science education to form a pool of supervisors for training experts in science education research.

In the research groups of the different departments, PhD education is conceived as an integral part of the research carried out in the groups. Consequently, the PhD education, supervision and guidance take place within the day-to-day workings of the research. This mode of PhD instruction is considered suitable for small research groups sharing interests and close collaboration. The PhD students are already integrated into the research collaboration, research networks and research communities from the beginning of their academic careers. However, the practice varies between the various research groups.

The PhD students will and are coached to communicate their research in international conferences and publications. The aim is that a PhD candidate participates and gives a presentation in one to three national and international conferences a year, submits papers in international refereed journals (usually with a success rate of one out of two submissions accepted) and additionally publishes two papers in refereed conference proceedings. This helps to maintain good quality standards of scientific communication, enable professional peer-to-peer feedback of research results and methods, and in a very natural way, help PhD students become acquainted with professional means of communication during their PhD studies. This mode of combining research and PhD education follows more or less the same pattern as the PhD education in subject (physics, chemistry and biology) departments in general, but is somewhat typical in the field of educational sciences. These “heavy” science

¹ <http://www.helsinki.fi/behav/seduce/index.htm>

traditions have also been followed in many research groups at the department of teacher education, especially in science and mathematics education research groups, as well as the educational psychology research group.

During the planning phase of the PhD education, a special emphasis was made on the quality of supervision of the PhD students. Five approaches were recognised to uphold the quality of the supervision, research and collaboration within the partners participating in the PhD education:

1. *Recruitment and selection of PhD students.* In the selection of PhD candidates for PhD education, general rules of the University of Helsinki will be followed. Selection is based on the research plan, publication and study plan. Moreover, the research plan should be in the focus areas of research of the community. These focus areas of research were recognised through an iterative process. In this process, the needs of society and the strengths of the research were taken into account.
2. *Supervision of PhD students:* Each PhD candidate has a main supervisor (professor, responsible for the student's studies) and one to two other supervisors. The educational environment comprises sub-research groups in each participating department with international profiles and researcher contacts. The supervisors publish in conjunction with PhD students in international journals and books. Since the candidates and research projects are interdisciplinary and focus on themes where both deep subject and pedagogical knowledge are needed, the researchers in the research projects and the candidates' supervisors, in some cases, cross organisational boundaries or departments. There are seminars and national meetings where PhD students and supervisors from different departments interact with each other.
3. *Good practises, research group collaboration, courses and quality assurance in PhD education.* The senior PhD student researchers participate in the national and international seminars or other activities two or three times a year. The topics of the courses are, for example, scientific writing and the philosophical basis of educational research. Evaluations or feedback of the PhD students will be collected, analysed and discussed in order to develop the courses.
4. *Collaboration with national and international graduate schools/PhD programs and training courses.* An important part of the PhD education will be organized through research projects and joint activities, such as courses in research methodology and scientific writing. Up until now, during the national network graduate school, international collaboration has been fruitful for PhD students. PhD students and senior researchers have actively participated in international conferences, such as EARLI, CERME, PME, ICME, NARST, AERA, GIREP and ESERA. Long-term collaboration with the graduate schools at the University of Duisburg Essen, Germany and the Swedish National Graduate School in Science and Technology Education Research (FontD) and other institutes, such as Tallinn, Tartu and Oslo universities, have been organised. PhD courses have also been organised in Nordic co-operation.
5. *Assuring good career prospects for the PhD students/new doctorates.* The PhD education aims at supporting PhD students in acquiring a wide-range of research knowledge and skills in addition to concentrating on a specific research area: PhD students are to become expert, autonomous researchers in the future.

Challenges of PhD Education in Science Education Research

During the national graduate school program period, a solid mechanism for collecting, analysing and discussing feedback of the PhD courses and supervision was developed in the *Finnish Graduate School of Mathematics, Physics and Chemistry Education*. The student

feedback was analysed and used for improving PhD education in order to better address the needs of individual students with various backgrounds. According to this feedback, the challenges in maintaining and developing the quality of PhD education were recognised:

- 1) the different needs of PhD students working on their degree part-time alongside their everyday work and full-time students;
- 2) recognising a common basis and themes for the research methodology courses;
- 3) integrating the research interests of the research groups and individual PhD students in order to create a basis for fruitful cooperation and supervision;
- 4) the consolidation of various traditions of PhD education at university departments;
- 5) to continue to develop the recruitment of PhD students in order to guarantee the quality of PhD students.

Several challenges recognised in previous analyses based on the PhD students' feedback have been transformed as aims for the PhD education as described in the previous chapter.

However, there is a continuous need for collecting the opinions of students and analysing this feedback in research groups. Moreover, practises on how to listen to employees' voices on the competence of the new PhDs should be developed.

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