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Exploring the perceived learning of 'students as researchers' through two theoretical lenses

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ABSTRACT

This study investigates how students and teachers perceive learning outcomes when employing an inquiry-based learning approach, and how this relates to two conflicting perspectives on teaching and learning in the Norwegian curriculum. The informants are strategically chosen from among Norwegian elementary schools that use the 'students as researchers' approach, whereby the students develop research questions, form hypotheses, decide which research methods to use, and conduct the research. The conceptualization of learning outcome is connected to the traditions of Didaktik, whereby matter and meaning are separated and the outcome cannot be predicted in advance, and outcome-based education, where the learning outcome is defined in advance as the first element of instructional planning. Twelve semi-structured interviews were conducted, and the data was analysed qualitatively using the NVivo 12 software. Although the students engage with the same subject matter, the results show a considerable variation in what they report having learned. Additionally, the teachers are often unable to plan for the outcomes of the lessons. Our findings therefore emphasize why an awareness of different understandings of teaching and learning is decisive in capturing perceived learning when applying methods such as 'students as researchers'.

KEYWORDS

Students as researchers; inquiry-based learning; learning; Didaktik; outcome-based education

1 Introduction

In 1990, the Norwegian Research Council developed the concept of 'students as researchers' (*Nysgjerrigper*), which remains active and firmly established in primary schools today. Students' engagement in inquiry is encouraged and promoted internationally (Mills et al., 2014); however, learning outcomes are debated, especially if only subject content is assessed (Jiang & McComas, 2015; Minner et al., 2010). Nonetheless, experience with inquiry is reported as being meaningful and involving abundant learning (Bjørkvold & Blikstad-Balas, 2017). This article examines these apparently conflicting views of learning in relation to inquiry in school by investigating what students and teachers report as being the learning outcome when working within the 'students as researchers' context.

The backdrop is a curricular development in Norway that has taken place during the past fifteen years, through which the curriculum has changed from being largely content-oriented to more outcome-oriented; instead of prescribing the subject matter with which students should engage, subject curricula now list the expected results in terms of students' learning, which is expressed through the term 'competence' (Mølstad & Karseth, 2016; Willbergh, 2015). These content- and

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outcome orientations are represented respectively by the German–Scandinavian *Didaktik* tradition (Hopmann, 2007) and outcome-based education (OBE) (Spady, 1988), both of which are present in Norway's school culture and national curriculum today (Karseth, 2019). Further, the emphasis on local curricular traditions results in a conglomerate of curricular understandings within and among schools (Wermke & Prøitz, 2019).

The current Norwegian curriculum, which took effect in August 2020, reinforces the outcome orientation, and continues the trend of decentralization by explicitly refraining from prescribing detailed content and establishing that content-related decisions should be subject to the teachers' professional judgement (White Paper 28, 2015–2016). At the same time, the wording of the competence aims in the new curriculum indicates a move away from verbs that denote observable outcomes towards more 'process-oriented' verbs. This is evident, for example, in the social studies curriculum, in which formulations such as 'the student should be able to account for … ' have been, to a great extent, replaced by 'the student should be able to reflect upon' or 'explore' (Ryen, 2020b). This development towards a more localized process of content selection and more process-oriented competence aims is hardly compatible with the standardized assessment and accountability associated with output-based curricula (Hopmann, 2003); therefore, the Norwegian curriculum still seems to harbour strong tensions.

'Students as researchers' is a pedagogical approach that is used to teach students how to establish new knowledge and develop their understanding of the world (Norris & Phillips, 2003). The approach, which is often associated with the natural sciences, is based on an epistemological understanding of the nature of science (Abd-El-Khalick et al., 2004) but can also be understood as cross-curricular. 'Students as researchers' can be categorized within open inquiry (Howes et al., 2009) and has two hallmarks. First, the students pose their own research questions with their own hypotheses, inquire into them systematically, collect data, and analyse their findings (Howes et al., 2009). Second, the students share or present their research before a real audience (Elmesky & Tobin, 2005). Thus, heavy emphasis is placed on the process—the act of inquiry—and 'students as researchers' can be said to build on a formal, methods-based theory of education (Klafki, 2001).

The study's informants participated in a national research contest that was organized by the Norwegian Research Council (Furøy et al., 2014). The contest targeted Grades 1 to 7 and was based on the 'students as researchers' approach. Examples of the research questions from students' projects include 'Why do elderly people shrink?' and 'From how far away can dogs smell a treat?' The entire process—question, hypothesis, methods, results, and discussion—is documented in a report that is evaluated by a national committee before the winners are announced. Since the competition was established in 1990, approximately 90,000 students, averaging 3,000 annually, have participated (Hauge, 2020). The teacher serves as project supervisor and facilitator. Based on the conflicting curricular positions in schools and the 'students as researchers' tradition, we formulated the following research question: how are learning outcomes perceived by students and teachers in applying an inquiry based learning approach, and how do their experiences relate to the conflicting perspectives on teaching and learning in the Norwegian curriculum?

To approach the research question, we first present both theoretical approaches: Didaktik and OBE. Second, we outline the Norwegian context vis-à-vis these theoretical stances. Third, we present earlier research on learning connected to 'students as researchers'. Finally, we present the study, which consists of interviews with students and teachers participating in three different projects from the 2nd, 6th, and 7th grades.

2 Two theoretical lenses

As the Didaktik approach has traditionally been dominant in Norway, it is presented before OBE, which has become more prominent since 2006, when competence aims were introduced into the national curriculum for the first time.

2.1 Didaktik

While the term 'didactic' has rather negative connotations in English, denoting an inflexible, insistent, and often moralizing way of teaching, Didaktik is considered a cornerstone of the educational tradition in Northern Europe, as it was established in the 19th century (Hopmann, 2007).

As understood in Germany, France, and Scandinavia today, Didaktik includes the theory and practice of teaching and learning (Gundem, 1998). It is an analytical tool for the practical, theoretical, and discursive levels. According to Hopmann (2007), three foundations of Didaktik can be identified: autonomy, matter and meaning, and Bildung.

Autonomy within the Didaktik tradition applies to both students and teachers. As the student struggles with the subject matter, the meaning created in the process is the basic element of learning. This is an autonomous process in the sense that a certain meaning (Gehalt) cannot be presupposed to emerge from the given content (Inhalt): 'Such a concept of teaching requires a considerable amount of autonomy for both the teachers and the students. Or more precisely: it presupposes the existence of such an autonomy in all teaching irrespective of its official status' (Hopmann, 2007, p. 117).

Thus, the teacher's role in educational planning is limited, in the sense that the outcome of any given lesson will necessarily be uncertain, regardless of the teacher's experience or pedagogical refinement. Importantly, however, this does not make teaching a superfluous or arbitrary activity. Quite the contrary; the uncertainty and contingency implied by the autonomy of teacher and students is understood as *a critical precondition* for teaching. The limitations as to what can be achieved by way of teaching that are implied by autonomy and the separation of matter and meaning, lead to an understanding of teaching as a process of interpretation; both in planning as well as in conducting a lesson, the teacher must constantly look for ways to draw on the varieties of meanings that can be derived from the curriculum in order to present the content of the school subject in ways that enhance the possibility for the students to connect it to their unique experiences —opening a possibility for them to deepen their understanding of the world.

Bildung is seen as the overall purpose of education in the Didaktik tradition, meaning that new generations of individuals are socialized into the existing and future society. Løvlie (2003) states that 'the principal aim of Bildung is to strengthen the student's innate powers and character development' (p. 2). In his definition, development is centred on the individual, but Hopmann (2007) points to Bildung as the individual unfolding both independently and socially.

In the Nordic countries influenced by Didaktik, defining state curricula traditionally meant making decisions regarding what to teach in the schools. By limiting state control to input and leaving the evaluation of output—that is, individual students' learning—to teachers, an autonomous space was created within which schooling could take place while still making public deliberation and the official endorsement of the national curriculum possible (Sivesind & Karseth, 2019). To the teachers working within this tradition 'the knowledge of how to create a bridge, by means of argument, i.e. Didaktik, between institutional frameworks and locally chosen activities' (Hopmann, 2003, p. 470)—that is, to negotiate between the requirements of the national curriculum and individual teaching practice—became an essential task.

2.2 Outcome-based education

At the heart of OBE lies a strong belief that the 'traditional' way of teaching content, emphasizing 'curriculum coverage over student mastery' (Spady, 1988, p. 5), has been ineffective, thereby leading to constrained learning opportunities. According to Spady (1988), '"Organizing for results" is an inherently attractive concept. It implies a deliberate attempt to plan and conduct essential activities so as to accomplish our aims successfully—in other words, purposefully doing what we set out to do' (p. 4).

Assessment is an integral part of outcome-based curricula, as it provides information to teachers and students about the extent to which they are achieving the aims and how they can adjust their teaching or apply different learning strategies to maximize output. Using the description of the expected learning outcome as the starting point logically leads to 'backward planning'; in other words, having decided which competence aims the students will work towards, the first step is to identify the evidence that needs to be collected to ensure that the aims have been met and determine how to collect it (Wiggins & McTighe, 2005). By promising a form of instructional design that can be used to plan for and successfully assess whether students have achieved the 'desired understandings' (Wiggins & McTighe, 2005, p. 22), OBE rests on the assumption that the relationship between matter and meaning can be established *prior to the lesson*, thus making standardized assessment possible. Consequently, OBE is premised on an understanding of the relationship between teaching and learning that differs fundamentally from that of the Didaktik tradition.

According to Spady, not only does OBE promise more effective learning, but it also has the progressive potential to make 'all students learn, not just the fastest and the brightest, or the most advantaged' (Spady, 1988, p. 4). Importantly, making the definition of learning outcomes the first step in the process of designing curricula and organizing schools, facilitates the measurement of the schools' effectiveness vis-à-vis the delivery of the desired outcomes and thus increases the possibility of holding the schools and teachers accountable for the results.

2.3 The Norwegian context

In Norway, Didaktik has traditionally held a strong position. However, since the turn of the millennium, international tests have revealed the performance of the national school system to be lower than expected (Elstad, 2009); thus, the dominant position of Didaktik has been challenged by elements of OBE. In 2006, the new term 'competence aim' was used in the 'Knowledge Promotion' curriculum that was introduced that year and whose revised 2020 version is currently in use. The curriculum is developed with close reference to the 'Definition and Selection of Key Competences' (OECD, 2005) and 'The Future of Education and Skills: Education 2030' (OECD, 2018) projects, which aim to define the competences that students will need to possess for them to prevail in a complex, fast-changing, and uncertain future environment (White Paper 28, 2015–2016).

As a result, the Norwegian curriculum can now be characterized as hybrid, as elements of both Didaktik and OBE are present (Hopmann, 2015). The current curriculum consists of two parts. The first is a document called 'Core Curriculum—Values and Principles for Primary and Secondary Education', to which the teachers are legally bound (Udir, 2020). The second consists of subject curricula that prescribe the various competence aims that teachers are also legally obliged to work towards fulfiling.

The core curriculum establishes that schools should fulfil the dual mission of education (utdanning) and all-round development (danning/Bildung), which are seen as 'interlinked and mutually dependent' (Udir, 2020, p. 9). While there is nothing controversial in stating that education systems have many different tasks, the contradictions resulting from the attempt to marry OBE and Didaktik become clear when we examine the definition of 'competence' that is provided in the core curriculum and the discussion preceding the adoption of this definition: 'Competence is the ability to acquire and apply knowledge and skills to master challenges and solve tasks in familiar and unfamiliar contexts and situations. Competence includes understanding and the ability to reflect and think critically' (Udir, 2020, p. 11).

While the core curriculum makes it clear that there is a connection between competence—understood as the development of skills and knowledge—and the development of attitudes and ethical judgement, the definition of competence is 'narrow' in that it in itself does not include the development of attitudes and the ability to make ethical assessments. The Norwegian government's decision not to include this in the definition directly contravenes the recommendations of the committee that was tasked with 'assess[ing] the subjects in primary and secondary education and

training in terms of the requirements for competences in future working life and society'—that is, laying the groundwork for the latest curriculum reform (NOU 2015:8, p. 15). This committee recommended a 'broad' definition of competence that encompassed 'social and emotional learning and development, including attitudes, values and ethical assessments' (NOU 2015:8, 2015:8, p. 20). It argued that this was necessary because of '[t]he complexity of the challenges the pupils will encounter in school and later in life' and found support in 'research on learning and development and the school's societal responsibilities' (NOU 2015:8, p. 20).

In White Paper 28 (2015–2016), the government recognized that social and emotional skills are important for learning and succeeding in life, referring to the OECD's 'Education 2030'. However, given that the subject-specific competence aims to be developed based on the definition of competence in the core curriculum would be made subject to the teachers' formal assessment, a broad definition would mean that attitudes and values would also need to be assessed. Within the frame of an output-based curriculum, the consequence would be that the authorities would in effect set standards for and measure the development of the citizens' characters. This not only conflicts with the ideal of Bildung within the Didaktik tradition but is also highly problematic from a liberal democratic perspective. The government thus concluded that this dilemma could be solved only by excluding these aspects of learning and development from the definition of 'competence'.

Restad and Mølstad (2020) describe this decision as 'drawing a red line for measurability' and point to the result that '[t]he Norwegian curriculum does not align with the broad position of an international knowledge base that sees social and emotional skills as an equally important and integrated part of academic learning in schools' (p. 10). Leaving aside the conceptual debate on the limitations of competence as an educational concept (Willbergh, 2015), the failed attempt at introducing a broad definition of competence into the Norwegian curriculum shows how important traits of the Didaktik tradition—the autonomy of the student and the idea that Bildung is to some extent irreducible and impossible to break down and measure—are retained, at the same time as an output-based curriculum that challenges important principles in the same tradition, such as the distinction between matter and meaning and the autonomy of teachers and students, has been introduced.

The strong tensions apparent in the Norwegian curriculum make it an interesting case for empirical studies, as it is not obvious how learning is understood by teachers and students in practice. What makes this even more interesting is the large degree of freedom granted to schools and teachers regarding the local implementation of the curriculum (Prøitz, 2010, p. 135).

4 Earlier research on open inquiry learning

This study examines perceived learning when students act as researchers, which can be characterized under the open inquiry umbrella. Earlier research concerning open inquiry learning shows variable results, and what is actually learned is contested. A synthesis of 138 studies shows that open inquiry is not associated with high learning outcomes connected to subject content (Minner et al., 2010), pointing to a lack of reflection on subject matter when undertaking hands-on activities. The results of a study connecting results from the Programme for International Student Assessment (PISA) and inquiry revealed a low level of science achievement; however, the level was higher when the students were encouraged to draw conclusions themselves, which is an approach that is seldom used (Jiang & McComas, 2015). In a similar vein, Sjøberg (2018) finds a gap between the low level of student achievement on standardized tests and the high standing of inquiry-based teaching among science educators. However, open inquiry is also criticized for offering students only minimal guidance and yielding a low level of learning results, which is also connected to subject-specific content (Kirschner et al., 2006). In summary, the existing research mainly connects open inquiry learning to subject-specific matter. Our study fills a gap by introducing the Didaktik tradition as an alternative means to conceptualize learning when employing open inquiry methods.

5 Method

This is a strategically chosen case study (Flyvbjerg, 2011) of the perceived learning that occurs when elementary school students act as researchers. The case approach is herein understood as a design strategy that indicates an inquiry into contexts in which 'students as researchers' occurs naturally (Stake, 2005). The case strategy is used to shed empirical light on the theoretical challenges regarding the Norwegian curriculum (Yin, 2014). It should be noted that the 2013 curriculum was still in place during the time that the study was conducted, but as discussed above, the basic composition of the Norwegian curricula has been retained since 2006, and the theoretical challenges thus remain the same.

5.1 Informants

The informants were recruited through the Norwegian Research Council from among 120 participants in the aforementioned national contest. All 15 teachers who volunteered were interviewed, as were students from three classes. This study is based on the three projects where both teachers and students were interviewed—one from each of the 2nd, 6th, and 7th grades. Table 1 shows the informants and the research projects that the various classes conducted.

The three teachers differed in terms of experience and level of acquaintance with the method: June, who taught the 2nd-grade class, had five years of experience as a teacher, during which she completed projects using the 'students as researchers' approach. Peter, a teacher with 11 years of experience, was in his third year at a school using the researcher approach for the oldest students. Nina, the 7th-grade teacher, had 18 years of experience, 11 of them using the 'students as researchers' approach. The teacher interviews (35–40 minutes) were individual and semi-structured (Kvale & Brinkmann, 2009), and they addressed student learning.

The student interviews were conducted in groups, were semi-structured, and focused primarily on what the students thought they had learned while undertaking their research projects. The students had all recently submitted their research reports to the contest. The interviewees comprised all students who wanted to participate—that is, 36 of the 75 students in the class (table 2). The interviews with the students lasted only 11 to 24 minutes to maintain their interest and concentration. Pseudonyms were used, the language was adjusted to the students' ages, and the interviews were video-recorded and then transcribed. The transcripts were adapted to customized orthography to focus on the content and then translated into standardized English. For each class, three interviews were conducted, totalling nine.

5.2 Analysis

Using the NVIVO 12 software, the transcribed interview material was sorted according to the categories 'subject curriculum' and 'core curriculum' to reflect both facets of the Norwegian

Table 1. Overview of informants.

Grade and age	Class	Teacher, experience	Project title
2nd, 7 years old	28 students, 13 boys and 15 girls	June, 5 years	'Why do elderly people shrink?'
6th, 11 years old	26 students, 14 boys and 12 girls	Peter, 11 years	'Why is the hallway so narrow for the 6th graders?'
7th, 12 years old	21 students, 15 boys and 6 girls	Nina, 18 years	'From how far away can dogs smell a treat?'

Table 2. Overview of data material.

Informants	Interviews	Time
2nd grade, total 12 students	3	44 min.
6th grade, total 10 students	3	48 min.
7th grade, total 14 students	3	59 min.
Teacher, total 3 teachers	3	112 min.
Total, 39 informants	12	263 min.

Table 3. Analytical theories.

Category	Description	Example
Subject curriculum	Utterances containing themes that can be placed in the subject curriculum	I learned about the back and that there are some kinds of pillows in the skeleton. (Student) But you can be pretty sure the students will know about research. (Teacher)
Core curriculum	Utterances containing themes that can be placed in the core curriculum, mainly related to Bildung	We learn not to give up easily. (Student) We are working towards confident children [so] that they dare to take responsibility [and] stand up for themselves and the choices they make. (Teacher)

curriculum (table 3). The former category was used for utterances containing themes that could be placed in a subject curriculum, and it mainly entailed content related to competence aims. The latter category consisted of utterances containing themes that could be placed in the core curriculum; these were mainly connected to Bildung. Some utterances contained several elements and thus included different types of content. Such utterances were divided into smaller phrases, which were then categorized.

A possible limitation of this design is that the analytical categories are theory driven from the curriculum on a policy level. However, we discuss the problematic aspects on the theoretical level. The result of this discussion is not presupposed in the design. Further, there are only 39 informants, and the interviews are limited to learning within a special context. Nonetheless, these data provide valuable insights into challenges related to the realization of the curriculum.

6 Results

Using the subject and core curricula as the analytical framework, we present perceived learning as formulated by students and teachers.

6.1 Subject curriculum

Three 2nd-grade students were interviewed in one of the groups. They had researched why elderly people shrink and answered the question 'What did you learn from working as researchers'?

> Anna: I learned about the back and that there are some kinds of pillows in the skeleton. And now I know how to do research.

The three students collaborated on the same research project. In this case, the subject matter was competence aims from one of the three main areas of science, focusing on the research method (Udir, 2013). Anna stated that she now knew how to conduct research, thereby indicating that this was what she had learned. These students chose to research shrinking elderlies and thus learned facts about the body. Anna also highlighted this academic subject matter, which, like learning, was expressed in goals formulated in the subject curriculum.

By inquiring into why their hallway was narrow, the 6th graders accentuated a central aspect of research in their learning—namely, asking several people. This need to seek relevant informants is essential to not only undertake research but also to be a critical thinker.

Josuf: I learned that I had to ask a lot to get answers. Usually, I can only ask the teacher. But now, he didn't know, so I had to find new people and people outside of school. I even had to find out who we believed had the right answers.

When asked about what they had learned during the project, the three 7th-grade students emphasized writing:

Randi: And we learned how to write a report and so on. When you are doing research, it leads to a lot of writing. So, we learned to organize [and] write requests because we will surely need to do so when working by ourselves.

Randi pointed out that they learned how to write a report, which is central to the science curriculum. However, she also stated that conducting research requires a considerable amount of writing, indicating disciplinary writing at a general level but still within the subject curriculum.

June, the 2nd-grade teacher, answered in general terms:

Teacher June: Working like this, you never know what or where you will get. But you can be pretty sure that the students will know about research and learn a great deal about themselves afterwards.

In her reflections on learning, June pointed in two directions. First, the students learn about research within the subject curriculum. Second, they learn about themselves, which is part of the core curriculum. For June, the two are formulated into one sentence in an unproblematic and seemingly natural manner.

Another teacher, Peter, had recently started working at a school that used the 'students as researchers' approach in the two upper grades. When asked an open-ended question regarding what the students learn, he responded as follows:

> Teacher Peter: I am uncertain what the students actually learn working like this. They spend a lot of time working, but I cannot check the outcome; I just have to believe that it is worth the effort. … At this school I have to use it [the approach], even if I am in doubt about the efficiency.

Peter was further asked to elaborate on his uncertainty about the students' learning.

> Teacher Peter: I have tried the approach three times now, and my experiences have been very different. Once they counted cars. This year the students worked with the narrow hallway. It seems kind of random. I find it hard to believe it is worth the effort, and I don't know if I would defend it. I prefer to plan for goals.

Peter indicated a central point of what, in his view, good education entails—a testable outcome. In the OBE tradition, the subject matter is presented as testable aims at the curricular, school, and lesson levels. In the excerpt above, the teacher states that he just has to believe in the method, although, from his ontological standpoint, he can hardly defend this way of working. When asked to elaborate, he emphasized the randomness of the themes in the student projects and stated that the approach was imposed on him. While he maintains his loyalty to the local curriculum, which binds him to the method, he would clearly prefer a more goal-orientated approach. .

The third teacher, Nina summarized the learning as follows:

> Teacher Nina: I know they learn something each time they get to inquire, but I never know in advance. This year, the students have struggled with getting information from dog experiments that can be compared. They really had to challenge themselves to understand that they had to plan in detail and discard their first experiments. So, they learned to face a methodological problem and to do the same thing over and over again to be trustworthy. That led to interesting discussions. I could never have planned for that.

Nina indicated that she could not plan in advance what the students learned. However, she constantly looked for what the students could learn and let them struggle and 'challenge themselves'. She mentioned 'interesting discussions', wherein she aimed for the class to focus on trustworthiness. Thus, trustworthiness became relevant content in the students' meeting point between the matter and meaning they created.

In summary, few examples in the student interviews concerned the subject curriculum. This

applies to all three age groups. However, the teachers' stances were divided. The 2nd- and 7th-grade teachers stated that they could not plan in advance for learning but had to be alert to be able to spot good learning opportunities and discuss these with the students. Conversely, the 6th-grade teacher was troubled by a learning context that did not enable him to plan learning goals for each lesson.

6.2 Core curriculum

In the group interview with the 2nd graders, two boys answered as follows when they were asked what they had learned:

> Thomas: We learned not to give up easily.
>
> Christian: We travelled a lot, and we learned to behave and to talk in the right way to adults. There are many more adults outside of school, and they are different from teachers.

Thomas expressed that he learned not to give up easily. This was his most foregrounded learning experience after conducting weeks of intensive research on the elderly and their height. Reference to the ability to endure hard work can be found in the OECD's 'Key Competencies' (OECD, 2005) and the Norwegian Core Curriculum (Kunnskapsdepartementet, 2011, 1993; Udir, 2020). Although not included in the competence aims, Thomas derived this meaning from the context as he conducted research. The second student, Christian, emphasized learning outside school boundaries as they travelled and learned how to talk to adults who were not teachers. Behaving appropriately in different social settings is highly relevant to a successful life and a living democracy (OECD, 2005).

The 6th graders also emphasized that asking questions was essential to their research.

> Ida: We also had to ask the question in different ways, because I think some of the teachers thought we were complaining about our hallway. So, we had to use other words to convince them that we were doing research. Then they kind of had to answer the question, not tell us to behave.

These students have discovered that the manner in which they ask questions can elicit different attitudes towards them. Thus, their ability to adapt to the situation and convince the adults to take them seriously as researchers, and not view them as rude students, was an important lesson.

The 7th-grade students initially referred to and reflected on their perceived learning in regard to their writing. In response, the interviewer asked one student what she meant:

> Randi: And we learned how to write a report and so on. When you are doing research, it leads to a lot of writing. So, we learned to organize [and] write requests because we will surely need to do so when working by ourselves.
>
> Interviewer: What do you mean?
>
> Randi: I mean when we get older and get a job of our own. Because in a lot of jobs, you have to write a lot.
>
> Interviewer: So, what are you thinking? Is it more like a job?
>
> Randi: Yes. We will need it later. So, we have written reports.
>
> Ulrik: People who work write emails all the time. I suppose you do, don't you?

The 7th-grade students emphasized that they learned how to write; according to Randi, this included aspects that 'we will surely need … when working by ourselves'. Thus, the students related their learning to skills they would need in their future jobs. What they wrote thereby became relevant beyond their schooling. Another 7th-grade group drew parallels between their experiences as researchers and their lives as adults:

> Karen: [We learned] a little about how to manage on our own after school. When you are done with your education and live by yourself … alone.

Interviewer: What do you mean?

> Karen: Maybe a little about how to do things and take the initiative. It's like that at work when you get a bit older. Then, it's not like this: 'Do this … these tasks'. Then, it's a little more like 'Write this text. Do it like you want to. Make your own presentation'.
>
> Adam: Yes … you can make it yourselves and don't have to follow things. You can write what you want, like a presentation, as long as it is within what you are writing about.

Some students, such as Thomas from the 2nd grade, pointed to the importance of their efforts to work:

> Thomas: If I hadn't kept reading, I would not have learned enough to do an interview, and then there wouldn't have been an interview, even though that was the best. I decided to read more and more, even though I really wanted to do the interview and the others were waiting for me.

Thomas problematized how his reading was a precondition for conducting an important interview. His effort was crucial, and he was aware of his responsibility towards his peers. The possibility of failure is great if each student is given freedom and responsibility; however, success can be more rewarding without the teacher monitoring every step. The teacher touched upon the same theme, emphasizing individual responsibility:

> Teacher June: We are working towards confident children [so] that they dare to take responsibility [and] stand up for themselves and the choices they make.

As posited by Didaktik theory, learning cannot be guaranteed, but has to—if it is to occur—emerge through the engagement of the student with the subject matter. Nonetheless, teachers need to prepare a classroom culture that enables individual students to feel that there is room in which to 'stand up for themselves' and that this is encouraged, as June verbalized. For example, Ruby, a 7th-grade student, took it upon herself to draw a dog for the front page of the report:

> Ruby: I wanted to do something important for our research in the class, so I started drawing a dog for the front page. I am not that good at writing and calculating, but I wanted to do something great. So, I drew the dog without telling anyone, and then they loved it.

Ruby grasped the situation, understanding the need of the collective—in this case, the need for a front page. Wanting to be appreciated, she decided to draw. Here, we see a student reflecting on the sense of self-determination that she experienced in conjunction with the obligations she felt towards the community; this solidarity illustrates how the capacity to be independent in the Bildung tradition is connected to responsibility for the community (Klafki, 1998). Peter commented on the teacher's role regarding motivation:

> Teacher Peter: Normally, I have to motivate the students—give them something to look forward to, tell an interesting story, show a video, or anything to make them interested. Working like this [using the 'students as researchers' approach], the students are much more motivated than I. I don't have to motivate them but keep them on track, because they hardly have any limits on what they want to do.

Peter is somewhat puzzled about his role as motivator when the students are working as researchers. He is accustomed to finding inspiring ways to teach different subjects, but in this paradigm, he has to limit the students to 'keep them on track', as their interests veer in different directions.

Thomas and Christian both identified learning as a part of their growth as individuals during their interactions with others inside and outside of school. The ability to withstand the challenges of hard work and to engage strangers to obtain necessary information can be seen as an aspect of Bildung. Bildung is also evident in the attitude towards learning and in how one engages with information that is presented. Thomas (2nd grade) pointed out the following:

Thomas: I don't believe everything I hear anymore.

This can be understood as a step towards critical thinking, which is also central to Bildung (Ryen, 2020a), and is in line with the 6th-grade students' initial responses when they were interviewed about what they had learned by inquiring into the narrowness of their hallways:

> Daniel: We learned that the teacher is not always right. She thought the hallway had certain requirements, but that could not be true. We measured the other hallways at our school, and ours was much narrower. That means she could not be right. That was kind of strange.
>
> Linda: Yes, you have to find out for yourselves.
>
> Fredric: Sure, but she was only guessing; she didn't know. But I think you should say you are guessing, because we often believe teachers.

These 6th graders reflected upon their discovery that teachers are not always right, even if they claim to know something. This was 'strange', according to Daniel, and Fredric stated, 'We often believe teachers'. Experiencing a teacher being wrong was the first topic that these students mentioned when asked what they had learned. For them, this insight was likely a paradigmatic shift from being students who trusted the teacher to have the correct answer to students who had 'to find out for yourselves'.

June referred to the core curriculum as she pointed out an aspect of the outcome for the students:

> Teacher June: According to the curriculum, the students should become 'good citizens'. I find that by working with 'students as researchers', I can actually say that I work towards this. Or else, you just have to assume they come out of the school system as good people. With this approach, they encounter some important basic human issues, such as what we can know, what is ethical to do or tell others, [and] what to believe when two experts say different things.

As a sign of ironic distance, June made the quotation gesture while saying 'good citizens'; this might have been done to signal that the term is too abstract for everyday school life. Nonetheless, as her students work as researchers, she pointed to aspects of being a good citizen as 'some important basic human issues'. Peter touched briefly on a theme that is associated with Bildung—making a bridge between the school and the rest of the world.

> Teacher Peter: One good thing is that the world outside the classroom becomes more relevant. Usually, we are happy in our world of textbooks, [with] the teacher telling the students what to do and the students doing their tasks. Now, however, the world outside is something to bring back into school because the students are inquiring into something.

Peter emphasized that because the students are 'inquiring into something', the world outside school 'becomes more relevant'. The 'students as researchers' approach thereby functions as a way to combine different cultures that are part of the students' lives.

6.3 Summary

In summary, we found that learning within the core curriculum, addressing personal growth, socializing, and relating their current experiences to adulthood, rather than investigating subject-related topics, dominated the students' answers when asked what they had learned. Further, the teachers emphasized that it was impossible to plan for what the students learned; this was seen as unproblematic for some, as the students learned valuable lessons related to Bildung, and as problematic for others.

7 Discussion

We inquired into the research question regarding perceived learning from the points of view of students and teachers when students act as researchers, and how this relates to tensions in the Norwegian curriculum resulting from the combination of elements of Didaktik and OBE. Three tendencies stand out in the material: the distinction between matter and meaning, autonomy, and planning for learning.

First, we discuss the relationship between matter and meaning. A central aspect of 'students as researchers' seems to be that matter that is presented in the process of doing research creates different meaning for students. This meaning might be outside the subject-specific curricular goals (Hopmann, 2007). The exact theme of the students' own research, be it shrinking elderlies or dogs' smelling sense, is subordinated as perceived learning for both students and teachers. Although the search for answers is an important motivating factor for learning the research method, other learning outcomes, such as personal growth or learning to approach adults appropriately are emphasized by the students and two of the teachers. Thus, as formulated in the Didaktik tradition, working with the matter results in a diversity of perceived learning or meaning (Westbury, 1998). This is in opposition to the OBE tradition, where the outcome should be consistent for the students even if their learning processes differ (Spady, 1988).

A major ontological pillar of the Didaktik tradition is the idea that meaning is negotiated between individuals in social settings (Klafki, 1995). The core of the lessons is that matter must be adapted to the different students and their constructions of meaning. The discrepancy between the goals formulated in the national curriculum and what the students actually learn is seen as natural, not problematic. The paradox of the curriculum worlds—the written and the conceived (Gundem et al., 2003)—is a necessity of teaching in the Didaktik tradition but is problematic in the OBE tradition. If a certain subject is taught and a test shows that the students did not learn what was intended, but perhaps something else, this is seen as problematic (Prøitz, 2015). The OBE tradition seeks methods of effectively and efficiently teaching students subject matter. Therefore, the 'students as researchers' outcome would appear weak if only the subject-specific goals were taken into account. This mirrors the case in the reported studies about learning from open inquiry (Jiang & McComas, 2015; Minner et al., 2010; Sjøberg, 2018). The backward planning (Wiggins & McTighe, 2005) from the science curricular aims was not adequately met through planned-method open inquiry because the individual's encounter with the matter was not considered.

Second, the students' autonomy is a recurrent theme. Within a 'students as researchers' context, the work develops according to the interests and abilities of the students. However, the wide range of different answers given by the students when they were asked what they had learned from working with their projects, clearly show that the resulting learning cannot be understood as occurring along a pre-defined, standardized path. Rather, the student's individuality comes to the forefront as different meaning is constructed through the unique meeting of the student with the subject matter. At the same time, we see that the teachers face the challenge of analysing the situation, identifying which themes require further exploration and which should be abandoned, and continually looking for possibilities for meaning to be created that can bring the students closer to achieving the broad aims of the curriculum and the ideals of Bildung. There can be no fixed regulations for this kind of teaching; rather the professional autonomy of the teachers to plan and conduct their lessons within the confines of the curriculum is indispensable. A possible downside of enhancing students' autonomy (Westbury, 1998) is that those who are unwilling or unable to learn will fall behind. In the curriculum tradition, the significance of motivation is prominent (Klein &

Boscolo, 2016); this applies to outer and inner motivation. In other words, in this tradition, the teacher is to a great extent responsible for preparing the students for learning and ensuring that they continue to work. However, our findings corroborate those of Gruschka (2011): When students are focused on understanding a problem that needs to be solved, motivation and willingness to learn are created.

The idea that the students' interests—in this case, their research questions and hypotheses—should determine lesson content stands in stark contrast to the OBE idea of working towards pre-defined and standardized educational goals. Based on this view, a teacher is seen as an implementer of the curriculum and is directed by system regulations (Westbury, 1998). This implies that the professional teacher implements the subject matter according to the level of the students and the methods they have acquired. The reflectiveness of the Didaktik tradition emphasizes the transformation of the subject matter to meaning through teaching, while in OBE, this customization is centralized by concretizing the learning goals and devising methods for how these should be assessed. However, from the Didaktik standpoint, this kind of customization is problematic, as it misses the meaning that results from the unique meeting between students and content in a concrete classroom setting; this is because it necessarily occurs in the moment and is 'an emerging experience which is always situated in unique moments and interactions' (Hopmann, 2007, p. 117). Thus, the students' motivation and learning cannot be secured in advance through a clever design nor in the classroom through the employment of certain techniques (Gruschka, 2011); rather, it requires the teacher to engage the students in a common meaning-making process whereby the 'myriad unforeseeable possibilities' that any lesson holds (Klafki, 1995, p. 16) are utilized to focus the students' attention on the subject matter they are attempting to make sense of. For this to occur, the students' and teachers' autonomy to create meaning and engage in the common effort to make sense of the subject matter is essential.

Third, learning and lesson planning are highlighted by the teachers. In line with OBE, Peter is accustomed to the idea that learning goals should be defined in advance of a lesson (Spady, 1988), processed through work in class, and preferably tested thereafter to check the effectiveness of the lesson (Klein & Boscolo, 2016). This somewhat instrumentalized view of teaching and learning, which focuses on methods and aims, is challenged, as what the students will actually learn is difficult to predict. The idea of learning does not fit the theoretical foundation; therefore, Peter has a conflicting working situation when he applies the 'students as researchers' approach. He is conflicted by what constitutes valuable learning, as formulated by Prøitz (2010). At the core of Peter's conflict is the idea of good education as effective, which is measured in post-tests. This reflects a radically different concept of teaching than that found in the Didaktik tradition, but is completely in line with the logic underpinning the output-based curriculum on which Peter bases his teaching.

Nina, however, remains confident that the students 'learn something every time they get to inquire', but she also challenges the class to establish a clear aim—to learn about and achieve 'trustworthiness'. Thus, letting the students inquire does not mean that the teacher must refrain from setting aims for their learning. However, there is a crucial difference between aims that are based on the students understanding something—that is, making sense of it in their own way—and aims that are based on the students being able to perform certain predefined tasks. Only the first types of aims are compatible with the Didaktik perspective, but they are also necessary if the students encounter content that challenges them in ways that enable them to confront aspects of the world that the teacher believes are necessary for them to develop their individuality in relation to society.

Peter is in disarray because he cannot check the outcome of the students' learning and must fall

back on the belief that 'it is worth the effort' to use the 'students as researchers' method. This indicates that perhaps the implementation of output-based curricula has fallen short. As control of the meaning-making process cannot be assumed by the schools and teachers—as it is an indispensable aspect of teaching—the real outcome of the lessons cannot be controlled through the implementation of competence aims and learning goals. Hopmann (2015) expresses this point quite eloquently:

> Seen from the Didaktik point of view, this competence attribution is nothing more than an attempt to suspend the contingent connection of curricular matter to instructional meaning. Which is nothing more than an attempt to nail jelly to the wall. All that gets stuck is the nail, the test, which in this case represents the yardstick, which then unabashedly becomes the actual goal of teaching. (p. 18)

However, as the goals of the subject curricula—the basis on which the teachers evaluate the students—are formulated in this way, coming to terms with the problems of measuring outcomes is challenging. Peter instead sought recourse in the method, which meant diverting the focus from the content and towards a formal theory of Bildung, thus possibly leaving him exposed to the danger of neglecting the objective sides of Bildung, as Klafki (2001) warned. While there are good pedagogical reasons for letting the students decide the research question and conduct their research according to the same principles that are used by scientists, these choices cannot be justified without taking into consideration the objective side of Bildung—that is, the aspects of the world that can become available for the students through the use of the method when it is applied to specific subject content. However, the output-based subject curricula offer little room for the teacher to explore this question, as it is presumed to be predefined. This can explain why June stated that the students should become 'good citizens', as this is part of the core curriculum and is therefore not explicitly connected to the competence aims of the subject curricula.

8 Conclusion

Through this study, we have attempted to present how students and teachers perceive learning while working within the 'students as researchers' context. Despite the students reporting ample learning, much of their reported learning can seem limited if it is connected solely to the measurable curricular goals within the subjects. At the heart of the problem is the suspension of the distinction between matter and meaning that is central to Bildung-centred Didaktik.

As our discussion of the recent reform of the Norwegian curriculum showed, the Norwegian government decided against making social and emotional learning, attitudes, and ethical assessment part of the new definition of competence, thus maintaining the non-alignment with '[the] broad position of an international knowledge base that sees social and emotional skills as an equally important and integrated part of academic learning in schools' (Restad & Mølstad, 2020, p. 10). In fact, the government did not neglect this knowledge base, but having already decided that the new curriculum should be output-based, the solution became a clause stating that 'the competence goals must also be understood in light of the objectives clause and the other sections of the curriculum' (Udir, 2020, p. 11) to which the broad aims connected to Bildung were confined. However, as the concept of Bildung is not compatible with output-based curricula, the peculiar non-alignment of the core curriculum with the subject curricula will continue. Our findings indicate that this tension creates problems for the teachers who put the curriculum into practice; as Hopmann (2003) notes, the institutionalization of the two practices requires a fundamentally different type of reasoning. In the Didaktik tradition, the core of profession-

alism is 'the ability to connect the institutional frame with the not-yet defined variety of local day-to-day activities and outcomes by means of pedagogical arguments' (Hopmann, 2003, p. 472). In contrast, in the product-centred OBE approach, '*efficiency* becomes the core of the profession: the best teacher is the one who gets his students to "stand up and deliver" at the right time' (Hopmann, 2003, p. 472, italics in original). The Norwegian government's recognition that OBE has its limitations regarding the measurement of attitudes and dispositions means that teachers can still ground their choices in the overarching aims of the core curriculum. However, the lack of theoretical compatibility between the two logics is problematic; thus, it seems somewhat paradoxical that the newly adopted core curriculum states that 'teachers and school leaders must regularly reflect on the connection between the teaching and training in the subjects and the overriding goals, values and principles for the teaching and training' (Udir, 2020, p. 11).

What this continued misalignment between the principles of the core and subject curricula will mean in future practice, remains to be seen. As some of the examples from our research show, it is possible to handle such a situation in ways that do not limit students' opportunities to explore and create their own meanings from the content they encounter. The Didaktik tradition is deeply entrenched in the Norwegian educational system, and teachers tend to have a high capacity when it comes to adapting new concepts and reforms to their accustomed ways of exercising their professional autonomy (Hopmann, 2003). The key question is perhaps whether new modes of standardized assessment will be introduced in line with the logic of OBE or whether the highly decentralized features of the new curriculum will extend to the area of assessment. If high-stakes testing is enforced, the confusion that Peter experiences when he cannot account for the expected learning of his students, might force him and his peers to abandon methods such as 'students as researchers' in favour of 'teaching to the test'. Conversely, and on a more hopeful note, if the benefits of working with open-ended methods, such as 'students as researchers', are recognized despite often taking students and teachers in unexpected directions, we might see a realignment between the core and subject curricula. However, this will require a return to content-oriented subject curricula that leave open the opportunity to explore the plethora of possibilities of interpretation and meaning-making.

Looking to the fast-growing international field of curriculum development, the findings of this article illustrate some of the practical consequences—and limitations—of combining two very different approaches to teaching and learning. The teachers that were interviewed are using an educational approach that they generally appreciate, and that leads to their students engaging with subject content in ways that also develop important aspects of their characters as human beings. However, the degree of unpredictability that is a necessary and unavoidable aspect of working with the 'students as researchers' approach, sits uneasily with the logic of OBE, where the aims should be stated in advance and where accountability is a matter of delivering the 'desired understandings' at the right time. By highlighting these tensions, we hope that the study can contribute to the international exchange of experiences (Hopmann, 2015), that is needed in order to make sense of the consequences of the ongoing internationalization and discuss the viability of the options curriculum makers as well as teachers face as they must choose what new ideas and concepts to adopt and how to adapt these to their national and local contexts.

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No potential conflict of interest was reported by the authors.

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