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The First Years of Teaching Physics in Swedish Upper Secondary School

What New Physics Teachers Experience That They
Lack in Their Education

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Abstract

This thesis aims to investigate the experiences of new physics teachers in Swedish upper secondary schools in Gothenburg. The study uses a qualitative method where nine active teachers were interviewed. This study's contribution is to highlight what the teachers themselves feel they lack from their own education. I found out that the teachers felt they lack both teaching knowledge (practicing more teaching and grading methods) and subject knowledge (both content knowledge and knowledge about laborations). They also mentioned that practicum experiences can be very different depending on which school you have your practicum in. In the discussion I formulate a number of hypotheses that address the findings of the study and suggest how new physics teachers can be more prepared for the challenges that the teaching profession presents.

Keywords: physics, teachers, first years, upper secondary school, high school, education, practicum, learning, Sweden, Swedish

Disclaimer

This thesis started as part of a group project that I and Gustav Bohlin started together. Therefore the method chapter is almost identical in this thesis and Gustav's thesis (Bohlin, 2017) since we did all the planning and conducting of the interviews together.

His thesis focused on the teachers' high workload, if and how they cooperated with colleagues, how they perceived the support of their school management as well as how the teachers felt about their opportunities for professional development while this thesis focused on what the teachers felt they lacked in their own education.

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Chapter 1

Introduction

1.1 Background

The Swedish school system has recently been a hot topic in Sweden because of the rapidly falling results in PISA, the worldwide OECD study of 15-year-old's performance in mathematics, science and reading (see Figure 1.1 for an illustration of the declining PISA results). In fact, no other country participating in PISA has seen a steeper fall (OECD, 2015b). Due to these troubling circumstances the Swedish government requested that OECD review the Swedish school system in 2014 (OECD, 2015b). In the report *Improving Schools in Sweden* (OECD, 2015a) released in the aftermath of this request OECD identifies three areas of improvement for the Swedish school system, namely:

- Establish the conditions that promote quality with equity across Swedish schools.
- Build capacity for teaching and learning through a long-term human resource strategy.
- Strengthen the steering of policy and accountability with a focus on improvement.

Of special interest to this thesis is the second bullet point. In a press release related to the report OECD further recommends that Sweden needs to:

Improve the quality and attractiveness of the teaching and school leadership profession. Only half (53%) of lower secondary teachers would choose the same career if they could decide again, partly

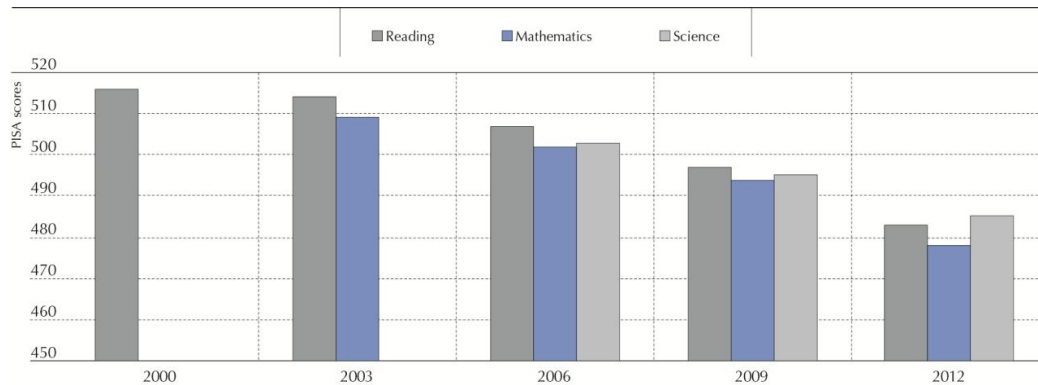


Figure 1.1: A diagram showing Swedish PISA results. The diagram comes from the OECD report *Improving Schools in Sweden*.

due to the heavy workload and relatively low salaries for experienced teachers. School leaders and their employers should prioritise pedagogical leadership and encourage greater co-operation among teachers and invest more in professional development. A publicly-funded National Institute of Teacher and School Leader Quality would help improve recruitment and the quality of teaching and leadership in the education system. (OECD, 2015b)

This thesis is part of a group project that I and Gustav Bohlin started together. He is my classmate and we planned and conducted the interviews together. Differences in our school, work and home conditions have prevented us from finishing the thesis together, however. Gustav’s thesis (Bohlin, 2017) focused on the teachers high workload, if and how they cooperated with colleagues, how they perceived the support of their school management as well as how the teachers felt about their opportunities for professional development.

In this thesis I explore what new physics teachers in Swedish upper secondary school experienced during their first working years. I have identified some specific parts that the teachers realized they lacked in their education or things they wanted to learn more about to be able to feel comfortable in their profession. My hope is that this thesis could make a small contribution to tackling the challenges of preparing new teachers for their profession.

1.2 Purpose

The purpose of this study was to *explore* how new physics teachers in Swedish upper secondary school experienced their first working year. We have tried to

identify some of the challenges and difficulties that the teachers experienced during their first years in the profession. Furthermore, we have looked at what kind of support the teachers felt that they had gotten from other teachers as well as their school managements. Our hope was that we would be able to gain insights which possibly could help school managers and politicians improve the teachers working conditions and thereby increase the reputation and attractiveness of the teaching profession.

1.3 The research questions

As I explained in 1.1 this thesis is part of a group project and in this thesis I have tried to answer the following research questions:

- What does new physics teachers experience that they lack in their education?
- Is there a specific part in the teachers education that need more focus?
- How can new physics teachers prepare to make their entry into the profession easier?

1.4 Selection Criteria

We limit our research to only focus on teachers meeting the following criteria:

- Teach physics
- Teach in upper secondary schools
- Teach in the Gothenburg region
- ≤ 5 years of teaching

Chapter 2

Literature review and previous research on the subject

I have looked at research about teachers experiences their first years. In this chapter I will summarize my findings from the following articles:

- *Vad bidrar lärarutbildningen till i scialiseringen till lärare?* (Jönsson, 1998)
- *Nya lärares upplevelser av arbetsplanering och mentorskap under ett år* (Lindgren, 2003) and *På väg mot en yrkesidentitet* (Lindgren, 2006)
- *Lärare och specialpedagoger värderar sin utbildning* (Erixon Arreman, 2008)
- *En hållbar lärarutbildning* (SOU 2008:109, 2008)
- *Challenges New Science Teachers Face* (Davis et al., 2006)
- *Teacher Education is not Enough!* (Cruickshank & Metcalf, 1994)

A study about trainee teachers (Jönsson, 1998) showed that the students uncertainties for the teacher profession were mainly concerned with parental contact, pupils in need of special support and that they wouldn't be respected. Lindgren (2003) also writes that the teachers spoke about their uncertainties about parental contact and student conflicts with their mentors. These challenges still remains after their first year (Lindgren, 2006)

According to Lindgren (2006) all of the interviewed trainees feel that they lack something from their education. The trainees choice of discussion during the interviews reflects to some extent what they lacked in their education,

so the experienced teachers (mentors) could be a good complement to their (the trainees) education.

Lindgren (2006) also writes that the teachers planned mostly for teaching during the first year. But the teachers she studied have become better at planning both long-term and short-term after the first year. They had also started planning more for development talks, parental contact, etc.

In 2007, a survey of 2001 and 2006 graduate student teachers at UMEÅ University was conducted. (Erixon Arreman, 2008) The questionnaire contained questions about, among other things, how well the teachers thought that the education corresponded to the teaching profession and to what extent one felt confident in the various parts of the teaching profession. The respondents were also asked about which parts should be strengthened in the teachers education. For the more specific questions, I have chosen to only look at the results from the high school teachers because they are the ones that are relevant in my thesis.

Some of the lower results are found in the question regarding knowledge in documentation, assessment and evaluation of students' learning. Only 16% of upper secondary school teachers answered at the higher levels (5-6 on a 6-point scale) while 62% answered at level 3-4. Regarding the question about grading students, as many as 39% of upper secondary school teachers answered at the lowest levels (1-2).

When the teachers were asked to mention things that should be strengthened in the teacher education, *methods for teaching* and *practicum* were mentioned by more than half of the respondents.

The Swedish government investigations (SOU 2008:109, 2008) also show that teachers do not feel prepared for assessment and grading. Another part of the teaching profession where teachers feel ill-prepared is personal development dialogues with students and their parents.

Davis et al. (2006) look at the challenges that science teachers face in their first years in their profession. They go through 112 papers and make a systematic catalogue of the challenges to help those educating the teachers:

If teacher educators do not understand their learners' needs, then their instructional approaches will be hit-or-miss.

According to their research about 20% of the science teachers below the age of 30 leave the profession. They argue that one of the reasons is that the expectations of the new science teachers is almost the same as for the experienced teachers, except with less efficiency. Science is a very broad concept and Davis et al. found multiple papers *indicating that new teachers have relatively weak understandings of science overall*. Many papers also showed knowledge gaps in one or a few parts of the teachers science discipline.

Other themes that Davis et al. lists is *understanding learners* (students), *instruction* (how to teach) and *creating effective science learning environments*.

Cruickshank and Metcalf (1994) lists 10 abilities needed for effective teaching and even though they don't focus on specific science teachers they find almost the same themes as Erixon Arreman (2008). Two of the themes are planning and conducting instruction, they point out that several papers show that the educators teach and describe some methods for instruction, but the students never practice how to use them. What Cruickshank and Metcalf wants to show through their report is that it is not enough for teacher education to just teach about different methods and skills in the teaching profession, but it is also important for future teachers to practice these methods and skills before they have to teach on their own.

Based on my literature study, I can see that my thesis builds on earlier research by focusing on high school teachers and especially swedish physics teachers. This field has a low coverage in the literature that I have found.

Chapter 3

Method

As I described in section 1.1 this thesis was a group project from the beginning and I and Gustav planned and conducted the interviews together. Therefore, this chapter is mostly the same as in his report.

3.1 A short introduction to qualitative research

According to Merriam (2002)

The key to understanding qualitative research lies with the idea that meaning is socially constructed by individuals in interaction with their world. The world, or reality, is not the fixed, single, agreed upon, or measurable phenomenon that it is assumed to be in positivist, quantitative research. Instead, there are multiple constructions and interpretations of reality that are in flux and that change over time. Qualitative researchers are interested in understanding what those interpretations are at a particular point in time and in a particular context. Learning how individuals experience and interact with their social world, the meaning it has for them, is considered an interpretive qualitative approach.

Qualitative research relies on technique and systematization but intuition, spontaneity and immersion are important aspects of qualitative research as well, according to Johannessen and Tufte (2003). They argue that good qualitative studies needs to be conducted using both of these quite different sets of skills. Furthermore, *the researcher is the primary instrument for data collection and data analysis*.

The purpose of this study was to *explore* physics teachers experiences during their first working year. Because of the *explorative* nature of the

study we naturally chose a qualitative approach. We initially had a quite open scope of research together with quite a collection of different potential research questions all loosely related to the subject of challenges during the first year, co-operation with colleagues and support from school management. We tried to keep an open mindset and “cover as much ground” as possible in our interviews.

3.2 The interview

In this section we write about how we have designed and carried out the interviews. In doing so we have relied heavily on the books *Interviews* by Kvale, *Qualitative Research Practice* by Ritchie and Lewis, *Introduktion till samhällsvetenskaplig metod* by Johannessen and Tufte and *Lära till lärare* by Dimenäs et al. We have also had great help from our supervisor Jens Kabo who has many years of experience with conducting research using interviews.

Kvale (1996) states that the purpose of the qualitative research interview is to obtain “qualitative descriptions of the life world of the subject with respect to interpretation of their meaning”, (p. 124).

In an interview situation the researcher unconditionally becomes a “participant”. It can be argued that, as a researcher, being immersed in the interview with all that it brings, like being able to adjust your questions according to the situation, the data becomes richer. We have had a guide for our interviews.

One important point made by Kvale (1996) is that “the interviewer must establish an atmosphere in which the subject feels safe enough to talk freely about his or her experiences and feelings”, (p. 125).

Before the interviews we had had mail contact with all the teachers. In the e-mail we had stated that the purpose of the interview was to research physics teachers first time in the profession as a part of our master’s thesis.

We started every interview by telling the participant that we wanted to explore. We did very little of the talking, and was very careful not to put words in the interviewees mouths. The interviews were followed by a debrief where the interviewer could talk more freely. We have not included the topics of the debriefings in our analysis. They often fell outside of the topic of this thesis and were performed mostly as a pleasant way to end the interview (both for us and the interviewee, we believe).

We carried out all of our interviews at the schools of the teachers during working hours. When we conducted the interviews we made sure that there was plenty of time set aside for the interview, so that the interviews could

be conducted in a calm and pleasant manner. We had made sure to tell the interviewees that we would need an hour of their time when we in fact knew from the pilot interview that it was very unlikely that we would need more than 40 minutes. The interviews did indeed end up lasting about 33 minutes on average, including some time for debriefing.

During most of the interviews we were both attending. It could be argued that this creates an even greater power imbalance between interviewer and interviewee, but we felt that the nature of the conversations during the interviews were very pleasant, and we would like to argue that the fact that we were two did not create any unpleasant feelings for the interviewee.

According to Kihlström (2007) it is important to not direct the interviewee or to ask leading or suggestive questions. She argues that to avoid this it is important to be aware of your own pre-conceptions of the subject at hand.

3.2.1 Ethical considerations

We have abided to the ethical recommendation made by The Swedish Research Council (Vetenskapsrådet), which can be found in the report *Forskningsetiska principer inom humanistisk-samhällsvetenskaplig forskning*. These recommendations can be summarized in four requirements on

- information
- consent
- confidentiality
- use of the data.

To fulfill these requirements we have informed all participants of the purpose of the study. We have gotten their consent to participating and to being recorded. We have also not unnecessarily saved or recorded any data that could be used to identify any of the teachers. In our transcriptions of the interviews, for example, we have omitted both names and genders. While writing this report we have been careful not to mention anything that could be damaging to any of the teachers or anything that could be used to track and identify the source of the quotes. Lastly, these requirements mean that the data will not be used for anything other than for research purposes.

3.2.2 Pilot interview

To evaluate the initial interview protocol we performed a pilot interview. The teacher we interviewed was personally acquainted to us and did not fit

the selection criteria that we applied to the rest of the teachers. After the pilot interview we sat down and discussed the outcome together. We tried to evaluate how much “coverage” each topic had gotten, how we had asked questions, if there were leading questions, etc. We were quite satisfied with the outcome of the interview and only did minor changes to the protocol (mainly re-ordering/structuring as well as writing out several support questions).

The results from the pilot interview is not included in the results chapter since the interviewee didn’t match our selection criteria.

3.2.3 Finding physics teachers for our interviews

To find teachers to interview we compiled a list of the 23 upper secondary schools in the Gothenburg region that offers the natural sciences program (Gymnasium.se, 2015). We then looked at the schools’ websites for contact information to individual physics teachers. We found contact information to physics teachers at 11 of the 23 schools. Some of the teachers on the list were omitted because we knew the teachers and therefore knew that they would not be suitable candidates for our interviews (due to too many years of experience in the profession).

When we had compiled a list of suitable candidates, we e-mailed all the suitable candidates asking if they could help us with our thesis by talking to us about their experiences. As described in section 1.4 we requested teachers with up to 5 years of experience in our e-mails. In the end we found 8 teachers, all from different schools, who were willing to talk to us.

When we conducted our interviews we discovered that two of the teachers had more than 5 years of teaching experiences. We also discovered that it is somewhat tricky to define exactly *when* the first year of teaching physics was. Most of the teachers we interviewed had been working part-time as teachers while still studying. Many of them had also changed workplaces a lot during their first year in the profession and some of the teachers were not licensed yet, despite having finished their educations, due to the incredibly slow bureaucracy involved in applying for your teaching license. However, we do not think that this is a big problem. We can safely say that that all the teachers were relatively new and that all the interviews were about their early teaching experiences.

3.2.4 Performing the interviews

The interviews were conducted in a semi-structured form. We had brought our pre-constructed interview protocol with us which contained different pre-written questions organized under headlines with the different topics that we

wanted to cover in the interview. The topics were:

- Overall experience during the first year
- Workload and time allocation for different tasks
- Anything lacking from the teacher’s own education
- Co-operation with colleagues
- Support from school management

Both the topics and the pre-written questions originated from a brain-storming session which we conducted after our initial literature study, once we had narrowed down our research questions slightly. The pre-written questions were included because, during the pilot interview, we found that having questions written out helped us to not ask questions in a leading manner.

The interviews were always started in the same manner. First we informed the interviewees of the purpose of our study, as is appropriate according to the ethical guidelines outlined in Section 3.2.1. We stated something in the following manner:

We want to study how the first years as a physics teacher are. We have a focus on the support that you get from your workplace, school management, colleagues, mentor and so on. We are also interested in the opportunities for professional development and in-service training. We ask you to primarily think about your work as a *physics teacher*.

Vi vill undersöka hur de första åren som fysiklärare är. Vi har ett fokus på stödet som man får av sin arbetsplats, skollädaingen, kollegor, eventuell mentor och så vidare. Vi är även intresserade av möjligheter till kompetensutveckling och fortbildning. Vi ber dig tänka framförallt på ditt jobb som fysiklärare.

The exact wording of the purpose statement might have differed slightly from interview to interview, but the message has always been the same.

By starting the interviews in this manner we have “primed” our subjects to think, which naturally effects the topics that the teachers talk about. By “priming” our subjects, many of them would spontaneously cover many of the topics outlined in the guide spontaneously, without having to be explicitly asked about them.

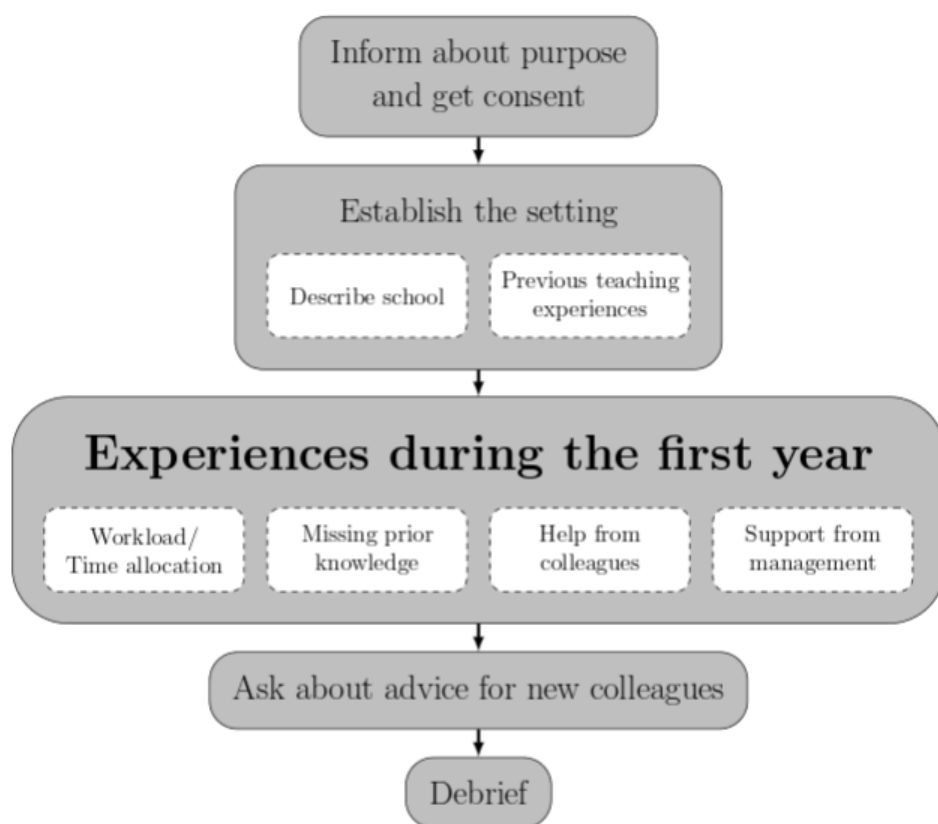


Figure 3.1: A schematic illustration of the interview structure.

3.3 Analysing the interview data

According to Johannessen and Tufte (2003) the main goal of a qualitative data analysis is to compress, systematize and organize the data in order to be able to develop an interpretation of the data. To analyse our transcribed interviews we have used “a general inductive approach for analysing qualitative evaluation data” which is a method that is outlined in the paper “A General Inductive Approach for Analyzing Qualitative Evaluation Data” by Thomas (2006). The method is pretty straight forward and the procedure is as follows:

1. Prepare the transcriptions for reading (i.e. format all the interview transcriptions in a common fashion, filter out patterns of speech such as ‘um’ or ‘sort of like...’, insert extra paragraph breaks, bold-font interviewer questions, etc.).
2. Do a close re-reading of the texts to gain familiarity and understanding of the data.
3. Highlight segments of text that are *relevant to the research question* and label them according to theme. *Multiple labels per text segment is allowed.*
4. Sketch out relationships between themes to organize them in networks, hierarchies (possibly with overarching themes and several sub-themes) or causal sequences. Reduce overlap and redundancy by merging themes.
5. Continue revising and refining the system or model of the themes.

There are two major differences to other typical approaches to quantitative coding (Thomas, 2006), namely that one segment of text may be coded with more than one theme and that a considerable amount of text may not be coded at all due to not being relevant to the evaluation objectives.

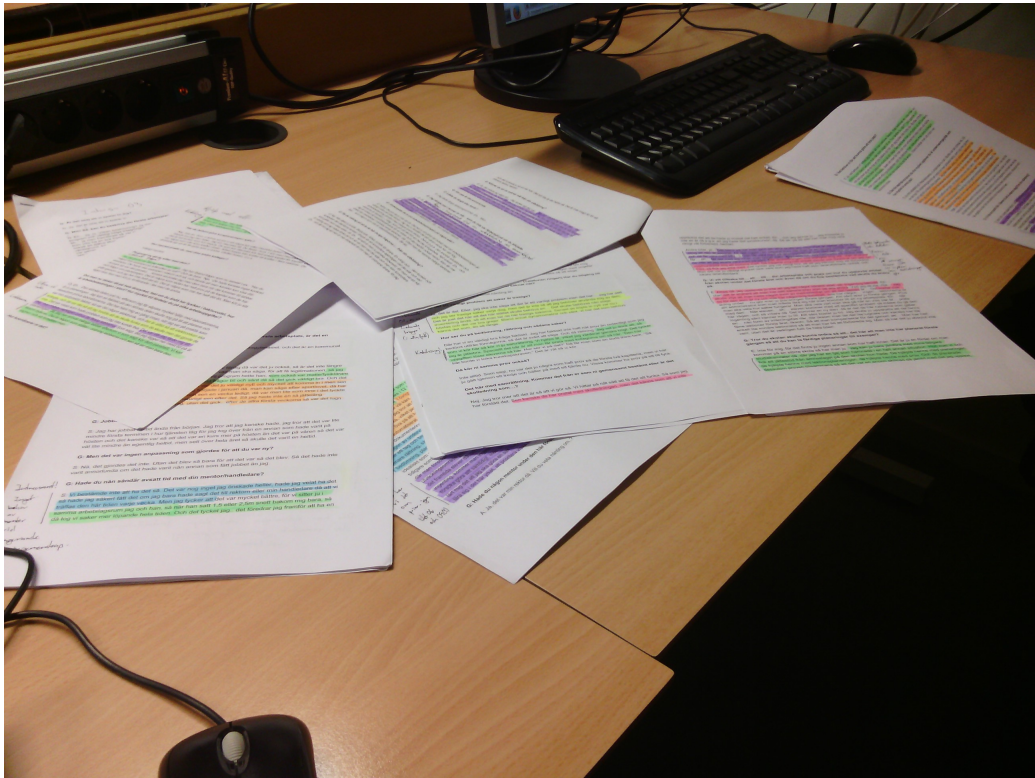


Figure 3.2: This picture shows the transcribed interviews being coded with several different themes using marker pens as outlined in step 3 of the "general inductive approach for analyzing qualitative evaluation data" (Thomas, 2006).

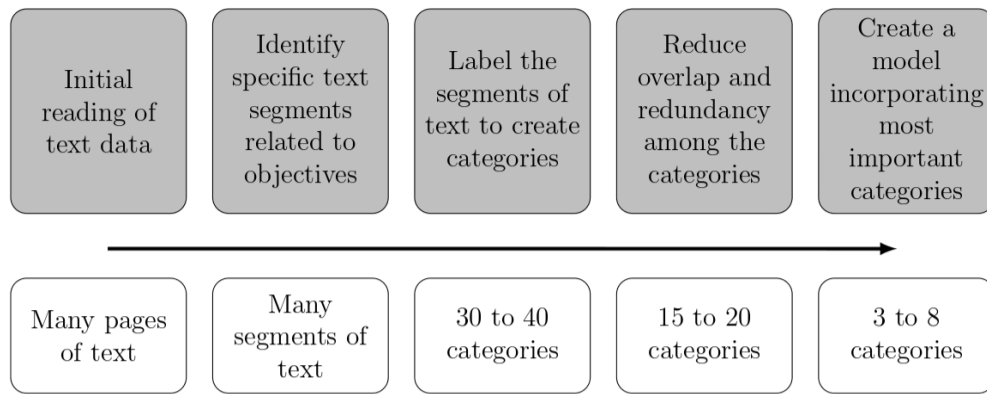


Figure 3.3: The diagram shows an outline of the data analysis procedure. The diagram is an adaptation of a table found in the article “A General Inductive Approach for Analyzing Qualitative Evaluation Data” by Thomas (2006).

Chapter 4

Results

In this section I want to summarize my findings. After I did the analysis described in 3.3 I found that the answers about what the teachers lacked in their own education could be categorized into the following themes: Teaching knowledge, subject knowledge and practicum.

I have selected a few quotes to show a condensed version of what I learned from the interviews. The quotes will be translated into English as well as given in Swedish. The original material contained a few broken and unfinished sentences, so I have made edits to create more easily readable and comprehensive quotes. While editing I have of course done my best to be true to the interviewees original meaning by giving regard to the context in which the quotes appeared. I have also done a few edits for confidentiality's sake, i.e. removed names and genders from the original quotes.

4.1 Teaching knowledge

4.1.1 Laborations - how to do

One of the more pronounced challenges for physics teachers seem to be planning and executing laborations which is a mandatory part of the physics courses (Skolverket, 2013).

Several teachers felt that they lacked experiences with laboratory work from their own educations. Even though these teachers all have had some experimental training during their educations they asked for more explicit lab courses to feel more comfortable working with the students.

There was too little practical laboratory work during my education. [...] I would have liked a course with only laboratory work.

Det var för lite praktiskt laborerande under utbildningen.[...] Jag hade gärna sett en kurs med bara laborationer.

4.1.2 Missing specific “fall-back” methods

4.1.2.1 Teaching methods

Many teachers said they wanted to learn more practically applicable methods and not only general more abstract methods. One of the teachers expressed it the following way:

[I] still lack a lot of methods. I wish there was a part of the education that said ”how to do this?” ”You can do this by default anyway”. The only thing you get from your education is theories about how learning works [...] You get very few [practical] methods. [...] I think it would have been good and effective for all future teachers [to get] a few methods [...] or strategies for [actual] teaching.

[Jag] saknar ju fortfarande mycket metoder. Jag har velat att det fanns en del i utbildningen som sa “hur ska du göra?” “det här kan du göra som default iallafall”. Det enda man får från utbildningen är teorier om hur lärandet fungerar [...] Man får väldigt få [praktiska] metoder. [...] Jag tror det hade varit bra och effektivt för alla blivande lärare [att få] några metoder [...] eller strategier för [faktisk] undervisning.

And another teacher stated:

[I wish that we would have talked more about specific methods for] teaching specific topics that one covers in the high-school curriculum. [...] There was a lot of abstract talk about learning and such that did not feel very applicable. There were never concrete examples.

[Jag önskar man hade pratat mer om olika metoder för hur man ska] undervisa i just det här specifika området som man tar upp i gymnasieskolan. [...] Det var väldigt mycket abstrakt prat om inlärninng och sånt som inte kändes så verklighetsnära. Det var aldrig konkreta exempel.

Even though many teachers asked for practical teaching methods, one of them actually gave us a possible reason for not choosing specific methods:

[I think that] there is a fear of choosing a few methods and teaching about them because they might not be the best.

[Jag tror att] det finns en rädsla att välja några metoder och undervisa om dem för de kanske inte är de bästa.

4.1.2.2 Grading methods

Another topic the teachers mentioned was grading their students. Physics contains many different parts and there is a big difference between assessing and grading a written text, a lab with a lab report and a written test. One of the teachers expressed it as follows:

What I miss was probably a lot of grading. How do you evaluate students in a good way? [...] we didn't talk enough about it, and that's something very important.

Det jag saknar det var nog mycket bedömning. Hur bedömer man elever på ett bra sätt? [...] vi pratade inte tillräckligt om det, och det är nåt väldigt viktigt.

Another teacher mentioned that this was specifically when grading physics students:

[...] but it was not so much evaluations when it came to physics. Very few ... It feels like there were very few lab reports that we had to grade. Like sample lab reports.

[...] men det var inte så mycket bedömningsgrejer när det kom till fysik. Väldigt få... Det känns som om det var väldigt få labbrapporter som vi fick bedöma. Typ exemplarlabbrapporter.

Some teachers were instructed to not give summative gradings on tests, but instead give formative gradings.

The principal does not want us to put points on tests [...] but you have to be clear in your communication about how you assess the students.

Rektorn inte vill att vi ska sätta ut poäng på prov [...] men man måste vara tydlig i sin kommunikation om hur man bedömer eleverna.

4.2 Subject knowledge

4.2.1 Laborations - what to do

Three of the teachers pointed out that they also wanted to find laborations containing every-day objects that the students can find in their homes to make the laborations and the physics involved feel less disconnected from “ordinary” life. As one of the teachers put it:

My own personal idea is that I really like when you can do physics laborations with every-day material to somehow show that it’s a property of nature and not something that suddenly emerges in the lab.

Min egen personliga idé är att jag gillar verkligen om man kan göra fysiklabbar med någorlunda vardagsmateriell, lite för att på nåt sätt visa att det är en egenskap hos naturen och inte inte nånting som helt plötsligt kommer fram i ett labb så att säga.

Some of the teachers wanted more different laborations, or some kind of library of laborations to pick from instead of having to “invent the wheel” again.

There should have been much more lab-time during the education filled with laborations that were adapted for a highschool level so that you get a set of laborations. [...] It is good if you have a background with a big set of different laborations to choose from.

Det skulle vara betydligt mycket mer laborationstid under utbildningen med laborationer som är anpassade för gymnasienivå så att man får ett batteri med laborationer. [...] Det är bra om man har en bakgrund med en mängd olika laborationer att välja mellan.

One teacher would even like to have a couple of mandatory laborations that all students should do during the course. Because of those difficulties with laborations, some teachers felt that the planning took a lot of time and that they had to cut down on other planning to be able to make acceptable laborations.

4.2.2 Lacking content knowledge

Another pronounced challenge was that several teachers felt that they were missing content knowledge. The teachers argued that physics is more difficult to plan lessons for, considering the kind of questions that you can get, as well as that most teachers felt that their own content knowledge was much more robust in their other subject (which for all interviewed teachers would be math). One teacher worded this the following way:

The subject in itself invites a different kind of questions. You can ask difficult questions [in physics] without much prior knowledge which is quite difficult to do in math, I think. [It is difficult] to ask really difficult mathematical questions without being on that level.

Själva ämnet inbjuder helt klart till en annan sorts frågor. Man kan ställa svåra frågor [i fysik] utan att ha höga förkunskaper vilket i matte är ganska svårt, tror jag. [Det är svårt] att ställa riktigt svåra matematiska frågor utan att själv vara på den nivån.

4.3 Challenges with rewarding practicum

A part of the education that is difficult to predict the outcome of is the teaching practicum that every teacher has to go through during their training to becoming a teacher. Even though the teachers take a similiar practicum course there is no way to accurately predict what the different teachers will meet at their specific schools.

It may have to do with the practicum you are on. What kind of school you end up with. How much can you get out of it? During my practicum, I got very much out of my math supervisor that I had, but my physics supervisor might not have been quite as good at catching my questions in some way [...] It all depends on where you end up on your practicum.

Det kan ju ha att göra med också den praktik man är ute på. Vad hamnar man på för skola. Hur mycket kan man få ut från den? Under min praktik så fick jag när jag var väldigt mycket ut från min mattehandledare som jag hade, men min fysikhandledare kanske inte var riktigt lika bra på att fånga upp mina frågor på nåt sätt [...] Det beror ju helt på var man hamnar på sin praktik.

Most teachers hopefully get to see many different situations but some teachers may miss out on certain parts depending on where they end up. That's how it was for one of the interviewees:

[I was missing] most from practicum. It was just unfortunate so to speak. That I missed certain parts of physics

[Jag saknade] mest från praktiken. Det var ju bara otursamt liksom. Att jag missade vissa delar av fysiken

4.4 Human interaction

Although these are not things that are specific to physics teachers, many of the teachers said they knew what they were supposed to do inside the classroom but some of them felt unprepared for other parts of the teaching profession such as student conflicts and the contact with the students' parents:

Things like "how do you meet students in crisis?" "What do you do when it does not help to talk?" "What are my obligations, towards parents ..." such things were discussed very little in my education

Sånadär saker som "hur möter man elever i kris?" "vad gör man när det inte hjälper att prata?" "vad har jag för skyldigheter, jämt emot föräldrar.." sånadär saker diskuterade vi väldigt lite i min utbildning

Chapter 5

Discussion

As described in 3.2 we had to be very careful not to put words in the interviewees mouths to not manipulate the interviews. We did this by letting the interviewee do most of the talking and by carefully constructing our interview questions

One of the challenges with the data analysis has been to find a balance between *very distinct but many themes* and *few but diffuse themes*. It has not always been easy to distinguish between the themes and some of them overlap slightly. My approach to solving this problem was to divide the laborations into one part about how to carry out laborations and one part about the content of the laborations.

This is a qualitative study with only nine interviewed teachers, so it is dangerous to draw too general conclusions from so few interviews. I will however discuss some hypotheses that can be drawn from my study and how this relates to previous research.

One thing that the interviews revealed is that many of the teachers experienced that during their own educations practice was lacking. A teacher is expected to be “fully operational” from the day that they graduate. Davis et al. (2006) also describes this as one of the reasons that young science teachers leave the profession.

Like Lindgren (2003) I find that several of the teachers we have interviewed recommend that new teachers should not be too ambitious and not have too high expectations of themselves. I would say that this is especially important when you have to plan your own physics laborations since that takes up a lot of time in the beginning if you don't have access to a library of laborations as explained in Chapter 4. It is also safer from a grading point of view if you have a well prepared lab where the teacher has taken into account how the lab is going to be graded already at the planning stage.

Another thing that the teachers mentioned was that you could ask much more complicated questions about physics without being on a higher level yourself. This raises the question about how much physics should be taught during the teachers own education. The amount of physics needed to get through the high school courses doesn't give a broader understanding of physics, and understanding the concepts of physics is an important part when answering questions that may rise during the lectures.

One of the interviewees mentioned a possible reason that the teachers isn't taught a specific teaching method could be that that specific method might not be the best. I think that this may only be one of many reasons and another possible reason could be that there isn't a universal teaching method that reaches all the students. The teachers may have to "experiment" with different methods to find how they could reach as many students as possible.

Cruickshank and Metcalf (1994) summarizes this quite well:

With few exceptions, neither preservice nor inservice teachers receive more than awareness of the need to have these abilities [...] they are told what direct instruction is and perhaps a few forms of it are described [...] Hardly ever does training or gaining know-how in any of them follow.

The fact that grading can be difficult is something that the National Agency for Education ("Skolverket" in swedish) know about and actively work with. They have compiled an article on formative and summative grading (Skolverket, 2020) in which they describe, among other things, that the teacher should not give points or grades to such an extent on homework and tests but instead give responses in the form of comments that lead to in-depth learning.

Assessment and grading are also two of the things that Erixon Arreman (2008) and the Swedish governments investigations (SOU 2008:109) finds that teachers are less confident in.

The National Agency for Education also describe that research shows that formative assessment is effective for students learning progress. But be careful. According to Alli Klapp (2010), teachers grades not only measure students subject knowledge but also their personal characteristics, although this is often done subconsciously. It takes time for the teacher to see and analyze their own practice and the consequences for the students.

Regarding the challenges with rewarding practicum, it is difficult to guarantee that you get to see all the parts in a specific subject. During the practicum, the teacher trainee will have his or her own responsibility to stay in touch with the supervisor and ask questions if he or she feels that they

haven't got everything they expected from the practicum. To facilitate this, the teacher education could offer a checklist of things that the teacher trainees are expected to see during their practicum.

During my own practicum, I discussed with my mentor whether you should have all your practicum at the same school to get a routine to work by or if you should visit different schools to get a greater variety and to see different workplaces and meet different student groups.

5.1 Practical implications

Based on my findings and the suggestions from the interviewed teachers, my suggestion for physics teacher trainees is to take advantage of the time during their training and ask supervisors and others they meet about teaching methods and grading methods that worked well for them, and also if they can get access to some lab instructions or other things that may facilitate their first year in their teaching profession.

For physics teacher educators, my first suggestion is to focus more on laborations to make sure that the new teachers are well prepared in both planning and conducting laborations. This is one of the parts that most of the teachers mentioned when we asked them what they lacked in their education. This could be done either as part of learning different teaching methods or as part of the practicum. I also suggest that the educators make a checklist available about what the teacher trainees are expected to meet during their practicum so that the practicum experiences can be more equal.

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Appendix A

Interview Structure

Vi sparar inga namn eller annan information som kan identifiera dig. Du får gärna ta tid på dig och fundera på dina svar.

- Får vi spela in dig?

Vi vill undersöka hur de första åren som fysiklärare är med fokus på stödet man får av sin arbetsplats; av skolan, kollegor, mentor, o.s.v. och med fokus på möjligheter till kompetensutveckling och fortbildning. Vi ber dig att främst försöka tänka på ditt arbete som *fysiklärare*.

- Beskriv din första arbetsplats som legitimerad lärare.
- Hur upplevde du ditt första år?
 - Jobbade du heltid eller deltid?
 - Hur såg dina tidigare erfarenheter ut?
 - ◆ Hade du vikarierat innan du började arbeta?
 - Hur tyckte du arbetsbelastningen var?
 - Var det som du hade tänkt dig?
 - ◆ Vad hade du haft för förväntningar yrket?
 - ◆ ... arbetsbelastningen?
 - ◆ ... på kollegorna?
 - ◆ ... på skolledningen?
- Känner du att du saknade något från din utbildning?
 - Känner du att dina ämneskunskaper var tillräckliga?

- Var du förberedd på att planera och hålla lektioner/laborationer?
 - Var du förberedd på att möta elevernas föräldrar?
 - Var du förberedd på arbetsbelastningen?
- Hur fördelade du tiden mellan olika arbetsuppgifter under det första året?
 - Hur mycket tid la du på lektionsplanering?
 - ◆ Hur planerade du dina lektioner?
 - ◇ Använde du boken när du planerade dina lektioner?
 - ◇ Tittade du på Skolverkets ämnesplan när du planerade lektioner?
 - ◇ Har du kunnat pröva på olika arbetssätt, t.ex. projektarbeten, laborativa arbetssätt, o.s.v.?
 - ◆ Hur långsiktigt planerade du dina lektioner?
 - ◇ Hur fungerade det med kursplaneringen?
 - ◇ Kunde du planera långsiktigt?
 - ◇ Kunde du planera kursen i större delmoment, så som arbetsområden, etc.?
 - Hur mycket tid la du på att förbereda och planera laborationer?
 - Hur mycket tid la du på att hålla i undervisning?
 - Hur mycket tid la du på att förbereda och rätta prov?
 - Hur mycket tid gick åt till annat?
 - ◆ Planerade du för föräldramöten, utvecklingssamtal, o.s.v.?
 - ◆ Fick du lägga mycket tid på något du känner inte borde ingå i jobbet?
- Hur fungerade samarbetet med dina kollegor under det första året?
 - Tillhörde du ett arbetslag?
 - Var hade du din arbetsplats?
 - Hade du stöd av dina kollegor?
 - Har du samarbetat med kollegor som har andra ämnen än ditt?
 - ◆ Har du kunnat arbeta ämnesövergripande?
 - ◆ Har du någonsin funderat på att arbeta ämnesövergripande?
 - Hur såg samarbetet ut mellan dig och andra fysiklärare?

- ◆ Använde ni samma kursplanering?
 - ◆ Kunde ni samarbeta kring labbar?
 - ◆ Kunde ni samköra prov?
- Upplevde du att du fick tillräckligt stöd från skolan under första året?
 - Hade du en introduktionsperiod?
 - ◆ Vad hade du för förväntningar på introduktionsperioden?
 - ◆ Fick du en mentor?
 - ◆ Fick du stöd av din mentor?
 - ◆ Fick du tid att träffa din mentor?
 - ◆ Tycker du att du blev hjälpt av introduktionsperioden?
 - ◆ Tror du introduktionsperioden hade kunnat bli bättre?
 - Upplevde du att du hade tillgång till allt material du behövde?
 - ◆ Kunde du använda kollegors tidigare material?
 - ◆ Hade du tillgång till kollegors lektionsplaneringar?
 - ◆ ... tillgång till kollegors tidigare prov?
 - ◆ Hur var laborationsutrustningen?
 - ◆ Hur var boken?
 - ◆ Fanns det en provbank med uppgifter för att konstruera prov?
 - Erbjud din arbetsplats möjlighet till fortbildning och kompetensutveckling?
- Hur ser din situation ut idag jämfört med det första året?
 - Läger du mer eller mindre tid på något idag?
 - Är något lättare idag?
 - Har du ändrat dina förväntningar?
 - Har du ändrat din ambitionsnivå?
- Om du fick bestämma, hur skulle du vilja förbättra skolan?
- Har du några tips till nya kollegor?