



Preservice Subject Teachers' Lack of Interest in Their Minor Subject: Is It a Problem?

Johanna Havia^{1,2} · Sonja Lutovac¹ · Tiina Komulainen¹ · Raimo Kaasila¹

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Abstract

Interest in a particular subject is one central factor in preservice teachers' decision to become subject teachers. Interest in a subject can also become visible in preservice teachers' teaching and may consequently impact their students' interest in the subject. However, the interest of preservice teachers in their major and minor subjects has been scarcely addressed. In Finland, secondary school teachers usually study and teach two or three subjects. Major subjects are often chosen based on interest; however, the reasons for choosing a minor subject can vary. In this study, we examined the narratives of three preservice subject teachers regarding their interest in their minor and major subjects. They all studied mathematics, physics, and chemistry and revealed a much weaker interest in the minor subjects compared to the major subjects. Interestingly, our findings also reveal that preservice teachers' perceived strengths in a specific subject may not be as crucial to their interests, as has been suggested by prior research. We discuss the consequences of preservice teachers' weaker interest in certain subjects and provide recommendations for teacher education.

Keywords Subject interest · Teacher interest · Subject teacher education · Narrative inquiry

✉ Johanna Havia
johanna.havia@oulu.fi
<https://orcid.org/0000-0001-5755-2162>

Sonja Lutovac
Sonja.Lutovac@oulu.fi

Tiina Komulainen
tiinamaria.komulainen@gmail.com

Raimo Kaasila
Raimo.Kaasila@oulu.fi

¹ Department of Educational Sciences and Teacher Education, Faculty of Education, University of Oulu, P.O. Box 2000, FI-90014 Oulu, Finland

² Research Unit of Sustainable Chemistry, Faculty of Technology, University of Oulu, P.O. Box 8000, FI-90014 Oulu, Finland

Introduction

Subject teachers are usually interested in the subject matter they teach. In contrast to elementary teachers, they do not need to teach a wide variety of subjects; they can focus on only a few. Becoming a subject teacher, however, includes two central choices: choosing a teaching career and choosing one or several subjects. Motives for choosing a teaching career have been investigated in many studies (König & Rothland, 2012; Paulick et al., 2013; Watt et al., 2012). The findings show that intrinsic value, perceived teaching ability, the desire to make a social contribution, to work with children and adolescents, and having had positive prior teaching and learning experiences are among the highest rated motives (Watt et al., 2012). Although this is not always the case, becoming interested should be the starting point for studies in higher education and teacher education (Rautiainen et al., 2018).

Interest in a particular subject has been found to be a central factor in preservice teachers' decision to pursue a teaching career (Flores & Niklasson, 2014; Heinz, 2015; Manuel & Hughes, 2006; Pellikka et al., 2020; Younger et al., 2004). We can also think of interest in particular subjects as situated in and linked to preservice teachers' developing subject-specific teacher identities (Lutovac & Kaasila, 2018a). Subject-specific interest can translate into preservice teachers' teaching and may consequently impact their students' interest in a particular subject. Indeed, several studies have shown a connection between teacher's enthusiasm and students' interest in a subject (Kim & Schallert, 2014; Lazarides et al., 2018; Lazarides et al., 2019). In some countries, subject teachers have to teach more than one subject, and some preservice subject teachers may not be genuinely interested in the second (or third) subject that they have been "forced" to choose because of educational policies. As different countries have different policies for the choice of the second subject in subject teacher education, the degree of freedom of choice varies considerably. Bezeljak et al. (2020) studied preservice biology subject teachers in Austria and Slovenia and documented their subject choices. For example, at the University of Ljubljana, biology preservice teachers needed to choose their minor among only two options: home economics and chemistry. By contrast, at the University of Vienna, preservice biology teachers could choose one of 27 possible subjects. In Germany, preservice teachers studying mathematics, physics, chemistry, biology, or geography as their first subject can choose the second subject from the same subject group, but they can also choose the second subject among subject groups of languages, social studies, and humanities (Glutsch & König, 2019). The same is true in Finland, where preservice subject teachers are free to choose their subject combinations, although typically mathematics, physics, and chemistry preservice teachers choose their minor subject among these same subjects (Lavonen et al., 2007).

The differences in the policies are important, as they may relate to preservice teachers' interests or lack thereof in the particular subject. For example, in a study with 386 preservice subject teachers, Glutsch and König (2019) demonstrated that preservice subject teachers can rate their interest in their two subjects

differently and that some preservice teachers rated their interest low in both of their subjects. However, high subject interest correlated positively with intrinsic and social motivations. These findings, paired with the implications they may have for preservice teachers' development as teachers and the possible impact on students' interest development, raise the question of whether subject teachers would need to be interested in all the subjects they will teach in the future. Moreover, a strong interest in only one subject also misaligns with the current trend in STEM education, which suggests a more integrated approach to curricular areas and disciplines.

Choosing all subjects from the same subject group could provide some advantages. Bruckermann et al. (2018) studied preservice biology teachers' understanding of the nature of science. They collected data from 232 biology preservice teachers from 20 German universities and found that preservice biology teachers with a science subject (physics or chemistry) as a second subject outperformed participants who had the other second subjects. Neumann et al. (2021) reported that preservice physics teachers may benefit from having mathematics as their second subject and end up with slightly better physics content knowledge compared to those who have some other second subject. The study included 200 preservice physics teachers from 12 German universities, and their physics content knowledge was tested with 59 items covering different physics subjects. Mathematics, physics, and chemistry are closely related sciences, and studying two or even all three of them can provide synergy. This is another point of view to consider regarding subject choice relative to subject interest.

Preservice teachers' interest in their major and minor subjects has not previously been addressed in the research literature. To our knowledge, this study is the first report to address this gap in the research on teachers' interest. To this end, we examined three Finnish preservice science teachers' narratives of their interest in their major and minor subjects. The preservice teachers in our study were studying to become secondary school mathematics, physics, and chemistry teachers. In Finland, science teachers usually study the three subjects mentioned above, and once they graduate, they are likely to teach two of these subjects, occasionally all three. The preservice teachers in this study reported a weak interest in at least one of their minor subjects. Based on the analysis of their narratives, we discuss whether low interest in a minor subject should be a concern and how teacher education could approach this matter. The research questions guiding this study are: *What do preservice science teachers tell about their interest in their major and minor subjects? How can this knowledge inform teacher education?*

Teacher's Subject Interest

Interest has been widely studied and conceptualized by various researchers in the field of educational psychology. In this study, we used the conceptualization of Krapp, Hidi, and Renninger (Hidi, 1990; Hidi, 2006; Krapp, 1999; Krapp et al., 1992), who understood interest as a content-specific motivational variable that includes interactions between persons and their objects of interest. The fact that

interest is always directed at certain content or objects confers special characteristics and is the main criterion of this concept (Krapp, 2007). Interest-based activities involve positive feelings, typically enjoyment and involvement (Schiefele, 1991). In the context of learning, interest can have many positive effects on the learning process and the learning results (Krapp, 2007). Preservice teachers' interest is often directed at a future profession; for many of them, studying is an interphase and a means toward the real goal of the teacher's profession (see also Rautiainen et al., 2018). Dewey (2009) called this a mediated interest. In this study, we focused on individual interest and, more specifically, teacher interest in the subjects of choice. A person has an interest if he or she is actively keen on an object that has personal meaning for him or her.

Interest studies often focus on student interest, and teacher interest has been less studied (Schiefele, 1991; Schiefele et al., 2013). Teacher interest has been studied even less in the context of teacher education. Schiefele and colleagues classified teacher interest into three dimensions: subject interest, didactic interest, and educational interest. In this study, we focused on subject interest, which is interest in the subject matter taught (e.g., mathematics, physics, chemistry). Subject interest covers the curricular content but also broader aspects (Schiefele et al., 2013). For example, a review study by Heinz (2015) showed that preservice teachers' interest in teaching subject(s) was one of the intrinsic motives for choosing teacher education studies. Enjoyment of the subject was the most popular reason for choosing a teaching career among Slovenian English teachers (Kyriacou & Kobori, 1998). Clarke (2009) showed that "love of subject" was ranked as the third highest motive for choosing a teaching career in an Irish study. Further, studies have shown that one's perceived strengths and weaknesses play a key role in the development of interest regarding a subject (Krapp, 2002; Möller & Marsh, 2013; Rösler et al., 2018). For example, Rösler et al. (2018) explored how achievement comparisons contribute to preservice teachers' domain-specific interests in their main subject and in educational studies in general. The findings of the study demonstrated decreased interest in the individual's weaker domain and increased interest in the individual's stronger domain. The above-mentioned studies clearly demonstrate that teachers' subject interest is important in choosing a teaching career and that the choice of the teaching subject may rest upon one's sense of competence in a particular subject; however, little is discussed about the positive or negative consequences that teachers' subject interest might have in the long run.

Methodology

Data Collection

In this study, the participants were preservice secondary school teachers who participated in a course on the didactics of mathematics, physics, and chemistry during their pedagogical studies at the Faculty of Education. Most of them were 3rd year university students, who started soon after their first teaching practicum. In Finland, subject teachers have a master's degree in a given field from the

university faculty in which the subject is taught. Further, they complete a 1-year pedagogical program in the Faculty of Education. After graduation, these preservice teachers will be qualified to teach their major subjects and minor subjects of the 60 European Credit Transfer System (ECTS, a point system used in European universities). Although two subjects (one major and one minor) are enough for graduation, in Finland, many open positions for secondary school teachers in mathematics, physics, and chemistry require applicants to have qualifications for teaching all three subjects. Therefore, many students choose to study all of them. Some preservice teachers study computing science to replace one of the subjects. Preservice teachers can choose other subjects as well, but future job opportunities naturally guide most of them in choosing fixed-subject combinations. Secondary school teachers in Finland can teach in lower secondary school (classes 7–9, pupils aged 13–15 years) or upper secondary school (in Finnish, “lukio,” pupils aged 16–18 years).

The data in this study were collected as part of the coursework in the mathematics, physics, and chemistry subject didactics exercise group taught by the first and third authors. As views or beliefs are of key importance in learning and teaching mathematics and science (Beswick, 2007; Cady & Rearden, 2007; Hudson et al., 2012; Vesga-Bravo et al., 2021), the authors were interested in the students' views of the subjects and designed a questionnaire for this purpose. The participants ($n = 31$; 22 males and 9 females) answered an initial questionnaire about their subjects and their views of their major and minor subjects. The questionnaire also included some open-ended questions, such as “Why have you chosen these major and minor subjects?” and “If you get to choose, which subjects would you like to teach in your future job?” Our aim was to further interview preservice teachers based on their views of the subject; thus, we chose those who showed negative views of a minor subject ($n = 2$), positive views of all the subjects ($n = 2$), positive views of all subjects but insecurity about subject knowledge ($n = 2$), or changed views of a subject ($n = 2$). During the interviews, deeper knowledge was gathered about the preservice teachers' views, and some of these early classifications changed. Some of the questions asked during the interviews were “Tell about how and why have you chosen your major and minor subjects?,” “Have you ever thought of some other options?,” and “What kind of view do you have of yourself as a learner and student and teacher of mathematics, physics, and chemistry?” The interviews were conducted in Finnish, transcribed in Finnish, and, in the later stages of the analysis process, translated into English. The interview schedule (see the Appendix) was designed with the initial aim of understanding the kinds of views the preservice teachers had about the subjects they were studying. Based on the initial analysis of the data, however, interest emerged as a concept often mentioned by the participants, and we decided to examine this concept more closely.

In line with the aim of our study to address preservice teachers' subject interests or the lack thereof, among eight conducted interviews, we identified three preservice teachers who reported having low interest in at least one of their minor subjects. Their pseudonyms are Joonas (major physics, minor mathematics), Mikael (major mathematics, minors physics, and chemistry), and Henri (major mathematics, minor physics, and planning to also study chemistry).

Data Analysis

We applied narrative analysis (Lutovac & Kaasila, 2014, 2018b; Lieblich et al., 1998; Polkinghorne, 1995) to analyze the three preservice teachers' narratives in-depth. In the beginning phase of the analysis, the first and third authors read their interview transcripts in the original language several times to form preliminary ideas regarding the preservice teachers' subject interests. All researchers then discussed these ideas, including how to proceed with the analysis. In the next phase, the first and third authors constructed a coherent and chronologically organized story based on the interview transcripts to account for the preservice teachers' subject interest in their major and minor subjects. In constructing the narratives, the authors used the process of emplotment (Lutovac & Kaasila, 2018b; Polkinghorne, 1995), which begins with identifying the outcome of each narrative. Based on the reading and rereading of each interview, a strong interest in a major and a lack of interest in a minor subject emerged as the outcomes of each narrative presented in this study. To construct a coherent and unique narrative that accounts for each preservice teachers' subject interest, we searched the interview data for key experiences or significant events that would explain how the outcome of the narratives evolved. From each interview, we extracted the most compelling data examples. These examples and their interpretations were again discussed among all the researchers working on the study. The chosen examples were then translated into English and pieced together to construct the three narratives. The narratives presented allow readers to judge whether the interpretations and claims we make are credible, plausible, and trustworthy (Polkinghorne, 2007).

Researcher triangulation was used to ensure the validity of the interpretations (Cohen et al., 2011). During the initial analysis process, the wider data were shared with the second and fourth authors, who also formed preliminary interpretations independently and agreed upon the importance of the significance of the subject interest in the data. Afterwards, when the three narratives were constructed, the second and fourth authors read the narratives and discussed and negotiated the interpretations made. All authors agreed on the final interpretations.

Results

In what follows, we present the narratives of three preservice mathematics, physics, and chemistry teachers: Joonas, Mikael, and Henri.

Joonas

Joonas's major was physics. Although he found the subject quite difficult, he also liked it very much. His minor was mathematics, which has always been very easy

for him, and he succeeded in it. However, Joonas reported that he did not find mathematics interesting. He described his journey with mathematics as follows:

Since I was a first grader in primary school, I have always been amazingly good [in mathematics]. ... It [mathematics] has not been a thing that I have been interested in, but I have been very good at it and therefore like it. ... But in upper secondary school, it became more difficult so that I needed to open the books for the exams, but still, the difficulty is much less compared to the other subjects and ... Of course, in the university. The workload has increased, but I still believe that even here, I find mathematics easy. ... Now that I have been a substitute teacher in mathematics, I have experienced it as natural for me. It is easy for me but did not necessarily transmit meaningfulness. I haven't taught it with enthusiasm. And I think this would be completely different with physics, because it is my thing, I like it, even though I experienced many problems with physics in lower and upper secondary school and in university as well, I like mathematics less than physics.

While Joonas narrated being good at mathematics, he did not find it truly interesting. However, he seemed to feel quite the opposite about his major subject, physics. In what follows, he described his true interest in and enthusiasm for physics:

I didn't like physics in lower secondary school. ... I had an average of 6 [in physics, scale 4–10] in lower secondary school. But then in upper secondary school, we had this one compulsory course in physics, and there, we simply had such an excellent teacher, who enthusiastically did everything with us, like experiments; they demonstrated many things, which was so cool, such as nail explosion and stuff like that. I just followed the course closely. And I got a grade of 9 in that first course of physics, which amazed me ... I got so interested in physics that I wanted to become like my teacher; they became a role model to me. ... It wasn't until during the second and third year [in the university] that I started to study more physics, and it took me so much more time to study it than, for example, mathematics. I experience it [physics] to be really challenging for me. But it is so interesting to me that I have the energy to study it, and I have the drive to do it. Hmm, those [physics subject content things] have been [interesting] probably because ... They are very concrete, I see them every day, like in everyday life. And the greatest enthusiasm might have started in upper secondary school when the teacher showed us all those demonstrations, and we did experiments ourselves. Those were almost like magic tricks we did, so maybe I had been enchanted a bit.

Joonas narrated his memories of mathematics classes in upper secondary school:

[During the mathematics classes], we calculated. We calculated and did the tasks on the whiteboard; we did homework, and so on. It is actually an interesting question as to how mathematics can be made different. It is a good question for me, too, because I am going to teach it as a minor subject. So, what kind of applied mathematics lessons could there be? Could mathematics be done in small groups? and so on. Maybe my attitude toward group

work in mathematics is like “how,” because I feel that the aha experience is more individual, so it would be difficult to handle mathematics like that. This is a really difficult question, and I might not know how I would teach mathematics more interestingly.

Joonas also narrated how he felt about teaching both subjects:

I think my subject knowledge in mathematics is good. I am very good in it, and I know the things, but I am not so interested in it, and I don't know how it will show up when I am a teacher. ... Physics is still challenging for me; so even though it is interesting and I am enthusiastic about it, it is a thing that I have to put some effort into during the practicum. I know I certainly have the enthusiasm, but I need to learn to teach the subject content properly. I need to have something in my head to teach it to them. ... For me, it would be ideal to teach only physics. But I believe it would actually enhance my interest in physics if I had to teach mathematics, because I will remember that well. I also do not find mathematics so interesting, so I am very lucky to teach physics. But mathematics will bring some variety to the studies of the course. ... Well, our upper secondary school physics teacher was so good; it may reflect the fact that he had more knowledge about science; he knew physics much more, and because he was just a physics teacher and didn't teach both physics and chemistry, he had stronger enthusiasm in his work. ... I have huge difficulties picturing myself as a mathematics teacher. I see myself as a physics teacher who sometimes teaches mathematics.

As shown above, due to his knowledge of mathematics, Joonas felt confident about teaching the subject. However, he was somewhat insecure about his subject knowledge of physics. He would like to teach only physics, as he believed that his upper secondary school teacher was a good teacher, partly because he or she taught only physics. Lastly, Joonas also narrated that if he had a better mathematics teacher during his school days—one that was inspirational and could have made him interested in the subject—perhaps he would have become interested in mathematics and ended up having mathematics as his major. His memories of the mathematics classes in upper secondary school gave the impression that he had participated in quite traditional, teacher-led mathematics classes. However, he found his physics studies at the same school level very inspiring. He also emphasized how meaningful the teachers' interest in the subject is for the students. He hoped that he could still find inspiration to teach mathematics in the future.

Mikael

Mikael's major was mathematics, and his first minor was physics. He would have liked to study music as his second minor, but he felt it was not an acceptable choice. He felt that physics and chemistry come into a package with mathematics, and that is why he eventually chose chemistry:

Well, I applied to study mathematics at the university; I was especially interested in mathematics. I was planning to be a mathematics teacher, maybe not a mathematician. ... During the first year, I don't even remember why I started to study physics, maybe when I had to choose between physics and chemistry. Somehow, I ended up studying physics. At the beginning of the third year, I discussed with my study tutor that it would be good to take a third subject. It would be useful for a job search in the future. So maybe it wasn't even my own choice to study physics and chemistry. It feels as if they are included in the package with mathematics. ... When I applied to a subject teacher education after upper secondary school, I asked if it is possible to take music as a minor subject ... But in the mathematics department, they didn't think it was a good idea; they said maybe not, rather something more traditional. ... In a way, I have had a feeling that I would have preferred to take music, history, or physical education as a minor subject. I understand it well; teachers should think about the job market, but I don't have the same kind of enthusiasm for chemistry as I have for physics and mathematics ... I really like chemistry laboratory experiments, but I think the theory is somewhat boring. ... Well, [chemistry] experiments are nice and fun, I liked them very much. The more cracking and bursting there is, the better. And the experiments have been kind of mainstay for me to learn chemistry, the reason why I have been able to study it ...

Further, Mikael said that his lower interest in chemistry might have been caused by the fact that he studied many different courses in a short time frame and did not have time to focus only on chemistry. He also described teaching his major and minor subjects and the role subject interest played in this:

Well, I managed well with comprehensive school and upper secondary school mathematics and physics. I am confident because I have good average grades in them here, and they have always been very clear to me. I trust that I will survive teaching these subjects. It is easy if I can explain things mathematically. However, I am afraid of chemistry because it has so many vocabulary and terms, and I always fail with them, particularly if there are some words that I have to explain, interpret, or remember. That is the thing I am most afraid of. ... Well, I think that from the point of view of a pupil, it can be nice if I can bring my enthusiasm as a resource to the class, and it wouldn't escalate to some massive and fast transparency presentations, but rather I could bring my own enthusiasm into mathematics and into applications too, to make some experiments and so on. ... During one of my courses, we discussed how the teacher's motivation significantly affects pupils' willingness to work and be a part of the group. I think it is very important that the teacher is interested because then he or she is working hard, and maybe even the mood can be transferred to pupils. It is not the purpose itself, but it might be a great help for learning. I think it is a good thing to have a certain passion and enthusiasm for the subject, but it must be implemented reasonably. ... I would not want it [lack of interest in chemistry] to affect my pupils. I am afraid it might shine through if there is a dull subject. Or then I will get around the problem and take the subject in the direction I want and sort of take more experiments and demonstrations there, which will bring in my own enthusiasm, and when I start to explain based on that,

perhaps there will be more students ... willing to do it. And I like chemistry, for real. I mean, I wouldn't be upset to teach chemistry classes.

Above, we observe that Mikael felt that he had sufficient subject knowledge in mathematics and physics. However, he was afraid of teaching chemistry because he felt that there was a lot of vocabulary and terms to remember, which he seemed to have difficulty with. Mikael acknowledged that a teacher's interest in his or her subject is important, and he would like to overcome his own lack of interest in chemistry. Mikael thought that chemistry could be interesting if more experiments were performed. Similarly, many secondary students have reported having few experiments in school chemistry, although experimenting is an important part of good-quality chemistry teaching.

Mikael discussed how his class had done a hydrogen bomb in a bottle, among other experiments in lower secondary school chemistry classes:

Back then, it was very fascinating and would still be. I think I will do such experiments myself if they are still possible in the future, something really concrete with the help of chemistry. So, I think those are among the best memories. ... In my opinion, quality chemistry teaching includes good reasoning and pupils doing experiments by themselves. So, I think functionality is very meaningful. And often, the chemistry tasks are like 'tell how you would prepare something'. The whole field of science aims to be useful ... like useful science. So, I think the practical side needs to be brought out strongly.

Mikael seemed to have memories of quality chemistry teaching. However, he was more interested in other subjects, such as mathematics, physics, music, history, and physical education and not as much interested in chemistry. Chemistry was rather low in his personal preference, which was not clearly explained by his past experiences. He admitted, however, that chemistry studies at the university had felt a bit burdensome, which partly explained his slightly negative feelings at the time of the interview.

Mikael thought that being interested has some impact on his teaching:

How it [being interested in mathematics] affects my teaching is that I would like to reason the usefulness of mathematics with the facts of how all our infrastructure and everything works under the laws and rules of mathematics. Everything is based on someone's knowledge of mathematics. All techniques are based on mathematics, even when school mathematics possibly seems to be very distant from it but ... Maybe it helps to understand the world surrounding us, and ... it is so universal. I think that's why it is valuable in itself.

Henri

Henri's major was mathematics, and his minor was physics. He was also planning to study chemistry as a third subject. He felt that he was not good at chemistry, but he thought he needed to study the subject to secure a job in the future:

[I chose] mathematics because it was my strongest subject in school, so I became interested in it. Besides this, physics came into the picture mostly

at the university because math and physics are connected to each other. And then, because of the employment situation, I decided 'why not to take chemistry as well'. That's how, we get a combination of these three. ... I am not quite sure is it necessary [to have three subjects], but I understand that it could help secure one's position [in the job market]. ... [I want to teach] Mathematics, for sure. Apart from that, I could take physics. Chemistry—I would like to teach it, but I haven't studied it at the university yet, so I can't dare to say whether I want to teach it or not. My success in upper secondary school wasn't very good. But I hope I want to teach it, too. Let's put it like this: physics and math are my strong candidates.

Henri described his memories of mathematics classes in upper secondary school:

He or she [mathematics teacher] was one reason why I decided to become a teacher, now that I started to think about this. The desks were arranged so that there were rows of four persons in three columns. In practice, we calculated the tasks together. In practice, it was never planned, or no one talked in the beginning, but we just started to work in those groups automatically. It did not matter whether you knew your group members or not; everybody just started doing the tasks together in groups of three or four persons. And it was a very good method. In the beginning, we were shy and not much was said, but during the second and third years, everybody was asking and explaining diligently and willingly.

Henri was unsure whether he wanted to teach chemistry in the future, as he felt that he had not studied it enough yet. He narrated his memories of chemistry from his years at school as follows:

My memories of chemistry are very limited, and I am not as interested in it as I am in math and physics. I'm choosing it just as a third subject, and it feels partly like a demand. There are not many memories of it ... Ummm in lower secondary school, we did experiments, just like in physics. ... In upper secondary school ... I do not know, but chemistry was really challenging. I don't know why, but I didn't succeed in it at all. I just passed through it somehow in the end. ... Well, physics is so ... it is everywhere, but chemistry is more based on atomic level and so on. I think that this might have made it more difficult for me. So maybe in upper secondary school, I wasn't yet able to concentrate on such a small area. ... This might be a bit exciting word choice, but I got a father-like feeling of him [chemistry teacher in upper secondary school], he was exciting, but he also was a very relaxed and funny guy. He didn't try to be funny during class, but you noticed it when you talked with him outside the classroom. He taught us in the upper secondary school these chemistry labs, and I noticed that he was this sort of relaxed, funny guy. And I think he really knew how to teach and so on, and now I wonder even more why I didn't succeed with chemistry in upper secondary school. I don't know the answer. It gets more interesting at

this point when I say that even the teacher was good. ... I don't understand chemistry, in practice. It's a bit of its own exciting sector. I have been hoping that maybe I need to get to know it better here in the university and maybe there will be a review of previously learned stuff like, okay, it goes like this and so on. I hope I will have some enlightenment, like, okay, this is not so hard after all now that I get to know this; that is what I hope.

According to these excerpts, Henri was not as interested in chemistry as he was in mathematics and physics. He felt that he did not understand chemistry. He was hoping, however, that he could learn it, and he acknowledged the importance of teachers' subject interests:

[Quality teaching in physics is] to make pupils think about some things they see, like what is the thing there, why it happens, and in practice, doing demonstrations and modeling those things. And favorably, let the pupils do it by themselves. Because it is even better that they can do it by themselves and get the wow experience. Then some teaching may be added about why it happens, what is the thing there, what is the magic behind, and what is it based on. ... I think good chemistry teaching is the kind of teaching I had when I succeeded; it is the same I had in physics—an inspirational or enthusiastic teacher who is genuinely interested in the subject matter, and who can explain the thing like it really goes and what is the theory behind it and so on. The same kind of teaching that I had in physics. ... You will notice it during the lecture, if the teacher is interested in the subject or not. If he or she is approaching pupils, well not approaching, but he or she has a relaxed attitude that says that he or she understands, is interested in the subject and wants to tell about it, to teach. ... [My view of good teaching in mathematics has not changed] ... Not much, in the end. Perhaps there is a slight emphasis on how important it is to be interested but, otherwise, quite the same. ... Well, I am less interested in it [chemistry], so I suppose it is the main thing; as I said, interest is important. I am a little bit interested, but I hope it will improve here at the university.

Discussion

In this study, we examined three preservice subject teachers' narratives about their interest or lack thereof in their major and minor subjects. In the future, all three preservice teachers will teach 1–3 subjects, that is, mathematics, physics, or chemistry. To our knowledge, preservice subject teachers' own thoughts about their subject interests have not been addressed before in the literature; thus, our study makes a valuable contribution to the existing, although limited, body of knowledge.

In response to our first research question relating to what preservice science teachers tell about their interest in their major and minor subjects, we observed that Joonas, Mikael, and Henri had all chosen their majors based on their interest in those subjects. This is in line with the finding that interest in the particular subject is an important factor in preservice teachers' decision to select a teaching career (Flores & Niklasson, 2014; Heinz, 2015; Manuel & Hughes, 2006; Younger et al.,

2004) However, the choice of the minor subject(s) was driven by various reasons, the common ones being the job market demand or the expectations regarding the kind of subjects that can be studied together. Most importantly, our findings revealed that each of the preservice teachers in question had one minor subject that they were not genuinely interested in and for different reasons.

Joonas found mathematics boring, although it was his strongest subject. In the past, he had experienced quite traditional and teacher-led mathematics teaching, which might be one reason for his feelings of boredom. Mikael was not interested in chemistry and felt uncertain about his skills in the subject, along with the fact that it was not really his choice to study it. He could have chosen, for example, music, which was his dream, because in Finland, preservice teachers are free to choose their subjects, but he decided to follow recommendations and knowledge about working life demands. Mikael did not dislike chemistry, but he preferred many other subjects. Perhaps the biggest issue was the feeling that choosing chemistry was not genuinely his own choice, and he also experienced recent chemistry courses at the university as somewhat burdensome. He was excited about experiments, and he thought they were part of quality chemistry teaching, pointing out the importance of the practical side of this school subject. Henri did not have particularly good memories of the school chemistry but felt that chemistry was demanded by working life. He thought his upper secondary school chemistry teacher was good; nevertheless, he felt that he had personal shortcomings in understanding chemistry.

Henri compared quality chemistry teaching to quality physics teaching and thought they were similar. It seemed that his difficulties in understanding some basic concepts of chemistry could be the cause of his lower interest in the course. There is plenty of research on learning difficulties in chemistry, and one of the most important factors has been identified as the interplay between macroscopic and microscopic worlds (Sirhan, 2007), which Henri, indeed, referred to when he alluded to chemistry as being based on the atomic level. At the time of the interview, Henri had not yet started his chemistry studies at the university, so he still had a good chance of improving his subject knowledge in the course. If he overcomes these difficulties, he can turn his experiences into strengths as a teacher by better understanding students who experience difficulties with the subject.

Interestingly, the narratives of the preservice teachers also suggested that being good in a particular subject does not necessarily translate into being interested in it and vice versa. For example, Joonas explained that he had always been talented at mathematics and that it had been very easy for him, but he found it utterly boring. Instead, he loved physics, which had always been a challenge for him, but the connections between the subject and everyday life made it interesting. Lastly, our findings showed that while all three preservice teachers revealed a lack of interest in their minor subject(s), they also expressed that subject interest was of utmost importance for their future teaching, particularly as it may impact their future students. This is in line with the finding that there is a connection between teacher's enthusiasm and students' interest in a subject (Kim & Schallert, 2014; Lazarides et al., 2018; Lazarides et al., 2019). During their own school time, these preservice teachers have experienced this themselves: some of them had enthusiastic teachers who showed interest in the subject they were teaching (see also Lutovac & Kaasila,

2018b; Lutovac, 2020), which also awakened interest in them as secondary school students. However, Joonas experienced “traditional and boring” mathematics teaching; in addition to the fact that this might have made him less interested, there is a danger that he will adapt this teaching style and transfer the same feelings to his future students. Low interest may cause many problematic outcomes because teacher interest is reported to have a positive impact on career satisfaction (Eren, 2012), enjoyment, and feelings of flow (Schiefele et al., 2013). Overall, the three preservice teachers in this study believed that a teacher’s interest can have an impact on how a student experiences a certain subject and that a teacher’s interest can be used as a resource for teaching. This suggests that they identified their lack of interest as a potential problem and were worried about its impact on their teaching.

As teacher educators, we were also puzzled by the question of how the knowledge gained from these narratives could inform teacher education, which was our second research question in this study. Most of our students (from a wider sample) reported being interested in their major and minor subjects. Nevertheless, we were able to identify four students, three of whom we addressed here, who were not interested in their minors. These findings raise a series of questions: Is future teachers’ lack of subject interest a problem? Is it better to take three subjects that most likely match the job demands, or is it more important that future teachers are interested in their subjects? In what way can a lack of subject interest affect teaching? In what follows, we provide some thoughts to consider in teacher education.

As subject choice may impact teaching motivation, we agree with Glutsch and König (2019) that it is important for preservice teachers to choose subjects they like and think are important to them and others. In Finland, preservice subject teachers who have mathematics, physics, or chemistry as a major subject usually select minor(s) among these three subjects too, because open teacher positions may and often do include all three subjects. It is beneficial for them to study all three to increase their chances of obtaining a desired job. However, interest and becoming interested should not be taken for granted (Rautiainen et al., 2018), and just because some subjects are conceived of as a “package” and should be studied together does not necessarily mean that the students will display the same interest in them. Provided that the personal meaning of the subject is highly relevant to the interest of the preservice teacher (Rautiainen et al., 2018), the possibility of studying even one subject could be an option. Mathematics, physics, and chemistry are rather demanding subjects, and studying all three of them at the university level requires a lot of work. Studying only two of them could make it possible to delve deeper into the subjects and have stronger content knowledge. However, as long as the job market guides the subject choices, it is natural that preservice teachers make choices that guarantee them a good position in the job market. Unfortunately, this encourages preservice teachers’ mediated interest (Dewey, 2009); as in reality, they choose only one subject in line with their interests and the others because of the requirements of their future profession.

What we could do in teacher education is to support preservice teachers’ professional development in subjects they do not find interesting for various reasons, and some studies have shown that it is possible to support interest development (Kiemer et al., 2015; Kosiol et al., 2019). In our data, all three interviewed

preservice teachers who lacked interest in one of their subjects recognized it as a possible problem. Recognition is the first step in addressing the problem, and teacher education can help in this process. For example, Mikael thought that he could make chemistry more interesting by demonstrating many experiments. This is very much possible, as experiments are always part of quality chemistry teaching. Joonas thought that mathematics was boring because he thought it did not have real-life connections like physics. However, there are tools and possibilities to make learning mathematics more connected and concrete.

Further, as acknowledged by the vast literature on the importance of autobiographical experiences for teacher development, we argue that an in-depth retrospective approach to understanding preservice teachers' prior experiences with their majors and minors would help uncover and explain preservice teachers' differing interests in their major and minor subjects, not only to teacher educators but also to the preservice teachers themselves. This may ultimately initiate potential changes in their subject interests. We also suggest that a longitudinal approach, including the phases from the beginning of initial teacher education and to the in-service teaching, would be necessary to determine whether subject interest can at all be influenced during teacher education (Glutsch & König, 2019) and whether it can change as a result of practical experience during the in-service phase.

Finally, given the nature of this small-scale study, we are cautious about avoiding any generalizations of our findings to other contexts. As identified earlier, educational contexts differ and so do educational policies regarding preservice subject teachers' choice of the subjects they will study and teach in the future. Thus, our findings might benefit the most those teacher educators working in contexts that resemble the Finnish context, requiring future subject teachers to study more than one subject discipline. We are of the opinion that in such contexts, teacher educators can rather easily identify similar cases as the ones presented here in their courses. However, it is important to note that even in those countries where preservice teachers have the freedom to choose their minor subject from different subject groups, there are various reasons behind the choices, and the reason is not always interest. For example, Glutsch and König (2019) found low subject interest even though German students can freely choose their subject combinations. The study did not report the reasons behind the subject choices; therefore, we are not able to compare whether these reasons are the same or different than in the Finnish context. However, for those teacher educators and researchers working in contexts that allow for a greater variety of subject choices, including the possibility of studying a single subject discipline, this study hopes to open up a discussion on the importance of subject interest in becoming a teacher, which is currently an underexplored research area that needs more attention. In particular, our finding that interest in a subject and being good at it do not necessarily go hand in hand might benefit more exploration in educational contexts other than the one discussed here. Lastly, our observation that preservice teachers' lack of interest in the certain subjects they will teach in the future might be an issue is, therefore, something worth considering and exploring further.

Appendix

Interview schedule

- 1) Tell about how and why you have chosen your major and minor. Have you thought of some other options?
- 2) How do you see the connections between mathematics, physics, and chemistry?
- 3) Do you think one of these subjects is more important than the others?
- 4) Tell about which subjects would you like to teach after graduation? Give a reason for your answer.
- 5) Tell about the memories that first come into your mind of studying mathematics/physics/chemistry at school.
- 6) Tell about the kind of experiences you have about studying mathematics/physics/chemistry at the university.
- 7) What kind of view do you have of yourself as a learner/student of mathematics/physics/chemistry?
- 8) What kind of view do you have of yourself as a teacher of mathematics/physics/chemistry?
- 9) How would you describe good-quality teaching in mathematics/physics/chemistry? Give a reason for your answer.
- 10) Do you have experiences of failure in mathematics/physics/chemistry? If there is, tell about those you remember first.
- 11) Does your view of mathematics/physics/chemistry influence how you feel about teaching it?
- 12) Has your views of mathematics/physics/chemistry during your years at school changed since university? If they have, tell about it.
- 13) If your views have changed, give examples of experiences that influenced the change.
- 14) If your views have changed, have your view of good-quality teaching changed?
- 15) Do you consider yourself to be:
 - a. A specialist of a single subject (if so, which?)
 - b. A natural scientist?
 - c. An educator?

Give reason for your answers.

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