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Scientific methods assignments as a basis for developing a profession-oriented inquiry-based learning approach in teacher education

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ABSTRACT

Numerous studies emphasise the contribution of inquiry-based learning approaches to positive learning outcomes for students; however, in this study, we explore how a scientific methods assignment may qualify as a profession-oriented, inquiry-based learning approach in teacher education. The paper presents analysis of student teachers' reports on a scientific methods assignment completed during their fifth school placement. The student teachers were each required to conduct a focus group interview with a group of pupils. The overall aim of the assignment was to integrate aspects of inquiry-based learning and a profession-oriented approach. Our analysis demonstrates that the scientific methods assignment qualifies in some ways as a profession-oriented, inquiry-based learning assignment. However, several aspects of the assignment need to be improved and further developed to optimise its potential. The paper is concluded with some suggestions for further developments.

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Introduction

Teachers' professional work is complex. On a daily basis, they make numerous instant decisions followed by a variety of actions; hence, they need knowledge and skills to identify, assess and justify their choices and actions (Jenset, Hammerness, and Klette 2018). Teacher education (TE) programmes around the world have been heavily criticised for being too theoretical, for not preparing prospective teachers for professional practice and for lacking a profession-oriented approach (Afdal 2017). Such knowledge and skills may be developed through research-based educational courses or programmes (and activities), and may help to equip prospective teachers with the ability to manage and develop their complex work activities as professional teachers (e.g. Jakku-Sihvonen and Niemi 2006; Jyrhämä et al. 2008; Westbury et al. 2005). Requirements for research-based higher education programmes have gradually gained recognition internationally over the past decade (see e.g., Afdal 2017).

Although the idea of research-based TE is widely recognised among researchers, teacher educators and teachers themselves, relatively few studies report on how to actually design such courses and activities in TE. A range of pedagogical approaches

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have been suggested that emphasise investigative work (generally in collaboration with others) with knowledge in other educational fields (e.g. Aditomo et al. 2013; Spronken-Smith and Walker 2010). Inquiry-based learning (IBL) is considered within the category of investigative approaches to teaching and learning (Damsa and Nerland 2016). Defined as a 'pedagogy which best enables students to experience the processes of knowledge creation' (Spronken-Smith 2012, 5), IBL differs by incorporating empirical observations, data or complex real-world problems in the learning process (Prince and Felder 2006). An overall aim of IBL is that such learning activities position the students as agents who produce new knowledge and meaning through exploration (Damsa and Nerland 2016).

This paper reports on a study that is part of a longitudinal project. In Afdal and Spernes (2018), we reported on how the *Science of Education* course was designed and redesigned so that the teaching and learning activities would meet the requirements of a research-based programme. In the present study, we report on an IBL activity that we designed as part of the research-based feature of the course. We developed a scientific methods assignment to meet the requirements for a research-based and profession-oriented approach, which would be completed during student teachers' school placement. The assignment was required to integrate aspects of IBL and a profession-oriented approach.

In this paper, we present an analysis of student teachers' reports on the assignment. The main research question driving our analysis was as follows:

> *In what way(s) may a scientific method assignment in TE qualify as a profession-oriented IBL approach?*

In the following, we first provide an overview of earlier research and conceptualisations of IBL. Next, we introduce the context of the study, the data and the analytical strategy before imparting the results of our analysis. The paper concludes with a discussion on the ways in which our scientific methods assignment may actually qualify as a profession-oriented IBL activity.

2 Conceptualising inquiry-based learning

To explore how our assignment might qualify as an IBL activity with a profession-oriented profile, we considered the following questions: (1) How does IBL support and enhance student learning? (2) What are the characteristics of IBL? (3) How might IBL be organised? and (4) How can IBL benefit prospective professionals? In the following, we refer to previous research on IBL activity in higher education.

2.1 How does IBL support and enhance student learning?

Various reasons have been suggested in support of promoting IBL. A common argument is that inquiry is thought to support and enhance students' learning by eliciting both a critical mindset and problem-solving abilities, affording active and productive participation in work supported by knowledge (Damsa and Nerland 2016). Hence, IBL activities provide students with opportunities to explore questions, problems and knowledge, which enable the potential to 'make transparent particular characteristics of the way students employ knowledge and learn to perform practices specific to their future profession' (Damsa and Nerland 2016, 276). Damsa and Nerland (2016) further argue that in professional

programmes, IBL requires engagement with real-life settings. This requires curriculum design, in which the boundaries between the learning space of institutional contexts and professional practice are (to some extent) loosened, and learning activities that can engage the students with profession-specific knowledge and practices. This could also offer opportunities to illuminate how actions and new insights might be realised in the intersection of abstract knowledge resources and practical situations.

Weaver et al. (2016) recognised the importance of writing as a tool for developing inquiry and analytical skills in IBL. They argue that writing is a tool for learning, and students who write down their IBL results build connections between prior and new knowledge. They found that the most significant result of the written IBL activity was that the students' performance related to critical thinking was significant improved.

2.2 What are the characteristics of IBL?

Justice et al. (2007) developed an inquiry process model based on the following six steps: (1) engaging a topic and building basic knowledge, (2) developing a question, 3) identifying resources and gathering information, (4) assessing information, (5) weighing evidence and synthesising understandings, and (6) communicating new understandings.

Similarly, Spronken-Smith and Walker (2010) identified some of the same steps, claiming that an IBL approach is (1) driven by a question, (2) based on a process of constructing knowledge, (3) student-centred, involving learning by doing, (4) dependent on students taking increasing responsibility for their learning, and (5) focused on the process of research instead of concentrating on the end result. They differentiated between three specific modes of inquiry as structured inquiry, in which the teacher provides the issue and outline of the process; guided inquiry, in which the teacher provides questions for the inquiry but the students make their own choice about how they will conduct the inquiry; open inquiry, which involves students choosing both the questions and the form their inquiry will take approach). Spronken-Smith and Walker (2010) also identified important qualifiers for initiating an IBL process as the level of scaffolding provided by lectures and whether students should explore existing knowledge or develop new knowledge.

Taking a slightly different approach, Levy and Petrulis (2012) explored how first-year undergraduate students themselves characterised the IBL process in various programmes. Using data derived from interviews with 29 students in their first year of programmes in the arts, humanities and social sciences, Levy and Petrulis found that students characterised the process as gathering of information, exploring others' ideas, evidencing and developing students' own ideas, and making discoveries. Based on their findings, they developed a model that described IBL as moving from active learning to real research, or as Levy and Petrulis (2012, 97) claimed, from 'inquiry for learning' to 'inquiry for knowledge building'. The first level – inquiry for learning – refers to when students explore existing knowledge and the final level – inquiry for knowledge building – refers to students developing new knowledge.

2.3 How might IBL be organised in a course or a programme?

The conceptualisation of undergraduate research and inquiry has been influenced considerably by the work of Healey and Jenkins (2009). Their conceptualisation draws on numerous examples of good practice in the field of undergraduate research on IBL. They designed a model, mapping the nature of undergraduate research and inquiry that included research, teaching and learning. Their model demonstrated four ways to engage students with research and inquiry in higher education: research-led engagement (through which students learn about current research in the discipline); research-oriented engagement that develops research skills and techniques; research-tutored engagement that relies on research discussions; and research-based engagement that undertakes research and inquiry. Healey and Jenkins also argued that the nature of the activities could range from emphasising the research content (conceptual), the research process (procedural) or research problems. They further argued that higher education traditionally emphasises activities in which students more commonly serve as an audience.

2.4 How can IBL benefit future professionals?

Billett and Choy (2014) claim that IBL approaches provide opportunities to integrate academic learning processes and outcomes with learning for professional practice, thereby maximising educational benefits. Thus, IBL activities position students as active learners, which is beneficial for both settings. They also claim that professional practices can be significantly messier than depicted in a higher education setting, and IBL activities may provide a reality check for students. Learning in practical settings through IBL may therefore develop and/or strengthen professional identity, as students gain the opportunity to develop individual and social beliefs, attitudes and understandings about their professional role through practice-based experience. According to Billett and Choy (2014), practising and developing an IBL attitude may also lay the groundwork for developing effective professional capacities in terms of procedure and theory, developing profession-specific knowledge, and developing effective practitioner-learners across the professional lifespan. Their final argument concerns the benefits of IBL activities for students in professional programmes (such as TE). They state that such activities may secure smoother transitions to professional practice, because prospective teachers will have already experienced how they can explore, challenge and develop practice and have developed skills for approaching potential uncertainties.

Justice et al. (2007) understand IBL activity as a tool to provide the students with an educational environment that requires students to become 'self-directed and engaged learners' (201) to develop skills 'to navigate in a diverse, complex, and changeable careers' (203), and to become 'lifelong learners' (202).

As this review demonstrates, initiating IBL activities is not a straightforward process. Activities need to be carefully designed in relation to desired learning outcomes and available knowledge resources and various practices should be taken into account in relation to each other. In the next section, we give an account of the context of our study before presenting the data and the analytical strategy.

3 Designing a profession-oriented IBL activity

As outlined in the introduction, the focus of this study was one cohort of student teachers' and their IBL experiences as they progressed through the 60-ECT-credit course *Science of Education* in a Norwegian TE programme. The student teachers were required to participate in six school placements (each of three weeks' duration) during their three-year course. In all but the final period (which was related to their bachelor thesis), they were required to complete a scientific methods assignment. This was focused on observation and interviews because these methods most clearly relate to teachers' everyday practices.

The scientific methods assignment was carefully designed to position our student teachers as active participants (cf. Healey and Jenkins 2009; Spronken-Smith and Walker 2010), and the assignments were designed to be conducted sequentially. The IBL activities ranged from emphasising the research content to participating in a research process (cf. Healey and Jenkins 2009). Throughout the whole course, the intention was that the level of scaffolding should decrease as the student teachers experienced the various assignments from the first to the fifth semester. As a point of departure for our design, the inquiry process assumed an active orientation towards all the steps in the IBL activity, and by the fifth semester, the student teachers had practised a full cycle of reporting on an entire empirical study relatively independently (see Figure 1).

During the fifth school placement, the student teachers were required to conduct a focus group interview with a group of pupils on how the pupils experienced the transition from primary to lower secondary school. Using this as a common overall research question, the student teachers were required to complete the assignment in accordance with the steps shown in Figure 1. These steps were a guideline for developing their written report. Table 1 presents the student teachers' working process.

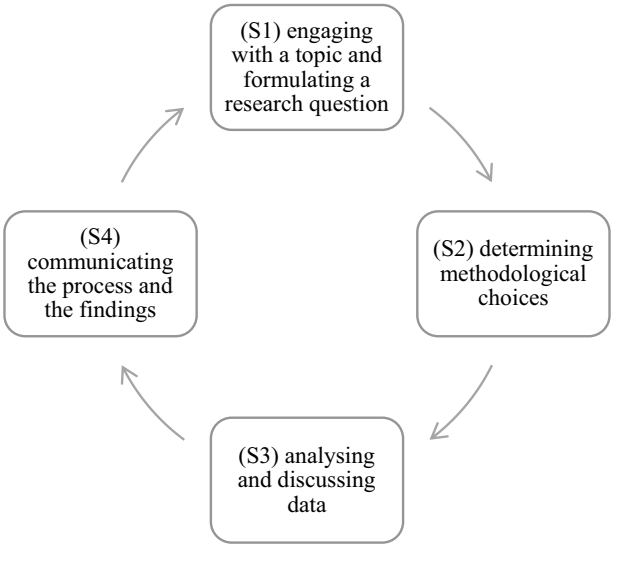

Figure 1. The scientific method assignment in the fifth period (based on Justice et al. 2007; Spronken-Smith and Walker 2010).

Table 1. The student teachers' working process with the scientific method assignment in the fifth semester.

Arena	Activities
At campus	Lectures about the overall theme: pupils transitions between school levels Lectures about the scientific method, how to practice a focus-group interview Workshop in practice groups, supervised by the teacher educator and the supervisor from school discussing possible more specific research questions
At school	Plan the focus-group interview together with the teacher educator and their supervisor Collect data, individual or in pairs
Self-study	Transcription, analysing, read theory and write the report

Table 2. Overview of desired academic outcomes and professional capacities.

Desired academic outcomes The student teacher should acquire:	Desired professional capacities The student teacher should:
• knowledge from and about educational research, and start to explore actively the knowledge base in response to questions, problems and scenarios in/from professional practice • knowledge about how to plan and conduct a focus group interview • abilities to connect and negotiate theoretical and empirical resources • knowledge about pupils' experiences in transitions between school levels knowledge and experience of academic writing while pursuing their own questions or lines of inquiry	• develop the attitude of an active learner • develop skills for critical reflection in and on professional practice • integrate research-based and practice-based knowledge • make theory-based decisions in and for practice • be able to identify and determine professional challenges and explore them systematically • develop communication skills • be able to identify shifts in pupils' needs

As Table 1 demonstrates, the student teachers were engaged with the scientific methods assignment on campus, in their school placement and as self-study – throughout the entire study process.

Our aim in developing the scientific methods assignment was twofold: to contribute to the student teachers' academic outcomes *and* their professional capacities. For this reason, we formulated both 'desired academic outcomes' and 'desired professional capacities' beforehand (see Table 2).

The main research question in this study was: In what way(s) may a scientific method assignment in TE qualify as a profession-oriented IBL approach? Based on the preceding context, we developed more specific sub-questions, as follows:

(a) What type of knowledge resources do the student teachers utilise in their written reports, and how may the student teachers use the report to become more conscious about the knowledge generated through the assignment?
(b) How might student teachers be provided opportunities to practice knowledge and skills valuable for becoming inquiry- and profession-oriented teachers by conducting a small-scale focus group study?

The concept 'knowledge resources' (sub-question a) is understood in this paper to be the conceptual, procedural and practical resources (ref.) to which the student teachers refer when reporting on their assignment. The concept 'inquiry-oriented teachers' (sub-question b) is understood to be professionals with the capacity to observe, analyse and develop their teaching.

4 Data and analytical strategy

The cohort involved in this study comprised 47 student teachers, who were able to choose to work on the assignment individually or in pairs. This resulted in the submission of 31 reports from the student teachers' school practice in the fifth period. The reports were approximately 1,500 words in length.

We conducted the analysis in three steps. First, we read the reports inductively to gain an overview of their content and to determine how data concerning our predefined desired academic outcomes and professional capacities could be derived (Table 2). More specifically, we noted the concepts and the passages in the reports that could be understood in relation to the desired academic outcomes and the profession-oriented capacities. Then, we conducted a theory-inspired content analysis of the reports based on the three following categories: (1) core components and ways of understanding the inquiry process (cf. Figure 1); (2) types of knowledge resources generated and utilised by the student teachers (see left column of Table 2 summarised as conceptual, procedural and practical resources); and (3) desired profession-oriented capacities (right column of Table 2) visible in the texts. Here, we use excerpts from the reports to illustrate our findings. While translating the excerpts from Norwegian to English, we strove to maintain the oral format.

5 Results

The two specific sub-questions provide the structure of our analysis: 1) types of knowledge resources utilised by student teachers in their reports and 2) how IBL prepares inquiry- and profession-oriented teachers.

5.1 Knowledge resources generated and utilised by student teachers

By giving student teachers a scientific methods assignment during their school placement, the aim was to not only make existing knowledge on the topic known to them, but also enable the student teachers to generate new knowledge themselves (cf. Damsa and Nerland 2016; Levy and Petrulis 2012; Spronken-Smith and Walker 2010). Our analysis of the reports demonstrated how the student teachers utilised their theoretical, methodological and practical knowledge resources in different ways, and how they generated new knowledge related to the topic of pupils' transition between primary and lower secondary school. In the following, we report on how the student teachers described, justified and negotiated the three steps (S1–S3) in their written report (S4) (as per Figure 1) related to the desired academic outcomes for the scientific method assignment (bullet-points in Table 2).

Our first desired academic outcome was that student teachers should:

- acquire knowledge from and about educational research, and start to explore actively the knowledge base in response to questions, problems and scenarios in/from professional practice

A core feature of the student teachers' assignment was the research question (cf. Justice et al. 2007; Spronken-Smith and Walker 2010). Even where the student teachers were

provided with a main topic (pupils' transition between school levels) and a main research question (what were the pupils experiences of the transition between primary and lower secondary?), they had to limit the topic to the specific professional or social conditions of their school placement and further develop a more specific research question (S1). We found three different approaches taken by student teachers when limiting the topic and developing their research question (S1). First, we found that about half of the student teachers followed the instructions and narrowed down the overall theme of 'transition between primary and lower secondary school' to a specific topic within this theme. These student teachers also developed a precise research question, and some justified their choice; for example, as one student teacher stated: 'When I developed the research question, my point of departure was the core curriculum and the required learning outcome in the curriculum'.

Second, our analysis showed that almost half of the student teachers found it difficult to develop a specific topic based on the overall theme. One common argument for choosing a general research question was as follows:

> If we had chosen a more specific research question and asked, for example, whether the relationship between the pupils and the teacher was different in primary and lower secondary school, the research question might have been too specific, and we would have gotten little information from the interview.

It is apparent from this quote that some student teachers are yet to comprehend how a specific research question will influence the quality of their inquiries (cf. Spronken-Smith and Walker 2010). Finally, in two of the reports, the student teachers did not formulate a research question at all. One stated: 'I did not formulate a research question before the interview, but I had a small interview guide to support me during the focus group'.

The second desired academic outcome of the study was that student teachers should

- acquire knowledge about how to plan and conduct a focus group interview

One of the core elements of the IBL assignment was that student teachers should take responsibility for their own learning (cf. Spronken-Smith and Walker 2010). Accordingly, they were required to discuss their methodological choices (S2) taken before, during and after the focus group interview in their reports. Most student teachers discussed the importance of choosing the right informants. These discussions included questions such as 'Should we ask the class teacher for assistance?' 'Should we select girls, boys or both?' or 'Should we select informants based on their activity in class?' The following excerpt exemplifies how several of the student teachers justified methodological issues that arose when planning the focus group:

> The first thing we had to decide was the composition of the group. According to NN [methodological reference], the focus groups should be as homogeneous as possible. Although the group was homogeneous, when it came to age, place of residence, and school class, we applied the principle of diversity. We selected girls and boys, pupils at different academic levels, pupils with high and low social status, and students from different primary schools. In such groups, differences will often emerge more clearly because the participants can offer alternative views.

This excerpt demonstrates how the student teachers struggled, despite utilising literature on focus group interviews as a scientific method, while at the same time applying conflicting criteria for selecting informants.

Most student teachers negotiated the trustworthiness of their findings (cf. Levy and Petrulis 2012), commenting particularly on the limited number of informants that kept them from making generalisations. It appears that 'generalisation' was the concept they were most able to comprehend, even though they had also been introduced to 'validity' and 'reliability' through their studies.

Two of the desired academic outcomes were related to the connection of previous and new knowledge:

- ability to connect and negotiate theoretical and empirical resources
- knowledge about pupils' experiences in transitions between school levels

Because IBL is based on a process of constructing knowledge, we aimed to have the student teachers interpret their data with the use of theory and through analysis and discussion (S3) (cf. Justice et al. 2007; Spronken-Smith and Walker 2010). We found that all the student teachers had references in their reports. About a quarter referred mainly to policy documents discussing the topic, whilst others presented and referred to relevant theories. The ways in which theory functioned as a resource for interpreting, discussing and negotiating their data varied among the students. About half of the student teachers presented relevant theories, although these were linked directly to their own findings to a limited degree. About a quarter of the student teachers mastered alternating between their data and the theoretical perspectives while simultaneously reflecting on their work, as the following student teacher commented:

> The three girls in the focus group thought that it was changing schools that seemed scary for most pupils. They moved from an environment [that] felt safe to an unfamiliar and uncertain environment. NN [theoretical reference] claims that it's negative if a group gets too closed; then, no new impulses are available for pupils. I interpreted that the author argued that it is mostly positive for pupils to meet new people and get more impulses in the transition from primary to lower secondary school.

Being familiar with theoretical knowledge on socialisation and transitions between school levels provided this student teacher with the opportunity to widen her view on the pupils' statements. She was thereby able to see the data in a new light due to the theoretical resources, which helped her to generate new knowledge. As we understand it, the student teacher's conceptual knowledge was an actionable resource (Damsa and Nerland 2016) from which she demonstrated her capacity to broaden her knowledge base (cf. Levy and Petrulis 2012).

When the student teachers analysed their data, they responded to an authentic situation in a school and they were (to an extent) able to produce new knowledge (cf. Damsa and Nerland 2016; Levy and Petrulis 2012; Spronken-Smith and Walker 2010). New knowledge in this context can range from understanding existing knowledge to solving problems or generating novel knowledge (cf. Damsa and Nerland 2016) and does not necessarily mean new knowledge for the research field; rather, it applies to new knowledge for the student teacher. Most of our student teachers managed to illuminate and

clarify existing theories for themselves by creating an intersection between theoretical perspectives and empirical data.

We were somewhat surprised to notice that when it came to the kind of practical knowledge resources student teachers drew for in their assignment, they more frequently accessed their own experiences of being a school pupil rather than from their teaching practice. Some student teachers applied a retro-perspective when analysing and discussing their data, as the following comment demonstrates: 'It is clear that the school has not changed much since I was a pupil. The grades can make you feel completely miserable'. Some student teachers also commented on the pupils' statements by presenting their own perception of and opinions on excerpts from their interview with the pupils, as did this student: 'The pupils are happy that they are not expected to share their grades with each other. I think that's very good'.

The final desired academic outcome for the scientific methods assignment related to the student teachers communication of the process and the findings:

- knowledge and experience of academic writing while pursuing their own questions or lines of inquiry

Writing provides a tool for learning (Weaver et al. 2016), and when the student teachers were writing the report (S4), they further developed their inquiry, analysis and critical thinking skills (cf. Weaver et al. 2016). The student teachers were given a template that provided them with the required structure of the report, in which they were then required to present their discussion and reflections according to Steps 1, 2 and 3 in Figure 1. They were required to pay extra attention to the research process because a central aspect of IBL is focusing on the process of research, rather than concentrating on the product (Spronken-Smith and Walker 2010). While all the student teachers followed the correct structure, the degree to which they mastered the skill of writing an academic text varied significantly. As expected, the student teachers who had a well-refined research question managed to pinpoint the empirical focus to a greater extent when reporting. Although some student teachers made unsubstantiated claims, all student teachers demonstrated their ability to use direct and indirect quotes from the literature, to refer to literature in their texts and to compose a bibliography. They also mastered ethical issues such as protecting the anonymity of their informants.

5.2 Practising to become inquiry- and profession-oriented teachers

An important aim of our course design was that the student teachers would not just sit passively through lectures but would practise and experience various aspects of being an inquiry-oriented professional repeatedly (cf. Billett and Choy 2014). In this section, we return to the professional capacities that were desired as outcomes when giving the student teachers the focus group interview assignment in the fifth semester. The first four aims (bullet-points in Table 2) were that the student teacher should:

- develop the attitude of an active learner
- develop skills for critical reflection in and on professional practice
- integrate research-based and practice-based knowledge

- make theory-based decisions in and for practice

As our analysis indicates, the scientific methods assignment required the student teachers to take the position of an active learner whilst integrating resources from academic learning processes with learning acquired from the focus group interviews (learning in practice). Thus, they were able to maximise their educational attainments (cf. Billett and Choy 2014). It is evident after analysing the reports that the student teachers learned much more about pupils' transitions from one school level to another from both a theoretical and an experiential point of view. They were thus able to obtain in-depth knowledge about a specific aspect of their future profession (cf. Damsa and Nerland 2016). To an extent, the analysis showed that the student teachers were able to critically reflect on practice and integrate various knowledge resources in their reflections. We also found that some student teachers used both theoretical and procedural knowledge while discussing how they may work differently in the future, for example. However, we considered the results unsatisfactory. The student teachers had been provided with several opportunities to practise using theory in a critical way to explain or discuss various practices. We expected more student teachers to be able to conduct theory-based reflections and take theory-based decisions in and on their practice during the fifth semester.

The fifth aim of the activity concerning professional capacities was that the student teacher should

- be able to identify and determine professional challenges and explore them systematically

A core aspect of the scientific methods assignment was the research question (S1). When identifying a topic and developing their research questions, the student teachers were required to build on existing knowledge to identify and justify a practical phenomenon: transition between school levels (cf. Levy and Petrulis 2012). To become inquiry-oriented teachers, student teachers need to learn to be proactive; thus, they need to be aware of possible problems by asking nuanced questions, which will encourage the development of pedagogical thinking (cf. Billett and Choy 2014; Toom et al. 2010). Analysis of the reports showed that the assignment provided student teachers with the opportunity to practise how to revise, nuance and 'polish' research and interview questions (cf. Justice et al. 2007). The results also demonstrated that even though some of the student teachers admitted they had adopted a light approach to developing their research question, they reflected in their reports how they could have improved both the research and interview questions. An overall impression from our analysis is that the student teachers had a deeper understanding of how a well-prepared research question could improve the quality of their inquiry (cf. Justice et al. 2007). One possible explanation is that the concept of a research question was mainly connected to the academic aspect of the assignment for the student teachers. However, it seems that the actual 'physical' experience of how questions work in a communication situation (the focus group interviews) was something the student teachers could discuss in a rich manner. The explanation for this might be as follows: First, the student teachers were familiar with similar discussions in their school

placement when they were supervised after practising teaching. Second, poor questions led to awkward and messy situations during the focus group.

This brings us to the final two professional capacities we aimed for; namely, that the student teacher should

- develop communication skills
- be able to identify shifts in pupils' needs

More specifically, we aimed for an awareness of how to frame age-appropriate questions, who to choose as informants, how best to organise and provide communication, and how to develop the ability to interpret pupils' various implicit and explicit responses. In school, teachers have to communicate on different topics with different groups of pupils; thus, when the student teachers conducted the focus group interview they successfully acquired 'work-based experience' (Billett and Choy 2014, 488). As monitors of the focus groups, the student teachers were required to ask the pupils pre-prepared questions and follow up on the pupils' input, as well as reflect on this afterwards in their reports. As we understand, these competencies contribute to making student teachers capable of becoming intentional inquiry-oriented teachers. The reports showed that the student teachers became aware of how to organise a group of pupils with a specific purpose and to adjust and direct questions in an age-appropriate manner. By recording the interviews, student teachers were also able to listen to and critically reflect on their own role as the moderator of the conversation. For example, they reflected whether they interfered too much or too little in the discussion, such as by asking leading questions or not actively including all the children in the conversation. The following quotation provides an example of how a student teacher reflected on the experience of conducting a focus group interview and on the relevance for teaching practice: 'As prospective teachers, we need to develop a common understanding with the pupils. [. . .] Through this assignment, we have gotten an idea of how to develop this as prospective teachers'

6 Concluding remarks

In this paper, we initially sought to determine in what way(s) a scientific methods assignment in TE may qualify as a profession-oriented IBL approach. We acknowledge that we may have obtained limited knowledge from analysing the student teachers' reports, which may restrict the extent to which we can determine what kind of professional capacities the student teachers acquired after participating in the IBL activity. However, as our analysis shows, some aspects of the IBL activity can contribute to the development of an inquiry-oriented attitude. We will present these aspects in the context of the four steps described in Figure 1.

First, to limit a topic and develop a research question (S1), the assignment provided student teachers with the possibility to see the importance of developing a sufficiently precise question and the value of narrowing down a topic to see what was essential. Teachers need to be proactive in school; they also need to be inquiring with regard to unexpected situations that arise. To understand the challenges that arise in different situations they also need to work in an exploratory way.

Second, the student teachers were particularly concerned with how to select pupils for the focus group, a reflection that relates to determining methodological choices (S2). This experience gave them valuable knowledge about diversity in the classroom and the necessity of accounting for the pupils' resources and needs. The student teachers also gained knowledge about the importance of group composition, which is highly relevant in a school context. Communication skills are important in school, and the student teachers gained experiences in asking pre-planned questions and following up the pupils' input in the conversation.

Third, in terms of analysing and discussing data, teachers need to analyse different situations that occur and the pupils' explanations about those situations. The student teachers utilised school governance documents as well as theory to understand the pupils' statements (about the transition) as an actionable resource to develop new knowledge. This knowledge was mainly new to themselves; however, teachers in school are required to continuously develop knowledge about their pupils and the learning situation. This assignment may provide opportunities for the student teachers to understand the importance of both governance documents and theory when as prospective teachers they need to analyse new situations as they arise.

Finally, when communicating the process and the findings in their report, the students were made aware that IBL activity is worthwhile, and some emphasised the value of the thesis for their future profession as teacher.

Even if the scientific methods assignment was designed to be an IBL activity qualifying as a profession-oriented IBL approach, we recognised through our analysis that there are several aspects of the assignment that need to be improved and developed to reach the full potential of qualifying as a professional-oriented IBL approach. Even though the student teachers in this study had been involved in IBL activities for five semesters, our analysis revealed a need for both practising and modelling of each step, as well as closer scaffolding from the teacher educator and the supervisors in school practices before, during and after the process.

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No potential conflict of interest was reported by the author(s).

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