PhD Thesis

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What can the teacher education learn from preservice science teachers' experience of participating in Copenhagen Honours College?

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Abstract

This PhD project explores what teacher education learn from the experiences of preservice science teachers enrolled in the honors programme Copenhagen Honours College (CHC).

CHC is described as a talent program with the aim to improve science teaching in schools and the participating teacher students are expected to become 'beacons for science teaching'. It is an add-on programme to the regular teacher education, it adds 30 European Credit Transfer System (ECTS) to the last two years of the four year teacher education.

The student experience is explored by using a constructivist Grounded Theory Method with research on transfer of learning as the point of departure. The project has followed participants from the first two cohorts of CHC.

As the Grounded Theory Method is abductive, the focus of the project has followed the data. The exploration of the student experience provide valuable insights to how a programme such as CHC can affect student engagement and career plans of preservice teachers but the study also suggests limited influence from CHC regarding what the new teachers transfer from the teacher education to the teaching profession.

The first cohort had an initial experience of being part of an engaging community of peers who had a shared value of getting the most out of their education. The community proved to be fragile however and appeared to lose its importance due to a combination of factors such as the complexity of student life and the experience of a confusing structure in the program. The insights from this part of the project are useful in the debate about how to improve student engagement in general and at the teacher education in particular as it provides both suggestions for means to foster engagement through community but also reasons why such a community might lose its importance if not nurtured.

Another prevalent theme in the data was the students' thoughts for the future and the choices they made during education in relation to their possible future selves. The choice to sign up to CHC was by some respondents considered as a means to expand their opportunities upon graduation and only one respondent considered teaching a lifelong career. This part of the project is useful in the debate about teacher shortage, as it provides insights to how teacher students reflect on their future and how they think life as a teacher is going to be – and how long they think they will stay in the profession. A dominating theme was a perceived lack of opportunity for professional development.

The last part of the project revolves around the experience of entering the profession as science teachers who have been framed as 'beacons for science teaching' during teacher

education. The new teachers were all hopeful in terms of implementing new ideas in science teaching but the conditions they faced differed. The research provides insights to how alignment between conditions in schools and teacher education can foster transfer of learning between education and profession and thus be a means to change the way science is taught. This part of the study find such an alignment between the teachers who qualified from the Advanced Science Teacher Education (ASTE) and a recent change in exam at lower second level. The ASTE teachers further experienced being supported by their management when suggesting changes to the current science teaching practice. A teacher with a different profile faced misalignment, as the school assigned a class in a science subject they were not educated to teach. The findings further indicate that a community of practice, which had formed during the teacher education, proved valuable for the ASTE teachers in supporting their beliefs about the best way to teach science.

Resume

I dette PhD projekt er det undersøgt, hvad læreruddannelsen kan lære af naturfagslærerstuderendes oplevelse af at deltage I honors programmet 'Copenhagen Honours College' (CHC).

CHC er beskrevet som et talentprogram med fokus på at løfte naturfagsundervisningen i grundskolen og deltagende lærerstuderende forventes at blive 'faglige fyrtårne'. Programmet er en tilføjelse til den ordinære læreruddannelse og tilføjer en ekstra belastning på 30ECTS til de sidste to år af den fire-årige læreruddannelse.

Oplevelsen af at deltage i CHC programmet er undersøgt ved at bruge en konstruktivistisk Grounded Theory metode, med forskning indenfor transfer af læring som udgangspunkt. Projektet har fulgt deltagere fra de første to årgange af CHC studerende.

Da Grounded Theory er en abduktiv metode, har fokus i projektet været inspireret af data. Studiets fund giver værdifuld viden om, hvordan et program som CHC kan påvirke lærerstuderendes engagement og hvordan valget af CHC spiller sammen med karriereplaner. Studiet antyder dog også, at et program som CHC har begrænset betydning for nyuddannede læreres praksis.

Den første årgang på CHC havde en oplevelse af at blive en del af et engagerende fællesskab med ligesindede, der havde det til fælles, at de ville have mest muligt ud af deres uddannelse. Fællesskabet viste sig at være skrøbeligt og lod til at miste værdi for de studerende som en kombination af flere faktorer, heriblandt kompleksitet i de studerendes liv og oplevelsen af en uklar struktur i CHC. Fundene i denne del af projektet er relevante i arbejdet med studerendes engagement generelt og særligt i læreruddannelsen, da de på den ene side giver eksempler på hvordan engagement kan styrkes gennem fællesskab men også hvordan et sådant fællesskab kan miste værdi, hvis det ikke bliver plejet.

Et andet interessant tema i projektet er de studerendes tanker om fremtiden og hvordan disse tanker kan påvirke deres valg i løbet af læreruddannelsen. Beslutningen om at søge optagelse i CHC blev eksempelvis set som en middel til at udvide mulighederne efter endt uddannelse og kun en af respondenterne så jobbet som lærer som et længerevarende job. Et tilbagevendende tema blandt respondenterne var en forventning om, at lærerprofessionen har begrænsede muligheder for professionel udvikling. Denne del af projektet er relevant i debatten om lærermangel, da den giver et blik for, om, hvordan og hvor længe lærerstuderende ser sig selv som lærere i fremtiden.

Den sidste del af projektet har undersøgt, hvordan fire nye lærere, der havde deltaget i CHC, oplevede overgangen fra at være studerende i CHC til at være lærere. Forventningen om, at de nye lærere skulle agere fyrtårne i naturfag indikerer en forventning om transfer mellem læreruddannelse og lærerprofession. I denne del af projektet oplevede tre af de nye lærere at kunne overføre en fællesfaglig, problembaseret tilgang til naturfagsundervisning de havde med sig fra uddannelsen til professionen. Denne overførsel blev understøttet af, at de havde en faglig profil som lærere uddannet fra en specialiseret naturfagslæreruddannelse (Advanced Science Teacher Education), der gav dem fleksibilitet til at planlægge fællesfaglig undervisning. Transfer mellem uddannelse og profession blev endvidere understøttet af overensstemmelse mellem uddannelse og nyligt indførte krav til fællesfaglige forløb i udskolingen, en oplevelse af at blive støttet i deres tilgang til naturfagsundervisningen af skoleledelsen og af at de kunne trække på et praksisfællesskab etableret under læreruddannelsen. Denne del af projektet præsenterer derudover et eksempel på en lærer, der oplevede at have dårlige vilkår for transfer fra uddannelsen, blandt andet på grund af manglende opbakning fra ledelsen og ved at få undervisning i fag, læreren ikke er har undervisningskompetence i.

Denne del af projektet er relevant for at øge forståelsen for den kompleksitet der er på spil, når naturfagsundervisningen i grundskolen søges påvirket gennem indsatser i læreruddannelsen.

Indholdsfortegnelse

Prologue

I first heard of Copenhagen Honours College (CHC) as part of my job as a teacher educator at University College Copenhagen (KP). What I knew of the programme was that it was aimed at preservice science teachers, was inspired by a Dutch professor and saw talent as related to both willingness and ability under the slogan "those who can and will". What the programme entailed exactly was not clear to me, but it was clear that a lot of resources had been invested in its development. This investment came in the wake of the 2016 implementation of 2%-annual financial cutbacks in most of the public sector, including education. As such, the programme was received with a certain degree of ambivalence from myself and my colleagues. Was it fair to spend 28 million DKK on the development of an exclusive programme that would at maximum include 60 students over the course of 5 years under these circumstances? A colleague of mine had a point though; our conditions as teacher educators made it increasingly difficult to develop our teaching and not just stick to what worked. CHC had a generous teacher:student ratio and more resources for educators, including time for preparation, than at regular programmes. This provided an opportunity to experiment with different aspects of science teacher education. This again could serve as an incubator for improving the way we teach how to teach science at KP.

Structure and nature of CHC

The official documents steering the development of CHC left a lot to interpretation and, although specific activities were described, the content of the activities needed to be defined, planned and developed by the educators involved in the programme. This planning and development took place alongside the implementation of the programme and was coordinated by a programme manager, who was a science teacher educator. During the first years of the programme, approximately 17 teacher educators were part of the CHC team, of which approximately half were science teacher educators, and the rest were teacher educators who taught other non-science subjects at the teacher education programme such as maths, arts and crafts and pedagogy.

The student experience

When applying for this PhD, I did not hesitate to focus on the student perspective as the best way to understand how – or whether – the programme or aspects thereof could improve science

teacher education. The preservice science teachers are the ones who have to transfer what they are taught during the teacher education programme to science teaching in schools. If CHC proved to include aspects that the preservice teachers experienced could enhance the transfer to the profession, this would be valuable knowledge for the teacher education programme.

I followed the first two cohorts of preservice teachers, and it quickly became clear that the programme was struggling to attract participants. This challenge had been anticipated when applying for funding for the development of the programme: funding for a grant for the students of approximately EUR 300 per month. This did not appear to be enough to reach the maximum of 15 students per cohort. Although there was an application procedure, it did not seem to be difficult to be selected to the programme and, unfortunately, dropout rates were high, reducing the number of potential respondents in my project to a very small number: six graduates from the first cohort and seven graduates from the second cohort.

One of the most prevalent student experiences in my data was that of a chaotic structure, which is understandable given that the teacher educators had to define and develop the programme while it was running. Both the first and the second cohort of CHC participants describe a lack of transparency about when what would happen and the lack of a plan for the year. The experience of having no transparent plan made it hard for the preservice teachers to describe what the programme actually was, some participants dropped out and those who persisted, particularly in the first cohort, experienced that the lack of structure affected the expectations they were met with, which in turn affected their engagement in the programme.

Another aspect revealed by the student experiences relates to how the teacher educators interpreted the vague descriptions of the programme in the steering documents. Not surprisingly, the science teacher educators focused on science teaching and were in charge of activities such as journal clubs that focused on science education and courses with an explicit science teaching content such as out-of-school science teaching. The teacher educators who did not teach science focused on more generic competencies such as innovation and project management. One of the consequences of this has been that science teaching and science teacher education is not very prevalent in my data. Although the first cohort describe feeling engaged by the community in CHC and mention discussions in the journal club as an example, it is not clear from the data that this would not have happened if the focus had been on other aspects of teaching. It was an interest in teaching and research within teaching that was the common denominator among the students, not science teaching exclusively.

A consequence of the focus on generic competencies within innovation and project management had an interesting effect on the student experience in the second cohort. They

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describe how these competencies made them more attractive in the job market, which led me to explore further how they saw themselves in the future. Although the focus on project management and innovation was justified by an emphasis on managing science education projects in schools, the students considered those aspects of CHC as a means to expand their options and to not only consider themselves as teachers in the future.

What about talent?

CHC has been promoted as a talent programme and is defined as such in steering documents. However, the students did not like the word and, maybe for this reason, did not consider CHC a talent programme. They were more keen on defining it as a programme for the ones who were interested in putting in more effort than was called for within the regular teacher education programmes. Although it is interesting in itself why that is, I have chosen to focus on the student experience of the programme as they saw it, an extra-curricular programme. Whether there is such a thing as a talented preservice science teacher and, if so, how to define such a student will not be discussed in this project.

COVID-19 and its influence on my project

COVID-19 and the following hard lockdown in Denmark hit the first cohort of CHC students when they had four months left of their education and the second cohort when they had a year and four months left. This has undoubtedly affected the student experience of CHC, and the second cohort was hit the worst. The on-and-off lockdowns following the first lockdown announced on the 11th of March 2020 made it difficult for anyone to plan ahead. A consequence of this was that the teacher educators still had to define and organize what CHC was while the programme was running, because they could not reuse their planning or draw on their experiences from the previous year. Activities such as a summer school abroad and a case competition over the course of a weekend, which had both been experienced as a success by the first cohorts of students, had to either be postponed or moved online. Although there is no doubt that the pandemic affected the student experience and can in part explain why the first and second cohort experience community at the programme very differently, the pandemic is not prevalent in the data I present in my project. I adjusted my data collection plan to ensure the students had been back to face-to-face teaching for at least a month before I interviewed them about their experience, and although this does not exclude the fact that, for example, developing a sense of community had difficult terms in the second cohort, it made it possible to also explore aspects of their experience that were not directly related to lockdowns – the respondents were

surprisingly quick at 'bouncing back' and focusing on the experience of CHC and their education post-lockdown.

Intentions and surprises in the PhD project

One of my big hopes for this project was to explore how new teachers, in this case alumni from the first cohort of CHC, reflected on their education in the light of being a new teacher. In other words, what had the new teachers experienced to transfer from education to profession? Although the underlying agenda here was to explore if aspects of CHC were experienced as particularly valuable for the new science teachers and thus meaningful to implement in the general education, I chose to use a constructivist grounded theory method, an abductive methodology which left room for other answers. Although aspects of CHC were experienced as valuable to the new teachers, this image was blurred by the fact that three out of four respondents had also graduated from a special science teaching programme, the Advanced Science Teacher Education. It was not initially the intention to include an analysis of this programme in the project, but as it very clearly had an influence on the experience of being a new science teacher, it had to be included to some extent in the project.

In summary, my PhD was a project researching the student experience of an experiment, and in this synopsis I will present how I approached this and what I conclude teacher education can learn from my research.

Introduction

With the implementation of an executive order in 2015, institutions of higher education in Denmark were given widened opportunities to develop talent programmes, something which had only been possible to a limited extent prior to 2015. As a consequence, experience with how to develop such programmes and what their benefits are within a Danish higher education context is limited.

KP took advantage of the opportunities given in the executive order and, with the help of funding from the Novo Nordisk Foundation, developed the programme Copenhagen Honours College (CHC), targeting preservice science teachers.

An often-cited argument for spending extra resources on programmes such as CHC is that it not only benefits the students of the programme but also has a positive impact on development

of the regular teacher education programme. (Arbejdsgruppen til talentudvikling i uddannelsessystemet, 2011; Clauss, 2011; Kolster, 2021a, 2021b; Renzulli, 2005; Wolfensberger, 2004, 2012). However, very little research has been conducted nationally as well as internationally to explore if this is the case in higher education, even less research includes the student perspective and no research focuses on teacher education. In other words, there is a gap in research on how or if regular education in general and teacher education in particular, benefit from investing in honors programmes.

To contribute to fill this gap, I focus my PhD project on what teacher education can learn from the experiences of preservice science teachers participating in an honors[1] programme. As teacher education holds an implied expectation for graduates to pursue a career within teaching and thus an expectation to transfer what they learn from their teacher education to the profession, this implied expectation makes it relevant to focus on whether the experience includes elements known from previous research to enhance transfer of learning such as 1) similarity between contexts (Dohn et al., n.d.; Lobato, 2012), 2) experience of relevance of what is taught (Engle et al., 2012; Wahlgren, 2009) and 3) sufficient learning (Bransford & Schwartz, 1999; Engle et al., 2012; Pellegrino & Hilton). For this reason, the theoretical perspective I use to focus my research at the point of departure is transfer of learning from a situated cognition perspective, with particular inspiration from Lobato's (2003) Actor Oriented Transfer approach (AOT) in which what is transferred is defined by the actor.

Wolfensberger et al. (2004, 2012) and Kolster (2021a, 2021b) represent the main body of research within the field of how honors programmes influence ordinary education in higher education. Wolfensberger et al. (2004, 2012) and Kolster (2021ab) have researched what influence the presence of honors programmes have on ordinary education. They have found that the main influence on higher education is within development of content of teaching and pedagogy and that this influence is most likely to take place in the cases where there is an overlap of teachers within honors programmes and ordinary education. Wolfensberger et al. (2004, 2012) did not include the student perspective in their study. Students were included in the

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[1] According to Wolfensberger, 'honours' with a 'u' is from the UK tradition and her approach to honors is from the American tradition, which is spelled without the 'u'. By this reasoning, Copenhagen Honours College is an honors programme (Wolfensberger 2015)

study by Kolster (2021a, 2021b), but they were not found to play any significant role in how honors programmes affected ordinary education.

My study differs from Wolfensberger et al. (2004, 2012) and Kolster (2021a, 2021b) by focusing on the student experience and by using transfer of learning as a theoretical perspective to analyse what aspects of the student experience could prove relevant to the continuous development of teacher education. My main research question is

What can teacher education learn from the experiences of preservice science teachers enrolled in an honors college?

CHC is a relatively small programme with a maximum of 15 students enrolled per cohort, and in reality the first two cohorts were half that size. Furthermore, because it is a new programme, limited information was available at the beginning of my project as to what the programme entailed. For these reasons I have chosen to answer my research question through a qualitative, abductive study inspired by constructivist grounded theory in which I have followed the first two cohorts of CHC participants. The main part of the data collection consisted of three rounds of interviews with each cohort, supported by observations. Continuous analysis of the collected data led to the development of sub questions and additions of conceptual frameworks to support the analysis of findings related to these questions. The sub questions are

1) *How does sense of community in an honors programme affect the engagement of preservice teachers?*
2) *Why do preservice science teachers choose an honors programme, and how do possible selves and career plans evolve during participation?*
3) *How does participating in an honors programme with a focus on developing science teaching influence transfer between science teacher education and the science teaching profession?*

To support the analysis related to the first sub question, I used sense of community as defined by McMillan and Chavis (1986) and a conceptual framework for student engagement developed by Kahu and Nelson (2018). In the analysis of the findings related to the second sub question, I used the careership model developed by Hodkinson and Sparkes (1997) and the possible selves theory as described by Markus and Nurius (1986). In the last part of my project, I returned to the conceptual framework used as my part of departure, transfer of learning, with the addition of Wenger's (1998) concept of communities of practice.

In figure 1, I provide a graphical presentation of how the sub questions relate to the main question of what teacher education can learn from the experiences of preservice science teachers participating in CHC and which theoretical perspectives were added during the research process. A further presentation of the perspectives is introduced in a later section.

Overview of articles

My PhD project include three articles, one for each of the sub questions. I present the articles in a table below. How the articles are related to the main question is presented graphically below the table.

Article number	Title	Journal	Status	Co-authors
1	Linking preservice teachers' sense of community and engagement in an honors programme	Teaching in Higher Education	Submitted	Jan Sølberg
2	Teaching is not for life – preservice teachers' reflections on their possible future selves	Teaching and Teacher Education	Submitted	
3	Opportunity for change? The experience of being a new teacher educated to develop the way science is taught in schools	NorDiNa	submitted	

Table 1 Overview of articles

Graphical overview of the PhD-project

The mind map below serves to present an overview of my PhD project. Each sub question represents an article, and thus the overview shows how each article and related sub question serve to answer the main question and which theoretical perspectives were added to the analysis.
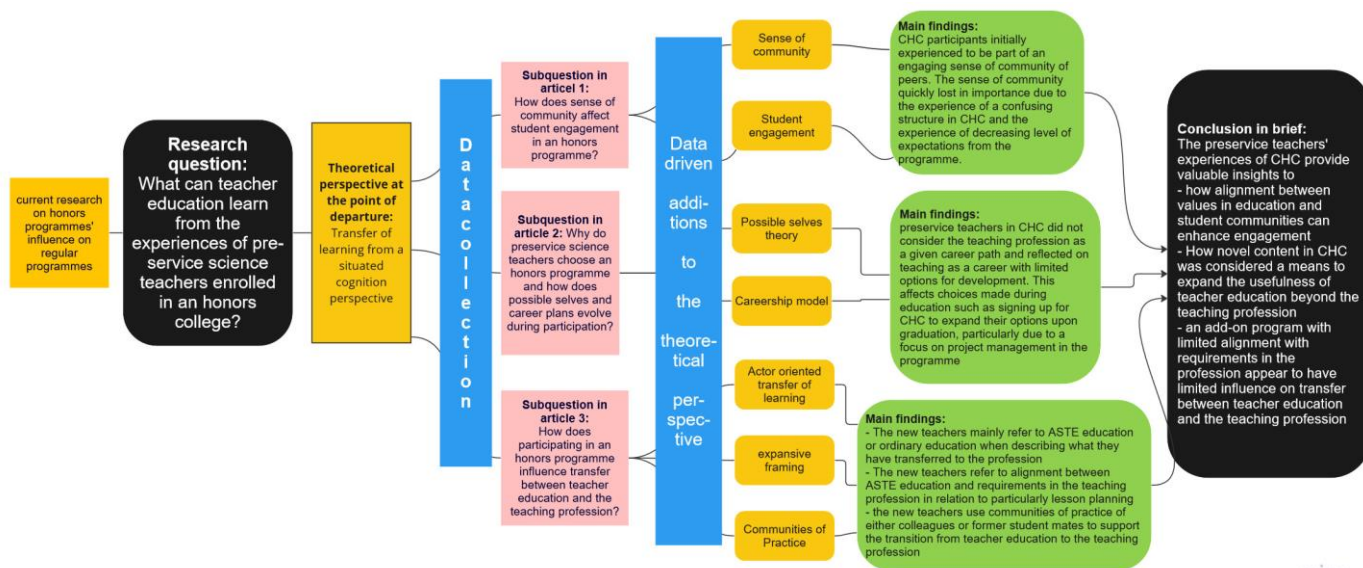
Figure 1 Overview of the PhD project. ASTE is an acronym for Advanced Science Teacher Education, a specialized science teacher education attended by the majority of the respondents. The programme will described in further detail in the section Context.

Figure 1 provides a stylized version of the research process in my project and serves to show the coherence between my three articles and my research project.

The mind map starts with a literature review of how honors programmes influence regular programmes, which leads to the main research question of what teacher education can learn from the experiences of preservice science teachers enrolled in an honors programme. After formulating the research question, I chose to use a constructivist grounded theory approach, which calls for an abductive research approach and an openness to either change or add to an initial theoretical framework after initiating data collection and analysis. As mentioned above, the initial theoretical framework I chose was based on transfer of learning from a situated cognition approach. This point of departure played a part in my initial research design, in which data was collected through interviews and observations. After initiation of data collection and analysis, the sub questions in the pink squares were formulated, and they formed the basis of each article. Based on further data collection and analysis, suitable theoretical frameworks

replaced or supported the initial theoretical framework; these are presented in the orange squares with rounded corners. The answer to the sub question for each article is presented in the green square, and how they relate to the main question is presented in brief in the black square. A more in-depth discussion will be presented in the discussion.

Below I present how I have structured my synopsis.

Navigating the synopsis

In the section above I have introduced my project and presented an overview of articles and how each article plays a part in answering the overall research question of what teacher education can learn from the experience of preservice science teachers participating in an honors programme.

In order to understand the context of my research, the following chapter will present Copenhagen Honours College and the rationale behind its development. To support the understanding of the context in which CHC is implemented, the Danish teacher education will also be presented. Because several respondents also graduated from a specialized science education programme called Advanced Science Teacher Education (ASTE), this programme will be added to the presentation of teacher education, and I will discuss how ASTE differs from ordinary teacher education and how ASTE and CHC differ in terms of aims, expected affordances and educational structure.

After presenting the context of my study I will present previous literature in the field of how honors programmes influence ordinary education. As this is a field with a very limited amount of research, I begin the chapter by introducing my literature search strategies to provide transparency about how I have located the literature reviewed in the section and how I have assessed relevance of literature.

The literature review is followed by an introduction of the conceptual framework of transfer of learning. As this is a constructivist grounded theory study, transfer of learning is used as a starting point to focus and design the study. Data-driven choices of conceptual framework are presented after a presentation of the analysis.

The methods and methodology are presented in the same chapter because constructivist grounded theory is a research approach that includes both. The chapter introduces constructivist grounded theory followed by a presentation of my data collection. After presenting the data collection, I discuss my position as a teacher educator in relation to my research.

In the section Analytical process, I use concrete examples from my data to show how I have used tools from constructivist grounded theory to analyse my data. This is followed by the

chapter Analysis of findings, in which I describe how codes were condensed to categories and sub questions in relation to each article developed.

In line with constructivist grounded theory, I have added conceptual frameworks to my analysis when I considered it necessary to support the analysis. The choices of these conceptual frameworks are related to categories developed from the data and for this reason, I have chosen to present them after presenting the analysis. The conceptual frameworks added are presented in the graphical presentation in figure 1. The additions to transfer of learning are as follows: definition of sense of community based on McMillan and Chavis (1984), student engagement based on Kahu and Nelson (2018), possible selves theory by Markus and Nurius (1986), careership model by Hodkinson and Sparkes (1997) and communities of practice by Wenger. At the end of the chapter Analysis of Findings, I provide an overview of categories, sub questions, conceptual frameworks and in which articles they are represented.

The analysis chapter is followed by a presentation of the articles that also serves as a summary of the findings in relation to each sub question and choice of conceptual framework.

I begin my discussion by first discussing my methodology and the quality of my research. I conclude the chapter with a discussion of how the findings presented in each article relate to the state of art presented in the literature review and how they answer the main research question of what teacher education can learn from the preservice science teachers' experiences of participating in an honors programme.

In the last chapter of my synopsis, I present suggestions for further research.

The three articles in my project are all placed after the references.

Context of the study

To understand my PhD project and how I attempt to answer the question of what teacher education can learn from CHC, it is necessary to not only understand CHC and why it was developed but also the context of Danish teacher education.

In addition to being participants in CHC, a large proportion of the respondents in my project were enrolled in ASTE. This had implications for the experience of my respondents and thus also calls for a description.

I will start the presentation of the context with a presentation of the rationale behind developing a programme such as CHC. This presentation is followed by a concrete description of

how students were selected for the programme and a rough outline of how the programme was structured for the first two cohorts of CHC students.

The presentation of CHC is followed by a presentation of Danish teacher education as it was structured at the time of study.

The section is concluded with a presentation of ASTE and a discussion of how ASTE and CHC differ.

Presentation of the CHC programme

In this section I will provide a brief overview of the rationale behind why CHC was developed. This information is necessary to understand the foci of the programme. However, the information is derived from documents written before the programme was implemented and not all aspects of the rationale are prevalent in how the programme was realised.

In the main steering document for the programme, "Copenhagen Honours College for naturfagslærerstuderende – drejebog" [Eng: Copenhagen Honours College for preservice science teachers - script], part of the argument for developing CHC was for it to be a means to counteract a challenge of attracting enough good and ambitious professionals to the Danish welfare sector (Professionshøjskolen Metropol, 2018). Professionshøjskolen Metropol (2018) argues that there is not enough focus on working with talented students at the vocational educations in Denmark. Professionshøjskolen Metropol (2018) argues that, as a consequence, talented students do not receive sufficient recognition for their effort and are not sufficiently challenged throughout their education. Professionshøjskolen Metropol (2018) is not explicit about what the term 'talent' entails but links the perceived lack of focus on talented students with the issue of attracting enough good professionals to the welfare sector.

The rationale behind focusing specifically on science teachers is that "…science teachers in primary and lower secondary school are crucial to improving the quality of the science field at primary and lower secondary school and thus in Danish society as a whole…" (Professionshøjskolen Metropol 2018, 3, my translation). There are no further details or references about why the science area is particularly important in terms of working with talented preservice teachers.

The development of CHC is supported by the Novo Nordisk Foundation (NNF), who, in their motivation for supporting the programme, argue for the importance of a strong science environment at schools (Novo Nordisk Fonden, 2018). As strengthening science teaching in

schools is one of the focus areas of the NNF (Novo Nordisk Fonden, n.d.), the choice to focus on science teaching can have been influenced by funding opportunities.

There are obvious science education elements in the CHC programme, but there are also a variety of elements and activities not specifically aimed at science education. I will go into detail with the activities in a later section. In order to understand my project in context of CHC, however, it is important to note that, in the eyes of the respondents, science education appears to have played a limited role in CHC, and this could be a result of the limited focus on science education in the steering documents.

CHC and talent

CHC was initially described as a talent programme, but 'talent' is not a term for which there is an agreed definition. In order to understand what is meant by talent here, the purpose of this section is to describe in detail how 'talent' is used in the CHC context and how it links back to the works by Marca Wolfensberger.

In the description of CHC and in the NNF motivation (Novo Nordisk Fonden, 2018), talent is mentioned several times and underlined as important. It is, however, not explicitly defined. Rather than defining what is meant by talent in general, and what it is to be a talented preservice science teacher in particular, Professionshøjskolen Metropol (2018) describes the students it hopes to attract to the programme as "capable, motivated and ambitious" and "capable and willing" (Professionshøjskolen Metropol, 2018; p. 3). Again, it is not clear what it entails to be a capable preservice teacher, but willingness appears to be equally important, and this willingness is described as a willingness to put in extra effort during teacher education.

Although Professionshøjskolen Metropol (2018) does not go in to detail about what is meant by talent, they refer to Wolfensberger's (2012b) work "Teaching for excellence – Honors[2] pedagogies revealed". Wolfensberger (2012b) fails to describe in detail what defines the target student of "honors pedagogy". She does not use the word talent but the related 'gifted' and, as in the CHC script, appears to ascribe equal importance to being gifted and being motivated and willing: "Honors programs in higher education are designed for gifted and motivated students who are willing and able to do more than a regular program can offer…" (Wolfensberger, 2012b;

p. 11). Thus, Professionshøjskolen Metropol (2018) and Wolfensberger (2012b) define an honors student based on something they are (gifted, capable, able, talented) and something they, in theory, can choose to be (willing, motivated). Although these definitions provide some hint of what a student needs to be to be an honors student, it is not entirely clear what is meant by gifted, talented or capable in this context, leaving it to speculation why it is not more clearly defined. One reason could be that those involved in describing the programme, as well as Wolfensberger (2012b), assume that the terms are self-explanatory and that we all know what they mean.

As CHC is explicitly described in relation to what Wolfensberger (2012b) term honors pedagogy, honors pedagogy requires a more thorough description. In the following section, I will first outline what is meant by honors pedagogy and then present examples of how the development of CHC was inspired by this pedagogy.

Honors pedagogy

When referring to Wolfensberger (2012b), Professionshøjskolen Metropol (2018) particularly refers to what she terms 'honors pedagogy', and it is clear that the concept of pedagogy in the sense that Wolfenberger uses it strongly influenced how the programme was initially described and developed. Wolfensbergers definition of honors pedagogy is based on a literature review of research done on honors programmes. Based on this literature review, Wolfensberger (2012) concludes that honors teaching consists of three pillars: 1) enhancement of academic competence, 2) academic freedom for students and 3) creation of student communities.

Enhancement of academic competence is described as providing honors students with increased knowledge, understanding and skills, and the means to achieving this is suggested to be through, among other things, involvement in research, learning acceleration (learning more content faster than at standard programmes), and through providing students with challenging learning tasks.

Creation of community is described as being both between students and between students and teachers. The suggested strategies to achieve such communities include interaction, peer feedback, availability of teachers and showing interest in students.

The third pillar of honors teaching, freedom, is described as the opportunity for students to pursue own interests and support of students' personal initiative. Among the strategies suggested are offering students flexibility, innovative teaching and allowing for student self-regulation.

Wolfensberger (2012b) argues that the three pillars of honors pedagogy are closely related to the three elements of the self-determination theory – relatedness, competence and autonomy –

as defined by Deci & Ryan (2000) and thus foster motivation in honors students subjected to this pedagogy, and this leads to what she terms high achievement (Wolfensberger, 2012b). The self-determination theory is a theory of general human motivation and innate psychological needs and not aimed at any particular group of students. Wolfensberger (2012b) does not present any strong arguments for why her pedagogy would only benefit a specific group of students. Her reference to Deci and Ryan (2000) only supports that what she has found to be useful for the group she refers to as gifted students might benefit all students. This supports the need to explore how teacher education can learn from the experience of preservice science teachers participating in CHC.

The influence of honors pedagogy on CHC

In this section I will relate the steering document by Professionshøjskolen Metropol (2018) to Wolfensberger (2012b), to increase the understanding of how CHC was inspired by Wolfensberger's (2012b) honors pedagogy.

The inspiration from Wolfensberger's (2012b) honors pedagogy is obvious in what Professionshøjskolen Metropol (2018) defines as the three main principles behind CHC:

1) A strong professional community between CHC participants, teacher educators and science teachers at primary and lower secondary level. This principle is clearly linked to Wolfensberger's (2012) pillar 'community', but whereas Wolfensberger (2012) described the community as being between students and educators, Professionshøjskolen Metropol (2018) includes the teaching profession in the community. Part of the means to achieve this community is described as partner-school projects, in which the students are expected to cooperate with teachers in the profession about relevant problems within science teaching. The partner-school projects are expected to challenge the preservice teachers "to the edge of their ability" (Professionshøjskolen Metropol, 2018; p. 4)

2) Enhanced academic depth and subject-specific pedagogical base. This principle is clearly inspired by the pillar 'academic enhancement'. Among the activities CHC describe to achieve this goal is Journal Club, course work and summer schools. Also mentioned is involvement in research and development projects, which was one of the concrete strategies to achieve academic enhancement mentioned by Wolfensberger (2012b). Professionshøjskolen Metropol (2018) describes the goal of this principle to be to increase the academic self-confidence of the preservice teachers. This principle also mentions that the students should be provided with the opportunity to influence their participation in CHC,

and as such the principle is further linked to Wolfensberger's (2012b) pillar of offering more academic freedom to students.

3) Responsibility for the task and the skills to facilitate academic development within science teaching. This principle appears to be most closely related to the pillar 'freedom', but it also adds a project management aspect. The principle emphasizes that it is required of each student to take a "great responsibility" (Professionshøjskolen Metropol, 2018), which can be related to the strategy to provide honors students with freedom through allowing students to self-regulate. The principle also stresses that the students are expected to facilitate the academic development at the schools involved in their partner-school projects, be able to cooperate with school management and contribute to academic cooperation at schools and thus develop project management skills.

In summary, CHC was developed with at least two purposes: 1) to alleviate a shortage of professionals in the welfare sector, beginning with science teachers and 2) to improve the level of science teaching in primary and lower secondary schools. Although attracting students to programmes offering qualifications aimed at the welfare sector is explicitly mentioned as the first purpose in the steering documents, the second purpose most clearly defines how the programme is structured. According to the principles outlined above, CHC graduates are expected to become academically strong within the field of science education and to use this to implement and manage projects within science teaching in their future schools of employment.

Teacher educators involved in implementing CHC

As is outlined above, CHC was strongly influenced by Wolfensberger (2012b), and this influence is visible in the steering document available to the teacher educators. As I have implied, the steering document left significant room for interpretation in that it only describes courses and activities in vague terms. This room for interpretation was given to a team of 17 teacher educators who I will refer to as the 'CHC team'. Of these 17, six taught a science subject. The team was coordinated by a teacher educator in science and chemistry. Teacher educators who did not teach science represented a range of subjects including arts and crafts, maths and pedagogy.

In the following section, I will describe in further detail how suitable preservice science teachers were described in steering documents and how they were selected.

The CHC students

In the following I describe how CHC initially advertised to students and how Professionshøjskolen Metropol (2018) described the application procedure prior to initiating the project, in order to give an understanding of who the prospective preservice science teachers in the programme were and what procedure they had to undertake to become part of the programme.

The first CHC advertisement to students provided a short presentation of the programme, who could apply and what the requirements were for applying. It further informed the preservice teachers of a scholarship of approximately EUR 270 per month.

Not much was said about what CHC was; it was described as a talent programme for preservice teachers in their 2nd year who were qualifying to teach one or more science subjects and who were not behind with their studies. The programme was described as challenging but that it in return offered skills that would provide the participants with opportunities to "make a difference, both within and outside the school" (Professionshøjskolen Metropol, 2018). The advertisement is not very clear about how CHC graduates can make a difference and, apart from mentioning a focus on science teaching, the purpose stated in the script on strengthening science in schools is not mentioned. The material briefly describes the content of the programme, included Journal Club, partner-school projects and the summer school.

The successful candidate is described as a preservice teacher who, in addition to the formal requirements, is "engaged, full of initiative and wants to make a difference". It is further emphasised that it is a bonus to be a ASTE student or have math, home economics ("*madkundskab*"), physical education ("*idræt*") or crafts and design ("*håndværk og design*") in addition to the required science subject (Professionshøjskolen Metropol, 2018).

Overall, the advertisement to prospective participants in CHC does not provide concrete information about what the programme entails but goes more into detail with who can apply and how.

Application process

The application process consisted of a written application in which the preservice science teachers were requested to explain why they applied and how they intended to make a difference to the science teaching profession. In the cases where the written applications lived up to the requirements stated by the assessment committee, the applicants were invited to a 20-minute interview with an assessment panel. According to the advertisement, the assessment panel would

consist of two CHC teachers and two experts. The advertisement does not specify from within which field these experts would be recruited. Professionshøjskolen Metropol (2018) provides more detailed information about who will be on the assessment panel and what the assessment criteria are. For the first round of applications, the panel consisted of

A) two science teacher educators

B) a school manager from one of the partner-schools

C) a representative from the organisation Science Talenter (eng. Science Talents).

The assessment criteria outlined by Professionshøjskolen Metropol (2018) are largely aligned with the criteria mentioned in the advertisement to the preservice teachers with two main exceptions: 1) it is mentioned that the panel will consider grades from the first three semesters of the teacher education and 2) it is mentioned that experience with science pedagogy, such as work experience at science centres, is considered a benefit. As the advertisement to preservice teachers and the steering document written for the program might not have been written at the same time, the discrepancy may be due to a change in assessment criteria between the time of writing up the script and making the call for applicants. This is the only time grades are mentioned as an assessment criterion.

Result of the application process

It proved difficult to attract enough applicants for the first cohort of CHC: 11 students were enrolled in September 2018, and the team behind CHC had hoped for 15. For this reason, the CHC team decided to increase the number of participants for the second cohort and succeeded in attracting 21 applicants, of which 19 initially enrolled. In both application procedures, several calls for applications were made in order to reach a sufficient number of participants. In total, two students were rejected during the application process from the first two cohorts of applicants, one for not showing enough engagement and one for being behind with their studies.

Assessment criteria based on motivation and difficulties attracting enough applicants and the numerous rounds of calls for applications are all likely to have influenced who became part of the programme and in turn who graduated from it – six graduated from the 2018 cohort and seven from the 2019 cohort. From the participants who became respondents in my project I know that information about the process from peers who had already signed up and encouragement to sign up from teacher educators played a more important role in the decision to apply to become part of CHC than the written advertisement material. It is not within the scope

of my project to explore who did not sign up and why, but for the preservice teachers who did sign up, their relationship to their peers and to teacher educators played a role.

A reason the participants gave for not responding to the first calls was confusion about what it was, which is understandable based on the information given in the advertisement material: it provided no clear definition of nor explained what the programme itself entailed.

Presentation of selected activities

The content and activities developed by CHC plays an important part in understanding how the CHC team interpreted the steering documents and hence the experience of the participants. Below is a brief, concrete description of the main activities in CHC mentioned under the CHC principles above. The descriptions are based on Professionshøjskolen Metropol (2018), the advertisement aimed at partner schools and interviews.

Four Journal Clubs per year (5 ECTS)

The Journal Clubs involved reading and discussing texts and articles within science education and were held approximately four times per year. Preservice teachers were encouraged to suggest texts, but it was largely the teacher educators who chose themes and articles. Examples of themes during the first year include science competencies, practical inquiry-based science teaching, national (Danish) science strategy and Big Ideas of Science.

Courses (5 ECTS)

The courses in CHC were a mixture of courses focusing on science, such as 'Open School' or 'Attitudes to Science' and more generic courses on project management, networking, innovation and talent development of pupils in schools. The generic courses were intended to support the preservice teachers during the partner-school projects, but there were issues with timing, particularly during the first year, and the first part of the project management course was held after the preservice teachers had initiated their cooperation with their partner schools.

Partner-school project (10 ECTS)

The partner-school projects were intended to be a large part of participating in CHC and to run over the course of approximately three semesters. In the steering document, Professionshøjskolen Metropol (2018) describes the purpose of the projects as providing the CHC participants with concrete experience with the teaching profession within science education. This experience with science teaching in schools was more specifically described as working with a problem or issue within science education that had been identified by the schools

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themselves. Ideally, the partner-school project should add a practical dimension to the courses on project management and networking and thereby strengthen the transfer from the courses to working with science education projects in schools.

The partner schools were initially intended to be public primary and lower secondary schools in the municipalities of Copenhagen and Frederiksberg, and the schools were paid for the time their teachers spent on the project. As it was difficult to find enough schools, private schools and schools outside Copenhagen and Frederiksberg were also included.

In the advertisement material sent to the schools, the purpose of the project was described as a means to link teacher education with the teaching profession. The project itself was described as a way for preservice teachers to "*develop elements in or around the science subjects*". The specific content should be decided in cooperation between the schools and the preservice teachers. The advertisement material further specified that the schools were to provide preservice teachers with supervision from an "*experienced and engaged science teacher*". It was the intention that the preservice teachers themselves should decide how to work with the issue chosen by the schools. As project managers, it was emphasised that the preservice teachers were not to be seen as teaching interns.

Case competition (0 ECTS)

The case competition ran over the course of 24 hours. In the competition, the preservice teachers were given authentic problems within science education that had been identified by the municipalities or schools. The preservice teachers were expected to use tools they had acquired from a course on innovation to develop solutions to the problems identified.

A five-day summer school (5 ECTS)

The summer schools focused on out-of-school pedagogy. The first summer school was abroad in the Netherlands. Due to COVID-19, the second cohort went to Jutland where they, among other activities, visited out-of-school environments and observed teaching of pupils in these settings.

Structure of Copenhagen Honours College

A widely acknowledged issue with the first two cohorts of CHC was that the programme was not very well organized. As such, it has been a challenge to piece together what the preservice teachers did during the first three years. This fact was frustrating for the participants in CHC and is evident in my data. As a reaction to this frustration, one of the CHC team members, Høiby (2020), developed a schedule based on those first two cohorts, as a means to provide the

subsequent cohorts with an overview of the programme. Below is a translated version of this schedule. It is important to note that this was approximately how the programme was structured for the CHC participants in my project, but such a schedule was never made available to them while they were studying.

	5th semester	6th semester	7th semester	8th semester
Courses	Three-day introduction seminar, "Programming and engineering" "Project management"	"Interdisciplinary cooperation" "Networking and resources"	"Out-of-school teaching" 1st elective course (e.g. "Attitudes to science")	"Talent spotting and talent development" 2nd elective course (e.g. Design-based innovation processes)
Other activities	Two journal clubs	Case competition Two Journal Clubs	Summer school Two journal clubs	Two journal clubs
Partner-school project		Start-up of partner-school project		Exam partner-school project

Table 2 Example of CHC structure, translation of Rasmus Høiby, n.d.

As mentioned, the journal clubs focused on science education and all the literature read and discussed was based on research within science teaching and learning. However, a majority of the courses were focused on generic competencies such as "innovation", "project management" and "talent spotting". This is important to note as it influenced how the preservice teachers experienced the programme and can therefore say something about what teacher education can learn from the preservice teachers' experiences of participating in the programme. By including activities which are not exclusively relevant to science education, the lessons learned from the programme are also potentially relevant to teacher education in general, and not just to science teacher education.

In this section I have described, first, that the rationale behind implementing CHC was related to 1) attracting more students to professional education and in turn the teaching profession and 2) improving the level of science teaching in schools. Moreover, I have argued that the rationale behind the focus on science teaching is not clear in the steering documents.

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I have further outlined how the development of the programme was strongly influenced by Wolfensberger's (2012) "honors pedagogy", which she compares to the self-determination theory developed by Deci and Ryan (2000), and how it is not clear from Wolfensberger (2012b) why this pedagogy should only benefit what Wolfensberger terms gifted students. I have further outlined the criteria for selecting students, and I concluded that there is no justification for ascribing special abilities to the CHC participants compared to their fellow preservice science teachers. This conclusion was followed by a description of activities in the programme and a table in which the structure of the programme is presented.

As mentioned, the programme took place during the last two years of the preservice teachers' qualification, and several of the CHC participants were also ASTE students. In order to increase the understanding of what context the CHC participants were part of, the following two sections will describe first how teacher education is structured in Denmark and finally how the ASTE programme differed from this.

Teacher education in Denmark

Teacher education in Denmark is a four-year bachelor's degree programme in education. The education is frequently reformed. The preservice teachers in the 2018 and 2019 CHC cohorts studied under a reform implemented in 2013. Part of the focus of this reform was flexibility, and one of the means to achieve this flexibility was called 'modulization'. The purpose of modulization was to divide required courses into modules and consider each module as an entity in itself. The rationale behind this was to make it possible for preservice teachers to follow modules in a random order and thus make their education more flexible. The exam for a course was taken when all modules were completed and approved.

A qualified teacher from a Danish teacher education programme is qualified to teach at least two subjects; the most common profile is a teacher with three subjects. Of these three subjects, the first Teaching Subject (TS) is either Danish for form levels 1-6 (ages 7-13); Danish for form levels 4-10 (ages 10-17); maths for form levels 1-6; or maths for form levels 4-10. In addition to qualifying for particular subjects, the students are required to follow four compulsory modules as part of the course "Pedagogy and Learning" (PL) and two modules as part of the course "Christianity, Enlightenment and Citizenship" (CEC). This is how the programme is structured at KP; other institutions may offer slightly different curricula.

The preservice teachers are further required to complete three periods of practicum (PR), each of a duration of approximately seven weeks. The practicum can be either seven consecutive

weeks or it can be extended over the course of a semester. At KP, students are also required to choose between a range of so-called specialization modules (SPEC), which can have a subject specific specialization such as 'out-of-school teaching' in relation to science or interdisciplinary focus such as education in human rights. Below is an overview of the structure of the teacher education programme under the 2013 reform for a preservice teacher qualifying to teach maths, music and geography. The numbers in brackets are the number of modules. As per the modulization, the schedule indicates a suggestion for students and during which semesters (spring or autumn) the modules are most likely to be available but the preservice teachers are free to follow the modules in a different order.

1st sem.	2nd sem.	3rd sem.	4th sem.	5th sem.	6th sem.	7th sem.	8th sem.
Maths (1)	Maths (2)	Maths (3)	Maths (4)	SPEC	BA1	PL3/4	BA2
Intro	Mus (1)	PL1	Mus (2)	Mus(3)	PL3/4	SPEC	PR3
CEC/PL2	CEC/PL2	PR1	SPEC	Geo (1)	PR2	Geo (2)	Geo (3)

Table 3 Example of educational structure of Danish teacher education

How to become a science teacher

By qualifying to teach geography, a preservice teacher who followed the modules presented in table 3 would be considered a science teacher. To become a science teacher, it is also possible to choose between the interdisciplinary subject science and technology (primary and mid-level) or physics/chemistry (form levels 7-9) in lower secondary school (most lower secondary schools do not offer form level 10). Each subject is taught in teacher education as three modules, each corresponding to 10 European Credit Transfer System credits (ECTS). There are no requirements to choose only one age group, such as Science and Technology if the first subject is maths for form levels 1-6, or only science subjects (Ministry of Higher Education and Science 2015). The pre-service teachers must decide on their first teaching subject when they begin the programme, but they choose their second and third subjects later with variable deadlines.

It is worth noting that the modules for the third teaching subject in the example in table 3, in this case geography, start in the fifth semester. Applicants for CHC had to qualify to teach a science subject, and initially science was underlined as important in the advertisement material.

If a preservice teacher only planned to qualify to teach one science subject, and this teaching subject was their third subject, they would have to apply for CHC before starting their science modules. This might have deterred some preservice teachers from applying, as they might have known little about science teaching or found it difficult to identify themselves as someone who was committed to improving science teaching at their future workplace.

Advanced Science Teacher Education (ASTE)

A large proportion of the respondents in this project graduated from the ASTE programme. As this proved to significantly influence their experience of both the teacher education programme and Copenhagen Honours College, it needs to be presented here.

The programme, which ran alongside the regular teacher education programme, was a development project between University College Capital and University College Metropol[3], the Department of Science Education at University of Copenhagen and the Danish School of Education at Aarhus University. To the respondents in this project, one of the most important aspects of the programme has been that they specialised in teaching science and maths for form levels 7-9 and qualified to teach four subjects rather than the usual three (maths, geography, biology and physics/chemistry). The third module in each of the science subjects and the fourth module in maths were replaced with four interdisciplinary modules, preparing the ASTE teachers to teach using problem-based and interdisciplinary approaches. In order for this to be possible, the preservice teachers enrolled in ASTE did not have any elective modules and they had to follow all modules in a fixed order, contrary to students enrolled in the regular teacher education programme. Below is an overview of how the education was structured for the preservice ASTE teachers who signed up for the first cohort of CHC and who were enrolled at the former UCC, kindly provided by Jens Aarby, who was part of developing the ASTE programme.

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[3] University College Capital and and Metropol merged and became University College Copenhagen (KP) in 2018.

Seme ster			
1st	CEC: Introductory module: **To become and be a teacher**	MATHS 1: **Mathematical learning, numbers and algebra**	PL2: **Learning and development of the pupil**
2nd	CEC: Education in the diverse schoo**l** CEC exam	GEO 1: **Geography - a changing world**	MATHS 2: **Geometry and the teaching of mathematics**
3rd	**PL 1: General Teaching competencies**	PRACTICUM – extended	Maths 3: Special-needs pupils and models in maths education
4th	Physics/Chemistry 1: **The world of physics and chemistry**	**ASTE 1** BIO 3/MATh4: **Health – Risk or Chance** 10 ECTS (7 from biology and 3 from maths)	**ASTE 2** : **Sustainability, Foodstuffs and Energy** 10 ECTS (4 from geography, 3 from biology and 3 from physics/chemistry)
5th	GEO 2: **Geography – the world around us** Geo exam	**ASTE 4** GEO 3/Physics-chemistry 3: **Energy and climate** 10 ECTS (geography 6, physics/chemistry 4)	**ASTE 3** MATHS 4/FK 3: **Natures game of dice** 10 ECTS (7 from maths and 3 from physics/chemistry) **Maths exam**
6th	Physics/Chemistry 2: **Development of scientific reasoning** **Exam, physics and chemistry**	MINI BACHELOR	PRACTICUM Exam, practicum
7th	BIO 1: **Living organisms and ecological relations – pupils inquiry-based and experimental work**	Practicum Exam in Practicum	PL 4: **Teaching of bilingual pupils**
8th	BIO 2: **Evolution, genetics and biotechnology – from everyday understanding to scientific understanding** Exam in Biology	Bachelor's dissertation	PL 3: Special-needs pedagogy Exam in LG

Table 4 Structure of ASTE from 2016 to 2020, provided by Aarby (2015), own translation.

The respondents in my study particularly reflect on the interdisciplinary aspect of ASTE as having importance for their professional lives as science teachers. However, the fact that the structure of the education was planned from the beginning also meant that the preservice ASTE teachers were part of the same group all through their education and followed all modules together, although they had the PL modules with preservice teachers from the regular programme. This is in contrast to the modulization of the regular programme, in which the preservice teachers are often in different groups for the majority of their modules as a

consequence of the flexibility in the education. This needs to be considered when the preservice ASTE teachers particularly mention community with peers from their education.

Influence of the structural difference between ASTE and general education

As mentioned above, the CHC assessment committee considered enrolment in ASTE as a benefit. Furthermore, because preservice ASTE teachers specialize in all science subjects, they are sure to have started their science modules in their second year of teacher education. Preservice teachers not enrolled in the ASTE programme might not start their science subjects until their third year, meaning that they will not have started their required subject before the call for applicants to CHC is made. This is not formally a problem in terms of applying. However, it might be a barrier to write an application in which you describe how you intend to make a difference within science in schools by participating in a programme with a focus on science teaching if you have yet to begin your qualification as a science teacher. As mentioned previously, it was beyond the scope of this project to explore why preservice science teachers chose not to sign up to CHC; however, considering that a majority of the graduating CHC students were enrolled in ASTE, it is worth bearing in mind that this organisational factor might have influenced who ended up signing up.

Differences between ASTE and CHC

One of the most important differences between ASTE and CHC is that ASTE was a complete education programme. In contrast, CHC was an add-on consisting of 30 ECTS that were added to the last two years of the teacher education programme.

ASTE had a focus on interdisciplinarity and on educating teachers who were qualified to teach in one subject more than the standard teacher profile. A consequence of this focus was a rigid structure of the education programme, but this also meant that the preservice teachers were part of the same group throughout all their modules.

CHC did not have a focus on the science subjects. Instead, it had a focus on the academic aspects of science education in general in the journal clubs and a strong focus on project management to enable the preservice teachers to 'facilitate academic development' within science teaching in their future workplaces – which were expected to be schools. The preservice teachers who signed up for CHC might as such have had very different profiles in terms of what subjects they were qualified to teach. With the opportunity to sign up for the programme without

qualifying to teach a traditional science subject such as biology but instead PE or home economics, the participants had very different prerequisites when it came to science education.

Summary of context

As I have presented in this chapter, the context of my project consists of the CHC programme which in turn is part of teacher education. As several of the CHC participants followed the ASTE programme, this was also a part of the context which had an obvious influence on the student experience.

In my presentation of CHC, I described how it was strongly inspired by Wolfensberger (2012b) and that the overall aims and goals for the programme were to alleviate teacher shortage and to improve science teaching in schools. The affordances the preservice teachers were provided with to do this were largely within project management and innovation, but the programme also included a focus on discussing science education research literature.

It is important to note that science was only part of the programme and the majority of the teacher educators in the CHC team did not teach science. It is further important to pay attention to the level of interpretation left to the implementing CHC team due to very general descriptions of the programme and activities in the steering document. These conditions illustrate the difficult task the teacher educators were given, which in turn affected the experience of the CHC participants.

Another important aspect of the context of my project is that the word talent is both vaguely described by Wolfensberger (2012b) and the steering documents. The most clear definition of talent offered by Professionshøjskolen Metropol (2018) is that the target preservice teachers are the ones who are willing and able to put in extra efforts in their studies. The pedagogical approach in CHC is inspired by Wolfensberger (2012b), who in turn is inspired by Deci and Ryan (2000), and nothing in Wolfensberger (2012b) or Professionshøjskolen Metropol (2018) suggests that what is developed within the programme only benefits a special kind of preservice teachers, thus making it relevant to explore what teacher education can learn from the experiences of the preservice teachers participating in the programme.

In the following chapter I will present current research in the field of how regular education is influenced by honors programmes.

Literature review

In this chapter I will position my project within the field of existing research related to what teacher education can learn from the student experience of CHC and argue how my project contributes to this field.

I start the section by outlining how I delimit the field of research related to the main question of what teacher education might learn from the experiences of the preservice science teachers participating in CHC. I move on to describe my search strategy consisting of a snowball search and an ERIC search. I proceed with a review of the literature in the field and conclude the section by arguing how my project attempts to fill a gap in the field of research.

Defining my field of research

My overall research goal is to explore how teacher education can learn from the student experience of participating in the CHC programme. Viewing honors programmes as a benefit to ordinary education is a common argument for having the programmes and for spending extra resources on selected students (Arbejdsgruppen til talentudvikling i uddannelsessystemet, 2011; Clauss, 2011; Kolster, 2021b; Renzulli, 2005; Wolfensberger, 2004, 2012a). The same argument goes for CHC as the presence of CHC is believed to have a positive impact on KP.

In figure 2 I have illustrated this statement as a small house (CHC) in a big house (Teacher education). The small house radiates into the big house, thus affecting its colour. My field of research is related to this radiation from honors programmes to higher education – does it exist? If it does, what does it consist of, why does the radiation take place and how is it affected by the students who participate in the honor programmes?

Figure 2 Assumption about how CHC influence Teacher education

In this section I will present the research related to this field. As it is very scarce, I will present my search strategy to clarify how I have located the research I have managed to find.

The presentation of my search strategy is followed by a review of the literature found, and I will conclude the section by arguing how my research fills a gap in this field of research.

To find the relevant literature in the field of how higher education institutions are influenced by honors programmes, I have used two main strategies, a snowball search and a database search in ERIC. First, I did a snowball search beginning with the first two articles I read in the field, Wolfensberger et al. 2004 and 2012. I chose these articles as the starting point for my literature search as Professionshøjskolen Metropol (2018) referred to the works of Wolfensberger as the main inspiration in the development of the CHC programme.

I chose to start out with a snowball search as I expected different words and phrases would be used to describe the influence of honors programmes on the hosting institution. Even though the phrase "laboratory for educational innovation" may only be used by Wolfensberger et al. (2004, 2012), the same concept might be called something different by other researchers. In order to make a sensible search query in a database, I needed to figure out what that could be.

I started my snowball search by checking references used by Wolfensberger et al. (2004, 2012) related to research on honors programmes as a means to educational innovation in ordinary education. I assessed the relevance of an article based on:

Inclusion criteria	Exclusion criteria
Empirical studies done by the authors	Studies on development of honors programmes
Referencing empirical studies done by other researchers	Anecdotal texts, e.g. texts with no references and no obvious research design or methodological reflections
Honors programmes' (or similar) influence on education or pedagogy at hosting institution	Development of honors programmes (not considering general education)
	Language not English or a Scandinavian language

Table 5 Overview of inclusion an exclusion search criteria

Empirical studies that reference empirical studies or the absence of such studies became important criteria because a lot of the literature I first encountered were testimonials from teachers or headmasters who had worked with honors programmes or similar, and although these studies described how the authors considered the presence of honors programmes to have influenced general education, the texts lacked transparency about how the authors had reached the conclusions they had. An example of this is Renzulli (2005), who argues that "[t]he field of gifted education has

been a true laboratory for the many innovations that have subsequently become mainstays of the American educational system", but it is unclear how he reaches this conclusion.

After outlining my exclusion and inclusion criteria, I used google scholar to identify articles referencing Wolfensberger et al. (2004, 2012) and assessed their relevance by using the same criteria.

Each article I found relevant according to my criteria was included in the snowball search using the same strategy as I used for Wolfensberger et al. (2004, 2012).

In the following section I will present the results from the snowball search.

Results of the snowball search

As mentioned, I started my snowball search with Wolfensberger et al. (2004) because Professionshøjskolen (2018) refer to Wolfensberger as the main inspiration in the development of the programme and because Wolfensberger et al. (2004) have conducted research on how honors programmes can play a part in developing educational practices at hosting institutions. Wolfensberger et al. (2004) reference the following in relation to honors as a means for educational development in the hosting institutions: Wolfensberger, Eijl, Cadée, et al. (2003); Wolfensberger, Eijl, and Pilot (2003); Van Eijl et al., 1999; Van Dam and De Klerk (1998) and Austin (1991).

Wolfensberger, Eijl, Cadée, et al. (2003) and Wolfensberger, Eijl and Pilot (2003) were excluded, as they are both in Dutch. Van Eijl et al. (1999) is unfortunately missing from the list of references in Wolfensberger et al. (2003), but appears to be from a conference paper called "Improving academic learning by an honors program"; I have not been able to find the paper, neither online nor in a library. Van Dam & De Klerk (1998) is also missing from the list of references, but on google scholar there is one article which matches names and year; this is in Dutch. That leaves Austin (1991). This text is a monograph in which Austin (1991) argues that honors programmes and educational innovation are often allied and that "[n]ew courses, new majors, living-learning centers, and community-centered programs have been developed within honors programs and sometimes made available to the entire campus." (Austin, p. 16, 1991). Unfortunately, Austin (1991) fails to reference any research or data regarding this statement. In Wolfensberger et al. (2012a) no additional references are introduced. With no new relevant references found in Wolfensberger et al. (2003, 2012a), I checked if any relevant articles had referenced them by using the "cited by" tool in google scholar.

Starting with the most recent article, 27 have referenced Wolfensberger et al. (2012a). These citations are not necessarily peer reviewed, as it is not an option to make this limitation in google scholar. The 27 articles included two articles by Kolster, both from 2021 and both live up to the criteria of being based on empirical research and of researching how educational institutions hosting honors programmes might learn from the programmes.

The two articles by Kolster are the only two among the 27 citations of Wolfensberger et al. (2012a) that I consider relevant for my field of research. The main reason why I consider articles in this search as irrelevant is that they do not consider the interaction between hosting institution and honors programmes. An example is Haenen et al. (2021). This research investigates how student and teacher perceptions of challenge differ in an honors programme. The main goal of the research was to improve the level of challenge within the honors programme itself, and there is no mention of how general education at the hosting institution might learn from this research, and thus the study is not related to my main question.

Wolfensberger et al. (2004) is cited in 39 articles, including the two Kolster articles and Wolfensberger et al. (2012a). Nine of the citing articles were in Dutch. One of the citing authors who appears to have worked within my field of research is Nelleke De Jong from the Netherlands. I have been able to find conference presentations, a research proposal, a round-table discussion and what is termed a 'research note' co-authored with three others (Gorp et al., 2017), which all relate to the issue of how honors programmes in the Netherlands might influence regular education. De Jong does not appear to have published any peer-reviewed research I could include in my literature review and cited literature is either in Dutch or literature I have already found.

An interesting article referencing Wolfensberger et al. (2004) is Otto and Kruif (2017), who explore what educators perceive as stimulating or blocking what they term diffusion from honors colleges to regular education. This article is included in the literature review below.

Kolster (2021b) is cited in 16 articles, but none of these relate to honors programmes' influence on implementing institutions. Their focus is on change processes in educational institutions.

Kolster (2021a) is cited in three articles, of which two are related to COVID-19 and the third is an article co-authored by Kolster about excellence in higher education that focuses on what honors students consider the ideal honors college, and as such it is not relevant to my field of how honors programmes influence implementing institutions.

The relevant literature referenced by Kolster (2021a, 2021b) will be presented in the literature review.

In summary, the literature found using a snowball search are: Kolster, (2021b, 2021a); Otto and Kruif (2017) and Wolfensberger et al. (2004, 2012a).

As this is not a very long list of literature and as it is all based in the Netherlands, I wanted to add a more systematic search in ERIC to my literature review to see if I could find relevant literature outside the Netherlands. This search strategy will be presented in the following section.

ERIC search

The second search strategy I used was a systematic search in the ERIC database. I added the ERIC search to my search strategy to reduce the chance of missing something important simply because it had not been in the circle of references used by the literature I had already found in my search.

My search string is divided into two. One string looked for terms related to honors and words that are used synonymously with honors: talent, excellence and gifted. I chose not to specify 'programme' or 'college', as this might rule out relevant literature. I did not get more hits than I could sift through them and rule out the hits that did not include anything resembling an honors programme.

The second part of my search string is specifically designed to look for research on how honors programmes influence ordinary education. Initially, I tried adding 'ordinary' or 'general' to get hits relating to influence on ordinary education, but the terms were too generic to provide any useful hits. The same was the case for the words 'impact' or 'influence'. Instead, I chose to use the terms 'educational innovation', 'educational development', 'pedagogical development' and 'pedagogical innovation'. These are terms used in the argument that honors programmes have a positive influence on the implementing institutions, such as Austin (1991), Clauss, (2011) and Renzulli (2005). I further included terms I had come across in my snowball search such as 'diffusion' from Kolster (2021a, 2021b), 'laboratories for educational development' and 'spin-off' from Wolfensberger et al. (2004, 2012a). I limited my search to only include peer-reviewed articles and articles about higher education. This resulted in the following search query:

> abstract:((honors OR talent OR excellence OR gifted) AND ('educational innovation' OR 'educational development' OR diffusion OR 'pedagogical innovation' OR 'pedagogical development' OR 'laboratory for educational development' OR 'spin-off'))

Results of the ERIC search

My search string in ERIC gave a result of 45 articles. Given the relatively small amount of hits, it was possible to read through all abstracts in order to determine if the hits were relevant to my field of how honors programmes – or similar – had influenced ordinary education at the implementing institutions.

The 45 hits included the articles I had already found in my snowball search. None of the remaining hits were relevant to my project. An example is Caliskan and Zhu (2020). The article appeared in the search because the abstract mentions higher education as important for talent development and part of the research aim was to explore how students perceive educational innovations. However, although the article includes educational innovation, it does not include anything resembling an honors programme. Therefore I do not consider the study relevant to my field of research as it does not research the influence of a talent programme on educational innovation.

The combination of a snowball search and a structured literature search in the ERIC database did not reveal a large field of research in which I can place my study. I cannot rule out that I have missed something, but based on the above it seems plausible that research within how honors colleges or similar might influence the implementing institution is not a very mature field of research.

In the following I will review the relevant literature in further detail, starting with which methodology has been applied to research the influence of honors programmes on regular education.

Approaches to research honors programmes' influence on educational institutions

As researching how higher education is influenced by an honors programme is a broad question, and hence a complex endeavour that can be approached in different ways, I will start my review of the literature by describing the methods and methodologies used in the relevant literature. This allows a further understanding of the findings presented in the following section but also plays a part in my argument for how my project fills a gap in the current knowledge.

Starting with Wolfensberger et al. (2004, 2012), they are very clear about what they research: innovations in regular education that are derived from honors programmes. They are not, however, transparent about what their data consist of and how they have analysed it. They mention that they:

…looked for innovations that were realised in the regular programmes and had their

origin in the honours programmes. (Wolfensberger et al. 2004, p. 120)

They do not specify how they define innovation or how they were able to determine the origin of such innovations. They list their data as "available documents and websites. Additional information came from interviews with some teachers, co-ordinators, and directors of honours programmes" (Wolfensberger et al. 2004, p. 120).

In terms of analysis, they refer to doing a grounded theory analysis of qualitative and quantitative data, but they do not provide any detailed information as to how they did a grounded theory analysis or what the quantitative data consisted of. They further mention researching the effects of honors on regular programmes through interviews with teachers, coordinators and directors and by doing in-depth studies of cases. They do not specify what these in-depth studies consisted of or how they chose their cases. Wolfensberger et al. (2012) are also not clear about how they researched honors programmes' influence on regular programmes and do not specify what analytical approach they have used. To sum up, what we know about the research methods in the study conducted by Wolfensberger et al. (2004, 2012) is that it involved collecting data consisting of documents, websites and interviews with teachers, coordinators and directors. The student perspective is absent.

Another study involving respondents that resembles the study of Wolfensberger et al. (2004, 2012) is the study by Otto and Kruif (2017). The aim of that study was slightly different to the study by Wolfensberger et al. (2004, 2012), as Otto and Kruif (2017) did not attempt to find influences on regular education from honors programmes. Instead, they aimed to outline what the invited stakeholders found to increase diffusion from honors programmes to regular education, that is, how they influence such programmes. The study consists of data collected from what they term a 'meeting of experts' within the field of honors programmes in the Netherlands. The experts had been invited through a network for stakeholders within honors programmes in higher education called Het informele hbo-wo honoursnetwerk. A total of 35 stakeholders comprising deans, programme managers, coordinators, teacher-coordinators, teachers, researchers, policy makers or policymaker-organizers accepted the invitation and participated in the meeting. One of the questions the stakeholders were asked to discuss was the following: What are necessary factors for honors programmes to function as laboratories for educational innovation? (Otto & Kruif, 2017, p. 198).

The discussions were recorded in the minutes by what the authors term student secretaries. The findings presented in Otto and Kruif (2017) are the three most recurring factors, which will be presented in the following section.

Common for the methods and methodologies applied by Wolfensberger et al. (2004, 2012) and Otto and Kruif (2017) is that they do not include the student perspective and that there appears to be an implied understanding that honors programmes serve as a means to innovate ordinary education. In the analogy of the houses in fig. 2, radiation is expected to take place and be in the form of new and improved ways of teaching. Not included in these studies is an understanding of the baseline, the context in which the honors programmes are implemented. We are led to believe that whatever takes place at the honors colleges is better than teaching at the rest of the ordinary educations and that these will benefit from what goes on at the honors colleges.

The study by Kolster (2021a, 2021b) is the most recent study I have found relevant to my study; this study is also the most transparent about the methodology applied. The same data is used in Kolster (2021b, 2021a), but the data is used in the attempt to answer two different questions. In Kolster (2021a) his research question is:

What are the diffusional effects, and its preceding processes, resulting from excellence education at five Dutch higher education institutions?

And in Kolster (2021b) the question is:

To what extent are the testing grounds formed by excellence education in five Dutch higher education institutions, structural ambidextrous explorative units that create educational innovations?

In other words, Kolster (2021a) attempts to answer what influence honors programmes have on higher education institutions, and Kolster (2021b) attempts to answer to what extent such programmes serve as a means to educational innovations.

The study by Kolster (2021a, 2021b) is a qualitative case study of five higher education institutions in the Netherlands, and the data consists of document analysis and semi-structured focus group interviews with what Kolster refers to as key actors, such as policymakers, administration and teachers who were all directly involved with the honors programmes; students who were part of an honors programme and students who were not. A big difference between Kolster and the studies by Wolfensberger (2004, 2012) and Otto and Kruif (2017) is that Kolster includes students in his study. The findings are presented below.

Current knowledge on honors programmes' influence on regular education

Above I outlined how the influence of honors programmes on higher education institutions has previously been researched, and in this section I will present the main findings from this research,

focusing on what aspects of education honors programmes are found to have an influence and what factors are found to be important to increase influence between honors programmes and regular education.

How do honors programmes influence regular education?

In the literature, there are two overlapping aspects of how honors programmes influence regular education: course content and pedagogy.

In terms of course content, Wolfensberger et al. (2012a) argue that spin-off, what I termed radiation in the house-analogy, within course content is 'sizeable' in the cases where the honors course content and the content of general programmes are closely connected. One of the examples provided by Wolfensberger et al. (2012a) is the development of a course in qualitative methods which was initially developed within an honors programme but later offered to all students. This example was based based on research conducted at the university at which the researchers were employed.

It is not stated in Wolfensberger et al. (2012a), how other such spin-offs had been detected. Kolster's (2021a) findings support the findings by Wolfensberger et al. (2004, 2012a) in relation to course content in honors programmes influencing course content in regular programmes. The examples provided are teachers who reported reusing assignments in regular programmes that they had tested and found successful in honors programmes. Kolster (2021a) comments, however, that regular programmes might also develop content that is implemented in honors programmes.

In terms of influence on pedagogy, Wolfensberger et al. (2012a) argue that teachers who participate in honors programmes acquire new understandings and skills in relation to teaching, and that the teachers report they apply these new understandings and skills to their teaching outside the honors programme. It is not specified in the study what the new understandings and skills consisted of or why they were worth applying to other parts of the education. Kolster (2021a) reports similar findings and specifies that teachers reported being inspired by the teaching approaches in the honors programmes to apply a more student centred approach to teaching and assessment in regular programmes.

Factors found to increase influence from honors programmes on regular education

The most important factor found to increase influence from honors programmes on regular education is related to the teachers. Kolster (2021a) found that in the cases where teachers had

classes in both honors and regular programmes, they were likely to be inspired by either content or pedagogy or both from honors programmes when teaching at regular programmes. This finding is supported by Wolfensberger et al. (2004, 2012), who also found that, when there was an overlap in teachers between honors programmes and regular education, what they termed spin-off was more likely to occur.

The teachers' importance on what and whether honors programmes influence regular education supports the relevance of Otto and Kruif's (2017) study, as their source of data was stakeholders such as honors teachers. In Otto and Kruif's (2017) study, three primary factors in terms of how honors programmes can be viewed as a means to educational development were outlined: 1) a safe environment for the teachers to experiment (the respondents shared a concern that honors students did not always accept the premise of teaching methods as being experimental); 2) the need for a community among teachers to share ideas between teachers who teach in honors programmes and teachers who do not; and 3) the need for institutional support. Although the findings by Otto and Kruif (2017) are important in so far as the respondents work with honors programmes, the study says more about what the stakeholders *suggest* will work rather than what they had *experienced* had worked.

As important as the significance of teachers' influence on diffusion (radiation in the house-analogy) between honors programmes and regular education, Kolster (2021b) concludes that the influence of honors programmes on regular education is limited. He argues that the programmes involve too few people to have large-scale effect and that teachers in the regular programmes are often not aware of which students are honors students. In other words, although there is agreement between Wolfensberger (2004, 2012) and Kolster (2021a) that honors programmes can influence the content and pedagogy of regular programmes, Kolster argue that the significance of this impact should not be overestimated. Returning to the analogy of the small house (CHC) in the big house (teacher education), the radiation between the houses is more isolated and harder to detect than implied in the statements

Figure 3 Honors programmes' influence on hosting institution based on current research

presented by Arbejdsgruppen til talentudvikling i uddannelsessystemet (2011), Clauss, (2011), Renzulli (2005) and Wolfensberger (2004, 2012a), who all indicate that honors programmes benefit higher education institutions in general, as represented in fig. 2. Based on the current research, influence between honors programmes and regular education appears to be more like it is

represented in figure 3; that is, it is dependent on the teachers (the arrow), who are few in numbers compared to the institution as a whole and thus have limited influence on the higher education institution (the little star).

Summary of literature review

Based on the limited research in the field, honors programmes have been found to influence content and pedagogy in regular education; however, this is mainly seen in the cases where there is an overlap of teachers between honors programmes and regular education. Kolster (2021a, 2021b) partly ascribes the limited influence of honors programmes on regular education to the fact that honors programmes are small and consist of very few people, students and teachers compared to regular education. As a consequence of this conclusion, Kolster (2021a) suggests improving the visibility of what happens in honors programmes and more systematic collection of information.

As I presented in the section on methods and methodology, only Kolster (2021a, 2021b) included students when researching the influence of honors programmes on regular education. However, what he found was that students did not have a huge impact on influencing diffusion between honors and regular education. Teachers did report that honors students were active in class and were supportive of non-honors students, but the number of students were few compared to the institution as a whole. It is also not clear if a higher engagement of honors students was a result of participation in honors programmes.

Contribution from my study

The fact that the students do not appear to be a factor in relation to what influence honors programmes have on regular education underlines the importance of researching the student experience. Although current research does not ascribe any importance to honors students in relation to how regular education is influenced by honors programmes, this might be due to low numbers of students compared to higher education in general as suggested by Kolster (2021a), but it could also be ascribed to limited student influence over content and pedagogy in regular education. As such, I will argue that there is a gap in the current research in relation to the student perspective. One of the consequences of this gap is that even if students experienced aspects of an honors programme as highly relevant to their education, the approach used in

current research has not had the goal of exploring if such experiences exist, how they could benefit regular education and whether they might have gone undetected.

In my project I have approached what teacher education might learn from CHC by following Kolster's (2021a) suggestion to gather information about the programme through research, and the aspect of CHC I explore is the student experience, which is missing in the current research in the field.

The students are only part of the programme for the last two years of their education and they are a very small number of students, six and seven graduates from the first two years, respectively. If their experience is not researched and disseminated, valuable insights could be lost. In the analogy of the little house in the big house, the door needs to be opened to the little house and it needs to be systematically researched what is going on behind those doors in order to be able to assess what teacher education can learn from CHC. To support the understanding of what goes on inside the little house and what parts of the CHC activities could be of importance and worth exporting to the big house (the teacher education), I will use transfer of learning as a theoretical perspective. In the following section, I will present my perspective on transfer of learning and why I find it suitable to apply this concept to this project to enhance the chance of teacher education learning from what happens in CHC.

Conceptual framework

As presented above, my overall research goal is to explore what teacher education can learn from the student experience of participating in the CHC programme. In this chapter I present the conceptual framework of transfer of learning from a situated cognition perspective and why I have chosen this as the point of departure in my PhD project.

Teacher education is a professional education, and preservice teachers are expected to become teachers upon graduation. This expectation is also framed in the rationale for developing CHC, as graduates from the programme are expected to gain competences to facilitate and manage science education projects in their future schools of employment. As part of the implied expectation that graduates enter the teaching profession, there is also an implied expectation that they have the ability to transfer what they have learned during CHC to their profession and become science-education project managers.

Due to the implied expectations of transfer to a specific profession, I find it relevant to use the concept of transfer of learning as a conceptual framework as my point of departure. By using the concept of transfer of learning in my research design and analysis, I have explored if CHC contains aspects that, based on previous research, might increase the chances of transfer of learning between teacher education and the teaching profession.

As transfer of learning is a century-old concept and different meanings are applied to the concept, it is not self-evident what meaning I ascribe to the concept and how I have applied it in my project. To clarify how transfer of learning is understood in the context of my project, I will outline how I define transfer of learning in this project in the following.

Transfer of learning from a situated cognition perspective

The long history of research on transfer of learning has led to different perspectives on the concept, depending on, among other aspects, context, focus and epistemology. In my project, I consider transfer of learning from a situated cognition perspective and the related developmental practices perspective, which I will describe in further detail in this section.

I will begin the description of the situated cognition perspective and the developmental practices perspective by providing a brief overview of what led to the development of these perspectives. Following the overview of the situated cognition perspective on transfer of learning, I will present the types of knowledge considered when researching transfer of learning from this perspective. After describing the types of knowledge considered, I review the works of Lobato (2003, 2006) and Engle et al. (2012) in relation to what is considered to enhance transfer from the situated cognition perspective and how Lobato suggests researching transfer of learning. I will conclude the section by arguing why the situated cognition perspective in general and the works of Lobato and Engle in particular are good fits for my research project.

The situated cognition perspective is partly developed as a reaction to the first approaches to transfer of learning, which were based on a behaviourist and cognitive perspective. For this reason, and to clarify how my approach differs from more traditional understandings of transfer of learning, I will start this section with a brief overview of this development. For the purpose of the overview, I draw on an extensive literature review conducted by Hachmann (2020). The same literature review is used in Dohn et al. (2020), who I also refer to in this section.

Critique of early perspectives on transfer of learning

In the early perspectives on transfer of learning, transfer was understood as a retention of knowledge from one situation to another and the ability to see similarities between situations (Lobato, 2003; Carraher & Schliemann, 2002; Dohn et al., 2020; Hachmann, 2020). Research in the field was based on positivist epistemology and thus focused on what could be observed (Carraher & Schliemann, 2002; Hachmann, 2020; Lave, 1988; Lobato, 2006). The first example of such research is Thorndike and Woodwoth (1901), who researched whether training a mental function could be transferred to new situations. The mental function trained was the ability to assess magnitude of different shapes, which was then tested on rectangles. Thorndike and Woodworth (1901) did not find any significant transfer of the ability to assess magnitude of different shapes. Another example is found in Gick & Holyoak (1983), who test respondents' ability to form an analogy between a story including a solution to a problem and a new problem. They find that respondents are not able to transfer the analogy of one story to a novel problem unless provided with more than a single story. In general, the traditional approach to transfer research, such as Thorndike and Woodworth (1901) and Gick and Holyoak (1983), has failed to find examples of transfer of learning (Bransford & Schwartz, 1999; Detterman & Sternberg, 1993). This failure has contributed to inspiring new approaches to transfer of learning (Hachmann, 2020; Dohn et al. 2020; Lobato, 2003; Bransford & Schwartz, 1999) such as the situated cognition perspective.

The situated cognition perspective as a reaction to traditional transfer of learning research

Lave (1988) was among the first to criticize the traditional approach to transfer of learning as briefly outlined above. Her criticism focused on a lack of consideration for the context and the social situation when considering learning. Lave (1988) argued that studies of transfer of learning such as the ones by Gick and Holyoak (1981) and Thorndike and Woodworth (1901) take place in laboratory-like settings. Because the research takes place in these laboratory-like settings, Lave (1988) argued that the results could not be meaningfully applied to everyday settings and that the research lacked consideration for the situation in which something was learned, including subjective experience and social context. The failure to detect any transfer of learning between contexts in the traditional transfer research further led Detterman and Sternberg (1993) to question whether transfer of learning could take place at all. Lave's criticism was supported by other researchers such as Bransford and Schwartz (1999) and Lobato (2003, 2006) and is considered an important contribution to the development of transfer of learning research within a situated cognition paradigm.

Within the situated cognition perspective of transfer of learning, transfer refers to how an individual transforms knowledge based on situational demands in a given situation (Hachmann, 2020). Lobato's (2003) concept of actor-oriented transfer is an example of an approach to transfer research developed within this paradigm. Lobato (2003) describes the difference between her situated cognition approach and what she terms traditional transfer approaches as "dynamic application of knowledge" versus "static application of sameness" and argues, in line with Bransford & Schwartz (1999), that failure to detect transfer might stem from the positivist approach, which has too narrow a focus on what to look for and how to look for it. In order to better understand what is considered to transfer within the situated cognition paradigm, Dohn et al. (2020) and Markauskaite and Goodyear (2017) provide a useful distinction between types of knowledge.

Types of knowledge within the situated cognition perspective

Dohn et al. (2020) and Markauskaite and Goodyear (2017) distinguish between three types of knowledge when reviewing the different perspectives within transfer research. First of the three types is declarative knowledge, described by Dohn et al. (2020) as "knowing that". For a science teacher this could be knowing that inquiry-based teaching motivates students. The second type is procedural knowledge, also described as "knowing how" (dohn et al., 2020), which in the case of the science teacher could be knowing how to teach science using inquiry-based teaching. Finally, the third type is relational knowledge, or "knowing of" (Dohn et al. 2020), which in the case of the science teacher could be knowing why inquiry-based science teaching can be motivating for pupils and in which cases it is suitable to use inquiry-based teaching. This aspect of knowledge is also called experiential knowledge to emphasize that it also considers experience with a matter (Markauskaite & Goodyear, 2017). In the case of our hypothetical science teacher, who was introduced in the section on structure of the teacher education in Denmark, this could imply that if she had previous experience with teaching through inquiry, she will also draw on her knowledge of what happened the last time she used this teaching approach in a given context or how she experienced inquiry-based teaching during the teacher education programme.

Transfer research within the situated cognition paradigm considers transfer of procedural and relational knowledge. As the example with the hypothetical teacher shows, teaching ideally draws on all three types of knowledge (declarative, procedural and relational). According to Dohn et al. (2020), declarative knowledge is not dismissed in the situated cognition perspective but is considered to be conceptualized through procedural and relational knowledge.

In the case of the CHC graduates, they are explicitly expected to be able and willing to implement and manage projects within science education. This implies an expectation of procedural and relational

knowledge transfer; that is, the graduates are expected to know how to manage a science education project, when and in what context it would be appropriate to implement one and how to draw on the experiences they gain from the honors programme. This explicit goal of CHC underlines the relevance of using transfer of learning within the situated cognition paradigm as a conceptual framework in my PhD project.

Above I have outlined which tradition within transfer research I apply in my research project. In order to assess whether the experience of CHC students might enhance knowledge transfer from education to the teaching profession, I will review how transfer of learning is considered to be enhanced within the situated cognition paradigm with particular emphasis on Lobato's "focusing phenomena" and Engle et al. 's (2012) concept of expansive framing.

Enhancement of transfer of learning

In this section I present the three most agreed upon factors for enhancing or inhibiting transfer between contexts: 1) similarities between contexts, 2) realizing the relevance of what is taught when it is taught and 3) knowing something well enough to be able to transfer this knowledge.

Similarity between contexts

Across perspectives on transfer of learning, attention is given to similarity between a situation in which something is learned and the situation in which something is expected to be transferred to. Lobato (2003) describes this as "the personal creation of relations or how the 'actors' see situations as similar" (Lobato 2003, p. 18). In the situated cognition perspective, transfer of learning is defined as the ability to transform procedural and relational knowledge to a situation where what is learned is required and possible to use (Dohn et al. 2020). In line with this, the question is then how the learning situation can affect and increase the chance of this happening. Dohn et al. (2020) list two general approaches to ensuring this: 1) through simulation of a non-educational context in an educational context or 2) by introducing an educational setting in a non-educational one. For preservice teachers, the non-educational setting would be a setting from a primary or lower secondary school. Although schools are obviously educational settings, they represent the situation the preservice teachers are expected to transfer to, the implied future profession. As such, from the transfer perspective, the schools are not the educational setting for preservice teachers.

In the case of CHC, the programme has attempted at least two activities where the non-educational context was included in the educational context. In the case competition, the students were taken out of an educational setting (teacher education) and spent a weekend together at a non-educational venue where they were presented with a problem related to science education in schools, in

the first case the problems were raised by municipalities. Although the problem was provided by a non-educational setting, the problem-solving activities were not in schools and more resembled simulation of the non-educational context. Another such example was the partner-school projects, as the students were both in an educational context as CHC participants, but they were also expected to implement a science-education project in a school, a non-educational setting in this context. Activities such as these underline the importance of researching the student experience of CHC from a transfer of learning perspective.

Relevance of what is taught

Engle et al. (2012) argue that how teaching is framed can either encourage or discourage transfer, and they distinguish between 'bounded' and 'expansive' framing. In bounded framing, it is not obvious to students why they are being taught something, and they are given the impression that the subject is only relevant in the school context. Conversely, expansive framing aims to teach while showing students opportunities for using their new knowledge outside the educational setting. An example from teacher education could be how to make lesson plans according to curricula requirements. Seeing the usefulness of what you learn when you learn it is recognised as beneficial to transfer by several transfer researchers across the theoretical perspectives, for example Wahlgren (2009) and Clark et al. (1993). In the case of my research project, this is an interesting aspect to research. Even though it has not been within the scope of my research project to follow all the CHC students into their profession, it was still possible to explore how they considered the usefulness of CHC when reflecting on their future.

Sufficient learning

Another important aspect in terms of enhancement of transfer of learning mentioned by Engle et al. (2012), and supported, by among others, Bransford and Schwartz (1999) and Pellegrino and Hilton (2012), is to have learned something sufficiently to be able to use it in a new situation. As the CHC programme is based on a pedagogy that emphasises academic enhancement, this is another aspect in which, based on previous knowledge in the field, activities such as journal club could be expected to enhance transfer of learning between the CHC programme and the teaching profession.

Based on the situated cognition perspective to transfer of learning, the following is recognized in the transfer literature as factors that have the potential to enhance transfer of learning:

1) Similarity between contexts to increase the chance of generalizing between contexts
2) Experience of relevance for the future
3) Sufficient learning

In the last part of this section on transfer of learning, I will introduce Lobato's actor-oriented transfer approach to researching transfer of learning as an alternative to the traditional approaches in which the researcher looks for the transfer of something that is predefined.

Actor Oriented Transfer (AOT)

In this section I will present Lobato's AOT approach and argue why it is a good fit for my research.

Lobato (2003, 2012) developed the AOT approach as a means to study what has transferred and how from the actor's perspective. Lobato (2003, 2012) argues that an actor's recognition of situations as similar can be unpredictable. A consequence is that a person's assessment of when to transfer what learning from a previous situation – that is, being able to generalize between contexts – is also unpredictable, and Lobato (2003, 2012) argues that this unpredictability calls for inductive, qualitative research approaches to the transfer of learning. This differs from more traditional approaches in which the methods are deductive and the researcher looks for the transfer of something specific, for example as seen in the examples mentioned above by Thorndike and Woodworth (1901) and Gick and Holyoak (1983).

An example of how Lobato has applied this concept is a study on pupils' ability to transfer learning from a maths class about how to calculate the slope and run of a slide. Lobato (2012) found that the pupils made unexpected errors. When she asked them about the task, she realised that even though they had been able to generalize between classroom lessons and the novel task, they made some unexpected errors. The the most common errors stemmed partly from phrases the teacher had used when explaining the main concepts. Lobato (2012) argues that a more traditional approach to transfer research would have failed to detect what had gone wrong for the pupils and simply found that they had not transferred correctly. Exploring how the pupils generalized between contexts provides information on how the teaching practices in the maths class could be improved to help the transfer.

I find Lobato's (2003, 2012) perspective to researching transfer of learning as an important inspiration in my research of what teacher education can learn from the preservice science teachers' experience's from CHC. Based on previous research as outlined above, it is a fair hypothesis that the CHC students will transfer what they have learned about project management in the partner-school projects, because these projects live up to what Dohn et al. (2020) argue enhance transfer through introducing an educational context (CHC) in a non-educational context (the partner schools). However, following Lobato, how actors see situations as similar is unpredictable, and as such my research is designed to be open to the fact that this hypothesis might not be correct; maybe the CHC students fail to see the usefulness of the partner-school projects in their future work life or fail to generalize between the partner-school projects and when an opportunity to apply project managements skills arises in their

workplace. As the teaching profession is complex and conditions for transfer might vary between schools, there is also the risk that the CHC graduates will not be in a situation where they are able to generalize between the partner-school projects and their future professions, there might be other aspects of their education which prove valuable instead that I have not thought of. By using Lobato's AOT approach, I let the respondents define how they generalize between contexts. This can provide the teacher education with valuable insights about how the respondents generalize between CHC and the profession.

Summary of conceptual framework

In this section I have described my conceptual framework of transfer of learning from a situated cognition perspective. Within this perspective, transfer is understood as the transformation of procedural and relational knowledge into a novel situation as the situation requires and to the degree it is perceived to be possible by the actor.

Within this understanding of transfer, but not exclusively, enhancement of transfer is considered to be through 1) strengthening the similarity between contexts, for example by bringing a non-educational context into the educational one; 2) by increasing the understanding of the usefulness of something learned in the learning situation and finally 3) by learning something sufficiently.

I have used the conceptual framework to design the outset for my study but in line with Lobato's AOT approach, I have used an abductive methodology, which has made it possible for me to explore *how* the preservice teachers generalize between contexts rather than *if* they transfer something specific. The abductive methodology I have used to achieve this is constructivist grounded theory, and it follows from this methodology that the conceptual framework is only a point of departure. As the project progressed, it was relevant to bring in other theoretical perspectives to help my understanding of the CHC participants' experience and what teacher education might learn from this experience.

How I use the concept of transfer of learning to design my study will be described in further detail in the next section in which I present my methodology. Additional theoretical perspectives will be introduced as part of the results and analysis section.

Methods and Methodology

This chapter presents the backbone of my project and serves to provide an understanding of my research process, from research design through to data collection, analysis and findings.

I will begin by arguing for my choice of the constructivist grounded theory method followed by a presentation of what this methodology entails and a presentation of my data collection. I will then go into detail with which parts of the constructivist grounded theory analysis I have used, followed by concrete examples of the analytical process.

As the constructivist grounded theory method calls for a data-driven choice of literature and concepts, I will go through how the categories I used in my articles were developed and how the research questions for each article were formulated based on the categories. The following section presents arguments for my choice of literature based on developed categories and sub questions. As the rationale for choosing the literature are based in the data, this is also the section in which I give a brief presentation of the main concepts I added to the conceptual framework of transfer of learning.

I conclude the chapter with an overview of categories, sub questions, related literature and titles of the resulting articles.

The choice of constructivist grounded theory method

The focus of my PhD project was on what teacher education can learn from the experience of pre-service science teachers' participation in an honors programme. I wanted to explore how the participants in the programme experienced the participation while they were still preservice teachers but also how – or if – the experience affected their transition to their work life.

When considering which methods and methodology to use to research this experience, I considered the field of study as well as the research question. CHC was new and although a steering document described the purpose of the programme as educating science teachers who could have a leading role in developing science teaching in schools and describe the main activities as courses, partner-school projects and journal club, the descriptions were not very detailed. For instance, the document did not specify how a year for a CHC participant would be structured, which courses they would be offered, what a partner-school project was or what the CHC journal club entailed. Furthermore, apart from the programme being new at KP, implementing a talent programme in a Danish teacher education programme was also new, and

as such no theories had yet been developed to explain the student experience of such a programme.

Another issue to consider was the number of potential respondents. According to the script for the programme, there was room for a maximum of 15 participants per cohort, but I knew at the time of the research being designed, that the first cohort would be even smaller than this, in fact, less than nine.

The focus on experience, the small number of participants and the novelty of the programme to be researched had me decide on a qualitative, abductive approach as this would allow me to start out inductively and explore the field without an initial hypothesis but instead allow me to develop hypotheses based on the initial data. Constructivist grounded theory method as described by Charmaz (2006) is a research method which caters for this need. This choice is supported by Creswell (2007) who argues that lack of a theory to explain the process of interest makes the grounded theory method suitable precisely because it sets out to develop such theories.

In the following section I will present the constructivist grounded theory method with particular emphasis on the works by Kathy Charmaz, who was the first to consider grounded theory within a constructivist paradigm (Mills et al., 2006).

Introduction to Constructivist Grounded Theory Method

In Charmaz (2006)'s constructivist approach to the grounded theory method, the theoretical perspective is based on symbolic interactionism, thus assuming that there is no single reality to be found or discovered; instead each individual creates meaning through activities and social interaction and people reflect and act on these interactions (Quist-Adade, 2018; Milliken and Schreiber, 2012; Charmaz, 2006). In Charmaz's words, the grounded theory method "serves as a way to learn about the worlds we study and a method for developing theories to understand them" (Charmaz, 2006, p. 10).

The constructivist grounded theory method is within the social constructivist paradigm, which acknowledges that data and theories are constructed by the researcher and that there is no one reality but several realities (Charmaz, 2006; Charmaz, 2009; Cresswell, 2007), which aligns with my view of what knowledge is. However, when the grounded theory method was first named and developed, it was markedly different from the social constructivist approach I have used in this project.

Of the most significant research within grounded theory prior to the constructivist grounded theory are Glaser and Strauss who initially coined the term and the later works by Strauss and Corbin.

Glaser and Strauss took on a positivist approach to knowledge (Bryant and Charmaz, 2008b) and believed it was possible to enter a field and discover a theory inductively (Cresswell, 2007, Bryant and Charmaz, 2008a). They have been criticized for being naïve in their assumption that the researcher could be objective. Together, the assumption that the researcher could be objective and the inductive approach have led to a debate about whether or not a researcher using a grounded theory method should do a literature review – or read anything about a field of study at all. The argument for not doing any reading is based on the idea that reading as little as possible about existing theories in a given field makes it easier and/or possible for a researcher to keep an open mind (Giles et al., 2013; Bryant and Charmaz, 2008b). Whether or not Glaser and Strauss actually believed the researcher could be objective and enter a field of study without any preconceived ideas is debatable (Bryant and Charmaz, 2008b, Charmaz, 2006), but it was a strong focus of their approach to research that a truth was out there to be discovered or would emerge from data, and the researcher was the tool to discover and disseminate the theory (Bryant and Charmaz, 2008b).

According to Corbin (2009), the approach to the grounded theory method she developed with Strauss in the 1990s was also based on emergence of theory from data: "the idea was that if the researcher is sensitive and look hard enough at the data, theory will emerge, the key word being emergence" (Corbin, 2009, p. 36).

Corbin no longer believes in one reality or that theory emerges from data (Corbin, 2009) and is now more in line with the constructivist understanding of theory being constructed by the researcher. In the constructivist grounded theory approach, it is not assumed that the researcher can enter a field of research with an empty mind. It is assumed that if you are interested in a field, this is most likely because you already know something about this field and want to know more (Charmaz, 2006). However, the earlier works by Strauss and Corbin are still used to describe the grounded theory method in qualitative methodology handbooks such as Cresswell (2007) and Brinkmann and Tanggaard (2017). This might contribute to a certain lag time between popular perceptions of the grounded theory method and the development that has occurred among the scholars who use it, such as Charmaz, Bryant and Corbin.

In the following I will elaborate on the constructivist grounded theory method used in my study and how I have used it.

Using the constructivist grounded theory method with inspiration from Charmaz

I think it is fair to consider the constructivist grounded theory method as a package that provides you with the theoretical perspective – symbolic interactionism – together with a set of principles and concrete suggestions for how to go about designing your study, collecting your data and analysing your data. They are suggestions, as each study will be different and require adjustments (Charmaz, 2006).

In the following I will present the principles and methods I have used from Charmaz (2006) together with how I have used them in my study. This presentation should not be considered as a linear process, as it is part of the grounded theory method to move back and forth between data and between data and literature.

Point of departure – sensitizing concepts

Although the constructivist grounded theory method is an abductive approach, the research design is guided by sensitizing concepts. These are particular areas of interest that serve as points of departure for the study (Charmaz, 2006). The use of sensitizing concepts is one of the concrete aspects of Charmaz's (2006) use of grounded theory method that differs from the earlier approaches to grounded theory, such as Glaser and Strauss' version. In constructivist grounded theory it is not assumed that a researcher can be objective and that the truth is something out there to be found. Instead, it is acknowledged that the researcher has ideas and knowledge prior to doing research (Charmaz, 2006; Bryant & Charmaz, 2008b) and that this background knowledge and preconceived ideas play a part in the research process; that is, having points of departure is just a way of starting a study.

Charmaz (2006) stresses the importance of using sensitizing concepts merely as points of departure as where your research takes you might not fit with the sensitizing concepts. As I presented in the section on transfer of learning, my point of departure is within the conceptual framework of transfer of learning from a situated cognition approach. In other words, my sensitizing concepts are based on the situated cognition approach to transfer of learning, and what played a part in designing my research are the three factors believed to enhance transfer of learning between contexts:

1) similarity between contexts to increase the chance of generalizing between contexts
2) experience of relevance for the future
3) sufficient learning.

These factors were used to design the first interview protocols, a process I will return to in the following section.

Data collection

This section will present the data collected in the project and how it is inspired by the constructivist grounded theory method.

The data collected for this project mainly consists of interviews with students from the first and second cohort of CHC students (cohort 2018 and 2019) and observations of activities where the same students were present. Table 6 provides an overview of the data collection:

	Interviews	**Observations**	**Other**
Spring 2019	*7 students*	*Introduction to case competition*	
		Team meeting, teacher educators	
		2x3 hours at a "case competition"	
		Final Journal Club of the year	
		Visit to Danish Design Museum	
Autumn 2019		*Intro seminar, cohort 2019, one day*	*Cohort 2019: Self-reported survey*
		Journal club, cohort 2018	
		Journal club, cohort 2019	
		Final day of "approaches to science" course, cohort 2018	
Spring 2020	*January: Cohort 2018, 5 students*	*Observations during two CHC examinations, online Observation during graduation ceremony*	
	January students from cohort 2019, 5 students	*Observation during online communal meeting, cohort 2018 and 2019*	
Autumn 2020	*September-October: 6 students from cohort 2019*	*Observation during networking course, observation during course at Copenhagen Zoo*	
Spring 2021	*May-June: 4 former students, now teachers, cohort 2018 June: cohort 2019, 5 students*	*Communal meeting at Amager Fælled, cohort 2019 and 2020 were present. First lectures of Talent-spotting course, cohort 2019. Graduation ceremony for 2019*	

Table 6 Overview of data collection

As is evident from table 6, my main source of data is interviews and these are supported by observations. In the following I will describe how I chose my respondents and decided on timing of the interviews.

Respondents

As I have chosen to focus on the student experience in my project, my respondents are CHC participants. In this section I will describe how the respondents from the two cohorts became part of my project. This description serves to give a better understanding of how the context of the two cohorts differed and why the respondents were selected to my project. I will conclude the section with reflections on ethical considerations and my position as an insider/outsider to further support the understanding of the situation my respondents were part of when participating in my project and how this might have affected the data collection.

Introduction to cohort 2018

As mentioned in the section on context, the CHC team had hoped to include 15 preservice science teachers in each cohort but had difficulties attracting participants and suffered from dropouts. As a consequence, 11 students were initially enrolled, but three dropped out within the first semester, leaving eight prospective respondents from the first cohort, of which seven were also enrolled in the ASTE programme described above. Of these eight, one was abroad when I initiated data collection.

My initial intention was to interview each respondent three times during the course of my project, with an expected duration of each interview of around one hour. I considered seven respondents a manageable amount for this purpose and also considered the possibility of more dropouts. Based on these considerations, I decided to invite all CHC participants from the 2018 cohort to be part of my project.

Invitation to participate in my project

My PhD project was initiated nearly five months after the first preservice teachers were enrolled in the programme. I was ready to start collecting my data in the spring of 2019. I first introduced myself and my project to the CHC participants in person in the spring semester of 2019. I had arranged with two of the teacher educators to do this in a break during a workshop, to ensure that as many of the participants as possible would be present. With the exception of one student who was abroad on an exchange, all seven participants from the 2018 cohort were present.

In the introduction I described myself as a teacher educator on leave. I underlined that I was not part of the CHC team and that to me it was not important how the programme developed but rather how they as students experienced CHC.

I further described my project as an abductive study, where the focus was on their experience of the programme and that the more concrete foci in the project would be based on data.

I underlined that it was voluntary to participate and that the preservice teachers would be anonymous to everyone but the research group. I handed out forms in which the students could indicate if they were interested in participating and provide contact information. Although they filled out individual forms, the group was so small that it was not possible to be anonymous within the group. All the students present were interested in participating in the project.

Development in the group of respondents

Of the seven respondents initially included in my study from the 2018 cohort, five graduated as planned, of which four graduated as ASTE teachers. The five respondents who graduated were all interviewed during the second round of interviews with the 2018 cohort.

The third round of interviews with the 2018 cohort took place approximately a year after their graduation. Unfortunately, it was not possible to reach all respondents, and thus the number of respondents was reduced to four, of which three were ASTE teachers.

Introduction to cohort 2019

One of the big differences between the 2018 and the 2019 cohort was in the number of preservice teachers initially enrolled in the programme. To compensate for the low participation in the 2018 cohort, the CHC team attempted to attract more than the required 15. They managed to attract 19, but this cohort also suffered from a high number of dropouts and, of the 19 participants enrolled, seven graduated. This had two significant implications for my data collection. First of all, I could not manage to include all 19 participants in my data. At this stage I had experience with how much time I needed to analyse my interview data, and data from19 participants would be more than I could transcribe and code within my timeframe. I had to decide how many respondents I wanted and how to choose them. I decided five respondents would be sufficient to provide ample data to answer my research question of what teacher education can learn from the student experience of CHC and that three rounds of interviews with five respondents was a manageable amount of data. The second issue in my data collection with

the 2019 cohort was caused by the significant number of dropouts, which also affected my respondents.

In the following section I will present the process of how I selected students and how I handled that some of my respondents dropped out.

Presentation of my project and invitation to participate

As with the 2018 cohort, I introduced myself and my project in person at an already planned activity. My introduction and presentation of my project was in line with what I informed the 2018 cohort. I informed the students that I was a teacher educator on leave, that I was not part of the CHC team, that I was researching the student experience of participating in CHC, that respondents would be anonymous and that my methodology was abductive, and then I described what that meant.

For this cohort, the activity was an induction seminar that took place at a hotel over the course of two days; I was present on the second day. The benefit of being present at this seminar was that all but one of the enrolled CHC participants were present. The downside was that the participants received an abundance of information, they were part of a group of preservice teachers who did not necessarily know each other before the seminar and they were introduced to several new teacher educators. Furthermore, a large proportion of the CHC team were present and some interrupted my presentation by asking questions. Later in the process, participants revealed to me that they had thought I was part of the CHC team. This confusion might have been caused be the setting in which they both received a lot of information and were introduced to a lot of new people. The majority of teacher educators present at the seminar were part of CHC, and all of these factors might have affected who accepted my invitation to be part of my project.

Due to the presence of the CHC team and my promise to keep the respondents anonymous, I did not ask them to volunteer by, for example, raising a hand or filling out a paper form. Instead, I had them fill out a questionnaire online in which they were asked if they would like to participate in my project.

A total of 17 out of the 19 participants accepted that I could invite them to my project.

My next step was to select five participants from the 17. I made a random selection where the only parameter was to attempt to get an even gender balance. I sent out six invitations via e-mail in the anticipation that there would be dropouts. When e-mails had not been responded

within a week, I sent a follow up. In the cases where I did not receive a response to the follow up e-mail, I invited another participant.

I succeeded at securing six interview appointments; however, one respondent did not show up and there was no opportunity for a reschedule, resulting in five interviews. Of the five respondents two were enrolled in the ASTE programme.

Development in respondents

As mentioned in the beginning of this section, a large number of the 2019 cohort did not graduate from CHC. At the time of my second round of interviews, two out of five respondents had left the programme. Although it was not ideal in a longitudinal study, I decided to add at least two more participants. It was not possible for me to get information about who had dropped out and who was still in the programme, but from an observation at a workshop it was clear that the amount of drop-outs could be as many as half of the original number of participants. For this reason I decided to send an e-mail invitation to all the CHC participants from the 2019 cohort. This did not result in any replies, so I attended a journal club and asked the CHC participants if they would stay for ten minutes after the journal club had finished. This time I requested that the teacher educators were not present when I presented my project again. This turned out to be a feasible approach. Some of the participants demonstrated frustration with the programme and that they were not interested in being part of a research project supporting it, confirming that it had not been ideal to introduce my project at the induction seminar.

I stressed that I was interested in their experience and what teacher education could learn from it, not in whether CHC succeeded. After this meeting I had two more respondents, who both graduated from the programme, none of which were enrolled in the ASTE programme.

Table 7 below provides an overview of the respondents included in my project, each represented by a letter. The purpose of the overview is to clarify how many times each respondent was interviewed and when.

Cohort	1st round of interviews	Respondents	2nd round of interviews	Respondents	3rd round of interviews	Respondents
2018	May-June 2019	A, B, C, D, E, F, G	February 2020	A, B, C, D, E	June, 2021	A, B, C, D
2019	February 2020	J, K, L, M, N	October 2020	J, K, L, O, P,	June, 2021	J, K, L, O, P

Table 7 Overview of interviews

One of the main differences between the data collection in the two cohorts was that the majority of the 2018 cohort were enrolled in the ASTE programme. Another big difference is that I included almost all participants in this year because they were very few. As a consequence of this, I did not add new respondents to my dataset as I did with the 2019 cohort.

It is also important to note that, because they had enrolled in CHC in the autumn semester of 2019, the 2019 cohort had only been part of the programme for a little over six months when COVID-19 resulted in a lockdown. I did not research whether this had an influence on the drop-out rates from this cohort, but the respondents in the project did note that they had missed out on activities they had looked forward to such as a summer school abroad and participation in a science education conference.

Timing of the interviews

The timing of the data collection had an influence on the student experience and thus on my ability to answer the research question of what teacher education can learn from the student experience of participating in CHC. Below I present my reflections on the timing of the interviews.

Cohort 2018

The first round of interviews with the 2018 cohort took place from the end of April 2019 to the end of May 2019. The timing was a pragmatic choice as I needed to design my research before I could start collecting data.

The second round of interviews was in January 2020, with the exception of one of the respondents who was interviewed in June 2020. This respondent had been difficult to reach via e-mail but with the help of the respondent's peers, I managed to get in touch with them and set up an interview, as they were still interested in participating in the research project. The different timing of the second interview had a significant influence on the June respondent's student experience, as a lot of things had happened between January 2020 and June 2020. First of all, COVID-19 and the ensuing lockdowns had an influence on the experience of being a preservice teacher. The June respondent was also just about to graduate at the time of the interview in June 2020, whereas the respondents I interviewed in January had just finished their winter exams at the time of the interviews.

The decision to conduct interviews at the end of January 2020 was to get a chance to interview the students before they graduated but with at least six months between the two rounds of interviews – and with respect for their busy exam schedules in December and January.

The third and last round of interviews with this cohort was with four of the original six respondents. This round of interviews was in June 2021 and because of COVID-19 and the fact that some of the respondents had moved to another part of the country, I included online interviews as an option. Three of the four students chose this option. The timing of this round of interviews was partly determined by COVID-19 and partly by the fact that I was interested in exploring how the respondents had experienced the transition from being a preservice teacher to being an in-service teacher. As COVID-19 blurred this experience due to school lockdowns, I waited until the end of the school year to conduct the last round of interviews so as to ensure that their last teaching experience was of in-person teaching rather than online teaching. The majority of the age group taught by my respondents were not allowed back in the schools until mid-March 2021.

Cohort 2019

The first round of interviews with the 2019 cohort took place in February 2020, as I wanted the respondents to have some experience with the programme before being interviewed. In February 2020, they had been enrolled in the programme for six months.

The second round of interviews took place in September-October 2020. The timing was pragmatic. COVID-19 had moved the majority of planned activities online during the spring of 2020, and I wanted the respondents to have had experiences with in-person activities as well before I interviewed them again. At the same time, there were rumours among the CHC participants that they might all drop out in frustration with the programme, and due to the risk of losing all of my respondents after one round of interviews, I did not dare to delay the second round of data collection beyond October.

The third and last round of interviews took place immediately before or after the final exams of the respondents, in June 2021. The reason for this timing was that the respondents could now look back on the full experience of the teacher education programme and CHC, but at the same time I expected them to reflect on this experience in the light of their hopes for future.

In the following I will describe my understanding of the methods I have used in my research project with a particular emphasis on interviews in relation to the constructivist grounded theory method and the rationale I had for choosing them.

Intensive interviews

In this section I will describe Charmaz's definition of the intensive interview, argue why I have chosen this method as my main source of data and go through the design of the interview protocol I developed based on the sensitizing concepts relating to transfer of learning as presented above.

The main purpose of my project was to explore how teacher education might learn from the experience of preservice science teachers participating in the CHC programme. As such I needed to use a method that was suitable for researching experience, and the qualitative interview suits that purpose (Brinkmann & Tanggaard, 2017; Charmaz, 2006). The intensive interview allows the respondents to give their voice and perspective on the focus of the research, in this case the experience of being part of CHC.

Charmaz (2006) describes the intensive interview as follows:

> The in-depth nature of an intensive interview fosters eliciting each participant's interpretation of his or her experience. (Charmaz, 2006, p. 25)

It follows from this description that what is gained in the successful intensive interviews is the participants' interpretation of the experience(s) they are being interviewed about. This follows the symbolic interactionist approach in which the researcher seeks to understand what meaning respondents make of their experience (Milliken & Schreiber, 2012). As such, the purpose of the

interview is not to arrive at 'truth', but at what is true to the respondent in the moment and situation of the interview.

An example of why it was important to me to focus on the voice of the students was that I was more curious about how they had experienced what happened rather than what I might have been able to observe. An example of this is the experience of being forgotten as a group during the autumn of 2019. During this semester I had conducted observations at a Journal club and a course, and I knew the respondents were working on their individual partner-school projects. The interviews both revealed the feeling of being forgotten, but also that demands from outside the programme, such as exams or family obligations, had an influence on how they prioritized their time. This was information I would not have been able to obtain through observations alone – as it was largely due to activities that were not there or happened in other arenas.

Design of the Interview protocol – first round of interviews

As with a semi-structured interview, I had made questions beforehand that served as overall themes for the interviews. The interview protocols can be found in appendixes 1-3 but should only be considered as outlines as the order of the themes and how the questions related to each theme were phrased varied between interviews. As mentioned earlier these themes were mainly structured around the sensitizing concepts derived from the conceptual framework of transfer of learning. When interviewing, I focused on getting the respondents to reflect on their experiences and paid attention to when there was a risk that I would assume too much from what they had said and when I should ask for further elaboration (Brinkmann & Tanggaard, 2017; Charmaz, 2006).

The first interview served as a template that was adjusted as the project progressed and after analysis of the first interviews had begun. In the interview situation, the order of the themes varied depending on how the interview went as I attempted to follow the respondents trail of thought, but I had the same opening questions.

The final question was always if the respondent had anything to add.

The themes in the first interview protocol were

- reasons for choosing teacher education
- reasons for signing up for CHC
- description of the programme
- experience of the programme so far
- expectations before induction

- surprises in the programme
- thoughts for the future

In the following I will go into detail with the themes mentioned above and what my rationale was for including them in my study in relation to the sensitizing concepts within transfer of learning.

Experience of relevance

The themes of "reasons for choosing teacher education", "expectations before induction" and "surprises in the programme" are potentially related to experience of relevance which is again linked to transfer of learning. That the themes are only potentially relevant is important to note. They are based on the sensitizing concepts, which are only points of departure. In this case, the idea was that "reasons for signing up for CHC" and "expectations before induction" were linked to thoughts for the future and that this in turn would have an influence on how the programme was perceived and whether it would be perceived as relevant. The theme of "thoughts for the future" is again linked to the transfer of learning theories; hope for the future influences perception of the education and potentially what respondents would transfer between education and workplace.

Sufficient learning and talent

Based on the available information it was not clear to me what the programme entailed, which is the reason why I included a theme in which the respondents were asked to describe CHC. By including this theme, I would get insights to what was most important to the respondents in the programme and how they described the programme was relevant to understand how they experienced it. One of the enhancers of transfer of learning is "learning something sufficiently", and by asking respondents to describe the programme I could explore if CHC was perceived to add knowledge or deeper understanding of science teaching to their teacher education. Note that it was the respondents experience of their own learning I focused on.

Another reason for asking the CHC participants to describe the programme was that, at this stage of the research project, I was not sure how much emphasis should be put on the concept of talent. CHC was initially advertised as a talent programme, but I did not know how this affected the student experience of the programme. As my research focus was on student experience, I

decided not to mention the term in the interviews and let the data decide if it was an emergent theme. If the respondents mentioned talent, I asked what talent meant to them.

Design of the Interview protocol - The second round of interviews

At the time of the second round of interviews I had initiated analysis of the interview data and observed CHC participants. Both observations and analysis of the first interviews helped inform the second round of interviews. As with the first interview protocol, the protocol used for both cohorts was the same, but I used different prompts related to the activities I knew the CHC participants had been part of.

The themes in the second round were:

- experience of the past semester as a preservice teacher and as a CHC participant
- thoughts for the upcoming semester
- the partner-school project
- thoughts for the future
- reflections on talent

Experience of the past semester

The second round was not as structured by the sensitizing concepts as the first one was, as other themes had caught my attention after initiating data collection and analysis.

During the first analysis, sense of community was an important theme for the 2018 cohort but at the time of the second interview, I had also noticed that attendance was low, and I was interested to know why that could be. I explored this through the theme of "experience of the past semester…". If sense of community was still experienced as important I expected it to be mentioned here. The theme included open questions about the respondents experience of the past semester. I started out by asking an open question of their experience and underlined that I was both interested to hear about their experience of teacher education in general and CHC. This was due to a preconceived idea, that factors in teacher education might affect the experience of CHC and vice versa. If sense of community was not mentioned under this theme, I asked specifically about it.

Experience of relevance and similarity between contexts

In the second round of interviews with both cohorts I had not completely abandoned my sensitizing concepts. The partner-school projects were an example of including a non-educational setting (i.e. the teaching profession) in the educational setting (CHC). Based on the sensitizing concepts of transfer of learning, this had the potential to enhance transfer of learning between teacher education and the teaching profession. For this reason, I asked the CHC participants to describe the projects to me and to reflect on whether they expected to use any of their experience from the partner-school projects in their future profession.

Further related to the experience of relevance of CHC and teacher education is the theme "thoughts for the future". In the first round of interviews, it was revealed that all but one of the respondents was considering a future that did not include being a teacher. Considering that both teacher education in general and CHC in particular are explicit about expecting graduates to enter the teaching profession, I was curious to explore how this thought about the future evolved as the participants came closer to graduation.

Reflections on talent

In the second round of interviews, I asked the respondents to reflect on talent in relation to CHC. If they brought up the concept on their own accord, I asked them about how they defined it and, if they did not bring it up, my final question was about what talent meant to them in relation to CHC. The main reason for including a theme around talent was that during the first round of interviews, the 2018 cohort had been on the same page as the steering documents; that is, they considered talent to be related to willingness more than ability. I was curious to know if this was still the case and, if not, if being in a programme defining itself as a talent programme had any implications in terms of how the participants experienced the programme.

Design of the Interview protocol - The third round of interviews

Because my PhD began in December 2018 (four months after the first cohort became part of CHC), the third round of interviews with the two cohorts differs between the cohorts, reflecting a difference in timing. For the 2018 cohort, the third round of interviews took place a year into their first year of teaching, whereas for the 2019 cohort, it took place just before they graduated.

The protocol for the 2019 cohort was the same in the third round as it had been in the second, but I adjusted questions for the individual respondent to match the activities they had

participated in and, where relevant, promote recall to the previous interview. This was particularly relevant in the case of the partner-school projects.

The protocol for the third round of interviews with the 2018 cohort was quite different. The themes were

- choosing what to do after graduation
- expectations before entering the profession
- which expectations were the new teachers met with
- reflections on teacher education and CHC
- contact with other former students

Choosing what to do after graduation

A recurring finding in my data was that the CHC participants did not consider the choice of entering the teaching profession as set in stone and, if they did become teachers, they expected to leave the profession after approximately five years. Part of these reflections were based on perceptions of what life is like as a teacher. I was curious to explore how the students chose what they would do after graduation and if they did choose to apply for a job as a teacher, how did they choose which schools they wanted to work in?

I was also curious to explore if participating in CHC had any influence on the respondents' choice of work, what they expected from their first post-graduate job and if they mentioned their participation in CHC in their application process. These questions relate to what the respondents expect from the future. This expectation is important when considering how newly graduated teachers consider the relevance of what they learned during their education, in other words, the theme of "choosing what to do after graduation" relates to experience of relevance derived from the sensitizing concept of transfer of learning.

Similarity between contexts

The themes "expectations before entering the profession" and "which expectations were the new teachers met with?" were also inspired by the sensitizing concepts from transfer of learning. I included them in the protocol to explore how context affected the respondents' transition from teacher education to the teaching profession and whether they experienced a similarity between the context of teacher education, including CHC, and the context of the teaching profession. I

added questions about what tasks they were given to this theme and what experience during the first year had meant the most to them.

Further related to the experience of similarity between contexts, was the theme of "reflections on teacher education and CHC". Under this theme I asked the respondents themselves how they felt prepared for the teaching profession. By doing this I build on Lobato's argument that the researcher has no way of knowing how a respondent generalizes between contexts. I phrased questions asked to the respondents openly, leaving room for the respondents to reflect on their education in general and not just on CHC. If they did not mention CHC, I asked specifically about this aspect of their education after they had reflected on other aspects of their education. The reason for this is that CHC was only a part of their education. I did not want to begin by asking questions that would force them to reflect on how CHC had prepared them for their current job if they felt that other parts of their education had been more important. If CHC was not top of mind, I saw this as a result in itself.

Contact with other former students

One of the last things I asked the respondents from the 2018 cohort about in the third round of interviews was whether they were still in touch with people they had studied with. I added the theme of "contact with other former students" because *sense of community* had been important to this cohort, and I was curious to explore if it had remained important to them as they embarked on their career.

Observations as a means to establish rapport and qualify interviews

As mentioned in the section above, interviews were the main source of data, but as is evident in table 6, I have also used observations. In this section I will describe how I have used observations in relation to my interviews.

I have used observations as a means to gain the students' trust but also as a means to acquire information about what kind of activities the respondents had experience with, and I used this information in my interviews (Szulevics, 2015). That the observations played a secondary role is in line with how Creswell (2007) describes data collection in a grounded theory study where interviews are the main source. Although the observations played a secondary role, they were necessary to understand "what was going on" for the respondents as they gave me concrete examples to inquire about during interviews, including reduced attendance in activities. The

observations further helped me establish rapport with the respondents. Had I not been present at several activities each semester, they would only have met me three times over the course of three years. This would not have been ideal in terms of gaining the trust of the respondents, and thus my observations also served a purpose in this regard. I did not expect to establish rapport with the respondents through sitting in a corner and taking notes, but I used my presence to talk to the CHC participants in general before and after an activity, and they also asked me questions about how my project was going.

I had intended to add observations of the 2018 cohort at their workplaces after they graduated. However, due to COVID-19 no visitors were allowed at schools for longer periods of time, and I decided to abandon the idea rather than hope for the schools to allow visitors before it was too late for my project.

In this section, I have provided in overview of how I have collected my data and why I have chosen to focus on interviews and observations. I have related the design of my interview protocol to my sensitizing concept of transfer of learning to give an understanding of the role transfer of learning has played in the initial design of my research. Because I have used a constructivist grounded theory method, I strayed from the sensitizing concepts once data collection was initiated and other concepts proved relevant to explore in order to answer my research question of what teacher education can learn from the student experience of participating in CHC.

Also influencing my data collection is who I am and my position in relation to the respondents. I will discuss my position in the following section.

Insider/outsider perspective

In this PhD project I have an obvious insider/outsider issue. I am a teacher educator and my field of research is preservice teachers. In one way, I do not consider myself part of my field – the respondents were preservice teachers; I am (when not pursuing a PhD) a teacher educator. As such, I do not know what it is like to be a preservice science teacher, I have not tried being one, but I do know a lot about science teacher education. However, I have experienced that some of my respondents include me as a part of their experience of being students, as seen, for example, in the following comment: "it would be nice if you would be more transparent about the structure". Moreover, in the cases where they viewed me as being part of a group of teacher educators, this most likely affected how they interacted with me and what they told me during an interview. Asselin (2003) describes a staff development nurse researcher as an example of an

insider researcher who "shares an identity, language, and common professional experiential base with staff nurse or staff development study participants" (Asselin, 2003, p. 100). Among the benefits Asselin (2003) mentions of this position is an easier access to study participants. However, she is also critical towards the insider researcher, for example when she mentions assumptions about the culture respondents' experience, issues of objectivity and that respondents might have perceptions of the insider researcher and their role. In other words, if I am not conscious of my role as an insider, I might make assumptions about what it is like to be a preservice science teacher because I know what it is like to be a science teacher educator.

According to Asselin's (2003) definition of an insider researcher, there is no denying that is what I am. I do benefit from knowing – some – of the students' professional jargon, I know the logistics of the teacher education, I know when there are busy times such as exams and hence when not to organize rounds of interviews. Asselin (2003) stresses that insider researchers need to make a conscious effort to ensure that assumptions do not, for example, prevent the researcher from asking follow-up questions to statements like "you know what it is like…".

In this regard, my own identity as different from the preservice teachers helps a bit of the way, but I have been very conscious of asking follow up questions to statements such as "I am glad I have learned to plan lessons the way I have". Such a statement came from an ASTE student, and I have taught at the ASTE programme, so I did have an idea about how the ASTE programme worked with lesson planning or, rather, I knew how I had worked with it. I have not taught these specific preservice science teachers and even if I had, I could not be sure that they had experienced it the way I had intended, and thus the follow up question of "how did you learn to plan lessons?" was crucial.

I am not a complete member and do not assume to understand their subculture (Adler & Adler, 1987; Asselin, 2003). I do, however, accept that I am, to some extent, an insider. I would not consider myself a member, though, complete or peripheral, because my intention is not to get the respondents to view me as an insider (Adler & Adler, 1987).

In terms of the respondents' perception of me as being a teacher educator who is part of the programme I am studying, Asselin (2003) stresses the importance of promising confidentiality to deal with this particular issue. I have been aware of this and started my interviews by stating that their teacher educators would never get access to the raw data and that the data is strictly confidential – even if their teacher educators are my former and future colleagues. Particularly with the second cohort, cohort 2019, I also had to underline more than once what my role was and that I was not part of the CHC team; I had to position myself as an outsider in this regard. When the students were frustrated with the communication with the CHC

team and how the programme was being run, they were not interested in being part of my project. I managed to get new informants after reinforming them that I was interested in their experience of CHC and not in whether CHC succeeded.

In summary, I am not a member of the same group as my study participants, nor am I a complete outsider. I am somewhere in between – as Dwyer and Buckle (2009) put it, in the space between. There are obvious pros and cons to my position, but keeping in mind what my position is, I have done my best to alleviate the cons. The analytical tools suggested by Charmaz (2006) have served has important means for me to do so, I will present them in the chapter on the analytical process.

Analytical process

When using a grounded theory method, analysis is nowhere near being a linear process. As soon as the first interview has been conducted, the analysis starts and informs both the further data collection and what theoretical framework to use. In the following, I will describe the analytical tools I have used in this project, as described by Charmaz (2006). This presentation is followed by a section on how I worked with the analytical tools with concrete examples from my data.

Initial coding

In the initial coding process, Charmaz (2006) recommends the researcher move swiftly through data and "remain open, stay close to the data, keep your codes simple and precise, construct short, codes, preserve actions, compare data with data, move quickly through the data" (Charmaz, 2006, p. 49)

One of the thoughts behind this coding process is to get as close to the data and as far away from preconceived ideas as possible and as such this process has served as a means to reduce the cons of my position as a researcher as mentioned in the previous section. Even though the researcher will always have an influence on what codes are created, by systematically and carefully moving through data in this way they will, at least in the ideal world, put their preconceived ideas in the background (Charmaz, 2006). I also found it useful to be aware of my preconceived ideas and write them down in a memo (see later section) and then 'bracket them' so I could check when my preconceived ideas might have influenced the coding process. Charmaz (2006) further argues that the ideas of the researcher are important to note during the process and to check whether they fit the data – and if not, explore further why they do not fit.

Charmaz (2006) further has suggestions for what to code, word by word, line by line or incident by incident. I used Atlas.ti as my coding software, and initially I coded on audio. While listening to the interviews, I divided the interview in to quotes based on incidents and attached codes to each incident, thus using the incident-by-incident approach. An example of an incident could be a change of subject from the respondent or a natural pause in speech. I found that this strategy made most sense when coding audio.

Focused coding and development of categories

Focused coding is the next step after initial coding (but bear in mind that it is not a linear process). In the process of focused coding, you either use the most significant or frequent initial codes to direct the further analysis and develop categories, the next level of analysis (Charmaz, 2006). In terms of significance, the researcher determines which codes are the most significant. When a decision has been made on which focused codes should guide the further analysis, the data is revisited by using the new codes, and the new, more focused codes are also used to analyse new data as part of the process of constantly comparing new data with older data and new initial codes with old, focused codes.

Memos and development of categories

Memos are a way to develop ideas based on the focused codes, data and observation (Charmaz, 2006). They are informal pieces of text in which the researcher writes down ideas. After writing down an idea or a theory in a memo, the researcher will then go back and test this theory in the data to see if it fits in with the constant comparison between data, ideas and theory, and if it does, elaborate on the theory in a new memo, a process which aids the development of categories. The memos can further serve as the basis for the first draft of an article – and the first draft of an article can serve as a memo (Charmaz, 2006).

Theoretical sampling

The last important tool I have used from Charmaz is theoretical sampling. As mentioned in the development of the interview protocols, they were influenced by prior analysis and data. This is an example of theoretical sampling; that is sampling of data based on initial categories and tentative ideas that then guide further analysis and also further data collection (Charmaz, 2006).

In the following section I will describe how I approached my analysis using the tools described above with examples from the data, including how I developed as a researcher during this process.

Concrete examples of the analytical process

In this section I go into detail about how I have used the analytical tools introduced above in my project.

My approach to analyse the data evolved as I gained more experience with the process. In the following I will provide an overview of the workflows and how I adjusted my approach. This is a simplified, stylized version, as the iterative nature of the process makes it messy to write up in full. The process described is relevant to all three articles and describes the progression in my analytical work. Details about choices made for each article will be presented in a separate section.

The initial coding – how to code on audio?

I started my analysis by coding on audio by using Atlas.ti, version 8. The choice to code on audio was partly based on the fact that atlas.ti makes this possible. I saw this as a means to save time, but I also had the idea that, by coding on audio, I would preserve the nuances in tone of voice and thus be able to code more closely to what the respondents said.

Atlas.ti makes it easy to code on sound by allowing you to divide the data into quotations and by linking the codes directly to each quotation, see figure 4. I used the program by listening to each interview

Figure 4 The screen print shows how the audio is divided into quotations with assigned codes, the little yellow label at the top is the note I have added about the content of this quotation. The text is an example of a note that pops up when the cursor is held over the quotation.

while writing down the essence of what the respondent was saying, paused and made a new quotation when there was a natural break such as a pause in speech or a new question. I then read through my notes and added initial codes and my notes to the quotation.

Initially my notes were very short and were in effect summaries of what the respondents had said. I was also not consistent with preserving actions in my initial codes as Charmaz (2006) argues to do in this part of the analytical process. I attempted to move as quickly through data as possible to avoid too much interpretation and just code my immediate impression of "what is

going on". After attending a summer school with Antony Bryant in 2019, I was introduced to the strategy of using gerunds when coding. This strategy helps preserve actions and is also used by Charmaz. Preserving actions is important, as the symbolic interactionist approach looks at how people make meaning out of actions and interactions, and this should ideally be reflected in the codes. Using gerunds was not that easy for me to translate to my Danish codes, but when in doubt, I thought about the codes in English and by using gerunds I became more aware of preserving actions in my codes. When revisiting my old coding, it is obvious that I gradually developed my coding strategy as I progressed. Initially, I did not fully succeed at preserving actions, examples are the codes 'journal club' and 'science', which are only useful as a sorting tool but not to answer the question of 'what is going on'.

I developed focused codes for each round of interviews with each cohort of students and then compared the codes across the datasets before deciding on which categories I found sufficiently interesting to include in the further analysis.

I also started to be very close to transcribing my data in the notes I attached to each quotation. I realized that when I worked with my codes and compared data with data, it was much more efficient when I could get a quick overview of what the respondents had actually said and not simply a summary of what they had said. This reflection led me to go back to my first round of data collection and redo my codes and elaborate on the notes.

Next step – sorting initial codes

After the initial coding process, I sorted my codes into themes by using the Atlas.ti function "code groups". I initially did this because the number of codes was overwhelming, and I needed a good way to 'tidy' my codes step by step. Each code could easily belong to several groups, and often did. Below is a screen print of the first round of interviews with the 2019 cohort. From the screen print you get the information that there are seven documents, in this case this represents five respondents as one interview was divided into three files. You further get the information that in total 228 codes were developed and those codes were sorted into 14 groups. It is also evident that the groups are not codes, they do not preserve any actions and say very little about what happened; they are merely themes.
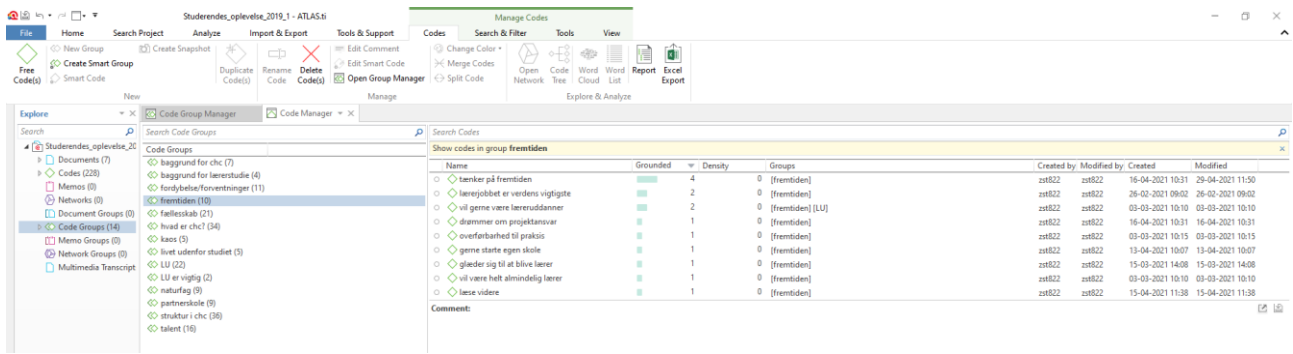
Figure 5 Atlas.ti code manager

Focused coding

I went over the codes in each theme a few times. First, I merged codes that had initially been given the same or close to the same name. Second, I merged codes that had the same meaning and often changed the name of the code to have it capture "what was going on" better. This process included a lot of re-listening to the quotations to be sure the codes and their meaning fit the quotations they were linked to. As I started to get closer to transcribing my data I could also use the function "code report". It allowed me to compare data with data in a much more efficient and useful way.

In the screen print below is an example of a code report generated from the code "Fået lov til de ting de har lyst til" (being allowed to do what they want). This code is from the last round of interviews with the 2018 cohort, which was professionally transcribed and this focused code was used in the last article.

Figure 6 Atlas.ti Code report

Choice of focus and developing categories

As is evident from the screen prints, the codes are in Danish and there are a huge number of them compared to the number of categories presented in figure 5. A good and reasonable question would then be, how did that happen? How did the process above result in the categories I ended up using in my articles? According to Charmaz (2006), categories should be developed based on those focused codes that best capture what is going on in the data. In reality, several

things were going on, and I had to make choices. Generally, it was a matter of choosing something rather than discarding something. I had two main criteria when I chose which codes to focus on: 1) did the story the codes told surprise me and was it likely to surprise others? And 2) could I see teacher education in general or science teacher education in particular benefit from knowing more about this aspect? These two criteria were among the reasons why I have not chosen to write an article about talent. It is one of the most dominant themes I ended up not using. The theme includes student reflections on what talent means, whether they themselves were talents and whether CHC was a talent programme. There is an interesting story in those reflections, and an article might yet come of that part of the data, but it has not been included in this PhD. Although the objective for the PhD project is to explore the experience of the participants of CHC, the rationale for this objective is to explore what teacher education can learn from CHC, and thus I have chosen to focus on the aspects of the student experience that I consider relevant for teacher education as a whole. In this regard, I did not see the focus of talent as the most interesting aspect of the student experience.

Elevating codes to categories with the help of memos

The further analysis was based on memos in which I wrote down what had surprised me, what I thought was going on, what I would like to dig deeper into and which themes and concepts I would like to read up on in the literature. Admittedly, I have not been as systematic about my memo writing as described in Charmaz (2006). I have written an abundance of memos, and I have found them very useful as a means to develop ideas to test in my data and as a means to try to understand 'what is going on' in the lives of my respondents. In the end, the memos also served as a tool that helped me decide on which categories became the foundation of my articles. In this process I looked at my sensitizing concepts derived from transfer of learning: could they help me understand what was going on in my data, or did I need to look somewhere else? In the end, all articles are mainly based on literature I had not read prior to data collection, but that was chosen during analysis as I constantly compared data with data and data with literature. I will elaborate on this process in the section "Linking data with literature". It was as a part of this process the codes were elevated to categories and thus became part of my findings.

Overview of codes and categories

The table below presents the development from initial codes to focused codes to categories which were the result of the analytical process described above. The categories became the foundation for the three articles, which is why they are bundled by article in the table

.

Round of interview	Number of initial codes	Number of focused codes	Categories, bundled by article
1st cohort 2018	193	13	"feeling a sense of community with peers", "being engaged to study by community", "unclear expectations", "structure is frustrating"
2nd cohort 2018	210	15	
1st cohort 2019	227	9	"Considering alternatives to the teaching profession", "having hopes and fears for the future", "choosing CHC to get more options"
2nd cohort 2019	284	19	
3rd cohort 2019	630	17	
3rd cohort 2018	403	23	"being allowed to do what s/he wants", "being limited by lack of support" "having a different approach to teaching science", "getting support from community"

Table 8 Overview of number of codes, focused codes and developed categories

In the following section I will present the developed categories in further detail and how they relate to each article, as well as the developed sub questions and how they relate to the main question of what teacher education can learn from the student experience of participating in CHC.

Analysis of findings

In this section I will present the analysis of my findings, which will elaborate on the development of the categories presented in table 8 and on how each article came to be as a result of this analytical process. In line with how Charmaz (2006) describes the interaction between writing memos and writing up drafts for articles, I used the writing up of articles as part of the analytical process. For this reason, I have organized this section based on each of the three articles.

For each article, the presentation starts with the development of categories with examples of the process from the data. Next follows an overview of how sub questions were phrased to coin what the categories were an answer to. This section is followed by an overview of the extant literature considered a relevant fit to further analyse the data.

It is important to note once again that the analytical process was not linear, and even though I present development of categories first and then which theoretical concepts were suitable theoretical lenses to apply in the analysis, theoretical lenses have been introduced in the process before I finalized the naming of the categories.

Analytical process of article 1: The experience of an engaging community

In the following I will present an overview of the process of developing categories for what became the first article in the PhD project. To support the overview of the process, I present data in the form of quotations. Although I did not transcribe the full interviews at this stage of my PhD, I have transcribed quotations in order to be able to give examples of how the categories were developed.

Choosing a focus and developing categories

After initiating the coding process during the first round of interviews, it struck me how prevalent an experience participation in the journal clubs was. Here are comments from three out of the initial seven respondents:

> *It (Journal club) is a really great opportunity to nerd research articles with others who also find it interesting.*

> *We sit in class (Journal Club) and everyone participates and I feel like we achieve something completely different than we do in our (ordinary) class.*

> *It is great to feel, when we are at journal clubs, that people are actually really interested and really want to discuss (articles) in detail. Those four hours pass quickly.*

All the respondents from the 2018 cohort mention journal club as something they had been particularly happy about and "being engaged by journal club" became part of the first set of focused codes. The reason why engagement became part of this journal club code was because the respondents reflect on the experience of being in a group where everyone was engaged and showed up prepared.

Theoretical sampling on engagement in the journal club

In order to understand what was going on in relation to the focused code "being engaged by journal club", I decided to include it as an extra theme in my interviews, as presented in the section on the design of my interview protocols. As it was already an interesting theme in the first interview, I could include it as an extra theme in the subsequent interviews during the first round of interviews and as such it became part of a theoretical sampling. The theoretical sampling included gathering concrete student descriptions of what the journal clubs entailed, and I also made sure that some of my observations took place at journal clubs to further increase my understanding of "what was going on".

Journal Club appeared to be fairly simple: my respondents described sitting around a table and discussing two to three journal articles with a focus on science education for up to four hours in the presence of two teacher educators. The teacher educators chose the articles and moderated the discussions.

Memos on ideas to follow

Memos at this stage of my research revolved around the question of why the preservice teachers felt engaged by, and studied for, these journal clubs, when in my experience, as a teacher educator, it could be a challenge just to get students to prepare for classes and participate in theoretical discussions.

A theory, or an idea to follow, which I wrote down in a memo, again based on my experience as a teacher educator, was that it was the generous teacher:student ratio that engaged the preservice teachers. However, this theory did not fit with my data; they simply did not mention this fact when I enquired about what was so good about Journal Club. It can of course have had an influence, but it was not the experience the respondents reflected on. In the quotations above, the respondents mention participating in an activity where everyone actively participates. In other words, in order to understand the enthusiasm for the journal club and the experience that all CHC participants came prepared for these sessions, it might be useful to understand the community they were part of in CHC.

Including sense of community in the theoretical sampling

The respondents from the 2018 cohort described feeling that they had become part of a community with other students who were as interested as them in investing more time in their studies:

> *It is just really cool to cooperate with someone who is also interested in putting in an effort.*

> *The community in CHC is that I have found someone else who feels the same (about studying), you want to put in an extra effort and you think the others (non-CHC preservice teachers) are weird because they are not interested in doing that…there isn't something wrong with us.*

> *It's nice to have found a group who spends as much time – if not more – than me studying.*

When the respondents reflect on what they like about journal club, their thoughts relate to everyone participating, and when they reflect on community in CHC, their thoughts are similarly related to the sense that CHC is a group of peers who have a shared approach of how to study.

An approach that also aligns with the CHC definition of talent: "willingness and ability to put in extra effort". This resulted in the first category: "feeling a sense of community with peers". However, this only partly captures what is going on as the motivation to come prepared seems to derive from this community of peers, and this is not captured in that category. For this purpose, the category "feeling motivated to study by community" was developed.

At this stage I then had the categories "feeling a sense of community with peers" to capture the participants reflections on being in a group of peers who shared values of how to study and the category "feeling motivated to study by community" to capture that this community affected student motivation and engagement.

Focus on interaction between sense of community and engagement

The shared values of the respondents are aligned with how CHC initially defined the term talent as willingness and ability to put in extra effort. The experience of being in a community with peers also fits well with Wolfensberger's (2012) three pillars of honors pedagogy which were adopted by the CHC team: freedom, academic enhancement and community. Although the circumstances of being in an honors programme were special to my respondents, the ordinary teacher education might be able to benefit from understanding how CHC was experienced as motivating and engaging. Thus, I considered it valuable insights for teacher education to know more about what this community entailed and how it was influenced by the CHC programme, as this could prove useful in the work with student engagement at the ordinary teacher education.

Further theoretical sampling on engagement and sense of community

After choosing to focus on "sense of community" and its relation to student engagement, I included these aspects in my theoretical sampling in the following data collection, with journal club as a special area of interest. I conducted three rounds of observations: once at a Journal Club before the summer holiday of 2019, and once at a common meeting after the summer holiday and once at course in December 2019. During these observations I noticed that the group of the 2018 cohort was not complete during any of those three events.

When I interviewed the respondents in January 2020, the talk about community or the sense of being engaged was no longer as prevalent as it had been during the first round of interviews. When I asked the respondents directly about sense of community or referred to previous statements about community in the group, some mention lack of time for social activities:

My record is six meetings in a week in various CHC contexts. Two or three different supervisions (partner-school project), two courses and then something else. It wasn't social activities. We don't really do that. We don't have time for that at all.

Another issue which appeared to be a strain on the sense of community was the structure of the programme. The respondents expressed feeling confused about what was happening when and particularly mentioned bad planning during the autumn semester of 2019:

It was just…it was cool to spend time together [at the summer school] during a longer period. I definitely felt we really got to know each other. And then it was a real pity, because then nothing really happened for us afterwards.

And then it is like, why? We have just had several months of complete radio silence except the odd common meeting here and there, why do they place all these things on top of it all exams)? Now I actually couldn't be bothered.

This led to the focused code "structure is frustrating". Related to this code was that the unpredictable structure of the programme made it difficult for the students to prepare for activities, which again led teacher educators to expect less – which added to the frustration:

It's been a bit like…since the beginning, whenever we participated in a course and needed to hand something in, it's been a bit half-hearted from all of us. It's been a mix of some courses where we didn't get the opportunity to prepare properly because it was there all of a sudden, and the teacher educators who had corresponding expectations and were like "I just made this so I can't expect that much of you, let's just do something and have fun". So, the requirements weren't that high … but it is a pity of course and a bit of a waste of time when it's not structured in a way where it's possible to expect something from us. You only ever scratch the surface.

From this quotations it is evident that there has been a significant change in the perception of the programme between the first and the second round of interviews. Whereas the first round of interviews revealed an enthusiasm for putting in extra effort and being in a group of peers, the second round revealed a group of respondents who were eager to put in extra effort but experience that the structure and expectations from the programme no longer cater for doing this.

Influence of structure in CHC, workload and expectations on sense of community and engagement

At the time of the second round of interviews with the 2018 cohort, the respondents experienced being busy and a lot was going on for them.

The respondents were finishing their teacher qualification at the same time as they were participating in CHC, and CHC appeared to be clear about expecting something but not clear about what this something was or when it was expected, which led to the codes "too busy for social activities", "unclear expectations" and "structure is frustrating".

"Structure is frustrating" and "unclear expectations" were elevated to categories. "Structure is frustrating" captured the frustration of not knowing when something happened and then having to plan around this uncertainty. As the quotation above shows, the respondents still express an interest to put in extra effort, but preparation takes planning and the structure in the programme seemed to prevent this. Although the teacher educators were perceived by the respondents to show understanding for their frustration, the respondents still felt let down and frustrated. They had expected to put in extra effort, and this no longer seemed to be required.

"Unclear expectations" is not the best category, it is not immediately clear what action it describes. However, I consider it important and kept the category because the respondents so clearly stated that what they liked about the programme was an opportunity to put in extra effort together with peers, and this opportunity appears to be lost a year and a half into the programme.

Formulating the research question for article 1

In summary, the categories developed for the first article were "feeling a sense of community with peers", "feeling motivated to study by community", "unclear expectations" and "structure is frustrating". When working with grounded theory it can seem a bit like a game of Jeopardy – I have some answers but need to determine what question fits with these answers and how question and answers relates to my main question of what teacher education can learn from CHC. For these categories the question revolved around the interaction between community and engagement. The research question for the categories has been through several iterations but in the end, I arrived at: how does sense of community in an honors programme affect the engagement of preservice teachers?

This question both captures the focus on interaction between community and engagement, but it also fits with the main question for the project, as it explicitly focuses on how community was realized in the programme and how it affected the student engagement.

In the section "Linking theory with data" I will elaborate on how the categories fit with the definition of "sense of community" developed by McMillan and Chavis (1984) and how particularly Kahu and Nelson's (2018) framework of student engagement in the educational interface aids in the understanding of what "was going on" for the respondents in relation to sense of community and engagement.

Analytical process for article 2: Thoughts on the future

In this section I will present how my second article came to be about preservice teachers who consider CHC as a means to keep their options open in the job market.

My interest in the transition between teacher education and the profession combined with extant literature on transfer of learning such as Hachmann et al. (2021) and Dohn et al. (2021) gave me the preconceived idea that because the partner-school projects were in schools and focused on the preservice teachers ability to manage science education school projects, this part of the CHC programme had the potential to create a similarity between the context of teacher education and the teaching profession, which again had the potential to ease the transition between education and profession and thus potentially increase transfer. What I had not anticipated was that the preservice teachers generally did not see themselves as working as teachers for very long, if at all. When my respondents reflect on the future as being something other than teacher, what they perceive to be relevant to them during their education might be different to what the education expects. This is an important insight for the teacher education as it has an influence on how preservice teachers experience the education and what they find relevant to learn.

Teacher shortage is considered a serious problem in several countries, including Denmark, and issues with recruitment to the welfare sector are mentioned as part of the rationale behind the development of CHC. My data not only gave insights about why the respondents considered alternatives to teaching but also what strategies they used during their education to get there – and for some, CHC was such a strategy. For these reasons, the focus of my second article was on how the CHC participants reflected on their future and how they acted on these reflections.

Reflections on the future as a teacher

In the first round of interviews with the 2018 cohort, the codes around thoughts for the future resulted in the category "the future is not being a teacher", which was later changed to

"considering alternatives to being a teacher". The reasons for this change was that in the category "the future is not being a teacher", I found an implied opposition to being a teacher; however, in reality it was just as often a matter of keeping options open to other career paths. Below is a quotation from a respondent from the 2018 cohort who in the first round of interviews reflects on where to go after being a teacher:

> *I have this pastime where I am looking at job ads (...) a lot of the jobs I am looking at are not as a teacher, but they often require experience from being a teacher. I've got this idea that I would like to be a teaching consultant or development consultant or something. I just think it requires that I serve my time (as a teacher) first.*

The term "serving time" as a teacher is not repeated by others but the notion is. There is a general interest in teaching but not necessarily as teachers in primary or lower secondary school, and this reflection on alternative career paths have the respondents consider how other options could become available. For the respondent above, it is experience as a teacher. For the respondent below, it is pursuing a master's degree prior to entering the teaching profession:

> *And it's really not that I don't want to be a teacher. It's just because some day, I want to try something different and lay the foundation…for many houses…and that has to be done now, so I don't end up like my parents.*

> *(Respondent from 2019 cohort, 3rd round of interviews)*

Hopes and fears of life as a teacher

 The reflections on alternatives to a career as a teacher occurred in all six rounds of interviews. Towards the end of their teacher education, all but one preservice teacher was considering leaving the teaching profession after a few years. The preservice teachers' thoughts about their future career and why they were considering alternatives to teaching involved both hopes for what it was like to be a teacher but also fears about what life as a teacher would be like and whether it was a life they wanted for themselves. This led to the category "hopes and worries for the future"; this was changed to "hopes and fears" after introducing literature.

The quotation below is from a respondent from the 2019 cohort, right before the respondent graduated and after they had secured a teaching job. This quotation was part of developing the category of hopes and fears. The respondent reflects on enjoying the theoretical part of the teacher education and is worried there will not be time for working with this aspect of teaching after entering the profession:

I am afraid that you don't…that you don't have the same time to be absorbed in…because then you kind of just need to prepare these 22 lessons for the following week…but I can always pursue a master's degree…If I miss it too much.

Apart from stating a fear for the future, the quotation also presents a strategy for handling this fear. This strategy is an example of how the categories "hopes and fears for the future" and "considering alternatives to teaching" are linked: a fear for the future as a teacher can be dealt with by having an alternative career path in mind. This leads to the third category developed in this analysis, which is more closely related to the context of CHC. In the two previous categories a variety of alternatives are considered by the students and fears and hopes for the future are interlinked with how they reflect on those alternatives. However, one of the reflections the students share in the cohort of 2019 is that their reflections on career path were a contributing factor to signing up for CHC, leading to the third and last category used in this part of the analysis: "choosing CHC to get more options". Below is a quotation from a student from the 2019 cohort who, in their first interview, reflects on how CHC courses in innovation and project management help expand their options:

If I get sick of teaching and want to find a job in a private company, the fact alone that I have a course in project management and a course in innovation processes gives me a background to build on.

Focus on the 2019 cohort

My initial intention to use data from four rounds of interviews and two cohorts was at this point revised. The main reason for this was that, considering the limited number of words allowed in a journal article, the initial results section was far too long. I chose the second cohort as they had become part of my research project at an earlier stage in their participation of CHC, and thus I could include three rounds of interviews with cohort 2019 that showed how their considerations for the future developed during the course of the last two years of their education. The longitudinal nature of my study made it possible for me to explore how the preservice teachers' thoughts for the future developed as they came closer to graduation and, because the last round of interviews was immediately before or after graduation, the respondents had made their choices for the immediate future.

Formulating the research question for article 2

The categories "considering alternatives to being a teacher", "hopes and fears for the future" and "choosing CHC to get more options" revolve around the issue of whether the preservice science teachers consider teaching a career for life. Understanding these reflections and how education might affect them might prove to be a useful insight to understand how students experience teacher education. It might also be a useful insight in relation to dealing with teacher shortage as the reflections on the future also include expectations about what it is like to be a teacher.

Through my data, it was evident that thoughts for the future had affected the choice of signing up to CHC but also that participation affected the thoughts for the future. Thus, the sub question needed to capture this interaction. The question developed to fit the categories is:

> *Why do preservice science teachers choose an honors programme and how do possible selves and career plans evolve during participation?*

As with the sub question for article 1, the question is phrased to emphasise the focus on what teacher education might learn from CHC but also captures the interaction between participation and thoughts for the future.

The term 'possible selves' is derived from the literature and is an example of how the process of analysis was messy and iterative. The categories were developed before I had chosen which literature to use, and the first sub questions did not include the term 'possible selves' but merely 'thoughts for the future'.

In the section "Linking data with the theory", I will describe how the concept of possible selves developed by Markus and Nurius (1986) and the careership model developed by Hodkinson and Sparkes (1997) fit well with the developed categories and aid the understanding of the respondents' thoughts for the future and related choices.

Analytical process of article 3: Transition from science teacher education to science teacher profession

The last article is special in that it both concludes my project but also only draws directly on data from the last round of interviews. Prior interviews do of course matter as they have helped me build a relationship with the respondents, but they are not directly part of the article.

Choosing a focus

As was described in the methodology section, the focus of the third round of interviews with the 2018 cohort was the transition from being a preservice teacher to being a in-service teacher. I chose to focus on how the respondents described their role as new teachers, how they described the conditions they met as teachers and their reflections on the education in relation to these conditions. This choice lived up to my two criteria of a surprising story and a story that had the potential to benefit teacher education. The surprise was in the level of support particularly the respondents with an ASTE background experienced receiving for their ideas. Although I knew they had an attractive education with the competence to teach all science subjects in lower secondary school and maths, I was surprised that they had managed to find jobs in schools where they felt supported in changing the current approach to teaching science, despite also feeling that they had a different approach to teaching than the majority of their new colleagues.

The focus of the article is particularly relevant to science teacher education, as the respondents describe implementing an approach to science teaching they were taught during their education into a profession they consider to be different to how they were taught to teach science. This indicates that they are able to generalize between the context of teacher education and the teaching profession and are transforming what they have learned to fit the school setting. What has been successful in terms of this transfer is the focus of the article.

Institutional support in the transfer situation

After initial coding, theme development and focused coding, I had a category – "allowed to do what they wants" – that ended up being a large part of the article, and it was developed based on experiences from the ASTE teachers. Below is a quotation from a respondent who experienced that although ideas might not be actively supported or encouraged, they were not stopped:

> *Every time I felt like doing something I told a colleague or my manager…and then I have just been a bit…they gave me the go ahead to do it.*

In an example from another respondent, they describe an experience of a high level of freedom in their approach to teaching and lesson planning and reflect on that it is a reward for working hard and being good at what they do:

> *…I get…well…I get more of a free reign. I am allowed to do stuff and such, because they can see I deliver (…) and they can also hear from the feedback from the parents that the students like me…so…so it's easier for me if I ask for things.*

A contrast to the freedom experienced by the ASTE teachers was a teacher who was not supported in their special interest developed from the CHC partner school project and who felt a lack of support in trying new ideas. This experience was assembled in the category "lack of support". The experience of a lack of support clearly influenced how this new teacher felt (un)able to implement aspects of their education they had hoped to. Although codes relating to this category only stemmed from one interview, I found that it strengthened the understanding of what can go on for a new teacher to also include experiences of not receiving support from relevant actors in their workplace (the quotation has been altered for anonymity):

> *They thought it was very interesting and asked a lot about my partner-school project (…) they found it relevant for the school motto. Turns out, after they hired me, though, that they are not interested in paying what it costs.*

Similarity between contexts?

Another prevalent finding was the respondents experience of having a different approach to teaching science than most of their colleagues. In other words, they experienced a dissimilarity between the teaching praxis of their colleagues and what they had been taught as preservice teachers. This experience appeared to influence how they engaged with their colleagues and managers. The codes revolving around this issue were merged to the category "having a different approach to teaching science". The ASTE respondents mention that they have learned how to do lesson planning in a particular way and contrast this to how some of their colleagues approach lesson planning. In the quotation below, one of the respondents is looking back on the first interdisciplinary science project they were part of at their school:

> *(I asked) how do you normally do it and should we meet, and they (teacher colleagues) were like, well the first week they do some reading and then they make research questions and work questions …and I was like what? You don't do anything to motivate them? Like why is this interesting, why are we…why is there a problem here (…) they completely killed their [the pupils'] motivation. And then I wrote to my manager and asked if he had time to listen to some frustrations about the interdisciplinary project.*

One of the elements the respondent had taken with them from the teacher education was how to motivate for a new subject, and "doing some reading" did not fit their idea of how to do that.

Community

The experience of having an approach to teaching that is different to what the colleagues did was particularly relevant for the ASTE teachers, and those teachers also stayed in touch with each other and used the community as former ASTE preservice teachers to develop teaching materials. In the quotation below, one of the ASTE teachers elaborates on how they use the community they formed during their education in their profession:

> *Yeah well, it is very (practical), someone writes in our facebook group: I have just made this and it is really cool. And…or: do any of you have an idea of how you teach this? Or something along those lines. And then we chat (on facebook) and then we meet and talk about it. We are meeting again soon. We are going to have a party doing annual plans together…(laughs)*

The teacher who did not graduate from ASTE also describes using the community from CHC as a means to sharing teaching materials, but since the non-ASTE teachers do not teach at the same levels as the ASTE teachers, the community is not as immediately useful to them.

Formulating the sub question for article 3

The categories for the last part of the study were "being allowed to do what they wants", "being limited by lack of support", "having a different approach to teaching science" and "getting support from community". These categories revolve around how the respondents experienced starting out as teachers and their reflections on how what they had learned during teacher education is aligned or misaligned with this experience. As is evident, most categories developed and used in this last article related to the ASTE teachers. I considered several times to leave respondent who was not an ASTE teacher out of the article. In effect, this would also eliminate CHC from the article, as the focus would then only be on the ASTE programme. In the end, I decided that the experience of this teacher is a contrast that underlines factors relating to both teacher education and conditions at the schools.

Another issue with the ASTE education is that it was difficult for the respondents to differentiate between their experience of CHC and their experience of ASTE. In the end, the sub question I have formulated for this last part of my project is:

> *How does participating in an honors programme with a focus on developing science teaching influence transfer between science teacher education and the science teaching profession?*

Again, the question relates to the main question regarding what teacher education can learn from CHC. Although the respondents had difficulties differentiating between what they had learned particularly in ASTE and CHC, the experience revolved around a particular approach to teaching science that is reflected in the category "having a different approach to teaching science", and I wanted the question to reflect this. I wanted the question to be relatively open and thus "focus on developing science" is not specific regarding what sort of development I am referring to. There are two reasons for this open formulation: 1) CHC is not clear about what is meant by development of science, and thus CHC's approach to science needs to be explored before it can be specified and 2) the open formulation can include the fact that ASTE also had an influence on transfer for the respondents who graduated from this programme as well as from CHC. In general, ASTE had an agenda of focusing on interdisciplinary and inquiry-based science teaching. This focus was not necessarily shared by CHC, which instead focused on educating science teachers who would facilitate development, but not in any particular direction. Moreover, because ASTE was not an honors programme, it can be argued that the sub question should reflect this.

In the section "Linking findings and literature", I present how I chose the AOT approach developed by Lobato (2003) and Wenger's theory of CoP to support the analysis of the new teachers' experience of entering the teaching profession.

Linking findings and literature

After coding, focused coding and the initial choice of focus and development of categories, I moved on to explore how my findings related to the literature. Choosing conceptual frameworks based on the literature was also part of the analytical process. The constant comparison between my data and extant literature was part of developing the final analysis; for clarity and readability purposes, I have chosen to divide the analytical process of the data and the link to literature into separate sections. It is important to note, however, that the process was not as divided as it is presented here.

In this section I present the conceptual frameworks chosen for each article and why I made those choices based on data. As in the section above, I have structured the presentation of the conceptual frameworks around the three articles. Because the frameworks presented here are also used in the articles, there are clear overlaps between what is presented here and what is presented

in the articles, but I have chosen to have this overlap to support my arguments for why the presented frameworks are relevant to use in my analysis.

Choice of literature for article 1: Linking sense of community and the student perspective on student engagement

The categories that became the basis of my first article were: "feeling a sense of community with peers", "being engaged to study by community" and "structure is frustrating". The sub question developed was "how does sense of community in an honors programme affect the engagement of preservice teachers?"

In order to answer this question, I needed to understand the community experienced by the preservice teachers and to help me do this, I turned to a seminal text in the field, McMillan and Chavis (1984), that presents a definition of "sense of community". This definition fits well with my data as it defines community in a manner that is similar to how the preservice teachers initially described their experience of sense of community in CHC, and as such it serves as a suitable conceptual framework for understanding the experience of the respondents. I will elaborate on McMillan and Chavis (1984) and how their theory fits my data in the following section.

Sense of community could only partly serve as the conceptual framework to understand how CHC was initially experienced as an engaging community and why this experience changed over the course of less than a year. To understand the relation between the sense of community and the experience of student engagement, I needed to also understand the link between engagement and community. Kahu and Nelson (2018), Strayhorn (2019) and Osterman (2000) mention sense of belonging as relevant for student engagement, and their definition can be traced back to McMillan and Chavis (1984), but this link has not been the focus of their work. The closest I got to literature that fits this aspect of my research is Kahu and Nelson (2018), who have developed a framework of student engagement. In this framework they take a holistic approach to understanding what can engage students to study, and this includes sense of belonging, or sense of community.

After introducing McMillan and Chavis's (1984) definition of sense of community, I will go into further detail with the framework of student engagement and how the two concepts of sense of community and student engagement support my analysis in this part of my project.

Sense of community

In this section I will present the definition of sense of community developed by McMillan and Chavis (1986) that I have used in the analysis of my first article.

McMillan and Chavis (1986) derived their definition of sense of community based on an extensive literature review. Although their definition did not initially focus on higher education, it has since then been used to understand sense of belonging among students at educational institutions (Osterman, 2000; Strayhorn, 2019).

McMillan and Chavis (1986) describe sense of community as *"a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members' needs will be met through their commitment to be together"* (McMillan, 1976 in McMillan & Chavis, 1986, p. 9).

Based on this description, they propose a definition of 'sense of community' that consists of four elements: 1) *membership*, 2) *influence*, 3) *integration and fulfilment of needs* and 4) *shared emotional connection*.

The element *membership* relates to who belongs to the group and who does not. This creation of a boundary can be emphasized by using deviants: those who are not perceived as living up to what it takes to be a member. Members of a group feel a right to belong, that they have invested in a group they can identify with and that the group provides them with emotional safety. Membership can also entail a common system of symbols, clothing, hand signs or vocabulary.

Influence is an interaction between the group and its members; members influence the group and the group influences its members and creates conformity over time. McMillan and Chavis (1984) stress that conformity in this sense is not the same as the individual loosing personal choice. Individuals are more attracted to the group if they experience that they have influence and that they matter, and the conformity is a dynamic result of the interaction between a group and its members.

Integration and fulfilment of needs or *reinforcement* is the third element of McMillan & Chavis's (1986) definition of sense of community. They describe the fulfilment of needs and the reinforcement of the group as "a primary function of a strong community" (McMillan & Chavis, 1986, p. 13). They further emphasise that reinforcement needs a guiding principle in order to be meaningful and that such a guiding principle can be values:

> *When people who share values come together they find that they have similar needs,*
>
> *priorities, and goals, thus fostering the belief that in joining together they might be better*
>
> *able to satisfy these needs and obtain the reinforcement they seek. (McMillan & Chavis,*
>
> *1986, p. 13)*

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Shared emotional connection is the fourth element. This is described as an experience with which individuals in the group can all identify. This experience can either be a part of the history of the group, or it can be something that has been experienced outside the group but by all its members. McMillan and Chavis (1986) stress that a feature such as frequent quality interactions in a group will strengthen the bond between members. A quality interaction is defined as a positive experience. However, McMillan and Chavis (1986) also mention that going through a crisis together is likely to increase group cohesiveness.

Sense of community in CHC

McMillan and Chavis's (1986) definition of sense of community provides an analytical tool to understand the nature of the sense of community in CHC, thus whether teacher education might learn from this community building.

My category related to "sense of community" was "feeling a sense of community with peers". By applying McMillan and Chavis's (1986) definition of sense of community to my data, the sense of community between peers can be described as a community in which *membership* required investment of effort in CHC-related activities. The members felt *integrated* and had a *need fulfilled* to study with peers who shared the value of putting in extra effort, and they experienced a *shared emotional connection* of feeling like the odd ones out in the regular education programme. One element contained in the definition of 'sense of community' is not prevalent in my data, namely 'influence'. This is not surprising as influence develops over time and the sense of community among my respondents lost its importance between the first two rounds of data. This analysis of the community in CHC can be used to understand the nature of the community, and this understanding can be used to work with community building in teacher education in general.

The community in CHC has a shared value of being engaged in teacher education and as such, it might seem self-evident that the community was experienced as engaging. However, that cannot explain why the community lost its importance, and sense of community is not inherently linked to student engagement.

The following section will focus on how I have linked sense of community with student engagement through the framework of student engagement developed by Kahu (2013) and Kahu & Nelson (2018).

Student engagement

Student engagement in higher education has received considerable attention albeit for various reasons. The concept is often linked to concerns about student retention (Tight, 2020; Tinto, 2012; Trowler, 2010), and some of the earliest work was concerned with student achievement (Astin, 1999). In this regard my project differs as it is concerned with the link between student engagement and sense of community. Although I do not question the connection between engagement, achievement and retention, my data brought my attention to a link between sense of community and student engagement, and it is with this link in mind I approach the concept of student engagement.

Although the concept has received much attention since Astin first presented the predecessor to student engagement, the Student Involvement Theory in 1984, the use of the concept is critiqued for lacking an agreed upon definition and to have too many different meanings ascribed to it (Kahu, 2013; Zepke, 2015; Baron & Corbin, 2012). Another criticism presented by Kahu (2013) of how student engagement is used in research is that there is no clear distinction between the state of engagement, its antecedents and its consequences. To fill this gap, Kahu developed what she called a "conceptual framework of engagement, antecedents and consequences". This framework was revised with Nelson in 2018, and the revised version of the framework serves as an important part of the analytical framework in this part of my study. The main reason why I have chosen to use this framework as part of my conceptual framework is that it includes how sense of community, in the framework termed sense of belonging, is one aspect of many that influences student engagement, thus supporting the analysis of how sense of community affects student engagement.

Figure 7 is a visual representation of Kahu & Nelson's (2018) revised conceptual framework.
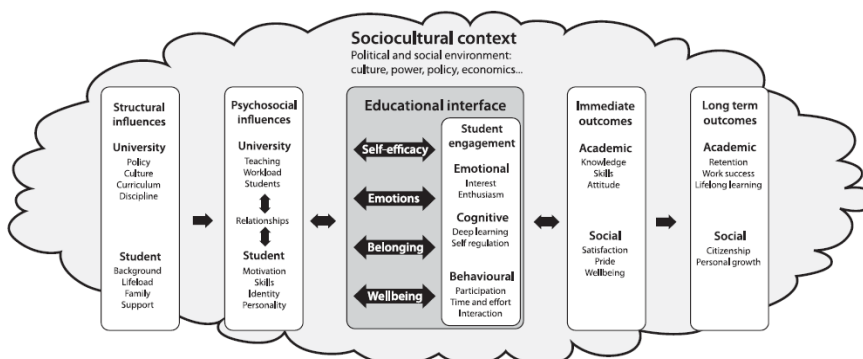
Figure 7 Refined conceptual framework of student engagement incorporating the educational (Kahu & Nelson, 2018, p. 64)

In the conceptual framework, Kahu & Nelson (2018) consider antecedents to, state of and consequences of student engagement. The centre of the framework is the educational interface in which mediating factors influencing student engagement are presented in double arrows between antecedents on the left-hand side and the educational interface. The mediating factors are divided into four factors: 1) self-efficacy, 2) emotions, 3) belonging and 4) wellbeing. This subdivision indicates a strong influence from Fredricks et al. (2004) who describe engagement as consisting of the following three elements: 1) behavioural (e.g. what does the student do? do they turn up for class and how do they act when present?), 2) cognitive (e.g. how does a student approach tasks? do they go beyond what is absolutely necessary, and do they like extra challenges and are motivated by learning in itself?), and 3) emotional engagement that entails how a student is feeling about their studies and whether they feel comfortable in, for example, the classroom. Kahu & Nelson (2018) argue that their model adds to Fredricks et al.'s (2004) understanding of student engagement by underlining how it is a complex construct influenced by not only the institution but also by individual student factors. They further underline that the interaction between student factors and institutional factors are crucial to student engagement, an aspect that is not considered by, for example, Fredricks et al. (2004). Kahu (2013) describes this interaction as alignment, which gives a good idea of what she means; if a student can see alignment between, for example, own interests and what is taught and the way it is taught, the chances of engagement are higher. The mediating factors in the educational interface are described as "mediating mechanisms that act to increase or decrease the likelihood of engagement and therefore success" (Kahu & Nelson, 2018, p. 68), and Kahu & Nelson (2018) suggest using these factors as focus points when working with student enhancement initiatives.

Kahu and Nelson's (2018) framework is a valuable addition to McMillan and Chavis's (1986) definition of sense of community as it offers explanations to not only why the sense of community was experienced as engaging, but also to why it lost its importance. Where McMillan and Chavis (1986) provide the analytical tool to understand the nature of the community among the respondents in CHC, the conceptual framework of student engagement provides the tool to understand how the community in CHC is affected by the context it is part of and that this also affects student engagement. Initially, the community is in alignment with the educational interface. The community of CHC participants shares the value of putting in extra effort, and this value is explicitly part of the definition of talent used in CHC. However, the community in CHC is not an entity in itself but is affected by the influences each preservice teacher experiences outside education, workload in the regular teacher education programme and the structure of CHC.

The category "structure is frustrating" derived from my data is developed to capture the experience the preservice teachers have of a programme that in theory had values aligning with that of the community but in reality had a structure that either clashed with ordinary education or was difficult to understand.

Choice of literature for article 2: Possible selves and the careership model

For the second article I had developed the three categories: "Considering alternatives to the teaching profession", "having hopes and fears for the future" and "choosing CHC to get more options". The sub question developed based on these categories was "How does participating in an honors programme affect possible selves and career plans for preservice teachers?"

As I had chosen to focus on how the students reflected on their future and how some of them were very explicit about choosing CHC as a means to improve their CV, I found it relevant to apply a conceptual framework related to career choices in order to understand what affected those choices and how a choice about the future can affect present behaviour and actions. To this end I have used the careership model developed by Hodkinson and Sparkes in 1997. This model provides an analytical tool to understand the complexity of career choices and how the reflections on the choices made are ongoing, as I noticed when interviewing the same preservice teachers over the course of a year and a half.

I combine the careership model with the possible selves theory developed by Markus and Nurius in 1986. The possible selves theory supplements the careership model by including reflections on what it entails to be, for example, a teacher, what kind of teacher the preservice teachers desire to be and how this affects the choices made during education. In the following I will elaborate on this literature and argue why I consider them good fits for my data.

The careership model

The careership model is inspired by the concepts of 'habitus' (how a person views the world based on their background) and 'field' (a social or institutional arena) developed by Bourdieu and a study on young people's career decisions to leave full-time study (Hodkinson & Sparkes, 1997).The model consists of three dimensions:

(1) pragmatic, rational decision making located in the habitus of the person making the decision

(2) interactions with others in the field

(3) location of decisions within turning points and routines.

Hodkinson and Sparkes (1997) describe the three dimensions as interlinked and assert that separation between them will always be arbitrary.

In talking about pragmatic, rational decisions, Hodkinson and Sparkes (1997) argue that a person is rational when making a career decision. This rationality is based on personal experience or the experience of friends or relatives rather than, for example, advice from a career consultant. In the case of my project, the choices made by the respondents are related to both teacher education and signing up to CHC. Following Hodkinson and Sparkes (1997), the decision to sign up to CHC was more likely if a friend had experience with the programme and recommended it or if a trusted teacher educator encouraged the student to sign up than if a poster in the lobby or an unknown speaker at a common meeting encouraged students to do the same.

Pragmatism refers to the notion that a person considers a few rather than all available options; the considered options fall within what Hodkinson and Sparkes (1997) term 'horizons for action'. This horizon is defined – or limited – by the context in which a career decision must be made, such as the perceived state of the labour market and the habitus of the person making the decision. As mentioned, I consider two decisions in this part of my project: the choice of teacher education and the choice of signing up to CHC.

Before conducting this study, I would not have considered CHC a career decision as it is part of teacher education and as such it can be argued that the choice of a teaching career was already made. However, based on the data it became clear that respondents experienced CHC as a choice that had the opportunity to affect their career, and thus it was relevant to analyse it as such by way of the careership model.

In the second dimension, Hodkinson and Sparkes (1997) argue that choices are affected by interactions in the field of a person: while the interactions are ongoing so is the decision-making process. This underlines that Hodkinson and Sparkes (1997) consider habitus as malleable and under continuous influence by interactions in the field: interactions affect a choice; a choice affects interactions. These interactions may in turn cause a re-evaluation of the choice, leading to the third dimension: turning points and routines.

Turning points and routines refers to how the three dimensions are interlinked. A person's experiences influence decision making, illustrating the model created by Hodkinson and Sparkes

(1997). A turning point is either a situation in which a person is forced to make a career decision or a situation in which a person re-evaluates a decision already made. Hodkinson and Sparkes (1997) classify turning points in three ways:

(1) structural (e.g. graduation where a decision has to be made about the next step)
(2) self-initiated – the person realises that their choice was not the right one and decides to reconsider
(3) forced, where external factors such as sudden changes in the labour market or family trauma forces a revision in career choice.

The most obvious turning point in my study that is shared by all respondents is graduation. As all interviews are conducted during the last two years of teacher education, each round of interviews is a step closer to the structural turning point of graduation, and in the last round of interviews for this part of the project, the respondents have made a choice of whether to enter the teaching profession or not and reflect on why this choice was made. As the respondents graduate from teacher education, choosing not to enter the teaching profession, as some respondents do, can also be considered a self-initiated turning point. The structural turning point of graduation forces them out of a routine so they have to find a new one; however, considering that the path laid out for them is to become a teacher and that there are teaching jobs to get, choosing not to become a teacher is self-initiated. Had teaching been a profession where it was difficult to get a job, they could be forced to reconsider their career, but particularly in the case of science teachers this has not been the case here, and there are no obvious cases of forced turning points in the data.

In between the turning points are routines: how a person experiences, for example, their chosen career path such as an education. Hodkinson and Sparkes (1997) subdivide routines into categories. Of these, I considered two relevant categories based on my data: 'confirmatory', in which the experience of a routine confirms that the choice of a certain career was right, and 'contradictory', where the experience is not what a person had hoped for, thus leading to a re-evaluation and possibly a self-initiated turning point (Hodkinson & Sparkes, 1997).

The careership model underlines both the complexity of a career choice but also how dynamic and affected by interactions such a choice can be.

I found the careership model a relevant fit to my data and to answer the sub question: "Why do preservice science teachers choose an honors programme, and how do possible selves and career plans evolve during participation?" as it considers the complexity of choices made regarding career and thus provides a means to support and understand the findings about students' reflections about their future career in my data. The clearest connection between my categories regarded the location of the decisions, so I needed to return to my data to see how or if the pragmatic, rational decision and interactions with others in the field were also present.

Figure 8 Respondents' evolving career reflections

All respondents were asked about their choice of teacher education in general and their choice of CHC in particular. Not all respondents remembered clearly why they decided to study to become teachers, but those who did had reflections based on personal experiences or advice from friends, which fits with Hodkinson and Sparkes' (1997) dimension of pragmatic, rational decision making. Furthermore, the longitudinal nature of my study allowed me to explore how interactions with others in the field – here mainly teacher education and CHC but also significant others – influenced how the respondents reflected on whether they intended to become a teacher, and how these reflections changed as they approached graduation. This can be considered an institutional turning point. To support my understanding of this development, I made a model of the development in career plans, see fig. 8 (names are pseudonyms). In the model, the development in career plans between the respondents from cohort 2019 are presented as they developed during the three interviews. The full lines indicate the futures they were most certain about and broken lines are careers they are considering.

Although I found that Hodkinson and Sparkes (1997) provided a theoretical framework to support my findings and understand the choices the respondents made regarding their career and also offered explanations as to why they did not consider to be teachers for long, the possible selves theory Markus and Nurius (1986) were needed to understand how plans for the future affected actions in the present.

Possible selves

In the careership model, Hodkinson and Sparkes (1997) take a sociological perspective to consider how habitus and context affect choices. What I noticed in my data was that the respondents reflected on what it was going to be like to be a teacher, whether it was a life they wanted for themselves and if it was, what kind of teachers they wanted to be and what to do to achieve that. In other words, their reflections on the future affected their motivation in the present. Although reflections on life as a teacher are most likely affected by past experiences with school, I needed a theoretical perspective that could add the reflections on the future and how these influence the experience of the present. To this end I chose the possible selves theory developed by Markus & Nurius in 1986.

Markus and Nurius (1986) describe the possible selves theory as a link between cognition and motivation, as what one hopes or fears of becoming in the future serves as a motivator for present behaviour. Markus and Nurius (1986) take into account that although each person is theoretically free to have any and many different possible selves, they will inevitably be affected by the context the person is and has been a part of.

Markus and Nurius (1986) divide the consequences of possible selves into two: 1) they serve as incentives for actions to either avoid or achieve a possible self and 2) they affect how a person experiences and evaluates the present. To answer the question of how an honors programme affects possible selves and career choices, I use the possible selves theory to understand how the respondents' reflections on their future work life affected the choice to sign up for the programme and also how possible selves affected the perception of the different activities in the program. One example of this is a respondent who is determined to enter the teaching profession upon graduation and evaluates the programme based on what this respondent perceives as being directly relevant in the future as a teacher. A preservice teacher who is determined to pursue a master's degree upon graduation might evaluate the programme based on its more academic aspects.

As with the careership model, Markus and Nurius (1986) do not consider possible selves as stable but dynamic as "possible selves are views of the self that often have not been verified or confirmed by social experience" (Markus & Nurius 1986, p. 955), and they argue that possible selves are malleable and influenced by the social situation of a person. This reflection on possible selves as being subject to social experience is relevant when analysing student turning points, in this case when preservice teachers approach graduation. When the preservice teachers make a new choice regarding their future, they reflect on experiences they have had during their education, such as participation in CHC or experiences in relation to a career outside of education. These

experiences are added to their hopes and fears for the future and, following the possible selves theory, will affect their motivation and actions in the present.

Choice of literature for article 3: Transition from teacher education to teaching profession

The last part of my study focuses on how four of the respondents from the first CHC cohort experienced their first year as science teachers. The categories developed for this article were: "being allowed to do what s/he wants", "being limited by lack of support", "having a different approach to teaching science" and "getting support from community", and the sub question was: "How does participating in an honors programme with a focus on developing science teaching influence transfer between science teacher education and the science teaching profession?"

These reflections on education in the light of profession are linked to the projects main question of what teacher education can learn from the CHC programme and is also the part of the project which most clearly draw on the sensitizing concept of transfer of learning used in the research design. As such, in this last part of my project the choice of using transfer theory was the least data driven choice made in my project.

Transfer of learning from teacher education to the profession

As I presented in the section on transfer of learning, I have been inspired by Lobato's AOT approach, in which it is the actor defining what is transferred and not the researcher defining what ought to have been transferred. This suits a complex field such as teaching and a novel programme such as CHC. Although I could have chosen to research whether a specific aspect of CHC had been transferred, a negative outcome might have led to the assumption that nothing had been transferred at all. By using AOT, I left it up to my respondents to define what had been transferred. What I found was that it was not aspects of CHC that dominated the respondents' reflections on their education, but other aspects of their teacher education. The ASTE teachers particularly refer to how they were taught to do lesson planning. Why this is an aspect of teacher education they have transferred can be explained by the concept of expansive framing developed by Engle et al. (2012), who argue that the likelihood of transfer increases if it is obvious to the learner why something is relevant in a given situation.

Communities of practice among former CHC participants

Another, more data-driven, choice of analytical lens was the aspect of community. The respondents used communities as a means to ease into the profession, thus making CoP as developed by Wenger a necessary supplement to expansive framing and AOT. In the following I will elaborate on the concepts of CoP and why I consider transfer of learning and CoP good fits to my data and my third sub question.

Communities of practice

As my interviews revealed an emphasis on community with either previous fellow students or new colleagues, I found the need to supplement AOT and expansive framing with Wenger's theory of CoP. Although both the AOT approach and the concept of expansive framing acknowledge the importance of context and the social situation for learning and transfer, the transfer theories mentioned above do not emphasize the influence of the communities in either the learning situation or the transfer situation. They also do not account for the fact that teachers are most likely not taught everything they need to know to be a teacher in their teacher education programme; they also learn when they participate in the practice of teaching. While Wenger's (1998) theory of CoP is more concerned with social learning and not particularly with the transfer of learning, the theory is relevant when exploring how the respondents experience transition from teacher education to the teaching profession. This transition from one social context to another involves participation in at least one new practice: the practice of teaching.

Wenger (1998) describes a CoP as consisting of three overlapping concepts:

(1) mutual engagement: the members are all engaged in the community and this engagement needs to be maintained by interaction
(2) joint enterprise: members communally negotiate their community enterprise and how to work toward it. The members do not have to agree on every aspect, but the negotiation of the enterprise is communal. Wenger (1998) further argues that CoPs do not exist in a vacuum; reactions to the conditions they face, such as institutional requirements, are part of the negotiated enterprise.
(3) shared repertoire: when working toward the joint enterprise, members of a CoP build up a repertoire. This repertoire's presentation depends on the context but could be jargon, tools or teaching material. The repertoire of a community reflects its continuously created history, or as Wenger (1998) puts it, "it reflects a history of mutual engagement" (Wenger, 1998, p. 83).

Wenger (1998) notes that CoP members are not just members of one but several communities and that this multi-membership can result in brokering between them. This implies that a member of one community might transfer practices between communities (Wenger, 1998), which in the case of my respondents occurs when they work in separate schools but draw on their community from teacher education for inspiration. This is further in line with later descriptions of CoPs, where E. Wenger-Trayner and B. Wenger-Trayner (2015) emphasize that it is not a prerequisite for the members of a CoP to have a shared practice in the same physical space: "Communities of practice are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly" (E. Wenger-Trayner & B. Wenger-Trayner, 2015, p. 1).

Combining transfer of learning and communities of practice

In this last part of my PhD project, I attempt to answer the question of how participating in an honors programme with a focus on developing science teaching influences transfer between science teacher education and the science teaching profession. By using the AOT perspective on transfer, I gain an insight into how the respondents themselves experience transfer between education and profession. Had I looked for transfer of specific aspects of CHC as in the more cognitive approach to transfer, I would have found very little transfer, and I would have overlooked how important working with lesson planning during the teacher education programme can be for the graduating teacher. In my study, the ASTE teachers reflected on how they had taught to plan their science teaching using an inquiry-based, interdisciplinary approach. They considered themselves able to apply this approach to lesson planning in practice despite feeling in opposition to their colleagues – but had the support of their fellow students.

Although the research is done retrospectively, the theory of expansive framing provides an understanding of how teaching with direct references to the profession, such as lesson planning, might ease transfer despite colleagues doing things differently. The transfer theories are supplemented by Wenger's theory of CoP, as it was evident from the data that learning from communities in practice, be it an already established community consisting of fellow students from teacher education or a new community consisting of new colleagues, proved a valuable means for the respondents' transition from being preservice to being in-service teachers.

Summary of linking findings to the literature

In this chapter I have provided an overview of how I have worked with constructivist grounded theory in developing categories based on my data and related my findings to conceptual frameworks. As is evident, all three articles are very different from one another, the common denominator being what teacher education can learn from the preservice science teachers' experience of CHC.

I have explored how working with a focus on a sense of community can affect engagement and found that a sense of community with a shared value of how to study that aligns with the values of CHC can have a positive impact on student engagement but that such a community is also fragile and affected by a perceived decrease in expectations and experience of a chaotic structure.

I have further explored how preservice teachers do not consider the teaching profession as a given career path and reflect on teaching as a career with limited options for development and how this affects choices made during education, such as signing up for CHC to expand their options upon graduation.

Finally, I returned to my sensitizing concepts of transfer of learning, by applying Lobato's AOT approach to my study along with expansive framing, in which I found that the new teachers particularly refer to transferring the approach to do lesson planning in science teaching and how the context of the school such as support or lack of support has an influence on the ability to transfer. As the social context of community of former students had an influence on transfer, I added Wenger's theory of CoP to increase my understanding of what was going on for the new teachers who had just entered the profession.

Overview of categories, sub questions and literature

It follows from the methodology section that my findings relate to the categories I developed in the coding process and that the sub questions phrased served to frame what the questions were an answer to in relation to the literature. An overview of developed categories, related sub questions and the title of each article is presented in table 9.

Article number	Categories developed	Sub question	Main concepts from the literature	Title of article
1	"feeling a sense of community with peers", "being engaged to study by community", "unclear expectations", "structure is frustrating"	How does sense of community in an honors programme affect the engagement of preservice teachers?	Sense of community (McMillan & Chavis, 1984); Student engagement framework (Kahu, 2013; Kahu & Nelson, 2018)	Linking preservice teachers' Sense of Community and Student Engagement
2	"Considering alternatives to the teaching profession", "having hopes and fears for the future", "choosing CHC to get more options"	Why do preservice science teachers choose an honors programme and how do possible selves and career plans evolve during participation?	Possible selves theory (Markus & Nurius, 1986), Careership model (Hodkinson & Sparkes, 1997)	Teaching is not for life – preservice teachers' reflections on their possible future selves

| 3 | "being allowed to do what s/he wants", "being limited by lack of support", "having a different approach to teaching science", "getting support from community" | How does participating in an honors programme with a focus on developing science teaching influence transfer between science teacher education and the science teaching profession? | Actor-oriented Transfer (Lobato, 2003): Expansive framing (Engle et al., 2012); Communities of practice (Wenger, 1998) | Opportunity for change? The experience of being a new teacher educated to develop the way science is taught in schools |

Table 9 Overview of developed categories, related sub question and the title of each article

In the following chapter I will present the three articles including the findings related to each sub question.

Presentation of the articles

As presented above, each sub question developed as part of the analytical process resulted in an article. In this section I present my articles, the findings related to the sub question for each article and how the individual article contributes to answer the overarching research question of what teacher education can learn from CHC.

Linking preservice teachers' sense of community and engagement in an honours programme

This article is based on the first two rounds of interviews with the 2018 cohort. It has a focus on the link between student engagement and sense of community and how it develops over time in CHC. The article answers the question:

> *How does sense of community in an honors programme affect the engagement of preservice teachers?*

That the two concepts of sense of community and student engagement are linked is not new, but research on how students experience the link appears to be scarce, as is research on the development over time. What initially struck me was how the programme succeeded at creating an engaging community very quickly and how this appeared to appeal to the CHC participants' values of how to study.

To help me analyse and understand the findings I used a definition of sense of community developed by McMillan and Chavis (1984) and a 'Conceptual framework of engagement, antecedents and consequences' developed by Kahu (2013) and refined by Kahu and Nelson (2018).

In the article I conclude that a community in which the members feel a shared value of putting in extra effort was aligned with the values initially implied in the talent definition presented by CHC. This definition was phrased as "willingness and ability to put in extra effort". The alignment between values in the community of CHC participants and CHC, appeared to serve as an engaging factor for the participants. However, I also conclude that the community quickly lost its importance for the respondents. This development appears to be a consequence of multiple factors both involving the life load of each CHC participant but also of the experience of CHC as not living up to the values of expecting extra effort from the participants.

The findings in this article contributes to answer the main question of what teacher education can learn from CHC, by exploring the importance of the sense of community formed in the programme and how it served as an engaging factor to the CHC participants. The insights in the article have the potential to qualify how teacher education work with student engagement as related to both community, alignment of values between teacher education and student community and clearly stated and executed expectations from teacher education.

The article has been submitted to Teaching In Higher Education

Teaching is not for life – preservice teachers' reflections on their possible future selves

This article is based on three rounds of interviews with the 2019 cohort.

The article attempts to answer the question:

> *Why do preservice science teachers choose an honors programme and how do possible selves and career plans evolve during participation?*

The focus in the article is on the CHC students' thoughts for the future and how they make choices based on these thoughts. As thoughts for the future and career plans were the dominant themes, I have used Markus and Nurius (1986) as an analytical framework to understand how the preservice teachers' thoughts for the future affected the choices. Hodkinson and Sparkes (1996) careership model informed my analysis of the students' reflections on long-term career goals.

In the article I present the finding that the preservice teachers in this project do not perceive a future as a teacher as a given. Although they do reflect on activities in CHC in relation to how they can use them in the profession as teachers, they also reflect on how they can use CHC as a means to boost their CV and have opportunities outside of teaching. Another interesting aspect of the respondents' thoughts for the future, was that they did not perceive teaching as a career with room for development, hence the need for a CV with opportunities for alternative careers.

Although the findings revealed a group of CHC respondents who considered CHC as a means to expand their options and who did not consider a career as teachers as a long-term decision seem less relevant to teacher education, it could serve relevant to alleviate shortage in preservice teachers. The respondents reveal a worry that the teaching profession holds limited opportunities for development, and while this is not within the scope of teacher education to deal with, providing an education which is perceived as relevant in the pursuit of different careers, might attract more prospective teachers.

This article has been submitted to the journal Teaching and teacher Education

Opportunity for change? The experience of being a new teacher educated to develop the way science is taught in schools

The last article is based on four interviews with respondents from the 2018 cohort after they have been teachers for close to a school year.

The research question in the article is:

How does participating in an honors programme with a focus on developing science teaching influence transfer between science teacher education and the science teaching profession?

The focus of the article is on the prospect of using teacher education as a means to develop science teaching. Two of the most important findings regarding the new teachers transfer of learning between teacher education and profession are 1) the influence of alignment between teacher education and teaching requirements in the school and 2) available support in the transfer situation.

In this article I applied the conceptual framework based on transfer of learning research and used the AOT approach developed by Lobato (2003, 2012) and the concept of Expansive framing developed by Engle et al. (2012). As the community developed during teacher education appeared to serve as a community of practice for particularly the ASTE teachers, I added CoP as described by Wenger (1998) to the theoretical framework in this article.

All respondents refer to an initial hope to transfer particular aspects from their education as science teachers to their profession. In one case however, suggested ideas were not supported by management and various difficulties in the classroom on top of this lack of support had them abandon, at least at the time of the interview, those ideas. The story is different for the ASTE teachers, who feel supported by management to implement new approaches to science teaching at their respective schools. They also draw on the CoP developed during teacher education for support in implementing what they believe is the best approach to teaching science. What they refer to as having had the most influence on their teaching, is lesson planning, particularly regarding interdisciplinary, problem-based projects. This aspect is derived from the ASTE education and was aligned with the requirements in a recently implemented interdisciplinary, problem-based science exam in lower secondary school.

An important lesson for teacher education in this part of my study, is that alignment between requirements in the teaching profession and what was taught at teacher education, appears to be more important to the new teachers than the extracurricular activities in CHC. The activities in CHC were intended to increase the new teachers' competencies within facilitating and managing science education projects but the day-to-day requirements of being a new teacher were more aligned with ASTE and thus appeared to transfer more readily.

Discussion of methods and methodology

In this chapter I will first discuss the strengths and weaknesses in my study and reflect on the suitability of my methods and methodology. The discussion is followed by discussions on how the findings presented in each article relate to state of the art presented in the literature review and how they serve to answer the main research question of what teacher education can learn from the experiences of preservice science teachers participating in an honors programme.

Saturation

According to Charmaz (2006), saturation of categories is different to looking for repetition, as saturation is achieved when collecting and analysing more data does not give new theoretical insights.

I have attempted to reach saturation within my project, but several factors have influenced my ability to do so.

First of all, CHC was under development when I started collecting data, and the circumstances for the CHC participants kept changing, both because the teacher educators kept improving the programme as they went along and because COVID-19 disrupted the development of the programme. This happened less than halfway through my PhD project.

Second, but not unrelated to the first factor, the number of respondents was low, and particularly the 2019 cohort suffered a significant number of dropouts, which also affected my ability to reach saturation as some of my respondents left the programme at an early stage.

A third factor was that I would have liked to explore further how transition to the teaching profession was experienced by the CHC participants. Although I initially kept the research question open in order to include multiple careers, only two respondents from the 2019 cohort entered the job market before I had to stop assembling data due to time constraints. Two went on to pursue a master's degree and one was planned to graduate in December 2021, six months later than the rest of the cohort. This led to the decision of focusing on what I had from the first three rounds of interviews, where only four interviews (the last round with the 2018 cohort) were with respondents who had entered the teaching profession.

Charmaz (2006) argues that a modest claim reaches saturation sooner than a more pompous one. As such the claims made in this study must be modest but also situated in the context in which the study was made which, again, is in line with Charmaz (2006), who argues that by thoroughly situating a study in its context it becomes possible to make "nuanced comparisons" with other studies (Charmaz, 2006, p. 180). Thus, by not claiming generality but by being transparent about the context, it becomes possible for others to generalize between my study and others (Brinkmann and Tanggaard, 2015). An example is the claim in the first article. This article claims that the nature of the sense of community developed among the respondents from the first cohort of CHC students was experienced as engaging. It further claims that the structure of the programme and complexity of student life appeared to cause the community to lose in importance. By situating the study within a context, I strive to make it possible for a reader to assess whether this particular study suits their need and assess the quality of my findings in relation to what I have done.

Reflections on using a methodology inspired by constructivist grounded theory

Being so strongly inspired by Charmaz's approach to the grounded theory method has been challenging. The field I entered was the dynamic field of an educational programme under development that kept evolving and attempted to do something that had not been done before in a Danish context: developing an honors programme in a teacher education programme. By using a methodology inspired by constructivist grounded theory, I could be flexible and open to what the students experienced.

The challenge of being as data driven as I have striven to be was that when my data took me down roads I had not anticipated, I needed to add new conceptual frameworks to my analysis. When I had developed a plan for theoretical sampling based on initial analysis of data and review of literature within relevant conceptual frameworks, circumstances for my respondents had inevitably changed, and this change was particularly drastic because of COVID-19 lockdowns. What I had hoped to explore further was no longer there, leading to new themes to explore. This again forced me to accept that there was a limit to how saturated my data could be with the time constraints and other circumstances, such as the rapid changes enforced on all aspects of the education system during COVID-19.

To me, my research leaves more questions than answers, such as whether preservice teachers who did not sign up for CHC have similar reflections on their future career and desires to expand their options beyond teaching. This is not necessarily a bad thing (Brinkmann and

Tanggaard, 2015). Although I would have liked more time to conduct my research and saturate my data, I would not change the methodology even if I could. I find that my approach provided insights a more deductive approach would not. An example of this is found in the last article. Had this project used a more deductive approach and researched transfer of learning from Wahlgren and Aakrog's (2012) transfer training perspective rather than Lobato's (2003, 2012) AOT perspective, I probably would not have detected the importance the students ascribed to the lesson planning during their ASTE programme. The focus in the project would have been strictly on aspects of CHC – and lesson planning was not part of that setting but was revealed as important by using the AOT perspective. As such, had I asked the question "will X transfer" rather than "what transferred", I would have had the opportunity to research what X was and how it was taught, but it might not have been transferred.

In the following chapter I will discuss how my findings serve to answer the main question of what teacher education can learn from the experience of preservice science teachers participating in an honors programme.

Discussion of findings

In this chapter I will discuss how my findings relate to state of the art within the reviewed literature on how honors programmes influence ordinary education. I will further discuss how the findings presented in each article serve to answer the main research question of what teacher education can learn from the experience of preservice science teachers participating in an honors programme. One of my interests in this aspect of teacher education implementing an honors programme stems from the argument that the presence of an honors programme is of benefit to general education (Arbejdsgruppen til talentudvikling i uddannelsessystemet, 2011; Clauss, 2011; Kolster, 2021b; Renzulli, 2005; Wolfensberger, 2004, 2012a).

In my literature review of current knowledge on how practice in honors programmes affects regular education, I found that research in this field is scarce, but what little research there is represents three main findings:

1) Kolster (2021ab) and Wolfensberger et al. (2004, 2012) have found cases where course content and pedagogy in regular education are inspired by teaching methods in honors programmes, examples given point in the direction of more student-centred teaching

2) the cases where regular education is inspired by teaching methods in honors programmes consist of cases where the same teachers taught at both honors and regular education

(Wolfensberger et al. (2012a, 2004), Kolster (2021b)) – students were not found to have any influence (Kolster, 2021a)

3) honors programmes did not have a huge impact on regular education. Kolster (2021b) argues that this is due to the fact that these programmes are small compared to the institutions that host them.

As there did not appear to be any findings in the literature related to what regular education might learn from the student experiences, and as students are at the centre of experiments such as CHC, I found it crucial to explore CHC from a student perspective. As Kolster (2021a, 2021b) had found no diffusion from honors students to regular education, I found it important that I as a researcher could explore the students' experience and assess which parts of their experience were relevant to not only continuous development of CHC, but also to science teacher education in general. As an analytical lens to aid me in this assessment, I used transfer of learning from a situated cognition perspective. I made this choice because a professional education such as teacher education holds an implicit expectation of graduates to be able to transfer what they learn from education to profession. CHC underlined this expectation by explicitly stating that CHC graduates were expected to transfer affordances acquired in the programme to enhance the science education milieu at their prospective schools of employment. As this explicit goal requires transfer, I considered it possible that CHC might develop means to enhance transfer between education and profession and if this was the case, this would be of interest to all of teacher education.

In the following two sections I will relate the findings in each of my articles to the state of the art related to what ordinary education can learn from honors programmes and in turn how the findings serve to answer the main research question of what teacher education can learn from the experience of preservice science teachers participating in an honors programme.

Discussion of potential influence from CHC on pedagogy in teacher education

An important finding presented in my first article is that the 2018 cohort initially felt part of an engaging sense of community where they shared the value of how to study. This value included investing a greater effort in their studies than they experienced among preservice teachers at the ordinary education.

Student engagement is considered important for student learning (Fredricks et al., 2004; Kahu & Nelson, 2018), and transfer of learning is considered to be enhanced when something is

learned sufficiently (Bransford & Schwartz, 1999; Engle et al., 2012; Pellegrino & Hilton, 2012). As such, student engagement can play a part in enhancing transfer of learning between teacher education and the teaching profession, making the experience of an engaging community relevant to pursue when considering what teacher education might learn from the experience of preservice teachers' participation in CHC.

In order to understand the community the preservice teachers were part of, why it was initially experienced as engaging, and in turn whether teacher education in general could learn something from the pedagogy in CHC related to community, I used the definition of sense of community developed by McMillan and Chavis (1984). By using sense of community as an analytical lens to understand the experience of the CHC participants, the community could be described as a community in which members shared the *values* of putting in an extra effort, who had a *shared emotional connection* through the experience of feeling like the odd ones out at regular education because they were interested in spending time studying and who felt a *fulfilment of needs* from the group through, for example, journal club where the experience was that everyone came prepared and everyone participated.

Linking sense of community with student engagement

Understanding the nature of the community in CHC is only partly useful to teacher education, as it only to a limited extent explains why and how the community was formed and also what made the preservice teachers experience the community as engaging. When I combine McMillan and Chavis's (1984) definition of sense of community with Kahu and Nelson's (2018) framework for student engagement in the educational interface, I also link how sense of community has the opportunity to increase student engagement and offer a suggestion to how this sense of community was initially a success in terms of student engagement. There is a striking resemblance between how CHC frames what is required of the students through the definition of talent as being able and willing to put in extra effort and how the CHC participants describe the community they feel engaged by. According to Kahu and Nelson (2018), student engagement occurs in the educational interface when there is alignment between student factors – which in this case is alignment between an interest in putting in extra effort and CHC's expressed expectation of extra effort communicated through the definition of talent. Sense of community is termed a mediating factor, a factor which supports the alignment (Kahu & Nelson, 2018).

The question for teacher education is if this alignment can be achieved without an honors programme or similar. Turning to (Tinto, 2012), students who start an education generally want to put in the effort required from them, and merely stating high expectations from the

educational institution has an effect. In other words, if teacher education states high expectations from the preservice teachers as CHC did, following Tinto (2012) this alone has the potential to increase student engagement and create alignment between what new students think is expected from them and what the institution says is expected from them.

Although alignment of values between students and educational institution has the potential to increase student engagement, my findings suggest the importance of sense of community among students. The modulization of Danish teacher education might have worked the wrong way. By dividing the education into modules where the same group of students were rarely together, the chances of forming a community are not high. The CHC participants had, at least initially, frequent interactions and activities such as Journal Club where there were long sessions of discussing something together. This provided the opportunity to strengthen the communal value of putting in extra effort and to share the experiences of having a different approach to studying than students from the teacher education programme in general.

Following this analysis, I will argue that a combination of teacher education being explicit about high expectations with the opportunities for preservice teachers to form communities around living up to this high expectation might have a positive effect on engagement. However, as was also the case in my findings, the preservice teachers realized that the expectations in CHC were not as high as was initially expressed, and the preservice teachers experienced that the structure in the programme hindered quality interactions. This drop in expectations was a misalignment with what the preservice teachers valued in their education, and the combination of misalignment and an experience of less opportunities for interaction in the group might have played a crucial role in the community losing its importance as an engaging factor for the preservice teachers. This is also an important finding for the teacher education to consider as it indicates a need for continuous consideration for community and student engagement.

Discussion of CHC's potential influence on content in teacher education

One of the innovative contents in CHC not already present in teacher education is courses on project management and innovation. In my second article I discuss findings related to the question of why the preservice science teachers chose to participate in CHC and how possible selves and career plans evolved during participation. I found that the preservice teachers were excited about the courses in project management and innovation, but also that they considered having them on their CV to expand their options beyond a career in teaching. To my respondents, the choice of career was not finalized with the choice of starting teacher education.

This finding is supported in research that argues that career decisions are continuous: a person does not stop considering what a desired career path is just because that person has entered an education (Hodkinson & Sparkes, 1997; Holmegaard et al., 2014; Vulperhorst et al., 2020).

My respondents' career choices were affected by factors related to their background such as past experiences with substitute teaching or recommendations from friends and family (Hodkinson & Sparkes, 1997). However, interactions with others continue to have an influence on whether the respondents stick to the original plan of becoming a teacher.

Before considering what teacher education can learn from the preservice teachers' experience of the content related to project management, an important issue to understand is why the respondents consider not entering the teaching profession or leaving it after few years. Although one respondent explicitly points to salary, the rest of the respondents are concerned the teaching profession will not hold sufficient opportunities for personal and professional development – and this is also the case for one of the respondents already employed as a teacher. By adding Markus and Nurius (1986) to the analysis, the concern about the teaching profession not holding enough opportunities for personal development is a fear for the future they act on by choosing CHC. An aspect of CHC considered to hold generic competencies relevant in other career paths is project management.

Using CHC as a means to expand options in the sense of options to leave teaching is counter to the goal of CHC, which was to strengthen science education in schools via the CHC graduates' ability to, for example, facilitate and manage science education projects in schools. As such, it could be considered a failure when parts of the programme's content are perceived as useful to pursue other careers. However, Professionshøjskolen Metropol (2018) also argued that CHC was a means to attract skilled candidates to the welfare sector and in this regard, my findings point in a direction that could be useful. The worry that the teaching profession does not provide the opportunity for future professional development is reflected in a survey from the Danish Evaluation Institute (Danmarks Evalueringsinstitut, 2022) that concluded that 10% of applicants to higher education considered teacher education but decided against it partly because they considered the working conditions to be too hard, the job too poorly paid and career opportunities too limited. If teacher education chose to include content such as project management that could be considered relevant in the teaching profession and a means to work with education in other lines of work, this might increase the number of applicants.

Where does my finding of respondents considering other careers than teaching leave the aspect of transfer of learning? There are especially two aspects of my findings I consider relevant in this regard. First of all, it is important to note that the respondents themselves recognized the usefulness of project management in contexts other than the teaching profession. This implies that they are motivated for transfer and that they can see the relevance of what they learn in their future career, which supports transfer of learning (Dohn et al., 2021; Engle et al., 2012).

Secondly, if preservice teachers consider teacher qualification worth their while because they consider it useful in the pursue of different career paths, this needs to be considered when transfer between education and profession are considered in teaching. Researchers such as Wahlgren and Aarkrog (2012) argue in favour of transfer training in which strong connections between education and profession are made. If the emphasis on this aspect of teacher education becomes too strongly directed at the teaching profession, there is a risk that the preservice teachers who are not sure about a career within teaching might drop out. Although this might seem self-contradictory, CHC succeeded with their approach to project management in schools – the school setting is relevant if you are considering becoming a teacher, and the project management aspect is useful both as a teacher and in other careers as well.

The above suggestions mainly concern recruitment issues for teacher education and not for the teaching profession. As my data suggests, the teaching profession is perceived as lacking opportunities for personal and professional development, and this perception needs to be researched further to fully understand to what extent the perception reflects the teaching profession and what is required to change this perception.

Discussion of limited influence of CHC on the experience of teacher education

In my study I have considered the student experience and as such not to what extent the programme has influenced the praxis in ordinary education while it was running as Kolster (2021ab) and Wolfensberger et al. (2004, 2012) did. Kolster (2021a) concluded that honors programmes had a limited influence on general education and argued this could be due to the fact that the programmes were relatively small compared to the educational institutions they were part of. In the literature section, I presented this finding as a small house in a big house where the small house had a limited influence on what was going on in the big house. While my study cannot say anything about CHC's influence on the practice of ordinary education, it can

say something about how big a part the experience of participating in CHC played for my respondents in relation to ordinary teacher education as they entered the profession.

In the findings presented in my third article, CHC appears to have been experienced as a relatively small part of the respondents' teacher education. Although the respondents express having enjoyed participating in CHC, what they reflect on using in their day-to-day life as teachers is aspects of their general teacher education. It is important to note that this result is based on the experience of the respondents at the time of the interviews, and as such not an expression of CHC having had no significance at all, but it is a finding important to consider when assessing what teacher education can learn from CHC.

Part of the rationale for developing CHC was that it should improve science teaching in schools and educate science teachers who would be willing to facilitate and manage science education projects (Professionshøjskolen Metropol, 2018). In other words, the CHC graduates were expected to transfer skills such as project management to the profession. Based on Lobato (2003), in order to do this the graduates would need to be able to generalize between what they had learned at CHC to the profession. As Bransford and Schwartz (1999) and Engle et al. (2012) among others argue, this requires that they have learned, for example, project management sufficiently well. This could be a reason why they did not reflect on using this skill. However, it also requires that the graduates can recognize the situation in their profession as sufficiently similar. As was the case for one of the graduates, this respondent expressed an initial interest in transferring aspects of the partner-school project they had worked with at CHC but experienced not being supported by the school and the conditions for transfer were simply not there. For the ASTE teachers, they faced the challenge of working with interdisciplinary projects. The focus on interdisciplinary projects followed a reform of the assessment in lower secondary school and was in alignment with how the ASTE teachers had been taught to do lesson planning during their teacher qualification. This alignment appears to have made it easier for the new teachers to generalize between what they had learned during their education and the requirements they were met with in their profession.

In this section I have not considered CHC's influence on the institution of teacher education but how the respondents described transferring what they had learned during their teacher education, including CHC, to the profession. What I conclude is that CHC appears to have had a limited influence on the respondents' teacher education. My findings suggest two reasons for this limited influence: 1) the programme is a relatively small part of their education and 2) the conditions in the schools and the tasks and expectations the new teachers are met with need to be more aligned with the programme.

As such it is questionable whether a programme such as CHC can be considered as a means to improve science teaching in schools, as is suggested by part of the rationale for the programme. The programme has educated few teachers and data from the 2018 cohort suggest that the programme had limited influence on the practice of these teachers.

Based on my findings, it is worth considering if the goal of improving science education is best achieved through a focus on project management, or whether it should be considered how the programme could align with requirements in schools to a larger extent. An example could be a focus on interdisciplinary, inquiry-based teaching similar to what was done in ASTE. The new ASTE teachers experienced alignment between requirements in the schools and ASTE, and thus it was easier for the new teachers to transfer what they had learned to the profession while still holding the potential to improve the way science is taught in schools.

Conclusion and suggestions for further research

My study of what teacher education can learn from the experience of science teacher education contributes to current knowledge in the field through a student perspective. As such my study differs from the current research by Kolster (2021a, 2021b) and Wolfensberger et al. (2004, 2012), which has not focused on what can be learnt from the student experience of honors programmes.

Current research suggests that the most evident influence of honors programmes on regular programmes is related to content and pedagogy. My respondents reflect on the activity called journal club as particularly interesting, and as such it would be tempting to suggest exporting the content and pedagogical approach used in these journal clubs to the teacher education. However, considering that the CHC participants place more emphasis on the sense of community than on the content and pedagogy of journal club, I suggest to further research how teacher education can enhance student engagement through supporting community building and considering student factors.

The aspect of project management is a novel invention in CHC that was specifically designed for this science teacher education honors programme. The main take away message from this part of the study is for teacher education to consider how generic competencies such as project management can increase the relevance of teacher education in career paths other than teaching, which might have a positive effect on recruitment to teacher education. As recruitment to teacher education is an increasingly big problem, this aspect of my project calls for more research. My study hints at preservice teachers being attracted to activities that offer more generic competencies.

My project is limited to a small group of preservice teachers who had partly been attracted to CHC due to an offer of such activities. Important research to follow up on my findings is if such activities are perceived as attractive to preservice teachers outside CHC and if recruitment to teacher education would improve if teacher education was perceived as relevant in more than one career path.

Another aspect in need of more research is my respondents' perception of the teacher profession as lacking opportunities for professional development. The respondents give this perception as a reason to want to expand their options beyond teaching. It is worth exploring further whether this perception is widespread among preservice teachers in general and preservice science teachers in particular. Further worth exploring is how the perception correlates with in-service teachers' perception of opportunities for professional development.

Finally, the last part of my study revealed how it was ASTE that had proved the most immediately useful when my respondents entered the teaching profession, likely due to alignment between requirements in the day-to-day teaching planning and what was taught at ASTE. Although this does not say anything about CHC not being useful, it hints at CHC being a relatively small part of the ASTE teachers' education, just as CHC is a small house inside the big house of teacher education.

The field of research within how new teachers experience transition to the profession from an AOT perspective is limited, and more research within this field would be valuable to understand how teacher education is experienced as relevant and hence what role teacher education can play in improving science teaching in schools.

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Appendix 1 – interviewprotocol, cohort 2018 and 2019, 1ˢᵗ Interview

Kan du fortælle mig lidt om, hvordan det var at starte på lærerstudiet?

Kan du huske hvorfor du meldte dig til CHC?

Prøv at beskrive programmet med dine egne ord.

Hvordan har du oplevet forløbet indtil nu?
        Hvad har betydet mest for dig i programmet?
        Hvordan/hvorfor?

Kan du huske, hvad du forventede af forløbet, inden i startede?

Er der noget i programmet der har overrasket dig?
        På en god måde?
        På en dårlig måde?

Kan du huske, hvordan du oplevede grunduddannelsen, inden du startede? (rettes til hvis det er nævnt)

Hvordan oplever du grunduddannelsen nu?

Hvad tænker du om fremtiden?
        Næste studieår?
        Når du er færdig på læreruddannelsen?

Appendix 2 – interviewprotocol cohort 2018, 2nd interview, cohort 2019, 2nd and 3rd interview

Hvad fylder lige nu?

Hvordan har du oplevet det sidste semester?

> I relation til studie
>
> I relation til CHC

Er der noget i relation til CHC, der har betydet mere for dig end andet siden maj?

Prøv at beskrive dit partnerskoleprojekt

> Hvordan har du oplevet processen med projektet?
>
> Hvad har været det mest udfordrende?
>
> Har du en fornemmelse af, hvad du tager med videre fra projektet?

Hvilke tanker gør du dig om det næste halve år?

> Udprøvning og afslutning på CHC
>
> Færdiguddannet som lærer
>
> job

Tanker om talent - (hvis den studerende ikke er kommet ind på det)

Appendix 3 – Interview-protocol cohort 2018, 3rd interview

Hvad skete der efter du blev færdig med læreruddannelsen?

Hvordan valgte du dit job?

Hvad har betydet mest for dig i relation til dit arbejde/studie det sidste år?

Hvordan oplever du, at dit studie har forberedt dig til det arbejds/studieliv du har nu?

    Er der elementer fra dit studie du oplever som lettere at anvende i din praksis end andre?

Har du kontakt til de andre studerende fra CHC?

    Hvilke tanker gør du dig om fremtiden?

1ˢᵗ article: Linking Preservice teachers' Sense of Community and Student Engagement

Although student engagement is widely acknowledged as important, research exploring the experience of engagement from a student perspective is scarce. This study explores the link between building a sense of community and student engagement using a constructivist grounded theory approach to explore the experiences of five science preservice teachers during their participation in the honours programme called, Copenhagen Honours College. The students felt engaged by being in the community of the programme, but the importance ascribed to the community decreased over time. To build and sustain a student community that fosters student engagement, there needs to be an alignment between students' individual factors and institutional factors, of which shared values and expectations are important aspects. The study details how student engagement is complex and dynamic and requires an ongoing investment and effort on the part of the institution to sustain it.

Key words: teacher education; student engagement; sense of community; honours programme; grounded theory

Introduction

Political focus by European countries on gaining a competitive advantage in the global knowledge economy has influenced government approaches to higher education policies (Wright and Ørberg 2008). The development of talent programmes in countries such as Denmark has become part of the educational strategy to 'keep up in the competitive international environment' (Wolfensberger, 2012, 111). In 2010, the Danish Ministry of Education appointed a work group to assess the talent effort in Denmark and suggest future strategies. In a report written by a working group on talent, the group argue that nurturing talents is not only a means to a global competitive advantage but also a means to create motivation and wellbeing among those in the broader student population who might have become demotivated and disengaged with their studies (Hermann 2011). In other words, they argue that talent initiatives have a positive influence on student engagement for other students than just the ones who benefit directly from the allocation of extra resources. This view is supported by Wolfensberger, Ven Eijl and Pilot (2012) who argue that honours programmes can serve as laboratories for educational innovation and thus benefit regular programmes as new pedagogies, course structures and/or content are tested and found valuable in selective programmes.

A legislative change following the report by Hermann (2011) made it possible for higher education institutions in Denmark to develop selective programmes. One of the institutions to use this opportunity, the public University College Copenhagen, introduced Copenhagen Honours College (CHC) in 2018. This was an add-on programme to its teacher education aimed at preservice science teachers privately funded by the Novo Nordisk Foundation. Its design was inspired by what Wolfensberger (2012) terms 'honours pedagogy', based on a literature review of research done on honours, or talent, programmes. Wolfensberger (2012) concludes that the three core factors in talent teaching are 1) enhancing academic competence, 2) giving the students freedom and 3) creating community for the students. These three aspects of honours pedagogy are closely related to the three elements of the self-determination theory – relatedness, competence and autonomy – as defined by Ryan and Deci (2000) and thus fosters motivation and high achievement in honours students subjected to this pedagogy (Wolfensberger 2012). Although Wolfensberger (2012) argues that honours pedagogy is particularly suited for a special type of student, there is no reason why it could not benefit students in general. Kolster (2021) has demonstrated that diffusion of educational innovations is possible and both teachers and students play a part in such diffusions. It is therefore valuable to delve into the student experience as they participate in an honours programme and assess the potential transferability of the activities, structures, and content to more general educational programmes. In essence, this involves

perceiving honours programmes as testing grounds for educational innovation (Wolfensberger, Van Eijl, and Pilot 2012) and to look for elements of the programmes that promote or hinder student engagement.

For years, politicians and researchers alike have been studying student academic engagement, its definition and influencing factors. And although the importance of student engagement is widely acknowledged (Tight 2020; Trowler 2010; Fredricks, Blumenfeld, and Paris 2004), Tight (2020) identified a gap in the research when it comes to more holistic approaches to understanding the student experience in relation to student engagement. This study attempts to fill this gap by exploring the student experiences through a constructivist grounded theory approach.

Following an initial examination of the data, two prominent categories related to the students' experience of being part of CHC emerged: *sense of community* and *student engagement*. This prompted a more targeted analysis, guided by the research question: How does a focus on sense of community affect student engagement in an honours programme? This study addresses this question within the specific context of CHC to shed light on some of the mechanisms that may contribute to enhancing student engagement in general.

Theory

Student Engagement

Kahu and Nelson (2018) state that the Student Involvement Theory, initially introduced by Astin, laid the foundation for what is presently referred to as student engagement. First proposed in 1984, Astin (1999) dedicated decades of work to unveiling 'the black box,' a term he coined to describe how higher education institutions impact students' achievements (Astin, 1999). Astin saw understanding student involvement as key. Focussing on the observable behaviour of the students, Astin described 'highly involved' students as students who '…devotes considerable energy to studying, spends much time on campus, participates actively in student organizations, and interacts frequently with faculty members and other students' (Astin 1999, 518). Observable student involvement as described by Astin (1999) is only one way to conceptualise student engagement. Another conceptualisation of engagement by Fredricks, Blumenfeld, and Paris (2004) includes cognitive and emotional involvement in addition to behavioural aspects. In their research, Fredricks, Blumenfeld, and Paris (2004) discovered that well-defined teacher expectations can have a positive impact on student engagement. Similarly, Tinto argues that simply expressing high expectations can enhance student performance. However, if institutions

fail to maintain these high expectations, students will notice and subsequently reduce their engagement (Tinto 2012). These findings are but a few examples of factors found to have an impact on students' engagement and numerous frameworks involving not only behavioural aspects, but also psychological, socio-cultural as well as organisational/educational aspects have emerged (e.g., Zepke 2015; Pittaway 2012; Duzević 2015, Kahu, 2013).

In 2018, Kahu and Nelson developed a comprehensive framework combining the works of Astin; Fredricks, Blumenfeld, and Paris (2004); and many others to illustrate how student engagement emerges as the result of many influencing factors and the dynamic interaction between those factors (Kahu and Nelson 2018). An important inference of the framework is that engagement is the result of educational factors (such as the curriculum or expected student workload) aligning with the student's unique background and aspirations (Kahu and Nelson 2018). More specifically, their model proposes that a student will likely display high levels of engagement if they experience that they perform well academically, their interests are met, the institution affords them a strong sense of belonging, etc. Their framework underscores the complexity of student engagement. In Kahu's words: 'No single research project can possibly examine all facets of this complex construct. (…) the focus can be on developing a greater understanding of one element without denying the existence of the others. (Kahu 2013, 769)'. Later, Kahu, Picton and Nelson (2020) empirically tested the validity of their framework through a study involving 362 interviews with 17 students over the course of their first year. The study confirmed the framework's utility and clearly demonstrated how rapidly student engagement can fluctuate.

While fully recognising and appreciating the complexity involved, this scope of the study is limited to the link between student engagement and their sense of belonging based on the initial student data.

Sense of Community

Wenger offers a conceptual description of sense of community based on the notion of 'communities of practice' (Wenger 1999). According to Wenger, a community of practice is a group of people who share a common interest, engage in regular interactions, and collectively develop a shared understanding of their domain. Within these communities, members learn from one another, collaborate, and build relationships based on mutual trust and respect. Sense of community emerges as a key element within these communities of practice.

Wenger argues that a sense of community is not merely a social bond or a feeling of belonging, but rather a deepened connection that arises from meaningful participation and shared

experiences. It goes beyond individual relationships and extends to a collective identity that defines the group's purpose and values. This sense of community is fostered through ongoing interactions and collaborations, as members engage in joint activities, exchange knowledge, and contribute to the group's shared goals. Through participation in the community, individuals not only acquire expertise but also develop a sense of belonging and identity within the group. While firmly established, Wenger's concept of communities of practice is very general and offers no specific framework for understanding students' sense of belonging. McMillan and Chavis' (1986) definition of 'sense of community' provides an analytical framework that has been used in many previous studies, including studies of educational settings (Osterman 2000; Strayhorn 2019). McMillan and Chavis derived their definition of sense of community from an extensive literature review (McMillan and Chavis 1986). They describe sense of community as …a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members' needs will be met through their commitment to be together. (McMillan 1976 in McMillan and Chavis 1986, 9).

Based on this description, they propose a definition of sense of community that consists of four elements: *membership*, *influence*, *integration and fulfilment of needs*, and *shared emotional connection*.

Membership refers to those who belong in the group, as opposed to those who do not. This boundary can be emphasised by using deviants: those not perceived as living up to what it takes to be a member. Members of a group feel a right to belong, that they have invested in a group with whom they share an identity and that provides them with emotional safety.
Influence is an interaction between the group and its members that creates conformity over time. McMillan and Chavis (1986) clarifies that conformity in this sense is not the same as the individual losing personal choice. Individuals are more attracted to the group if they experience feeling influential and that they matter.

They describe *integration and fulfilment of needs* or reinforcement:
When people who share values come together, they find that they have similar needs, priorities, and goals, thus fostering the belief that in joining together they might be better able to satisfy these needs and obtain the reinforcement they seek' (McMillan and Chavis 1986, 13).
They consider this element as 'a primary function of a strong community' (McMillan and Chavis 1986, 13).
Shared emotional connection is described as an experience that every individual in the group can identify with. This experience can either be a part of the group's history, but it can also be something experienced separately by all members in the group. McMillan and Chavis (1986)

observe that a feature such as frequent, quality interactions in a group will strengthen the bond between members. A quality interaction is defined as a positive experience. However, McMillan and Chavis (1986) also mention that going through a crisis together will likely increase group cohesiveness.

The definition of sense of community by McMillan and Chavis offers a practical framework for organising the subsequent analysis, which examines the connection between students' sense of community and their engagement.

Methodology

As mentioned earlier, Tight (2020) identified a gap in the research when it comes to more holistic approaches to understanding the student experience in relation to student engagement. To comprehensively investigate the students' experiences and capture a broad spectrum of pertinent factors, an approach influenced by constructivist grounded theory was employed. Grounded theory can be described as 'inherently symbolic interactionist' (Miliken and Schreiber 2012, 684) and symbolic interactionism does not see social reality as something out there, waiting to be found but rather '…it is created when people engage one another in communication' (Quist-Adade 2012, 21). Charmaz adds that symbolic interactionism is a perspective which 'assumes that individuals are active, creative and reflective and that social life consists of processes' (Charmaz 2006, 189).

Adopting such an approach in this context entails recognising that students' experiences are dynamic, personal, and influenced by the surrounding context. It is understood that individuals may exhibit contradictions in their responses over time, but their account of events can be regarded as genuine reflections of their experience at the moment of the interview. Consequently, open-ended interviews were conducted to capture students' experiences at different stages of their involvement in CHC to explore how their experience evolved over time (Charmaz 2006).

Data was coded, categorised and initial theoretical conjectures were refined and checked through constant comparison between analysis and theoretical data sampling (Charmaz, 2006). Based on the initial coding, the codes *feeling a sense of community* and *feeling engaged* were raised to conceptual categories and used to guide a further theoretical sampling of data to refine the understanding of the relationship between the two categories as suggested by Charmaz (2006, 80). To enhance the theoretical sensitivity, literature was reviewed on *sense of community* and *student engagement* while including the constant comparison between data and theoretical conjectures. This follows the suggestion from Giles, King and Lacey (2013) to time the literature

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review in grounded theory research during the research process to facilitate a link between existing knowledge and ongoing research. The literature review further helped to identify unavoidable preconceived ideas and hence acknowledge their influence on the research process, including the analysis of data (Giles, King and Lacey 2013).

Context of the Study

CHC is a specialised honours programme specifically aimed at elevating the quality and status of science education in Danish schools by cultivating dedicated science teachers (Professionshøjskolen Metropol 2018). This programme is a supplemental education adding 30 ECTS to the final two years of the four-year teacher education. Credits are awarded for participation in various activities including the following: A summer school focused on out-of-school teaching (five ECTS), journal clubs with emphasis on research in science education (five ECTS) and 10 ECTS are awarded for a variety of courses. The first cohort of CHC students followed courses on project management and networking, talent spotting, programming, cross-curricular cooperation, attitudes to science and out-of-school teaching. The last 10 ECTS are dedicated to a so-called partner school project in which students work with a topic related to primary or lower secondary science teaching chosen by the partner schools. During the project, the students are assigned to a teacher at the school and are supervised by a teacher educator from the CHC programme.

The CHC programme accepts up to 15 students in each cohort. Prior to the first year of the programme, teacher educators involved with the programme visited classes of students who would be eligible to sign up for the programme to inform them about CHC and encourage those students to apply. The programme advertisement described it as being for 'clever, motivated and ambitious science preservice teachers' (Professionshøjskolen Metropol 2018, 3, author's translation). It was made clear to the students that signing up for CHC would increase their study load but in exchange they would receive a monthly grant of approximately €270. Students eligible to sign up for the first cohort of CHC began their third year of teacher education in the academic year of 2018-2019 and were required to be studying at least one science subject (either Biology, Physics/Chemistry, Geography or Science and Technology). They were not allowed to be behind on their studies at the time of application. Interested students wrote a cover letter and were subsequently invited for an interview with a panel of teacher educators and a 'talent expert' (Professionshøjskolen Metropol 2018).

Data Collection

The CHC team had difficulties attracting applications, which resulted in the first cohort consisting of only 11 students. Of those 11 students, six completed the programme in 2020. The data analysed in this article consists of two rounds of interviews with the first cohort of CHC students. Each interview lasted approximately one hour. The data collection was initiated in May 2019, nine months after the students began the programme. At this stage, three students had chosen to leave the programme and one had left the country but remained in the programme. All remaining students were invited to participate in the research project, including the student who had left the country.

The first round of interviews was conducted in May and June 2019 and consisted of seven interviews. The second round was conducted in January 2020, except for one student interviewed in June 2020. At this stage, two more students had become inactive in the programme, leaving five in the research project.

The students have been promised anonymity and that raw data will only be shared within a specific research group of four people. Given the small number of respondents, they are presented as gender neutral in the results section to further anonymise them.

Analysis

This section is divided into two parts: Part one unfolds the two main categories, *sense of community* and *engagement* identified as particularly prominent in the initial analysis during open coding. The analysis traces how the students' experience related to these categories evolved between interviews. Part two compares each category to existing literature in a theoretic comparison with the theory presented above.

Part One: Categoric analysis

Many CHC students share the experience of not feeling sufficiently challenged in the teacher education programme. They describe the education as too easy and feel alone with the desire to get as much out of their education as possible. Students who sign up for CHC see it as a way to get more out of their teacher education but also as a way to become part of a community of students who share the same values. For the first two semesters, the programme appears to live up to the students' expectations as a sense of community emerges around a shared value of dedication to studying and a shared purpose of becoming the best possible teachers. This value is reflected in how the students negotiate the meaning of the word *talent*: 'The fact that you as a

student choose to spend your time on getting as good as you can, out of pure interest and willingness, that is what shows you've got talent. According to our [CHC] definition, that is'. This definition of talent reflects the students' reason for applying to CHC: they consider themselves more dedicated than the majority of students at the teacher education, but don't see themselves as inherently special: 'It is not that we are stupid or anything, but we are not these brilliant…what do you call it…one percent of the population…we are not geniuses, we just really want to do it [studying]'.

The students in CHC use the word *talent* to describe something you do, spending time, rather than something you are, such as being a genius. This definition influences the students' expectations of themselves: 'If I should be able to justify to like…call myself a talent…then I cannot allow myself to slack off'.

The students compare and contrast the definition of talent used in CHC and its implications for expected and accepted behaviour with the experience at the ordinary teacher education: I have found others who feel the same as me and who want to put in extra effort and who think others are weird because they don't want to do that. There is nothing wrong with us; we just think differently about it [studying].

Some students report that their desire to work hard creates a feeling of alienation combined with a sense that they miss the opportunity to obtain the full value from their education. The student attribute this to a curriculum designed with the lowest common denominator in mind but also the absence of enhanced learning experience that arises when everyone actively participates. A student describes this as follows:

> I would have liked there to be more like that [Journal Club]. Because…it gives a sort of idea of what the teacher education ought to be. We sit there in class and EVERYONE participates. And we just achieve…I just feel that we achieve something completely different, than if we had discussed the same text in our [ordinary teacher education] class.

According to the students, there is nothing magical about Journal Club. In fact, it could easily be part of the ordinary teacher education. But what makes Journal Club special is that everyone is keen to understand the subject at hand.

The wish to get as much out of the education as possible and a general interest in science teaching affect the students' involvement in all CHC activities, not just Journal Club. The students volunteer for interviews and events promoting the programme and participate in a Case Competition that takes up the best part of a weekend.

In addition to activities organised by the CHC team, the students use the CHC group to share knowledge and experiences about science teaching. They profess that they cannot help themselves. They even talk about teaching and science education over beers:

> Every time we meet, we talk a bit about what we've done during practical experience or what is going on in our [individual] projects…and it's like, "that sounds really interesting, have you considered doing it like this...I have done this…"

All in all, the students still in CHC at the time of the first round of interviews express enjoying the programme. Some briefly mention an unpredictable schedule, but it does not appear to affect their overall experience of CHC.

The CHC students begin their last year of teacher education by attending a summer school over five days in the Netherlands. These intense days together result in an enhanced sense of community. However, as the semester progresses, they experience a long gap in activities, which leads to decreased social or formal interaction that puts a strain on the sense of community:

> It was just…it was cool to spend time together [at the summer school] during a longer period. I definitely felt we really got to know each other. And then it was a real pity, because then nothing really happened for us afterwards.

The summer school ends up being the last time all CHC students are assembled. While nothing happens for the group of CHC students afterwards, other CHC events and activities do take place. There are two Journal Clubs during the semester and all students have their individual Partner School projects to attend to. The Partner School projects vary in content, workload and time required. The disparity strains the sense of community, as some experience nothing happening in CHC, while others have a busy schedule:

> My record is six meetings in a week in various CHC contexts. Two or three different supervisions (Partner School project), two courses and then something else. It wasn't social activities. We don't really do that. We don't have time for that at all.

The Journal Club remains a constant throughout the autumn semester, which the students still describe as their favourite activity in CHC. There are two of these during the semester, scheduled well in advance and following the familiar format of the first year of CHC. Despite the description of Journal Club as a favourite activity, students now experience the attendance as poor. They have different explanations for what is going on, but time pressure is mentioned repeatedly. As one student puts it, '…people have been busy. A lot of things have been at stake. People have been…they have been out on their Partner Schools. Some are also about to have children. A lot of things are happening in everyone's lives'.

The students are also troubled by how the programme is structured. They don't feel they have a say in scheduling of activities and never receive an activity schedule or timetable. They know CHC is supposed to consist of 30 ECTS and how many they have completed, but not the teacher educators' plan for the remaining credits. This makes some students worry about the last half of their education, as the lull in activities during the beginning of the semester is followed by an intense period with several courses and other activities in December and January. To confound things further, the courses coincide with the exam period. From the students' perspective, this scheduling conflict is avoidable, given that teacher educators know when the exams are: 'We have just had several months with complete radio silence, except the odd common meeting here and there. Why does everything have to be on top of [exams]? Right now, I actually couldn't be bothered'.

As the students enter the final semester of their education, their imminent graduation causes some students to switch their priorities from CHC to focus on the ordinary teacher education: 'In the first year of CHC I think we ascribed a lot to it. Now it is like…the rest of the education [the teacher education] is actually important as well'.

When asked if their reason was their upcoming graduation, the student responded:

Yeah, that but now I can also see that everything we have done at the teacher education is coming together and that there is a higher meaning to it all. It is like AH! I am starting to be able to use these things! I am beginning to work more towards becoming a teacher.

In general, the winter exam period in December and January takes up a lot of the students' focus. As they are recruited from different departments and programmes to be part of CHC, they do not share exam schedules outside CHC. They do not refer to the CHC community but rather their ordinary study groups from the ordinary teacher education as important for their exam preparations.

In addition, a CHC course ends up coinciding with one of the student's exam dates, making it impossible for the student to be prepared properly for both. Consequently, the student prioritises the exam. When asked how the student felt about not having time to complete the readings assigned the course, they responded, 'It felt really wrong. Also, we were not that many. We sit there, four people, and I haven't done the readings. It is not very nice to be in a situation like that'.

The CHC students describe doing well in their exams, which reflects their shared ideal of putting extra effort into their studies and a desire to become the best possible teachers. Looking back, however, the students reflect that the teacher educators in CHC did not require that much more effort from them:

It has been a bit like…since the beginning, whenever we participated in a course and needed to deliver something it has been a bit half-hearted from all of us. It has been a mix of some courses, where we didn't get the opportunity to prepare properly because it was there suddenly, and the teacher educators who had corresponding expectations and were like "I just made this so I can't expect that much of you, let's just do something and have fun." So, the requirements weren't that high … but it is a pity of course and a bit of a waste of time when it is not structured in a way, where it is possible to expect something from us. You only ever scratch the surface.

This experience is not consistent with how the students initially define talent. It turns out that they have agreed to stop using that word. The reason they give, however, is a feeling that it gave people the wrong idea about CHC; that it is to do with being particularly clever or considering oneself to be particularly clever. Instead, they would prefer to be perceived as someone who puts in extra efforts in their education.

The students generally describe the autumn semester of 2019 as a time of being busy, not seeing each other and focusing more on the ordinary teacher education than CHC. The engaging community of peers mentioned in the beginning is no longer a dominant part of their student experience of CHC.

Part Two: Theoretical Comparison

Sense of Community

Viewed through the lens of McMillan and Chavis (1986), the data clearly shows the development of a sense of community in CHC in which the membership is defined by putting in an extra effort and the wish to become the best teacher possible. The students in CHC have a shared emotional connection of feeling like the odd ones out at the ordinary teacher education and they express a fulfilment of needs through being in a group of people with shared values and approach to teacher education. This approach of investing extra effort and the students' description of their first year in CHC is similar to how Kahu and Nelson (2018) and Fredricks, Blumenfeld, and Paris (2004) define student engagement. However, the data also reveals that the sense of community did not last.

Expectations in the Community

Over time, there appears to be a growing misalignment between student and institutional factors. The students signed up to CHC hoping to be met with higher expectations than they experienced at the ordinary teacher education, which was initially honoured. However, as time passed, the

students felt met by low or unclear expectations and an unpredictable structure. The CHC students continue to see themselves as a particularly engaged group of students who are willing to put in extra effort, but they experience that this extra effort is not necessary to be a member of CHC as the teacher educators do not expect that much from them. As argued by Tinto (2012), too-low expectations can lower the time and effort students invest, which appears to be the case here. The students initially defined the membership based on an understanding of talent developed in CHC in which putting in extra effort was the dominant value. McMillan and Chavis (1986) argue that a sense of community relies on a clearly defined membership. If extra effort is not necessary to be a member, the defining feature of the community is not valued by the institution. As such, it is no surprise that an experience of low expectations reduced the sense of community in CHC.

Structure in the Community

The structure of the programme was described as a bit chaotic in the first round of interviews, but the high sense of community with peers dominated. During the second round of interviews, this is reversed: community is hardly mentioned but the structure of the programme is blamed for hindering the students from participating in activities. The students further argue that bad timing and last-minute course announcements prevent the teacher educators from expecting extra effort from them. As such, the students experienced a chaotic structure as the reason for the low expectations from teachers, who were aware of the planning issues, while difficulties with finding time for last-minute activities towards the end of the semester explains poor attendance at activities. The students' descriptions of the autumn semester as 'summer school', 'nothing' and 'too much' indicates a perceived lack of what McMillan and Chavis (1986) termed 'frequent quality interactions', since the intense summer school wasn't followed up with anything.

Declining Engagement in the Community

In line with the definition of student engagement by Fredricks, Blumenfeld, and Paris (2004), the CHC students' initial behavioural engagement was evident in the time they spent preparing for class, showing up for time-consuming activities and using social gatherings as opportunities to share ideas and experiences. The emotional engagement was expressed in their enthusiasm for activities such as Journal Club, and cognitive engagement was indicated in the explicit desire to become the best possible teachers.

Sense of community and student engagement are interlinked, but a sense of community by itself does not equal engaged students. The values of the students in the community need to be aligned with the values of the institution. Initially, this appeared to be the case. The CHC

students centred the values and membership of the community around the definition of talent expressed by educators in the programme. However, when the sense of community was not nurtured, the students' level of engagement also appeared to decline. After the summer school, they never manage to be fully assembled; instead of feeling engaged, they feel frustrated with the structure of the programme. The students give many reasons for not being assembled – being busy is one of them – but if the community had still been important to them, they might have tried harder to meet up.

Discussion

This qualitative study gives insight into how being part of a talent programme can affect preservice science teachers engagement. While CHC is a very specific educational context, there are general insights relevant to other educational settings to be gained.

One important takeaway from this study is that student engagement initiatives should consider the multifaceted nature of student life. As suggested by Kahu and Nelson (2018), students' sense of belonging is just one of several factors influencing their engagement. Part of this sense of belonging, or sense of community, stems from a shared set of values (McMillan and Chavis 1986). The connection between student engagement and sense of community likely relies on the alignment between the values upheld by the student community and those of the educational institution. According to Kahu and Nelson (2018), student engagement is likely if students' interests and the interests of the institution align in the educational interface, but only if the alignment is consistent with students' experiences. In other words, if students are interested in being met by high expectations while the institution expresses high expectations, the factors align.

In the case examined, the CHC team and the students initially exhibited a shared set of values, particularly regarding a dedication to putting in extra effort in their studies. However, when the students realised that the CHC programme did not honour the students' values with high expectations, they adjusted their efforts accordingly. This highlights the significance of Trowler's (2010) argument that the investment of effort and time must be mutual between students and the educational institution.

The institutional influence on student engagement is also expressed in the students' frustrations with structural issues within CHC and low expectations from the teachers involved. These issues strained the students' sense of community and thereby their engagement in CHC activities. As the students experienced fewer opportunities for quality interactions with each other, their sense of community was diminished. As CHC failed to consistently fulfil students'

academic and social aspirations, individuals redirected their priorities while remaining dedicated to fulfilling their CHC obligations. Thus, this study confirms the empirical findings of Kahu, Picton and Nelson (2020) that student engagement is complex and dynamic. Initially, the students expressed engagement in the initiatives of the programme, but over time many factors conspired to reduce their sense of community and ultimately their engagement.

Even though the study does not encompass all the factors of the comprehensive framework developed by Kahu and Nelson (2018), it captures some of the complexity in details that highlight the importance of understanding student experiences better as Tight (2020) argues. As an honours programme, CHC offers initiatives that potentially nurture the students' sense of community and student engagement. An initiative such as journal club is repeatedly mentioned by respondents as an activity where everyone participates and where they feel engaged. As such it could be tempting to copy an element such as journal club and implement it in other parts of the educational institution, hoping this would increase student engagement. However, what this study suggests is that it is the students' sense of community around values aligned with CHC which fosters their engagement, not the journal club itself.

An important question to consider here is whether the students who signed up for CHC were a particular kind of student – the already engaged ones – or if the group of students were engaged because the programme so explicitly expected it. They could have simply risen to the high expectations and reacted to the extra resources invested in them. If the latter is the case, there are definitely lessons to be learned by educational institutions from this study. The students' experience of sense of community around being engaged likely derives from self-selection of highly motivated students combined with heightened expectations from the institution. However, assuming that the programme itself played a part in the students' initial level of engagement would be in line with Trowler's (2010) definition of student engagement as an interaction between time and effort invested by students and time and effort invested by the institution. It would also be in line with Tinto's (2012) assertion of the importance of the institution's framing of expectations, thus supporting the argument that educational institutions have the opportunity to support engaging communities in general and not just within special programmes.

The low sample size of students involved in this study along with the potential selection bias due to the targeted recruitment process of CHC, gives rise to potential concerns related to the validity and generalisability of this study. Also, as the CHC programme was under development at the time of the study, the students' experiences are likely to have been shaped by factors that would not be present in a well-established programme.

However, some of these concerns are counterbalanced by the nature of a grounded research approach. In particular, the process of theoretical sampling, wherein data collection and analysis are conducted simultaneously, allows researchers to explore the particularities of the chosen context while refining the research questions and theoretical frameworks based on emerging findings. This continuously sampling and analysing data until theoretical saturation was achieved ensured the categories presented here align closely with the observed data.

The presented findings align with much of the existing research on student engagement but offers a more detailed description of the students' experiences of the factors related to their engagement than is commonly seen. As such the study adds a small piece to our growing understanding of student engagement.

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2nd article: Teaching is not for life – student teachers' reflections on their possible future selves

The focus of this study is career choices and possible selves of five student teachers who chose to participate in an honours programme. Through a qualitative, longitudinal study with a Constructivist Grounded Theory inspired approach, it provides an insight into the student teachers career choices and how their career reflections interact with the choice to participate in the honours programme thus improving our understanding of teacher shortage. Common for the students' reflections is that they see teaching as a profession with limited opportunities for personal and professional development and they do not expect to work as teachers for long.

Keywords: teacher shortage, possible selves, career choice

Introduction

Teacher shortage is a global problem which has been recognised for decades (Bruinsma & Jansen, 2010; Carver-Thomas & Darling-Hammond, 2019; J. Y. Hong, 2010; Rots et al., 2014) and Denmark is no exception (Rinne et al., 2023). A report made by Danmarks Evalueringsinstitut (EVA) for the Danish Union of Teachers concluded that approximately 16% of teachers in Denmark do not have formal education in teaching (Danmarks Evalueringsinstitut, 2021). Such a result raises the question of whether there are too few graduating from teacher education or if graduates choose not to become teachers. The answer is possibly both. In a report from the same year, Pihl and Lykketoft (2021) found that nearly 14% of those with a teacher education in Denmark did not work as teachers in primary or lower secondary schools within the first year of graduation. After five years, this figure rose to more than 19%. These reports indicate that more people need to graduate from teacher education and to stay in the profession in order for communities to have enough educated teachers in primary and lower secondary schools.

Due to the global and long lasting recognition of the challenge of teacher shortage, research has been conducted to understand what motivates the choice of the teaching profession in the first place (Bruinsma & Jansen, 2010; Heinz, 2015; Watt & Richardson, 2007), why teachers leave the profession ((J. Y. Hong, 2010; Kelchtermans, 2017; Sulis et al., 2022), within how the combination of teacher education and conditions during the first years of teaching affect new teachers' choice to stay or leave the teaching profession (DeAngelis et al., 2013; J. Y. Hong, 2010; Lavrenteva & Orland-Barak, 2019) and there is a growing research interest in an otherwise overlooked area of exploring how teacher education affects student teachers decision to either drop out or enter the profession and how long they intend to stay in the teaching profession (Horvath et al., 2018; Rots et al., 2014). In this paper, I have chosen to focus on the final theme. Previous research in this field has found that student teachers are more likely to enter the profession if they had a strong motivation to become teachers in the first place (Rots et al., 2013), if they feel well prepared to teach from the teacher education ((Bruinsma & Jansen, 2010; Horvath et al., 2018; Klassen et al., 2021; Lavrenteva & Orland-Barak, 2019; Rots et al., 2014) and if their beliefs about teaching align with their experience of teacher education (Rots et al., 2013; Lavrenteva & Orland-Barak, 2019).

At the University College Copenhagen, the talent programme Copenhagen Honours College (CHC) was introduced in 2018 as an add-on to the ordinary teacher education. CHC offers participating students a favourable teacher:student ratio, personal mentorship among the student teachers, connections with partnering schools and extra science-teaching coursework. Considering that feeling well prepared to teach is considered an important factor in the decision to enter the teaching profession, the level of support and relation to praxis provided by CHC suggests that the programme could be an ideal add-on to the teacher education for increasing rates of transition from teacher education to the teaching profession.

However, choosing a career and a strategy toward it is a dynamic process (Holmegaard et al., 2014; Vulperhorst et al., 2022) and the decision to enter the teaching profession upon graduation

is affected by multiple factors, which needs more attention if we want to fully understand recruitment and retention in the teaching profession.

In the present study I contribute to the field of research of student teachers' career reflections by exploring how the option to choose the honours programme CHC and subsequent participation affect five pre-service teachers thoughts on 1) whether they intent to enter the teaching profession upon graduation, 2) how long they consider staying in the profession and 3) how their perception of the teaching profession affect their career plans.

In the study I combine the careership model developed by Hodkinson and Sparkes (1997) and the possible selves theory developed by Markus and Nurius (1984) to answer the question: *Why do preservice science teachers choose an honours programme and how does possible selves and career plans evolve during participation?*

This qualitative, longitudinal study is inspired by constructivist grounded theory.

The Careership model

In this paper I consider why student teachers choose an honours programme and how the participants' possible selves and career plans evolve during the last two years of their teacher qualification. Although the respondents in my study have chosen teacher education and as such already have made a career decision, this decision should not be considered as final. As is discussed by Holmegaard et al. (2014) and Vulperhorst et al., (2022), the reflections on prospective career and whether the choice made was the right choice, does not end with entrance to an education. That this also goes for teacher education is supported by Horvath et al. (2018), who argue that teacher attrition starts with student teachers who decide against entering the profession despite being qualified to teach. For these reasons, it is relevant to understand influencing factors behind career decisions of student teachers, which in my case consists of the opportunity to participate in an honours programme.

To this end I have chosen to use Hodkinson and Sparkes (1997) as part of my theoretical framework. Hodkinson and Sparkes (1997) developed their "Careership" model, inspired by the

concepts of "habitus" (how a person views the world based on their background) and "field" (a social or institutional arena) developed by Bourdieu and a study on young people's career decisions to leave full-time study. The model consists of three dimensions:

(4) Pragmatic, rational decision making located in the habitus of the person making the decision

(5) Interactions with others in the field

(6) Location of decisions within turning points and routines.

Hodkinson and Sparkes (1997) describe the three dimensions as interlinked and assert that separation between them will always be arbitrary.

In talking about pragmatic, rational decisions, Hodkinson and Sparkes (1997) argue that a person is rational when making a career decision. This rationality is based on personal experience or the experience of friends or relatives rather than, for example, advice from a career consultant. The pragmatism refers to the notion that a person considers a few rather than all available options; the considered options fall within what Hodkinson and Sparkes (1997) term "horizons for action". This horizon is defined – or limited – by the context in which a career decision must be made, such as the perceived state of the labour market and the habitus of the person making the decision.

In the second dimension, Hodkinson and Sparkes (1997) argue that choices are affected by interactions in the field of a person: while the interactions are ongoing so is the decision-making process. Interactions affect a choice; a choice affects interactions and may cause a re-evaluation of the choice, leading to the third dimension: turning points and routines.

This again refers to how the three dimensions are interlinked. A person's experiences influence decision making, illustrating the model created by Hodkinson and Sparkes (1997). A turning point is either a situation in which a person has to make a decision or a situation in which a previously made decision is re-evaluated. Hodkinson and Sparkes (1997) classify turning points in three ways:

(7) Structural (e.g. graduation where a decision has to be made about the next step)

(8) Self-initiated – the person realises that their choice was not the right one and decides to reconsider

(9) Forced, where external factors such as sudden changes in the labour market or family trauma forces a revision in career choice.

In between these turning points are routines, how a person experience e.g. the chosen education.

Hodkinson and Sparkes (1997) further subdivide routines into categories. Of these, two are relevant to this paper: "confirmatory", in which the experience of a routine confirms that the choice of a certain career was right, and "contradictory", where the experience is not what a person had hoped for, such as in a job, thus leading to a re-evaluation and possibly a self-initiated turning point (Hodkinson and Sparkes, 1997).

This study researches both immediate and future career plans of student teachers using the Careership model to analyse the rationale behind their career plans, but not whether they made a choice that was right for them, as this part of the research ends with graduation.

Possible selves

To further support the analysis of why the student teachers in my study chose an honours programme and how their possible selves and career plans evolved during the last two years of their education I have chosen to supplement the careership model with the possible selves theory developed by Markus and Nurius (1986).

Where Hodkinson and Sparkes (1997) took a sociological approach to decision making, Markus and Nurius (1986) take a cognitive approach in which they argue that the possible selves of a person works as an incentive for present and future behaviour. Similarly, they also affect decision making. Hodkinson and Sparkes (1997) and Markus and Nurius (1986) both ascribe importance to "schema". Like habitus, schema is "constructed creatively and selectively from an individual's past

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experiences in a particular domain" (Markus and Nurius, 1986, p. 955), thus influencing a person's desires and possible vision for their future. This is similar to the argument made by Hodkinson and Sparkes (1997) that career decisions are based on personal background and experience. However, Markus and Nurius (1986) also argue that "…possible selves are views of the self that often have not been verified or confirmed by social experience". (Markus and Nurius, 1986, p. 955). In other words, whether a person's hopes and fears will occur can be hard to predict, as one cannot see into the future. The consequence is that possible selves are responsive to experiences in domains related to them, such as education in the case of possible selves related to career (Markus and Nurius, 1986). Markus and Nurius (1986) stress the importance of the possible selves for two reasons: they serve as incentives for future behaviour and they provide the context in which a person evaluates their present view of self. In this paper, the Possible Selves Theory will be used to understand how past experiences affect how pre-service teachers see themselves in the future and how their thoughts for the future affect their choices both during education and on the brink of graduation.

Teacher education and choice of career

It follows from Hodkinson and Sparkes (1997) that the choice of a specific career is influenced by the experience and background of the person making the choice. It also follows from the careership model that the decision is never final and that new experiences might lead to turning points and a new decision. As such, the model can help us understand not only why a certain education is chosen to begin with but why the decision might be changed along the way.

In a study specifically focusing on pre-service teachers, (J. Hong et al., 2018) findings support the Careership model's assertion that career choices are complex and continuous. They found that when students explore career options and settle on one, this negotiation does not necessarily happen in a linear fashion: "…pre-service teachers may still be exploring career options, while trying to balance career goals with other competing life goals…" (J. Hong et al., 2018, p. 421).

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Rots et al. (2013) found a correlation between the experience of teacher education and student teachers' intention to enter the teaching profession. This quantitative study found that a little more than 72% percent of new teacher graduates chose to pursue a career as teachers. It is not obvious if those students had a different career than teaching in mind all along, but the figure does indicate that 28% of the students in the study revisited their career choice during their teacher education. Although Rots et al. (2013) detected important correlations, the quantitative nature of the study makes it hard to grasp the complexity of career choice; as it is deductive, the possible explanations included in the study are only the ones already considered by the authors. The abductive and qualitative nature of the present study allows us to explore in further detail how pre-service teachers reflect on the future, what has caused these reflections and how they act on them.

Possible selves in teacher education

The Possible Selves Theory has been used as a framework to understand the development of professional teacher identity (Hamman et al., 2013), how possible selves of new teachers are related to motivation and self-regulation (Hamman et al., 2013; J. Hong & Greene, 2011) and how practical placement affects future selves of pre-service teachers (Blackley et al., 2018). These studies all use the Possible Selves Theory to explore pre-service teachers' hopes and fears for their future as teachers. For example, a qualitative study of the possible selves of pre-service science teachers/student teachers by Pellikka et al. (2022) notes that the respondents could clearly articulate their hoped-for and feared possible selves while balancing them against each other (e.g. the hope to become an 'inquiry-oriented teacher' was balanced against the related fear of becoming 'a knowledge-transmitting teacher') (Pellikka et al., 2020, p. 11). Through the Possible Selves Theory lens, they argue that this balance is likely to be a motivating factor in students' futures: the students are expected to adjust their behaviour to increase the likelihood of becoming inquiry-oriented teachers while avoiding becoming knowledge transmitters. Hamman et al. (2013) found a similar balance between hoped-for and feared possible selves among pre-service teachers where a general

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fear was becoming boring and disengaged from the students and its corresponding hope was to become a student-centred, engaging teacher. The respondents would regulate their behaviour to achieve the hoped-for self and avoid the feared self. The students' strategies focused on possible teacher selves – both Pellikka et al. (2020) and Hamman et al. (2013) only included respondents who wanted to become a teacher. However, the Careership model and the Possible Selves Theory imply that a career decision is constantly affected by experience and context. In line with this argument, Holmegaard et al. (2014) found that students who entered higher education programmes continued to wonder if they had made the right decision and Vulperhorst et al. (2019) found that reflections on the study programme choice were cyclical and affected by factors such as attractiveness of future opportunities. If we consider that student teachers are no exception, this may further influence the choices they make during their education.

In this paper, the Careership model and the Possible Selves Theory will be used to analyse how student teachers' possible selves and thoughts for the future interacts with the possibility to participate in an honours programme.

Methodology

In order to explore why student teachers choose to participate in an honours programme and how their career plans and possible selves evolve during participation, I have applied methods inspired by the Constructivist Grounded Theory approach as described by Charmaz (2006).

Using this approach assumes an acceptance of the respondents' experience as dynamic, individual and contextual. People may contradict themselves over time, but the experiences they describe are considered to be true to the individual at the time of the interview.
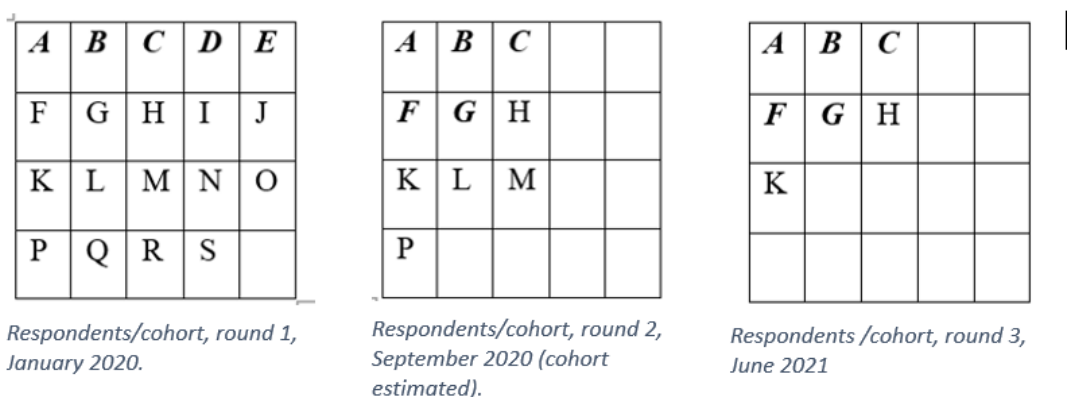
Methods

The data was collected through intensive interviews, which '…permits an in-depth exploration of a particular topic or experience…' (Charmaz, 2006, p. 25). In this case, student participation in

Copenhagen Honours College is the experience explored. The open-ended interviews asked questions around:

- why the respondents chose to study to become teachers

- their experience of teacher education

- why they chose to apply for Copenhagen Honours College

- the experience of Copenhagen Honours College

- their thoughts for the future.

Data was coded and categorised with initial theoretical conjectures refined and checked through a constant comparison between data analysis and literature. By initiating the data analysis after the first interviews were conducted it was possible to explore emerging themes from the initial analysis in subsequent interviews.

The data analysed in this article consists of three rounds of interviews with students from the second cohort of student teachers who participated in Copenhagen Honours College, which initially consisted of 19 students of which 17 had agreed to participate in the study. Rather than including all of the students in the project, I chose to strive for at least five of the same students throughout the study. I chose the respondents randomly for the project out of the 17 students who agreed to be invited for interviews. However, CHC experienced high dropout rates, which affected the data collection. Two of the student teachers interviewed in the first round had dropped out by the time of the second round of interviews. Therefore, all remaining CHC participants were invited to participate in the last two rounds of interviews. Two additional students volunteered. Figure 9 below illustrates respondents relative to cohort at the time of data collection. The size of the cohort at the time of rounds one and three are official numbers. The cohort size at the time of round two is estimated via accounts from respondents and participation at CHC activities.

A	B	C	D	E
F	G	H	I	J
K	L	M	N	O
P	Q	R	S	

Respondents/cohort, round 1, January 2020.

A	B	C		
F	G	H		
K	L	M		
P				

Respondents/cohort, round 2, September 2020 (cohort estimated).

A	B	C		
F	G	H		
K				

Respondents /cohort, round 3, June 2021

Figure 9 Overview of respondents relative to cohort, respondents in bold italics

The interview durations ranged between 45 minutes and 75 minutes with the majority taking 60 minutes. The first round of interviews took place in January 2020, five months after the student teachers entered the programme.

The respondents have consented to participating in the project and have been informed of how data will be treated. Although it is not public which students accepted to be part of the project, only seven graduated from this cohort. Given the small cohort, they are presented as gender neutral by using the pronoun 'they' in the results section to further anonymise them.

Context

Teacher education in Denmark is a four-year, full time vocational bachelor's degree at a university college. The most common programmes qualify participants to teach either maths or Danish plus two subjects in primary and lower secondary school (ages 7-16 years). The education consists of a combination of subject specific courses depending on which subjects the preservice teacher wish to teach, generic courses on teaching and pedagogy common to all students. Over the course of the four years the preservice teachers further have practical experience. How this is structured varies between the university colleges, but in total practical experience consists of 21 weeks of practical experience.

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The honours programme, Copenhagen Honours College (CHC) is an extra curricular programme offered to student teachers with at least one science subject as part of their last two years of education. The programme was first implemented in the autumn semester of 2018. The overall purpose of the programme is to strengthen science teaching in schools. The add-on talent programme adds 30 European Credit Transfer System (ECTS) points to the last two years of the four-year teacher education. The credits are awarded for participation in a summer school with a focus on out-of-school pedagogy (five ECTS), journal clubs with an emphasis on science pedagogy research (five ECTS) and 10 ECTS are awarded for a variety of courses (Professionshøjskolen Metropol, 2018). The last 10 ECTS are dedicated to a so-called partner school project in which students explore an issue related to science teaching at a public primary/lower secondary school. The intention is for the partner schools to raise science teaching-related issues while offering students the freedom to choose the project they find most interesting. (Professionshøjskolen Metropol, 2018).

The initial development of CHC was funded by the Novo Nordisk Foundation with the explicit goal of promoting science subjects in Danish schools. The participants in CHC have fulfilled the formal requirement of keeping up with their exams and studying to teach at least one science subject. There are no requirements regarding grades or other performance assessments, but students are required to write an application and, if successful, are invited for an interview.

Findings

I begin this section by providing a graphical overview of each respondents' considered careers. The overview is followed by a presentation of the thoughts on the future by each respondent in relation the careership model. The following section relates the respondents career reflections to the possible selves theory with a particular focus on the student teachers' hopes and fears for the future and how they describe acting on these hopes and fears.

Career plans

In each interview, students reflected on their thoughts for the future. Generally, they felt more certain about one plan for the future than others and they naturally narrowed down their options as they came closer to graduation. With the exception of one student, respondents did not think teaching was going to be fulfilling enough for them for more than a couple of years. Before or just after graduating, they were already thinking about what they would do after teaching, or in one case while still being a teacher. This pattern is visualised in figure 10: the squares represent the student teachers' predictions for their first jobs at each interview and the broken lines represent what they were considering next or as an alternative. The dotted line indicates a preservice teacher, who thinks a step ahead, teaching is somewhere after pursuing a master's, but not for the rest of their career.
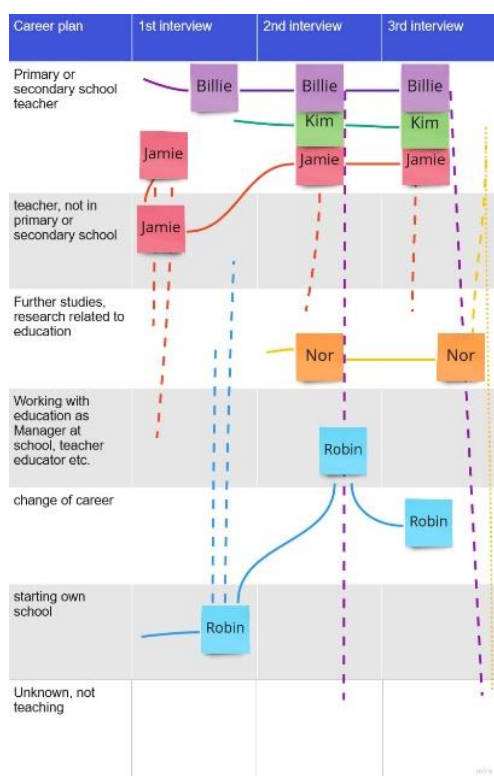
Figure 10 Career reflections of CHC participants

These findings will be explored further and the career plans will be analysed using the Careership model. As Hodkinson and Sparkes (1997) argue that the various elements of their model cannot be meaningfully separated due to their interdependence, the plans for the future of each

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respondent will be analysed considering all elements relevant in relation to the data. The Possible Selves Theory will be used to analyse the strategies respondents use to realise their career plans.

Billie

Billie grew up in a small town where everybody knew everybody. When Billie was unemployed, they were typically offered a job at kindergartens or schools. This led to a more permanent position when "…the headmaster of [school] approached [them] and asked if [they] would like to check out their school… Billie uses the story of different jobs in their hometown to argue why they chose to study to become a teacher. The pragmatic, rational choice to become a teacher is affected by their job experience and employment opportunities but also by stakeholder relations, the stakeholders being their local community and headmasters.

During teacher education, Billie makes themself busy and gets involved in several science teaching-related activities, both connected and separate from the university college. Teaching science is Billie's main interest when it comes to future plans. The closest they get to considering an alternative career is in a statement that they may not wish to be a teacher forever. At the third interview, they have no immediate plans to change career after graduation. On the contrary, they have been offered a position at a private school where they are currently teaching. For Billie, graduation is not a turning point, as their routine confirms their choice of teaching as a career. At the time of the last interview, they expect to work as a teacher for at least 10 years, "...but not just as a teacher; [they] would also like to do some projects on the side". They are not certain what such projects could entail other than being related to science teaching and topics Billie is passionate about, but they do think that applying for external funding and working with these projects would be outside working hours.

Billie likes their current job and has succeeded in securing themself a role where they can influence the development of a talent programme at the school as they had hoped. However, they do not expect to get all their development needs fulfilled through working at the school.

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Kim

Kim chose a career as a teacher because they consider it one of the most important jobs in society. Their personal experience has involved both good teachers and teachers who appeared indifferent. They want to be the kind of teacher who is not indifferent and makes a difference to pupils. As figure 10 shows, Kim has no doubts about their choice or alternative plans; they want to be a teacher. Like Billie, in addition to studying in a programme that emphasises easing the transition from student teacher to teacher, Kim too has a job as a teacher at a school with an inquiry-based approach to teaching. At the last interview, they have been offered a permanent position at that school. At the job as a teacher, they have developed a good relationship with the pupils: "I think my pupils are the world's sweetest…". Beyond wanting to keep teaching these particular pupils, they also feel acknowledged in the job and explain that "…when a position opened, I just had to try [to apply for it]. And they had interviewed much more experienced teachers … I feel really acknowledged for what I can do…"

In the words of the Careership model, Kim's interactions in the field and related part-time job routine have confirmed that teaching is the right choice for them.

Nor

Nor has no immediate plans to become a teacher. They do not remember why they chose teacher education but are very fond of the education and describe it as "good fun". Nor keeps returning to the fact that their parents never got more than a professional Bachelor of Arts degree (BA) – Nor perceives that their parents regret never earning a master's degree. This personal experience is the reason Nor gives for their post-graduate plan:

"I grew up with parents who have been regretting not getting a master's for the past 25 years. … Now I am used to not having that much money so it might as well stay that way and then I could get that master's, because then I have it".

At the last interview, Nor has been accepted at the master's programme they had hoped for. Nor is very clear that pursuing a master's is what they want to do but they also experience pressure from their teacher educators to go into teaching with the argument that "the school needs someone like you". This interaction in the field may have influenced Nor's change from not planning on going into teaching in their first interview to considering doing it at some point. However, they do not consider teaching a lifelong career:

"…I could work for 10-15 years as a teacher, at which point I will probably get bored with it…and bored is maybe too strong a word, but you need to develop as a human being".

They do not have any clear idea of what would come after those 10-15 years, just that they would probably want to quit teaching to develop themselves.

Robin

Robin resembles Billie in that their choice of teacher education was based on experiences with a teaching job after graduating from high school. Robin had considered both pedagogue and teacher as a career but chose teacher education because the pay as a teacher was better. The choice between the two careers, pedagogue or teacher, was the pragmatic, rational decision between the options on Robin's horizon for action. At the time of the first interview, Robin has a paid job at a school for children with special needs. This is a job they enjoy:

"… It is a cool group of children with some interesting challenges, some great colleagues and a very favourable salary compared to the ordinary public school".

 It is also a job where they might get a full-time position after graduating. However, the career as a teacher is not the only one on Robin's horizon for action. In the first interview with Robin, they are most interested in opening their own school – a dream they base on a personal experience with the public school system, which they did not enjoy and feel could be improved. Another option they consider is further studies: "…Partly because I find it interesting but also partly

because if I choose to open my own school, you just get more respect if you have a master's in something and X number of years of experience from teaching. People are like that; they like papers…" The belief that "people like papers" is partly based on testimonies from friends, thus introducing interaction with stakeholders as part of their reasoning.

In the last interview however, Robin has changed their mind about the future altogether. Initially, they did consider further studies within teaching but they end up applying for a position in an unrelated field. They explain this choice by saying that they have always had an interest in this field but also that the previous choice to become a teacher was based on experience without an exploration of other options: "I have thought about it for a while….because I…I have never really…I have never worked with anything but young people … I feel a bit like I just ended up here … I haven't really checked anything else out".

Retrospectively, Robin argues that a career in teaching was a pragmatic, rational decision based on their horizon for action then, but now, that horizon appears to have changed and is perceived as too limited. They decide to change their line of career toward the end of teacher education. Because teaching qualification is equivalent to a Bachelors degree, Robin has the option to pursue a master's degree that is not necessarily related to teaching, thus expanding the horizon. The structural turning point posed by graduation caused Robin to change career path, partly based on the new opportunities that come with achieving a BA. Another issue that caused Robin to change their career plans was money, which was mentioned in relation to their job at the special needs school, but also as a reason for the new choice: they have realised that salary increases within the public school system are difficult. Together with their partner, they dream of a future with a house in an area too expensive for a teacher's salary.

Jamie

Jamie, like Kim, has chosen teaching because they wanted to make a difference for children in the school and because they find teaching one of the most important jobs in society. Initially, they

consider working at a Danish residential school ("efterskole", which is primarily for 14-18-year-olds) or at an ordinary primary/lower secondary school. They also consider further studies within teaching and then becoming a teacher educator after earning a master's degree. During the second and third interview, Jamie is focused on becoming a teacher, but at the third interview they are also sad to have come to the structural turning point of graduation:

> I actually really liked being a student. … a lot of my fellow students are like "woow, I can't wait to graduate". I am a bit ambivalent about it. … I think it is really cool to be absorbed in…well, assignments and the bachelors dissertation. I am going to miss that a lot.
>
> Jamie's ambivalence about graduating is mixed with a worry that as a teacher they will not

have enough time to discuss concepts such as learning theories, an element they enjoyed while studying, but they acknowledge that they can always go back to studying, an option they have considered all along.

Summarising the Careership perspective

These five stories illustrate how context and experience are important when considering a future career. They are also examples of the ongoing process of this choice; the students do not see themselves in the same position for a very long time but consider the teacher education vocational BA as a starting point. As such, none of the respondents consider dropping out.

Possible selves: hopes and fears for the future

The presentation of the respondents' career plans in the previous section revealed a group of students who generally do not see themselves as teachers for the rest of their lives. This reflects both a hope for options beyond teaching in primary and lower secondary schools but also a fear of not being able to develop in their careers.

Fears of the future

In the third and last interview with Jamie, they have just been hired as a teacher and are sure they want to start their career as a teacher, but they also worry about what the work environment will be like. They fear getting colleagues who "… just go in [to the classroom], follow the textbook and go home again and not…and are not engaged …" They react on this fear by being very thorough when choosing which school to work at, looking for schools that, at least on paper, participate in various projects such as being a CHC partner school. Jamie is also concerned that they will miss studying and that there will not be enough room for professional discussions with colleagues: "… I am a bit worried that you don't have…that you don't have the same time to be immersed [in the pedagogical theory] … because you kind of have to prepare those 22 lessons …" Their plan to go back to studying discussed during all interviews appears to comfort them: "…I can always pursue a master's at some point if I miss it too much…"

As presented in the previous section, Nor's personal experience with parents who regret never pursuing a master's appears to have been crucial in their choice to enter a master's programme straight after graduating as a teacher, as they fear ending up with this regret themself. Nor also appears convinced that teaching has limited room for personal development and taking a master's will provide them with options beyond teaching.

In Robin's third interview, they perceive limited opportunities for financial advancement if they do not pursue a master's in a different line of work. They fear that salary negotiations between the public sector and the teachers' union will make it too difficult to earn a higher pay, even though as a science teacher, they are attractive in the job market: "… I don´t think I am one of the best teachers but I definitely think I am above average and I would like to be paid accordingly…and ehm…you can't".

These respondents fear being stuck in a workplace with no or little room for personal development, not that they themselves will become boring teachers. While Nor fears ending up like

their parents, they do not seem to doubt their choice to pursue a master's, thus they have already done what their parents never managed to do.

Hopes for the future

The respondents who are most certain they want to start their career as teachers share the hope of making a difference – either for the children, the school or the teacher education. For example, Kim explains in their second interview how their interactions with pupils can have a positive influence: "…I really want to contribute to making their time at school a good one".

Billie hopes to work with children whom they call "talented pupils" and hopes this makes it possible to work with pupils who "… are driven by an interest to learn". Billie's previous interest in working with pupils who have special needs stemmed from a desire to work in a "niche". Billie reckons they will be a better teacher for the pupils if they can focus on one smaller group. Their change in focus from one niche group of pupils to another is based on their hope to influence development in the school. In their third interview, they argue that there are already an abundance of offers for pupils with special needs and "… [I] think it is really exciting to work in a field where a structure has not already been developed and [therefore] you can have an influence on how it develops locally at the school." Thus, Billie hopes to be a good teacher for children who need extra challenges but also hopes to influence the development in this area at their workplace.

Nor hopes for opportunities their parents didn't have after graduating with a master's and to keep working in fields they find interesting. Generally, they appear very open to what kind of career they want, but have an interest in education in general and science education in particular. Their most clearly articulated hope for their future is when they reflect on an experience during the summer school when they saw a teaching session at an out-of-school class at a museum:

> I had this amazing wow experience of one of the people we saw teaching. She was so good! … There were so many things about her that were just 'wow' in relation to how one can teach. … I would like to be her!

Part of what impressed Nor was how this particular teacher involved the pupils but also how they wore clothing that Nor found atypical for a science teacher and was "… so completely herself…" At the time of the interview, Nor has a parttime job at an external learning environment and expresses how this job is "…too much fun to give up…", thus underlining their desire to have fun while working with teaching and/or science teaching.

Possible selves and CHC

To a large extent, the respondents argue for their choice to sign up for CHC through their possible selves. The fear of being stuck and ending up in the wrong workplace is countered with the hope of having other opportunities besides teaching in a public school when graduating. The respondents refer to CHC as something that "opens doors" (Kim and Nor in interview two, Robin in interview one) and thus provides them with those opportunities. For Kim, those open doors are to positions in good schools and for Robin and Nor it is for possible opportunities within teaching and other opportunities apart from teaching.

The respondents gave concrete examples of which parts of the programme they found particularly useful to their future careers. One of these examples, project management, is described by Robin:

> Robin: If I get sick of teaching and want to find a job in a private company, the fact alone that I have a course in project management and a course in innovation processes gives me a background to build on'.
> Interviewer: You think CHC opens for…
> Robin: Yes, it opens doors.

Jamie also emphasises project management skills as something they hope to benefit from, but within the teaching profession:

> …when I talk to friends who are new teachers it is often difficult to get new ideas accepted and it could have been a really good learning experience to have managed a

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project and then when I get a job at a school to be able to say, "I have managed this project in a school and that worked really well"…

Jamie hopes that project management skills and the experience of managing a project at a school will give them the necessary capabilities to convey new ideas to management at their future workplace.

Discussion

In this study I have explored why student teachers chose to participate in an honours programme and how their career plans and possible future selves evolved during participation.

The findings of this study reveal a group of student teachers who do not consider the choice of teacher education as set in stone and as such their career reflections did not end when they chose to qualify as teachers. Their reflections on career choice are influenced by interactions with the student teachers' stakeholders such as friends and family and also by personal experiences with teaching jobs and their expectations for future jobs. The respondents reflect on their choice to sign up for CHC in relation to their career plans and consider how the affordances provided within particularly project management is considered a benefit to their CV, regardless of if they plan to pursue a career in teaching.

Considering that the last round of interviews in my study was conducted immediately before or after final exams, a bigger influence from this institutional turning point could be expected. However, only one of the respondents, Robin, changed their plans dramatically at this point, as, in the words of Hong et al. (2018), they balanced career goals with life goals and found that a change of career was necessary to fulfil life goals. The rest of the respondents followed their previously decided course but continued to reflect on what to do next (i.e. after working as a teacher).

The student teachers most certain about their teaching careers, Kim and Billie, had already secured their future jobs at the time of the interview. As such, Billie and Kim knew their future

work environment through experience and were confident it would offer work conditions in alignment with their hoped-for future selves: Billie's job was at a private school with room for development within their area of interest and Kim's job was at a school with particular emphasis on project-based learning and supporting new teachers.

Combining the Possible Selves Theory with the Careership model contributes to an understanding of the student teachers' hopes and fears for the future and their effect on choices made during their education. With the exception of Kim and Billie who already secured a job and know what is in store for them, the respondents generally fear that the teaching profession will not be sufficiently challenging and that it will not allow them to continuously develop themselves as teachers and personally. They act on this fear by seeking out opportunities to expand their options after graduation either outside or within teaching, such as signing up for CHC.

The present study contributes to the research in teacher shortage that focuses on the transition from teacher education to the teaching profession and partly contradicts the findings by Rots et al. (2013). The respondents have received extra support from the education and do not seem worried about their own capabilities as teachers. Regardless, they still debate whether teaching is the right place for them. The findings are, however, in line with a report from the Economic Council of the Labour Movement in Denmark, which found in 2021 that the percentage of educated teachers working in primary and lower secondary schools falls five years or more post-graduation (Pihl & Lykketoft, 2021). Mayer and Mills (2021) has found the same trend and argue that a focus on new teachers' classroom readiness and standardisation with what they term 'evidence-based teaching' has led to an instrumentalist approach to teacher education and a teaching profession in which teachers are expected to uncritically apply '… existing evidence to improve their practice' – thus leaving little room for professional development as teachers. Mayer and Mills (2021) base their argument on examinations on policy documents from England and Australia, but there is evidence that this discourse is also found in countries such as Denmark. An example is a Danish report from

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2016 with the translated title, 'Why do teachers leave the public primary and lower secondary school?' by Vaaben et al., (2016). Based on surveys of teachers who quit after a 2013 Danish school reform, the report finds that too much focus on time management, top-down control and goal-oriented teaching, which teachers described as preventing them from being good teachers and making their own professional decisions, was a common reason for teachers to quit their jobs.

As the experience of the respondents in this research project differs from that of student teachers who had not signed up for Copenhagen Honours College, it can be argued that the respondents are not comparable with the general population of student teachers. However, the respondents' hopes for a career with the opportunity to continuously develop, resembles previous research by Illeris et al. (2009) on youth and labour-market perspectives (16-25-year-olds) and their approach to the job market. In this description, the most dominant expectation for a future job is the opportunity for personal development and new challenges. According to Illeris et al. (2009), young people find it hard to imagine themselves in the same job for the rest of their lives and expect to find a new job if a job doesn't meet their expectations, a finding supported in Manuel and Hughes (2006). That the current generation does not consider staying in the same job for the rest of their lives, is also reflected in a report by Danmarks Evalueringsinstitut (2022). One of the findings in the report is that one in ten people about to choose what to study, considered teacher education but decided against it. The reasons given were partly based on pay but also on the perception of limited career opportunities. This finding indicates that the respondents in my study are not special in their expectations from access to professional development in their future workplaces and in the desire to expand their options beyond teaching. Even though my respondents chose teacher education, they supplement the education through CHC. Two of the respondents do not even enter teaching initially but take advantage of the teacher education being a bachelor's degree which enables them to pursue a master's degree.

While CHC aimed to play a part in alleviating the teacher shortage, this does not appear to have been successful when considering the respondents in my study. Although the programme offered an improved educational experience through personal mentorship, extra course work and increased practical experience, the participants either decided against entering the teaching profession or considered to leave within a relatively short timeframe. This finding suggests that considering teacher education, as suggested by Rots et al. (2013), is not enough when seeking teacher shortage solutions. In light of my findings, I would argue that in order to alleviate teacher shortage, it is also necessary to consider working conditions in the schools and what career opportunities qualified teachers have or are perceived to have. The respondents consider the addition of CHC as a welcome expansion of their opportunities on the job market. As such, CHC might not have played a part in providing schools with more teachers, but the insights from this study suggests, that by adding courses such as project management to teacher education has the potential to make it attractive for more people. Although it might seem irrelevant to the teacher shortage to attract more student teachers if they never enter the profession, it is worth considering the one in ten prospective students who, according to Danmarks Evalueringsinstitut (2022), considered to enter teacher education but decided against it due to a perception of poor career prospects. These prospective students might have entered the profession if not for the rest of their career, then for a period of time.

Conclusion

To answer the question of why student teachers choose an honours programme and how possible selves and career plans evolve during participation, this study has found that student teachers partly base choices such as signing up for an honours programme during their education on their hopes and fears for their future careers. One of the fears is based on a perception of the teaching profession as a career with little opportunity for professional development and by choosing CHC

they can boost their CV and expand their options. During the last part of teacher education and participation in CHC, the student teachers are already considering the next step in their career.

The present study does not question the importance of teacher education when it comes to dealing with teacher shortage; but it adds to our understanding of student teachers' considerations when thinking about their futures. These considerations indicate that we need to both consider working conditions in schools and the opportunities they provide for professional development as well as teacher education. Teacher education can also play a part in attracting more students by being transparent about that teaching does not have to be a career for life.

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3rd article: Opportunity for change? The experience of being a new teacher educated to develop science teaching

Abstract

Bringing new approaches to science teaching such as interdisciplinary, problem-based teaching into schools has proved a slow and difficult process. One of the means to bring about the change has been through teacher education, but it has been contested whether new teachers were able to transfer what they had learned from education to profession. This study is a qualitative study inspired by constructivist Grounded Theory which explores how four new teachers educated from programmes with an explicit focus on changing science teaching in schools, experience the transition from being a teacher student to being a teacher. The study suggests that a Community of Practice formed during teacher education and a clear alignment between requirements in schools and what is taught at teacher education has the potential to increase transfer and in turn the opportunity for using teacher education as a means to develop science teaching in schools.

Introduction

Difficulty attracting students to the natural sciences is a well-known issue affecting countries across the northern hemisphere (Fletcher & Luft, 2011)(Smith & Gorard, 2011; Lavonen et al., 2008; Prescod et al., 2018; Rocard et al., 2007; Schreiner & Sjøberg, 2007).

Substantial research has been conducted to understand why a natural sciences career is not considered more desirable (Prescod et al., 2018; Archer et al., 2020). One possible answer has been that science in schools is too abstract, difficult to understand and too remote from the worlds of pupils who, as a result, find science uninteresting or irrelevant to them (Harlen, 2010). Furthermore, pursuing a career in science is perceived as inaccessible and only for certain kinds of people such as middle-class white men (Smith & Gorard, 2011; Archer et al., 2015).

The development of new pedagogies is among the solutions to the challenge of engaging students who perceive science as irrelevant to them. "Big Ideas of Science Education" (Harlen, 2010; Chalmers et al., 2017), inquiry-based science education (Rocard et al., 2007; Harlen, 2013) and integrated Science, Technology, Engineering and Mathematics (STEM) (Cunningham, 2018) generally have a more inductive approach to teaching, unlike traditional deductive science teaching (Rocard et al., 2007). This influences, for example, how lessons should be planned, how the teacher should approach the curriculum and what role practical work such as experiments should play. Although the above-mentioned developments have existed for more than 20 years, they have not necessarily made their way into classrooms sustainably (Chalmers et al., 2017; Saka et al., 2009). Teacher preparation has the potential to support reform within science teaching in schools (Marbach-Ad & McGinnis, 2008; Nordine et al., 2021), but whether this can be successful approach is debated. Sharma and Muzaffar (2012) argue it has largely been unsuccessful but Marbach-Ad and McGinnis (2008) found that it was possible to reform teaching in schools through teacher preparation programmes, but that this required alignment between what was taught and how it was taught. In general, for teacher preparation programmes to have any influence on the way science is taught in schools requires the new teachers to be able to transfer what they learn from education to profession. It is debated whether this is possible (Marbach-Ad & McGinnis, 2008; Pringle, 2006; Linhart, 2007), but the influence of teacher education or teacher professional development programmes on teaching practice is found to be related to 1) beliefs and interests of the preservice teachers or in-service teachers (Allen, 2009; Fletcher & Luft, 2011; Linhart, 2007). Although beliefs about teaching is not always defined when it is used in the literature, a common understanding appears to be in line with the definition used by Fletcher and Luft (2011), which is "personal constructs important to a teacher's practice (Fletcher & Luft, 2011, p. 1126). 2) structure and content of education (Nordine et al., 2021) and whether teaching content is aligned with teaching methodology (Marbach-Ad & McGinnis, 2008) and 3) the conditions teachers face in the profession such as support in relation to the new teachers' ideas and beliefs about teaching (Allen, 2009; Fletcher & Luft, 2011; Roehrig & Luft, 2004) and the ability to be part of a community of practice which supports professional development within the new teachers' approach to teaching (Saka et al., 2009).

This paper contributes to research on the potential for teacher education to develop science teaching in schools by exploring the experiences of new teachers who have participated in specialised educational programmes as they transition from the teacher education to the teaching profession.

The study is based on interviews with four new teachers towards the end of their first year of teaching. All four respondents have participated in an add-on honours programme and three of the teachers have graduated from a specialised science education programme. Both programmes describe the teachers who have participated in the programme as "beacons for science teaching" (Rasmussen, 2016; Metropol, 2018).

It is the purpose of this study to explore the question: How does participating in teacher education programmes with a focus on developing science teaching influence transfer between science teacher education and the science teaching profession?

The study is inspired by Lobato (2003)'s Actor Oriented Transfer (AOT) approach, which emphasises that it is the person doing the transfer who can define what has transferred. As such the research question is explored from the view of the respondents and they define how their education has prepared them for teaching science and how they use this preparation as teachers.

Theoretical framework

Transfer of learning

When considering how teacher education influence how new teachers teach, a useful theoretical framework is transfer of learning. Transfer of learning is broadly defined as learning something in one context and being able to use it in another (Dohn et al., 2021; Bransford et al., 2004; Wahlgren, 2009). Teacher education has an implicit expectation of its graduates to transfer what they have learned during education to a specific profession, the teaching profession. By considering how new teachers use what they have learned during education and their explanations for doing as they do, relates to transfer of learning.

In this paper, transfer of learning will be understood in line with the situated cognition perspective in which transfer of learning is considered to be the "…transformation of procedures and experiences from earlier situations, in accordance with the situational demands and possibilities" (Dohn et al., 2021, p. 83). By using the word "transformation" rather than "transfer", Dohn et al. (2021) emphasise that this approach does not consider transfer of learning as something fixed and static, learned in one situation to be applied, unchanged, in another, but rather that what is learned in one situation will, when considered relevant and possible in a given

situation, be transformed to fit that situation. One example of a researcher using a situated cognition approach is Lobato who has developed the concept AOT (Lobato, 2003). From the AOT perspective, transfer is seen as "…the personal creation of relations of similarity, or how the "actors" see situations as similar" (Lobato, 2003, p. 18) while understanding transfer of learning as knowledge generalisation (Lobato, 2003, 2012). This implies a view of transfer of learning as a process in which the learner experiences a transfer situation as something they have thought of before and thus generalises the knowledge from previous experience to the novel situation. Lobato (2003) describes one of the differences between the traditional cognitive approach to transfer of learning as "static application of knowledge" as opposed to the AOT perspective's 'dynamic production of "sameness"' (Lobato, 2003, p. 20). Lobato (2003) argues that since creating relations of similarity depends on subjective experience and social interactions, each person creates similarities differently – and often unpredictably – so to accurately research transfer of learning, the researcher needs to explore the actor's perspective through inductive, qualitative methods (Lobato, 2012). When looking at transfer between something as complex as teacher education and teaching profession, it is useful to phrase the research questions from the AOT perspective rather than the more traditional transfer perspective. For example, by asking "how has the education influenced teaching practice?", rather than asking "has this teacher transferred X to from teacher education to the teaching profession?".

In the AOT approach to learning, Lobato's focus is on what transfer of learning is and how it can be studied and is less explicit about what enhances transfer of learning (i.e., what enables a person to generalise between two contexts) partly because she argues that researching transfer with the AOT perspective provides knowledge of how learners generalise, which can inform how to foster transfer in different contexts.

According to Dohn et al. (2021), the situated cognition approach to transfer of learning assumes that transfer can be enhanced by simulating a non-educational context within the education, which is a means to create similarity between the learning context and the context a person is expected to transfer to. In relation to teacher education, the practicum/clinical experience is a good example of this. Engle et al. (2012) have developed the concept of "expansive framing", which deals with this issue of contextualisation. They argue that the ability to transfer from one situation to another requires having been explicitly taught how something can be used outside of the learning context. This both supports generalising between contexts by realising when they

are sufficiently similar, but also relates to perceiving the relevance of what is taught. In relation to preservice teachers, experiencing the relevance of what is taught can be influenced by their beliefs about teaching (Allen, 2009; Linhart, 2007). When applying this view on transfer of learning to research how teacher education programmes, which focus on development of science teaching, influence transfer of learning between teacher education and teaching profession, it provides an analytical lens to understand what factors enhances transfer between these contexts. In turn, this insight can be useful to understand the prospects for using teacher preparation as a means to develop science teaching.

By being inspired by Lobatos concept of Actor Oriented Transfer, this study considers how new teachers themselves perceive the usefulness of their education in the light of their current challenges as teachers. This provides an insight to what they found immediately useful from their education at the same time as considering the context of their schools of employment, as this context has a significant impact on their ability to transfer.

Communities of Practice

Although both the AOT approach and the concept of expansive framing acknowledge the importance of context and the social situation for learning and transfer, the transfer theories mentioned above do not emphasise the influence of the communities in either the learning situation or transfer situation. It also does not account for the fact that teachers are not taught everything they need to know to be a teacher in their teacher education programme; they also learn by participating in the practice of teaching. While Wenger's (1998) theory of Community of Practice (CoP) is more concerned with social learning and not particularly with the transfer of learning, the theory is relevant when exploring how the respondents experience transition from teacher education to the teaching profession. This transition from one social context to another involves participation in at least one new practice: the practice of teaching.

Wenger (1998) describes a CoP as consisting of three overlapping concepts:

(4) Mutual engagement: The members are all engaged in the community and this engagement needs to be maintained by interaction.

(5) Joint enterprise: Members communally negotiate their community enterprise and how to work toward it. The members do not have to agree on every aspect, but the negotiation of the enterprise is communal. Wenger (1998) further argues that CoPs do not exist in a

vacuum; reactions to the conditions they face, such as institutional requirements, are part of the negotiated enterprise.

(6) Shared repertoire: When working toward the joint enterprise, members of a community of practice build up a repertoire. This repertoire's presentation depends on the context but could be various jargon, tools or teaching material. The repertoire of a community reflects its continuously created history, or as Wenger (1998) puts it, "it reflects a history of mutual engagement" (Wenger, 1998, p. 83).

Wenger (1998) noted that CoP members are not just members of one but several communities and that this multi-membership can result in brokering between them. This implies that a member in one community might transfer practices between communities (Wenger, 1998). In later descriptions of CoPs, E. Wenger-Trayner and B. Wenger-Trayner (2015) emphasise that it is not a prerequisite for the members of a CoP to have a shared practice in the same physical space: "Communities of practice are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly" (E. Wenger-Trayner & B. Wenger-Trayner, 2015, p. 1).

For the purpose of this study, the Theory of Communities of Practice will supplement the concept of transfer of learning to understand how the communities the respondents consider themselves part of and the conditions in the practice they enter influence their ability to introduce aspects of teaching that are different to the existing practice to their respective schools.

Context of the study

To establish the context of this study the following four parts will be presented: 1) ordinary teacher education, 2) Advanced Science Teacher Education (ASTE), 3) Copenhagen Honours College (CHC) and 4) lower secondary school science teaching. The first parts presented here are the educational contexts the respondents were part of before entering the teaching profession. Following this presentation is a brief discussion of how ASTE and CHC differ from each other. The section is concluded with a brief description of science teaching at lower second level in Denmark.

Teacher education in Denmark

Teacher education in Denmark is a four-year bachelor's degree programme in Education, 240 European Credit Transfer System (ECTS) in total. Teacher Education is frequently reformed, but at

the time the respondents of this study were studying, a teacher would usually graduate with either Math or Danish which each consisted of 40 ECTS as their main subjects. Regardless of the choice of main subject the standard was for preservice teachers to choose two more teaching subjects, e.g. Biology and Geography which each consisted of three courses of 10 ECTS each. During the four years of teacher education, students had practical placements, most commonly three seven-week sessions (Ministry of Higher Education and Science 2015).

Advanced Science Teacher Education

Three of the four respondents in this study graduated from the Advanced Science Teacher Education (ASTE), which was a specialisation within the teacher education at University College Copenhagen (KP). This entailed Maths as the core subject qualifying to teach all natural science subjects taught at lower second level: Geography, Biology and Physics/Chemistry. By qualifying to teach all science subjects, ASTE graduates qualified to teach one more subject than the standard teacher qualification. The ASTE specialisation gave special attention to interdisciplinarity between science and maths with courses designed for this purpose (Rasmussen, 2016). Where the ordinary teacher education required three modules of 10 ECTS to qualify to teach Biology, Geography or physics/chemistry and four modules of 10 ECTS each to qualify to teach Math, the ASTE education merged the last courses in each subject with a minimum of one of the other STEM subjects. These interdisciplinary modules were each given a theme under which the preservice teachers were to develop inquiry based, interdisciplinary lesson plans or teaching materials. In the table below is an overview of the interdisciplinary modules and a brief description of the assessment format. The assessment format is derived from the written assignments provided by the respondents and the information on the modules is provided by Aarby (2015).

Subjects in module	Module theme	assessment
Math and Biology	Health – risk or chance?	Written page to a text book and a guide to the teacher. The material has a focus on interdicsciplinary teaching, problem-based teaching with malnourishment as the case
Geography, Biology, physics/chemistry	Sustainability, foodstuffs and energy	Written text book material, suggested activities and guide to the teacher. The material is focused on interdisciplinary, problem-based teaching aimed at a new interdisciplinary assessment in lower secondary school
Math and physics/chemistry	Natures game of dice	Written lesson plan with a focus on how to support interdisciplinary teaching and understanding between maths and physics/chemistry
Geography, physics/chemistry	Energy and climate	Log, lesson plan, workshop and poster presentation. Focus on engineering under the theme "technology and livelihood" – a theme included in the new assessment in lower secondary school

Table 10 Overview of ASTE modules

Copenhagen Honours College

The respondents in this project were selected because they participated in the add-on programme, Copenhagen Honors College (CHC). The programme targets preservice teachers qualifying to teach at least one science subject (Biology, Physics/Chemistry or Geography). In the steering documents for the programme, two rationales for its development are presented; 1) the aim to strengthen the

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welfare sector by attracting more qualified students and 2) to improve science teaching in schools (primary and lower second level) (Professionshøjskolen Metropol, 2018). The programme was developed following an executive order that allows higher education institutions to offer programmes that add ECTS to an otherwise full-time study and to accredit this extra workload on the exam papers. The programme is developed by University College Copenhagen (KP) and funded by the Novo Nordisk Foundation.

CHC adds 30 ECTS to the last two years of teacher education – the equivalent of six months of full-time study.

The main activities in the programme include:

- A five-day summer school with a focus on out-of-school pedagogy
- Journal clubs held twice each semester focusing on articles and reports within science pedagogy and science teaching.
- Courses with various foci ranging from project management, innovation and networking to more subject-specific courses within science teaching.
- A partner-school project. Each student in the programme must develop a science teaching-related project in a public primary or lower-secondary school in cooperation with the school (Professionshøjskolen Metropol, 2018).

There is room for 15 students per cohort in the CHC programme.

There are two main formal requirements: students cannot be behind with their exams at the ordinary teacher education and they have to study to teach at least one science subject. Interested students apply by writing an application and if successful are invited to an interview with teacher educators from the CHC programme and external reviewers.

ASTE vs CHC

Both ASTE and CHC were developed with the aim of strengthening science teaching in schools. In ASTE there was a strong and clear emphasis on interdisciplinary, problem-based science teaching. The steering documents for CHC emphasise the programme's aim of educating teachers with the skills and ability to strengthen science teaching and the science milieu in schools, but it is not explained what needs to be strengthened or how. The most explicit goals described in the steering documents concern the position of science in relation to other subjects and science teaching in relation to out of school teaching.

In the implementation of the CHC programme, there was an emphasis on competencies within project management. This focus was prevalent both in courses offered to participants and in the partner-school projects described above. As such, where interdisciplinary, problem-based teaching was the focus of ASTE, project management can be seen as one of the main affordances CHC added to the ordinary teacher education.

Another significant difference between the two programmes is that ASTE is a full, coherent science teacher education where the preservice teachers are in the same group all through their education whereas CHC is an add-on during the last two years, in which the preservice teachers follow both their regular education and the CHC activities.

Lower secondary school in Denmark

This study considers how new teachers experienced the transition from teacher education to the teaching profession and this section provides a brief overview of the context they became part of as teachers.

Primary and mid-level in Danish schools consists of ages seven to 13 while lower second-level spans ages 14 to 16.

At primary and mid-level in schools, science is taught as an interdisciplinary science and technology subject called "Nature and Technology". At lower second-level, the science subjects are divided into Biology, Geography and Physics/Chemistry (the latter is treated as one subject).

In 2017, a new problem-based interdisciplinary exam was introduced in the science subjects (Geography, Biology and Physics/Chemistry) at the end of lower-secondary school. The introduction of the new exam also came with a requirement of at least four interdisciplinary problem-based projects during the course of the three lower-secondary school years (Styrelsen for Undervisning og Kvalitet 2019). For a more in-depth description of the new exam, see Nielsen and Nielsen (2022).

Methodology

The methodology and methods used in this study are inspired by the constructivist grounded theory

method as described by Charmaz (2006). The constructivist grounded theory method does not assume that reality can be found. Rather, it is considered to be created by social interaction and has a symbolic interactionist epistemology (Miliken & Schreiber, 2012; Charmaz 2006). In Charmaz's (2006) words, symbolic interactionism is "…a dynamic relationship between meaning and actions (…) This perspective assumes that individuals are active, creative and reflective and that social life consists of processes" (Charmaz, 2006, p. 189). Using this approach in the study requires accepting participants' responses as true to them in the moment and that their experience is dynamic, individual and context dependent.

The constructivist grounded theory method is abductive. Instead of starting with a hypothesis, it uses sensitizing concepts as points of departure. These sensitizing concepts direct the design of the study but may change if new ideas develop during data collection and analysis. In this study it was initially assumed that transfer of learning would be a relevant theoretical framework, and the sensitizing concepts used to design the study were based on aspects of education believed to enhance transfer of learning:

(1) Similarity between contexts to increase the chance of generalizing between contexts (Dohn et al., n.d.; Lobato, 2003)

(2) Experience of relevance for the future (Clarke et al., 2014; Engle et al., 2012; Wahlgren, 2009)

(3) Sufficient level of learning (Bransford & Schwartz, 1999; Engle et al., 2012; Pellegrino & Hilton, 2012)

These factors were used in the design of the interview protocol as points of departure.

Methods

The data in this article consist of four intensive interviews, which "…permits an in-depth exploration of a particular topic or experience…" (Charmaz, 2006, p. 25). In this case, the experience explored is of being a new teacher having participated in a programme with an emphasis on developing science teaching. The interviews were open-ended with themes rather than specific questions. The themes revolved around the experience of graduating, getting a job, starting the new job as a teacher and thoughts for the future. The respondents were further asked how they experienced being prepared for their jobs by the education in general and not by CHC particularly.

The cohort of CHC participants which the respondents were part of during their teacher education, initially consisted of 11 preservice teachers of which six completed the CHC programme and four agreed to an interview towards the end of their first year of teaching, in June 2021. Of these four teachers, three graduated from the ASTE education and one was qualified to teach Maths, a science subject and a non-science subject.

The present study is part of a larger study in which observations of activities in CHC have been part of the data collection. Previous interviews and observations has influenced data collection by creating rapport with respondents and informing relevant prompts in the interviews, such as being aware of what activities the respondents participated in during education (Szulevics, 2015).

The interviews lasted between one hour and one hour and 20 minutes. They were transcribed and coded using atlas.ti. Coding procedures were inspired by Charmaz (2006) and consisted of three rounds of coding: initial coding, incident-by-incident coding and focused coding in which the initial codes were sorted, and emergent themes were compared to extant literature in an iterative, constant comparison process. In the third round of coding, selected codes were elevated to categories while continuing constant comparison with previous codes and literature. Table 2 provides a summary of the output from the coding process.

Table 11 summary of the output of the coding process

Number of initial codes	Number of focused codes	Categories
403	23	'Being allowed to do what they want' 'Being limited by lack of support' 'having a different approach to teaching science' 'Getting support from community'

The respondents have all consented to participate in the study and have been informed of how data is treated. As the cohort is very small, anonymity is a concern and has been discussed with the respondents. In order to ensure maximum anonymity, the respondents are presented as gender-neutral by using "they/them" pronouns in the results section while references to specific schools, teaching material, etc. have been anonymised. The respondents have also been given gender-neutral pseudonyms: the three respondents with an ASTE qualification are named Renee, Bobbie and Lucca and the respondent with Math and Biology among their teaching subjects is named Samie.

Results

The meeting between new and old ways of teaching science

The ASTE teachers in the study clearly state their beliefs about science teaching as interdisciplinary, inquiry-based and based on a variety of resources, not just the common textbook material.

When Renee reflects on how they feel teacher education prepared them for the profession, they particularly focus on how they learned to do lesson planning and describe this as inspiring to their science-teaching approach:

> …I am really glad I have learned to do it in the way I have because (the school), they use (specific textbook material) and it is ok, but I don't think they use it right. They just take the whole material, put it into the year plan and then just teach (based on the teaching material). And the pupils were just about to vomit, they were so sick of those books….I think (textbook material) should only be a small part and then you add inquirys, experiments or maybe other types of texts or videos or something.

From this description, Renee reflects on an aspect of their teacher education that was clearly framed as relevant for their profession: lesson planning. Renee observed that not all colleagues strictly follow the textbooks, however some do, which may cause "…a whole class to think Physics/Chemistry are the worst subjects because they think it is boring".

Renee also found that their colleagues' approach to the compulsory interdisciplinary problem-based science projects could be improved and used a good relationship with the management to air their frustrations with the way it was done:

> I was like – do you not do anything to get them interested in the subject? Why it is exciting, why this is a problem? Why should we investigate this? They just killed them (with boredom). And then I wrote to my manager…and ehm…asked if he had time to listen to some frustrations about the interdisciplinary science project.

After venting in their manager's office, the manager tells Renee that his plan with hiring them was to change up the way science was taught at the school, thus confirming their beliefs about science teaching offering suppport for their ideas.

Afterward, Renee has two strategies for doing the projects the way they think best. First, they intend to draft a new yearly plan for the cross-curricular projects and inspire their colleagues to approach the projects in a new way. They have plans to meet with friends from teacher education to get help with the draft, namely Bobbie and Lucca. This way, Renee can use their old and established community of practice from the teacher education to develop their teaching while at the same time hoping to broker between the old community of practice, their student mates and their new teaching colleagues.

The other part of Renee's plan is to teach all the science subjects in one class so they can decide themselves how to plan the teaching, which is possible because they are an ASTE teacher and thus qualified to teach all science subjects. Renee has a strong belief about the best way to teach science and feels prepared by the education for planning lessons according to this belief. When the transfer situation makes this difficult, they mold it to fit, thus creating the necessary similarity between contexts.

Another ASTE student, Lucca, also refer to benefitting from how they were taught to do lesson planning in the teacher education.

> When I am planning my teaching and what I intend to work with, I think back on my education and the parts that were about what it is important to focus on when you prepare your teaching. I constantly think back on how I learned one should plan teaching because I often feel like just getting started and work things out on the way (…) and I know that is not a winner, because then things get too messy for me

Lucca also emphasises project-based learning and interdisciplinary learning as most inspiring and the way they prefer to teach: "…I would say CHC has contributed a lot – but it is also part of ASTE –the idea of interdisciplinary science teaching…and it has been enhanced through CHC".

The belief that interdisciplinary teaching between the science subjects is the best way to teach science affects the way Lucca does their year plan. When they teach different subjects in the same class, they merge them:

> I have two lessons of Biology and one lesson of Geography a week per class. That is kind of the way it is planned. And I said to my manager, why is that? I think it is difficult to come up with what to do in one lesson (one hour) of Geography. I feel like just merging them and calling it

bio-geo and then I would have three lessons a week that would be interdisciplinary. And I was allowed to do that.

Thus, they apply the same strategy as Renee to create similarity between what they were taught to teach and the reality.

Bobbie is the third ASTE student. Like Lucca and Renee, they do not want to be limited by too few lessons in each science subject per week and also want to work with interdisciplinary teaching. As Lucca and Renee, they have the opportunity to be flexible with when they teach what subject. When asked to describe their expectations before starting their first teaching job, this was the first thing they thought of: "…I think, because I have an ASTE education I had an expectation to work with interdisciplinary teaching…"

Bobbie also talks about their role in the staff room as someone who comes in and plans teaching differently, but feels that their new colleagues appreciate their take on the interdisciplinary science projects – while the approach is new to seasoned teachers, it has been an important part of Bobbies education as an ASTE teacher:

> I am really good at thinking the subjects as they normally are but also to mix them. (…) And to do it a bit differently. There are a lot [of teachers] who, from the day the school year begins are stressed about all the content they need to teach before the exam….and then, when they are told from the top we have to do these [interdisciplinary science] projects…they sit there and are like…how am I going to make it? (…) And then it… seemed like a big help for them when I came in and said, "If we do this project then we will cover this content"…and then the pupils might not go into detail with an isotope map in physics but they get to do a lot of other things. They get to inquire, make things themselves…

In general, the three ASTE teachers describe how their qualification has influenced their beliefs about science teaching and how these beliefs influence their respective takes on lesson planning and their approach to the interdisciplinary science projects. It also gives them the practical, concrete opportunity to be flexible and plan their ideal teaching. ASTE has also provided them with a community of practice. They have a shared enterprise with a clearly defined belief about science teaching and an interest in improving how science is taught in their respective schools. They engage in a community that shares ideas and teaching material and they have a shared practice; though they work in different schools, their working conditions appear sufficiently similar to make it possible for them to help each other improve their teaching. One of these conditional similarities is the

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opportunity to teach more than one science subject in each class and the freedom, with support from management, to decide when to teach what.

Lack of support in the teaching profession

Where Bobbie, Renee and Lucca all have experienced support from management, the story is different for Samie. The best opportunity Samie had to transfer aspects of CHC, was when their manager asked them to be the main coordinator of a two-week STEM-project for all 75 six graders and a team of colleagues. Initially they were asked because their CV included a course in programming from CHC, but what they found most useful during the project was the skills they had acquired in project management from CHC courses and the CHC partner-school project:

> I had tried to manage a project before, where I had to tell teachers who had been in the profession far longer than me, what they should do…in my partner-school project I made an innovationproject with the teachers where I made the plan for the week (of the project).

The project took place a month into the school year and despite experiencing their coordination of it as a success, Samie did not receive any further support from their management. Despite appearing supportive of Samie's initial idea of implementing aspects of their partner-school project during the job interview, after starting the job, Samie realised that they would not provide the relevant resources to do so and quickly gave up on the idea and turned their attention to everyday challenges of classroom management.

Discussion

The aim of this study was to explore how participation in teacher education programmes with a focus on developing science teaching influenced transfer to the teaching profession. The rationale behind the question was to explore the potential to perceive teacher education as an opportunity for change within science teaching in schools. In this section I will discuss my findings of what the respondents reflect on transferring to the profession as teachers and how these findings contribute to the current research in the field.

The respondents in the programme all participated in the honors programme CHC and three out of four also graduated from the ASTE education. Both programmes had an explicit focus on strengthening science in schools but where ASTE was a coherent, specialised science teacher education with an emphasis on interdisciplinary, problem-based science teaching, CHC was an add-

on programme consisting of 30 ECTS and with a focus on project management within science education in schools.

ASTE – interdisciplinary, problem-based science teaching

The ASTE teachers refer to what they have learned about lesson planning when reflecting on how their education has prepared them for being teachers. Their descriptions of how they approach their science teaching focus on interdisciplinary and problem-based teaching. As presented in the context section, this is aligned with how they were taught in the interdisciplinary courses during their teacher education, which is again in line with how Engle et al. (2012) describe expansive framing, as lesson planning is explicitly framed during education as essential in the profession. From an AOT perspective, the new teachers generalise between what they have been taught during teacher education and the actual lesson planning in schools.

The findings of this study support the findings by Marbach-Ad and McGinnis (2008) in which new teachers were more likely to transfer reform-based teaching if the content of teacher education and the methodology were aligned. An example of how this was the case in ASTE, is that they were taught how to plan and teach interdisciplinary science through interdisciplinary courses.

The ASTE teachers' ability to generalise helps them when the conditions in their schools do not immediately appear similar to what they feel prepared for, for example, shorter lesson times in the schools than in their education. They seek out means to change the conditions rather than changing their belief about teaching. Based on the findings in the present study, the respondents provide two main reasons for sticking to their beliefs about teaching, 1) they are supported by management, which supports current research (Allen, 2009; Fletcher & Luft, 2011) and 2) they have a CoP with peers formed during the ASTE education. This supports the findings by Saka et al. (2009) to some extent, as Saka et al. (2009) argue for the importance of new teachers becoming a part of a CoP, in which it is possible to share new ideas. However, Saka et al. (2009) focused on a CoP in the respondents' schools of employment, where the respondents in this study drew on an already established CoP. As such, one of the contributions from my study is, that CoPs formed during teacher education has the potential to support new science teachers in their beliefs about science teaching.

Another factor increasing the similarity between the ASTE education and the teaching profession, is the new form of assessment in lower secondary school, which include an increased focus on

interdisciplinary, problem-based science teaching. The ASTE education had a very explicit focus on this development, and this clear alignment serves as an expansive framing between requirements in the profession and ASTE. Apart from supporting the new teachers' ability to generalise between education and profession, the change in assessment is also likely to have had an influence on the support the new teachers were given by their respective managers.

CHC – project management

CHC's unique affordance was a focus on project management. Samie had initially hoped to transfer what they had learned from this aspect of CHC and the partner-school project. Although they had an experience of success with coordinating a STEM project in the beginning of the school year, they experienced not receiving support from their manager to work with out-of-school teaching as they had hoped. As such, Samie's ability to transfer ideas from CHC appears inhibited from the start by the working conditions, and they did not have the same opportunity to generalise as the ASTE teachers did. Although Samie in this study is the exception, their experience is in line with Allen (2009), who warns that new teachers must be supported by their school's workplace community to act as change agents.

Conclusion

By exploring how participation in programmes with a focus on developing science education in schools from the perspective of the actors, this study contributes to current research in the field by suggesting that a CoP formed during teacher education can play a part in new teachers' ability to maintain beliefs about science teaching developed during teacher education. The study further contributes to the field of research by suggesting that clear alignment between requirements in schools and what is taught at teacher education has the potential to increase transfer and in turn the opportunity for using teacher education as a means to develop science teaching in schools. The study further suggests that affordances acquired through an add-on honours programme with a focus on project management is not as readily transferred to the profession as affordances from a coherent science teacher education aligned with assessment requirements in schools.

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