Preservice Science Teachers’ Opportunities for Learning Through Reflection When Planning a Microteaching Unit

Matti Karlström & Karim Hamza

To cite this article: Matti Karlström & Karim Hamza (2018): Preservice Science Teachers’ Opportunities for Learning Through Reflection When Planning a Microteaching Unit, Journal of Science Teacher Education, DOI: 10.1080/1046560X.2018.1531345

To link to this article: https://doi.org/10.1080/1046560X.2018.1531345
Preservice Science Teachers’ Opportunities for Learning Through Reflection When Planning a Microteaching Unit

Matti Karlström and Karim Hamza

Department of Mathematics and Science Education, Stockholm University, Stockholm, Sweden

ABSTRACT

Although microteaching is a common approach to engaging preservice teachers in reflection on teaching in on-campus courses, this reflection is usually carried out as a separate part. We examined how preservice middle school science teachers reflected amid planning a 20-min microteaching unit on sustainable development. Six groups of preservice teachers were video recorded and their conversations transcribed. We used practical epistemology analysis to analyze moments of reflection in these conversations. The preservice science teachers recurrently engaged in reflection in the course of their planning, which led to changes in perspective concerning important aspects of how to plan teaching that may be considered central for preservice science teachers to learn during their teacher education. Preservice teachers’ reflection was related to the openness of the task, as they had to make decisions about many different aspects of their teaching. Even aspects that are not on the table in a real-world setting, for instance having the possibility of deciding on the age of the target students, led to productive reflection and opportunities for learning. Our results contribute to increased awareness of the possibilities of microteaching for facilitating learning during planning. This may provide science teacher educators with better possibilities of supporting their preservice science teachers’ reflective practice.

KEYWORDS

microteaching; planning; reflection; science; preservice teacher education

In this study, we address the question of how to provide preservice middle school science teachers with relevant and authentic knowledge and experiences for their future practice. Loughran (2002) claimed that this question is a perpetual one. The challenge is particularly pertinent in on-campus courses, which risk becoming too theoretical and having little relation to teaching practice (Loughran, 2006). One approach to rendering on-campus courses more relevant to science teaching practice is engaging preservice science teachers in microteaching. Microteaching was introduced into teacher education during the 1960s at Stanford University, with the aim of helping preservice teachers develop teaching skills in a safe environment (Grossman, 2009). Microteaching can be seen as a scaled-down teaching encounter (Cruickshank & Metcalf, 1993) in which preservice teachers plan a short unit (planning phase) and teach the unit to peers (teaching phase) before reflecting on their teaching (reflection phase; Bell, 2007). Over time, various components have been added or altered, for example, video recording the teaching phase, carrying out the reflection phase in alternative ways (Benton-Kupper, 2001; Diana, 2013), and combining microteaching with lesson studies (e.g., Fernández, 2010; Fernández & Robinson, 2006). Nevertheless, the three original phases of planning,
teaching, and reflection remain a central part of microteaching in teacher education programs (e.g., Borgerding, Klein, Ghosh, & Eibel, 2015; Cofré et al., 2014). Today microteaching is considered to contribute to the development of a variety of pedagogical skills essential for preservice teachers. Abdurraham (2010) highlighted skills such as class management, determining appropriate teaching goals and teacher questioning. Arsal (2014) drew attention to preservice teachers’ development of self-efficacy, and Mergler and Tangen (2010) argued that microteaching increases preservice teachers’ ability to connect theory with teaching practice and to give and receive critique as well as encourages them to become reflective practitioners.

Reflection is an essential component of microteaching. Parker and Heywood (2013) described the process of microteaching as “small groups in which student teachers are supported by experienced science teachers and tutors in reviewing the effectiveness (or otherwise) of explanations of difficult ideas to pupils with a view to developing PCK [pedagogical content knowledge] through the reflective process in situ” (p. 411, our emphasis). When looking at the purposes of microteaching, it is thus noticeable that the center of attention is on the teaching and reflection phases. With Bell (2007), we may even argue that the focus is mainly directed toward the teaching phase, with reflection being primarily considered in relation to the enacted teaching. Thus, the idea is that it is primarily in the reflection phase following the teaching phase that preservice teachers get the opportunity to talk about what went well during the teaching phase as well as areas of improvement concerning the enacted teaching (Diana, 2013).

The planning phase of microteaching has been given considerably less attention in both practice and research. It may be carried out by preservice teachers alone (e.g., Diana, 2013) or through collaboration (e.g., Fenandéz & Robinson, 2006). When planning, preservice teachers make decisions about what should be taught, concepts, goals, and objectives based on national standards and how to assess student learning (Diana, 2013). Yet planning is usually carried out without the presence of teacher educators, which indicates that this initial phase is considered more of a means to the more important ends of the teaching and reflection phases. However, there is reason to believe that reflection may also be an important part of the planning phase of microteaching. Lederman and Gess-Newsome (1991) found that during microteaching, preservice teachers talked about planning as a two-component process, first writing a lesson plan and thereafter either going through a mental rehearsal or actually practicing the plan. Thus, preservice teachers did not simply produce a teaching plan and then carry it out but lingered (mentally or practically) over their ideas for the intended teaching. This suggests that preservice teachers engage in some sort of reflection during the planning phase of microteaching also and that this initial phase may play a more important role in learning during microteaching than has typically been assumed.

In this study, we direct our focus to the planning phase of microteaching, trying to understand the role reflection plays and what preservice science teachers may learn as they plan a microteaching lesson together. Our research questions are as follows:

- What moments of reflection occur as preservice middle school science teachers plan a microteaching sequence?
- What opportunities for learning about planning do preservice middle school science teachers have during these moments of reflection?

Bell (2007) claimed that microteaching, despite being well established and a central part of teacher education, remains underexamined and that a deeper understanding of its characteristics
might improve its use in teacher education. Increased knowledge of the possibilities for productive reflection during planning may also contribute to understanding of how teacher educators may make reflection an integral part of microteaching.

Setting

The Swedish teacher education program for middle school comprises eight semesters distributed over 4 years and corresponding to 240 European Credit Transfer and Accumulation System (ECTS) credits. This includes 30 ECTS school placement, 60 ECTS general education (the so-called educational core), 30 ECTS diploma work, and 120 ECTS subject and subject didactics. All preservice middle school teachers take 30 ECTS credits of mathematics, English, and Swedish, respectively. As for the remaining 30 ECTS subject and subject didactics, preservice teachers select between different orientations, one of which is science and technology. The preservice teachers in this study had selected this particular orientation and were attending the 30 ECTS credits course Teaching Science and Technology in Grades 4–6. The course took place during their third semester. The previous two semesters had included three courses in subject and subject didactics (Mathematics I and II and Swedish or Teaching at Primary School Years 4–6), four courses in general education (The History of Education and Its Role in Society, Perspectives on Learning and Development, Law and Ethics in School, and Social Relations in School), and School Placements I and II.

The preservice middle school science teachers were divided into six groups and invited to plan collaboratively a 20-min microteaching unit that would be cotaught by the group to all of their peers as though they were an entire class of middle school students. Each group comprised three to six preservice teachers, and the work of planning the unit took place between the preservice teachers’ classes. The microteaching unit was part of a section of the course focusing on science education for citizenship and socioscientific issues. At the end of the assignment, each preservice teacher had to submit a written reflection on his or her experiences during the task as part of the assessment in the course. Prior to planning the 20-min unit, guidelines concerning the microteaching were presented to the preservice teachers by the teacher educators. For the planning phase, the guidelines were to provide (a) information about the target students (e.g., age, previous teaching), (b) a short description of the purposes and learning goals of the microteaching unit coupled to the national curriculum goals, (c) a short account of the selection of content and assessment methods, and (d) a short description of the planned teaching activities and their purposes. Moreover, the preservice teachers were asked to devise three questions to discuss with their peers after the microteaching focused on pedagogical choices and dilemmas during the planning and enactment of the 20-min unit. In short, the preservice science teachers in this study were involved in planning a microteaching unit, together in small groups, with the overall purpose of learning how to plan and, in that process, take into account various means of assessing students’ learning in science. The preservice science teachers’ previous experiences concerning planning had mainly been theoretical. Although they had practiced planning during their school placement, this planning had been conducted together with an experienced teacher. Thus, for many of these preservice science teachers this microteaching task actually constituted their first experience of planning independently.
Data collection and analysis

This study is part of a larger collaborative project between science education researchers and science teacher educators in which cycles of designing and redesigning parts of a science education course are being conducted. This study presents results from the initial cycle, which was planned exclusively by the teacher educators, with the researchers exclusively taking roles as observers of what took place during the planning phase of the microteaching unit.

All six groups conducted their planning sessions, which lasted between 60 and 90 min, in different rooms on campus, with one video camera and one voice recorder per group. The first author had introduced the research project to the preservice science teachers 4 weeks in advance and had acquired individual written permission to conduct the recordings. The conversations were transcribed verbatim by the first author. Transcripts were then carefully read and reread several times (Moser & Korstjens, 2018) by the first author in line with the analytic approach described below. Analyses were then checked against the original transcripts by the second author, and modifications were made until the emerging themes were deemed robust and firmly grounded in data (Arthur, Waring, Coe, & Hedges, 2012).

Analytic approach

Our interest in this study was to examine to what extent the planning phase of microteaching contains significant, but possibly neglected, opportunities for learning, as preservice teachers encounter difficulties to be dealt with through some kind of reflective process. In our analysis therefore we needed to identify (a) moments of reflection in the preservice teachers’ discussions during planning and (b) the opportunities for learning that occurred during these moments. In order to accomplish this we used a pragmatist approach to reflection and its relation to learning. This pragmatist approach may be understood in two complementary ways. First, it is pragmatic in the sense that, without subscribing to any overall theory about reflection, we use useful ideas about reflection and learning in order to accomplish our analytic purposes. Second, we make use of literature that actually comes from a pragmatist tradition, in particular the works of John Dewey on reflective inquiry, but also recent developments concerning the relation between reflection and learning in education.

Dewey (1910/1997, 1933/1997) talked about reflection as a process beginning with the identification of some kind of problem interfering with the normal course of action and followed by an inquiry in order to resolve the problem. When something new arises in experience, confusion, hesitation, or doubt appears and a search for resolution takes place (Dewey, 1916/1996). Thus, “a state of perplexity, hesitation, doubt” (Dewey, 1910/1997, p. mw.6.118) becomes the starting point for an inquiry process that aims at “converting the dubious into the assured, and the incomplete into the determinate” (Dewey, 1925, p. lw.1.61). In his original edition of “How We Think,” Dewey (1910/1997, p. mw.6.236) developed these ideas into an idealized process with five distinct steps:

1. A felt difficulty
2. Its location and definition
3. The suggestion of a possible solution
4. The development by reasoning of the bearing of the solution
5. Further observation and experiment leading to its acceptance or rejection
Rogers (2002) used and modified Dewey’s framework in her work on in-service teachers’ reflection on their own teaching. However, she noticed that the teachers moved back and forth in this process. Rogers (2007) also observed that the problems, questions, and ideas that arose in the process of reflection were interwoven, refined, and further developed through the process. This was also acknowledged by Dewey, in particular in his revised edition of “How We Think” (Dewey, 1933/1997).

Having established a way of recognizing moments of reflection in an activity, namely, situations characterized by an experienced difficulty and a subsequent effort to solve the problem, we now turn to the task of determining to what extent these reflective moments in the preservice teachers’ conversations offer opportunities for learning. From a pragmatic point of view, there is indeed a close relationship between reflection and learning. For instance, English (2005) described the space between doubt and the solution in reflection as “the twilight zone of learning” (p. 29), where previous experiences and knowledge become insufficient and connect to new reflective experiences. Likewise, Biesta and Burbules (2003) stated that solving a problem in an experimental and reflective manner makes it possible to learn something about the relationship between one’s actions and their consequences. Dewey (1938) stated,

Inquiry, in settling the disturbed relation of organism-environment (which defines doubt) does not merely remove doubt by recurrence to a prior adaptive integration. It institutes new environing conditions that occasion new problems. What the organism learns during this process produces new powers that make new demands upon the environment. (p. lw.12.41–12.42)

In this study, we employ the analytic framework of practical epistemology analysis (PEA) to analyse the opportunities for learning that occurred during the moments of reflection identified in the preservice science teachers’ conversations. PEA is built on pragmatist notions of action and its relation to learning, and is an established procedure for analyzing learning in action in educational settings (Kelly, McDonald, & Wickman, 2012; Wickman & Östman, 2002). In PEA, learning is operationalized as the relations that participants establish as they proceed with an activity. This is an action oriented operationalization constituting a kind of minimal requirement for learning to be possible at all (Hamza & Wickman, 2008). As such, it has productively been employed to point out possible directions that learning may take as students engage in a learning activity (see for example Johansson & Wickman, 2018; Lidar, Lundqvist, & Östman, 2006; Rudsberg, Öhman, & Östman, 2013; Wickman, 2004). It cannot, however, tell us directly which of these relations will be retained and reactualized in future situations and which will play no such role in the preservice teachers’ future actions (Lundqvist, Almqvist, & Östman, 2009). In our case, therefore, the relations that the pre-service teachers established during moments of reflection in the planning activity are referred to as opportunities for learning. Relations are seen as the words and actions used by the preservice teachers to connect different experiences, present as well as earlier, in a situation. For instance, if the preservice teachers said “It’s better to select content that fits the syllabus,” we may say that they have established a relation between “select content” and “fit the syllabus.” This relation, in turn, is considered analytically to fill a gap that was noticed in the conversation. Gaps may be noticed implicitly through the creation of relations, whereas others are noticed through a question or hesitation about how to proceed with the activity. In our example, the gap filled by the relation “select content – fit the syllabus” concerned what content to select. Although it may never have been stated as a question, the implicit question corresponding to the gap could be framed as “what content should we
Sometimes a gap is not filled with new relations, and the gap is then seen to linger and the on-going activity stops or the topic changes. Thus, when gaps are filled, past and present experiences are successively transformed and made continuous with one another, thereby affecting the pathway that learning may take (Wickman & Östman, 2002). However, the potential educative value of the relations established also needs to be analyzed in relation to the purposes of the teaching activity (Wickman, 2004). Here the purpose of this part of the microteaching task was to learn how to plan for teaching. For instance, the relation “select content—fit the syllabus” was leading toward this purpose. However, consider the preservice teachers having filled the same gap by saying, “It’s better to select content that’s easy to pull off during the 20 minutes of microteaching” (thus establishing the relation “select content—easy to pull off”). This relation did not lead toward the purpose of the activity. In this way, we analyzed the educative value of the moments of reflection that the preservice science teachers experienced during the planning phase.

In sum, first, our analyses searched for moments of reflection in the preservice science teachers’ conversations. These were identified as instances in the conversations characterized by hesitation or doubt as the preservice science teachers engaged in planning the microteaching unit in which they subsequently tried to identify the problem and deal with it through some form of inquiry. Second, we analyzed what opportunities for learning occurred during these moments based on what relations the preservice teachers established during reflection and whether these relations led toward the purpose of the activity.

Results

We found several occasions in all six groups in which preservice science teachers engaged in reflection following moments of doubt and hesitation during their planning. Not all of these moments involved opportunities for learning related to the purposes of the activity (as shown in our last example). In those that did, however, a common theme was that they involved a change in perspective concerning important aspects of how to plan teaching. This is described in detail through the first five examples (Examples 1–5) derived from four of the groups. These examples were selected to represent as clearly as possible the variety of aspects found in the material as a whole. Not all aspects were found in all groups, but all groups displayed at least one of the aspects. Our last example (Example 6) was selected to illustrate an instance of reflection not leading to a learning opportunity connected to the purpose of learning how to plan. To facilitate the reading of the results we have summarized our six examples in Table 1.

Example 1: Content or purposes as the first step in the process of planning

Our first example illustrates how the preservice science teachers came to change their perspective concerning how to begin the process of planning as a result of reflecting on what content to select. In particular, here Mia, Björn, Lena, and Anne had an opportunity to consider purposes and goals before deciding on specific teaching content. When we enter the conversation, they are very much in the startup phase of the assignment. Their idea is to let the students reach a decision on a socioscientific issue, and the preservice teachers are suggesting ideas about possible content for the sequence:
Mia and Anne were offering suggestions about possible content for the sequence (turns 1–3) when Björn expressed doubts concerning how they were going about selecting that content (turns 4–7). Through the two gaps about whether the content should really be about animals (turn 4) and whether they maybe got a bad angle already from the start (turn 7), there was a growing hesitation concerning what content to select (Step 1 in the reflection process). Björn’s suggestion that they got a “bad angle,” moreover, located the problem as one about the starting points for their selection of content (Step 2). After that, we can see how the initial hesitation developed into an inquiry (turns 7–15), involving Björn suggesting a possible solution to the problem, namely, to reconsider their aims by taking a look at the curriculum (Step 3, turn 7), followed by the development of further reasoning concerning the suggested solution (Step 4, turns 8–15). In this reflection process, these preservice science teachers established relations such as “we can—take—something else” (turn 10), “start—with syllabus” (turn 11), and finally “thereafter—select content” and “select—later” (turns 13–15).
To sum up, the reflection that took place here made it possible for the group to take another perspective on the process of planning. Here Mia, Björn, Lena, and Anne had an opportunity to learn that instead of beginning with the content to be taught, planning may begin by considering the purposes and aims of instruction. This change in perspective on how to proceed with one’s planning may be considered a central aspect for preservice teachers to learn during their teacher education.

Example 2: Students’ age in relation to teaching content

Our second example also illustrates a change in perspective concerning how to begin the process of planning as preservice science teachers engaged in reflection over how to select content. Here Elin, Freja, Andy, and Albin had an opportunity to consider who their students were and how this may affect their choice of content. When we enter the conversation, they are trying to find possible content for the sequence in relation to the aims for the sequence as stated in the instructions:

16. Elin: No . . . but look into lektion.se [a Swedish website: lesson.se] then, check if we can . . . get some inspiration.
17. Freja: Then I’ll look into “biology” . . . [reads the syllabus on her laptop] “sustainable development,” “healthy meat,” “organic meat,” “take care of your arena,” and “about the rights of public access.”
18. Elin: So it [the microteaching task] has to include “man, nature and society”?
19. Freja: Yes.
20. Elin: In interaction for sustainable development [reads from the guidelines], so...
21. Freja: Yes.
22. Andy: I was thinking about the emission of carbon dioxide, we’re working with that right now . . . the analysis of life cycles. Maybe we can use that one here too?
23. Elin: Something like that or?
24. Andy: Because that’s still “man, nature and society.”
25. Elin: Mm, that’s also true.
26. Freja: Someone else should look into this too.
27. Albin: I can look. [Gets the laptop from Freja.]
28. Elin: What are you thinking about now? [Asked to Freja]
29. Freja: I was thinking about checking if . . . uhm . . . by looking at the syllabus, we might get some inspiration. What’s this? Is this the . . . task or? [Looks at the guidelines.]
30. Andy: It’s this conversation that we’re doing right now.
31. Freja: Or should we start from this one [points at the written guidelines]? Just decide . . . what students do we want to meet?
32. Andy: The thing is, we have to know about our activity to be able to make use of this one.
33. Freja: Or we just decide. This might be a class of 25 pupils, half of whom have mothers tongues other than Swedish and . . . I don’t know.
34. Elin: I . . . uhm . . . are we going to describe the class?
35. Freja: Yes, we have to describe . . . their age . . . But anyway, I want, I think it’s easier to base what to do on this one [points to the written guidelines] and just make a decision, okay? Because right now it’s more like “what are we going to start with?” We have so much, there’s so much. The theme is so big.
36. Andy: Yeah, it really is!
37. Freja: If we start with deciding: Who are the students? Are they Grade 4 or Grade 6? Have they got any knowledge of this or don’t they have a clue?
38. Andy: But the thing is, we have to find out the activity first to be able to [decide which students] . . .
39. Freja: But . . . or we decide activity based on who the students are because that’s what it looks like in reality. It’s not as if one finds out an activity as well as selects a class of students.
40. Andy: Nope.
41. Freja: But we can always alter this if we should find a superior activity—“No this might actually better suit a Grade 6 class!”
42. Andy: Yes.
43. Freja: Then we have to alter.
44. Elin: Mm, that makes things much easier for us.
45. Freja: Exactly. What do you think, shall we . . . Grade 4, then we really can start with something quite simple. But with a Grade 6 we have to go more in depth.
Turns 16–29 show a process clearly characterized by doubts and hesitation, as evident, for instance, through the preservice teachers’ recurring requests for inspiration (turns 16 and 29) and groping for different possible content. Out of this perceived difficulty, Freja located the problem as being about the starting points for choice of content (turn 31) and suggested a solution, as she looked into the guidelines (turn 31), that they begin instead with asking “What students do we want to meet?” Thereafter, a longer reasoning on the bearing of Freja’s solution followed (turns 33–45), which ended in an agreement to first decide on what students they had. This reasoning involved Andy initially contradicting Freja’s idea on the grounds that they needed to decide on an activity first and Freja maintaining the need to begin with deciding which students they had (turns 33–39). One crucial point in the inquiry is when Freja motivated her position by the relation “that’s—what it looks like—in reality” (turn 39). In-service teachers simply cannot choose their students at will but have to plan their teaching based on the students they have. The inquiry ended with relations between the age of the students and what content is possible: “Grade 4—quite simple—Grade 6—more depth” (turn 45).

The reflection that took place here made it possible for the group to take another perspective on the process of planning, similar to the first example. Here Elin, Freja, Andy, and Albin had an opportunity to learn that instead of beginning with the content to be taught, planning may begin by considering who the students are and what they know, and this in turn affects what content it is possible to teach. Even though the preservice teachers in this example were not very specific about the content, they made it clear that there were differences in what might be possible with Grade 4 students as opposed to Grade 6 students. This change in perspective on how to proceed with planning may be considered another central aspect for preservice teachers to learn during their education.

It is interesting to note, however, the relations established through turns 41–44. Microteaching was part of the course assessments, and therefore it became important for the preservice teachers to actually devise a lesson plan. Despite the relation made concerning how things are done in reality, Freja and Elin hedged by saying “we can always alter if we should find out a superior activity” (turn 41) and “much easier for us” (turn 44). This kind of rearrangement of the order of things is obviously not on the table in a real-world school setting but may rather be seen as a feature of the microteaching assignment being a safe environment of trial and experimentation.

**Example 3: How a 20-min unit may fit into a larger context**

In our third example, an additional change in perspective followed the preservice science teachers’ reflection, this time concerning the need to consider the larger context when planning a certain teaching sequence. In particular, here Mika, Lea, Anders, and Bengt had an opportunity to learn that what their students have already experienced, as well as what comes after, plays an important part when selecting content. As we enter the conversation, they are considering the idea that their students may work with some kind of problem-solving activity. But just as in the previous examples, the preservice teachers are struggling with what content to select for the activity, going through a number of suggestions:
In turns 46–51, the conversation was characterized by hesitation and doubt concerning what content to select, as evident through a number of vague suggestions for content (through relations such as “Uhm, problem solving . . . ‘How can we’ . . . uhm . . . ‘How can we help each other here at school, not dispose so much? Maybe we can’ . . . ‘We might do like this . . . ‘We who think it’s stressful to eat—we make sure that we wait for everyone to finish their meal, before we rush out.”

49. Bengt: Yes.
50. Mika: Or just “That was 20’ . . . just saying something . . . ‘Yes, but we have to reduce it to 15.” So there will be no competition, more like a joint goal.
51. Lea: You can investigate what happens to the food waste disposal in school. If it turns into biogas or if it becomes compost or if it will be burnt or somehow . . . [Pause for a second]

52. Anders: Is . . . this, what we’re doing right now, going to be part of a larger context dealing with our waste?
53. Mika: The content will increase, adding meat . . . all sort of stuff will enter into this.
54. Lea: Waste technology systems and things like that. It has to be decided what [interrupted].
55. Mika: But I think that these two tasks will answer well for 20 minutes.
56. Anders: Yes, yes, absolutely! I was thinking more of the big picture.
57. Bengt: There’s more than enough . . .
58. Lea: And then continue with waste disposal as a next step.
59. Anders: Yes exactly, and prior preknowledge and [interrupted].
60. Mika: For example, that they have worked with life-cycle analyses we might say. That they have made reports about different . . . well someone with concern of plastic, with meat or . . . fish or something like that. And now they have come to an end, which also was an aim, where they have the knowledge about how life cycles work and so . . . that they’re able to reach a decision. And they’re doing this . . . concerning how to handle food and . . . well, how to find solutions thus they have knowledge about all kinds of cycles and . . . well. Now they’re reaching decisions on how to reduce . . . or what we’re going to do with the waste.
61. Lea: Yes, and that they already . . . they already know that there’s a problem with . . . that we’re disposing so much food. With ecological footprints and [interrupted].

In turns 46–51, the conversation was characterized by hesitation and doubt concerning what content to select, as evident through a number of vague suggestions for content (through relations such as “Uhm, problem solving . . . ‘How can we’ . . . uhm . . .’ and “Or just ‘That was 20’—just saying something . . .”) and ending in a longer pause (turn 51). Then a location of the problem as being about the place of the sequence in a larger whole, as well as the beginning of a solution to the problem, gradually developed, starting in turn 52 with the gap “Is . . . this, what we’re doing, going to be part of a larger context?” In this way, Anders initiated a reflection that developed through objections from Mika and Bengt (e.g., turns 53 and 55), clarifications by Anders (rephrasing his question into “thinking more of the big picture” in turn 56), suggestions for potential prior knowledge their students might have (turn 59), and finally the creation of a very specific context preceding the teaching sequence (turns 60–61).

The reflection in this example led to a change in perspective concerning how to select content for a teaching sequence, namely, looking at a limited teaching unit within a wider sequence. This zooming out gave Mika, Lea, Anders, and Bengt the possibility of reflecting on how different parts in a wider teaching context may interact with one another and how it might be possible to create a teaching sequence that has the potential to be continuous. Mika, Lea, Anders, and Bengt thus had an opportunity to learn to view teaching as a larger endeavor not reducible to single teaching events. This may indeed be considered another central aspect for preservice science teachers to learn during their teacher education.

**Example 4: Methods from other subjects used for new purposes**

In the fourth example, the reflection that Sean, Vicki, and Lars engaged in led to a reappraisal of teaching methods encountered in another on-campus course and an appreciation that methods
emanating from one subject may be used in others. As in the previous examples, the preservice science teachers in this example are striving to figure out the content for their sequence:

62. Sean: It could be someone who writes a letter like to your friend.
63. Vicki: Yes.
64. Lars: Mm, well . . . if we have 20 minutes for this, then it feels as we might want an activity or . . . not a game but something you know to . . .
65. Vicki: Not only stand there for 20 minutes, talking . . .
66. Lars: And then like this: “Write a letter,” leaving them in . . .
67. Sean: But like . . . uhm . . . I mean sort of but not leaving the students on their own but, you know, something more complex . . . or something more fun. But the question is what it might be?
68. Vicki: Damn, this is harder than I thought!
69. Lars: I’m thinking of our Swedish [i.e., a previous course in home language], do you remember that circle model, you wrote a letter together, you wrote by yourself . . . You know, something emerging gradually . . .
70. Sean: Mm.
71. Lars: Do you understand [turns to Sean], do you remember?
72. Vicki: What Swedish?
73. Sean: Circle . . . letter, circle writing . . . nah.
74. Lars: No, it’s just like you build it on this model. Getting to know how to write an argumentative text you should first look at one. Then you wrote together. And after that you wrote by yourself . . . Genre wheel—that’s what it was!
75. Vicki: Don’t even remember that.
76. Sean: Can that be done based on environmental issues?
77. Lars: Yes, you know, with the same idea so to say.
78. Sean: Mm. Imagine that you’re to hand over stories to each other and the story might start like this: “Yes, but we are having a situation where . . . a little polar bear on the ice.”
79. Lars: Yes, that you start in something like this . . . and then . . . It can also be just as we did now and then we give them a situation like: “But now this is happening, how does the story continue?” And then after that the next one gets to write. Or simply: “You have your family living here and there and they work with this but then this happens and what are you going to do about . . .?” We can, it might be a role play if we split them into different, and they get to represent different like . . . It can be the endpoint of a SSI [SocioScientific Issues]-case: “You are the factory that produces, you are the consumers who buys, you are . . .” In that way, we get different perspectives of it.

In the first seven turns there was a gradual buildup of hesitation and doubt concerning how they should plan their sequence (turns 62–68), ending with Vicki exclaiming “Damn, this is harder than I thought,” followed by a longer pause. In the course of this perceived difficulty, the preservice teachers also located the problem more specifically as related to time constraints and the need to give the students the possibility of being more active in a short time frame, through the relations “20 minutes—want an activity” (turn 64), “Not only—stand there [as teacher]” (turn 65), “not—leaving students—on their own” (turn 67), and “more complex—more fun” (turn 67). In turns 69–74, a suggestion for a solution emerged through the relations “thinking—of our Swedish—circle model,” “wrote together—you yourself—emerging gradually” (turn 69), and finally “Genre wheel—that’s what it is” (turn 74). This solution was then further scrutinized starting with Sean asking whether the genre wheel could be done based on environmental issues as well (turn 76), followed by several relations confirming this possibility (turns 77–79).

The reflection that took place in this example involved the preservice science teachers investigating other on-campus experiences in a new context. Reconnecting to earlier experiences in this manner, even from outside the domain of science, might have created an awareness of the relevance of what the preservice teachers had learned earlier in the program in different courses. This in turn also gave them an opportunity to further develop their own teaching by modifying previous experiences in wider
contexts. Thus, Sean, Vicki, and Lars had an opportunity to learn that it is possible to adapt subject-specific teaching such as the genre wheel to another subject, in this case science.

**Example 5: Taking classroom interactions into account**

Later on, Sean, Vicki, and Lars finally decided on using Kahoot\(^1\) for a value clarification exercise instead of doing what they had previously talked about in Example 4. Having settled for the value clarification exercise, Sean, Vicki, and Lars were set on developing relevant questions that could lead to classroom discussion. In the reflection that took place concerning their students’ (i.e., their fellow coursemates’) possibility of engaging with the questions, there was another change in perspective. What was initially an issue of phrasing the questions appropriately developed instead into an issue about group size and students’ need for time to think before answering questions during the value clarification exercise. As we enter the conversation, the preservice science teachers have been suggesting various questions to use in the value clarification exercise:

---

80. Lars: Do we want any special structure to the value clarification questions? Because if everyone says “yes,” well then? . . . So that we somehow get a discussion going.

81. Sean: Yes.

82. Lars: Maybe one method could be saying like this: “Well, all of you in this group, say something” . . . or something like that . . .

83. Sean: “Say something!”

84. Lars: “Say something!” Otherwise it will become like this: “Who pushed ‘YES’?” . . . and then ‘Nah...’ No one will . . .

85. Sean: “When I look at you, I can see that you answered ‘NO’!”

86. Lars: “Can someone who pushed ‘YES’ say what they’re thinking?” . . . sort of . . .

87. Vicki: Yes.

88. Sean: Yes, but . . . Exactly!

89. Lars: We can do like this: “What kind of arguments, do you think, are useful when answering ‘YES’” and “What kind of arguments, do you think, are useful when answering ‘NO’”? Then they have to, well they don’t have to [interrupted].

90. Sean: Like trading places . . .

91. Vicki: But . . . I’m thinking . . . Does that get a discussion going?

92. Lars: No, maybe not.

93. Vicki: Because then, they might just drop it.

94. Sean: Yeah.

95. Vicki: Not because this sounds bad but I’m thinking if we want . . .

96. Lars: We want to engage them, but when you’re working with a large group it can be hard, you know . . . to be able to discuss all together, like that!

97. Sean: Yes.

98. Lars: It might be better to discuss in smaller groups then or?

99. Sean: Yes. It might be like . . . when to reach a decision, you’re in a lack of time, so you’re not able to [interrupted].

100. Vicki: Think!

101. Sean: Or . . . we could just do it in a way where we: “We give you this question now, so that you can discuss it, in your your groups . . . later.”

---

The preservice teachers’ effort to come up with good questions was replaced by reflection initiated by Lars’s question concerning whether they should have any special structure to their value clarification questions in order to get the discussion

\(^1\)Kahoot is a game-based learning platform used as educational technology in classrooms and other learning institutions.
going and avoid everyone saying “yes” (turn 80). One might say that in this single turn Lars both initiated a difficulty, located the problem as one about getting the discussion going, and suggested the beginning of a solution to the problem by asking about the structure of the questions. The reflection continued through turns 82–94, in which the preservice science teachers investigated consequences of different variants of questions to ask the students with an aim of generating active classroom discussions. However, here we may also say that the preservice teachers engaged in some kind of experimenting and testing of their questions, thereby enacting Step 5 in Dewey’s original five-step scheme of reflection. By putting themselves in the positions of teacher and students interacting (turns 82–84, 84–86, and 89), they were trying out consequences as a kind of imaginary way of acting, a rehearsal in mind. The temporary end of this reflection was a rejection of the questions suggested, beginning with Vicki asking whether this would really create the intended discussion and ending with everyone agreeing that it would probably not (turns 91–94). At the same time, this rejection constituted a new instance of hesitation and doubt. As the problem was not solved, a new location of the problem ensued. Thus, the preservice teacher no longer framed the problem as being about the structure of the questions but framed it as the difficulty of engaging students if the groups are too large (turn 96) and if the students lack time to think before getting the opportunity to answer the value clarification questions (turn 99). They also formulated solutions to these problems by suggesting that it might be easier to discuss in smaller groups and to hand out the value clarification questions in advance (turns 98 and 101).

The reflections in this example led to another change in perspective, from focusing on the wording of the value clarification questions to focusing on their students’ possibilities of engaging in the activity. Sean, Vicki, and Lars here had an opportunity to learn to deal with this through measures concerning classroom interaction and the structure of the activity. To give students enough time to consider and to realize possibilities in relation to questions in an activity, and to consider student group size, may be seen as central aspects for preservice teachers to learn during their teacher education.

**Example 6: Reflection without opportunities to learn about planning**

Of course there were other situations filled with hesitation or doubt in the preservice teachers’ discussions. However, not all of these situations involved an inquiry or were educative in the sense of leading toward the intended aims of the microteaching task itself. This can be seen in our last example. Although Ann, Erik, and Kim engaged in reflection concerning what content to select for their sequence, here it became an issue of comparing the importance of a parallel task to the present one concerning the preservice science teachers’ workload and possible rewards from either task:
Ann initiated a difficulty by addressing the question of what topic to select (turn 102) and located this problem as finding content based in an authentic context. She made several suggestions as to content by establishing relations to sorting, reduced use of chemicals, saving energy, eco-labeled food, fewer transports, digital storage ... No, I don't know ... (turn 104). Despite all of these suggestions, the gap lingered and the doubt remained, as she exclaimed "No, I don't know" (turn 104). Another solution was suggested by Erik, namely, a joint reading of the syllabus (turns 105–108). However, this also resulted in the gap still lingering, as Erik exclaimed "Damn, I feel completely blank in the head!" (turn 109).

The problem then became (re)located as one of too many parallel tasks in the course (turns 110–111). The reflection that followed contained suggestions for using content from one of these parallel tasks (the "modules") and evaluations based on which of the tasks had the highest priority and noted that the selected content of the present task needed to be good enough for the reflection phase following the teaching phase (turns 116–117).

Thus, what could have been an opportunity for learning concerning how to select content in relation to authentic contexts instead came to concern how to be strategic when working with parallel assessments in a campus course. Although this, as a result, led to Ann, Erik, and Kim to have an opportunity to learn something, this learning was not in line with the purposes of the microteaching task.

**Discussion and conclusion**

In this work, our intention was to investigate what moments of reflection occurred as preservice middle school science teachers planned a microteaching sequence and what opportunities to learn about planning occurred during these moments of reflection. Our results showed that all six groups of preservice teachers recurrently experienced situations
that required reflection amid planning a microteaching unit together. This reflection sometimes led to opportunities for learning, which may be considered central to their preservice education. In particular, our results showed important changes in perspective concerning the selection of content for a teaching sequence. For the sample as a whole, we identified the following opportunities to learn about how to plan science education for middle school students:

- Planning may begin by considering the purposes and aims of instruction, instead of beginning with the content to be taught.
- Planning may begin by considering who the students are and what they know, instead of beginning with the content to be taught, and this, in turn, affects what content is possible to teach.
- Planning may include viewing teaching as a larger endeavor not reducible to single teaching events.
- Planning may include questions of how to incorporate and adapt subject-specific teaching from areas other than science to develop one’s teaching.
- Planning may include dealing with intended teaching through measures concerning classroom interaction and structure of the activity, for example to give students enough time to consider and realize possibilities in relation to questions in an activity, and to consider student group size.

Considering that for most of the preservice science teachers this microteaching task constituted their first experience planning independently and without the support of a supervisor, our results may be interpreted as showing the potential educative value of the reflective moments that a microteaching task induces. Below we first discuss this potential educative value in light of what was common for all six groups, on the grounds that each group engaged in several moments of reflection and experienced at least one of the learning opportunities listed above. Thereafter we address the question of how to modify the planning session so that all groups may benefit from all learning opportunities that may surface in the different planning groups.

In particular, it seems as if the reflection that the six groups engaged in helped the preservice science teachers to begin noticing the order in which the teacher educators expected them to conduct their planning. On the surface, it would seem that this order would have been rather obvious through the instructions, which asked the preservice science teachers first to consider who their students were (age, previous teaching, etc.), then to decide on purposes and goals related to the syllabus, then to select content and how the learning of it should be assessed, and finally to decide on methods for teaching. However, having no firsthand experience planning, the groups instead typically began their planning by considering what content to teach. Only as they stumbled on concrete obstacles to selecting this content did they contingently begin to reflect on various issues having to do with the rationale for planning teaching. This educative value of contingency and error has been demonstrated for students’ learning of science (Hamza, 2013; Hamza & Wickman, 2009) and also seems to be an important aspect for preservice middle school science teachers’ learning of how to plan teaching.

An interesting question is what created these opportunities for change in perspective and learning. One possible answer may be the open character of the task. The preservice teachers
were given great opportunities to make their own decisions about the teaching sequence, in its entirety as well as in its details. They were to come up with a teaching plan for a microteaching unit with the broad theme “Human, nature and society in interaction for sustainable development.” At the same time, the guidelines challenged them, explicitly as well as implicitly, to make a variety of specific decisions. This freedom of choice may have provided the openness necessary to accomplish anything significant (cf. Dewey, 1934).

In fact, we may consider two aspects of the openness of the planning task. First, there was an openness that gave the preservice teachers an opportunity to make decisions similar to what they may experience as in-service teachers, for instance about content, teaching and assessment, and the location of the sequence in a broader teaching context. Second, however, the preservice teachers also had to make decisions about aspects that are not an issue for in-service teachers, for instance to freely decide who their students were and what they knew. Our results suggest that this inauthentic freedom from the hard realities of future in-service practice constituted potentially important and unique experiences. Through them, the preservice science teachers were able to explore different alternative content in relation to the age of their students (Example 2), which is not an option in real-life teaching. Likewise, the teachers invented their imagined students’ previous knowledge, again experimenting with different alternatives (Example 3). The preservice teachers’ horizons of action were potentially widened through their reflection and deliberations into various possibilities that will not be on the table in real-world settings and that would never have been considered had the microteaching task been rendered more authentic by the teacher educators in the first place.

Another aspect is that when we follow the conversations in the six groups, we notice a willingness to examine different perspectives, to participate more unconditionally, and finally to investigate the consequences of one’s thinking. This complies with attitudes such as open-mindedness, directness, whole-heartedness, and responsibility, all of which Dewey (1916/1996) stated as central for the process of reflection. Put differently, the preservice teachers engaged in conversations in which arguments for different views were presented and made clear and in which the bases and conditions of the different views were investigated. Moreover, the conversations were characterized by an endeavor to reach an agreement or a solution to a problem and the basis on which this agreement rested. Even when there was no agreement, they sought new approaches in order to settle the matter. This type of conversation could also be described as deliberative (Englund, 2007), in that the preservice teachers were “challenged to consider others’ reasons and thereby expand their own reasoning” (Hanson & Howe, 2011, p. 5).

Although all participating groups of preservice science teachers eventually succeeded in constructing final plans for their microteaching unit, their planning work was not a walk in the park. On the contrary, they struggled and sometimes even showed frustration over the difficulties they experienced during planning. These difficulties could be seen as arising from the openness referred to above, in which the preservice science teachers were invited—even required—to make decisions about a large number of things. However, these difficulties often led to reflection and opportunities for learning. As Dewey (1910/1997) stated, “Too much that is easy gives no ground for inquiry; too much of the hard renders inquiry hopeless” (p. mw.6.354), which implies that there must be a balance between the easy and familiar and the strange and difficult involved in reflection. Thus, perhaps these opportunities for learning became possible because of a balance of familiarity and
difficulty in the assignment between the preservice teachers’ previous experiences and aspects they had not met before.

What becomes interesting, both from a teacher educator perspective and as a matter of further research, is whether this balance of familiarity and difficulty can be modified; in other words, to what extent should the openness be increased, or limited, and in what way might this affect preservice teachers’ opportunities for learning? For instance, the openness in the studied microteaching project could have been greater if, for instance, the preservice teachers had also been required to decide about the theme of teaching or if they had had to present more than only one teaching sequence. We may hypothesize that they would also have succeeded with this more open assignment, although the planning may have required more time. However, an alternative possibility is that the challenge would have become too large, leading to them copying ready-made teaching plans from the Web. However, the openness could have been less, for instance through the predetermined age of the imagined students or if the teacher educators had provided a detailed description of the students’ preknowledge, thus creating conditions that might be considered more authentic. However, as indicated above, a narrower scope would have excluded certain learning opportunities that some of the groups displayed, for instance in Examples 2 and 3.

A central question emanating from this study is whether and how it is possible to modify the conditions for the planning phase of a microteaching exercise in order that all preservice teachers experience the different learning opportunities occurring in the different groups. One way may be to incorporate experiences from the planning phase into the final reflection phase that normally follows the teaching phase (cf. Bell, 2007). If preservice teachers are able to share with peers and teacher educators the difficulties and doubts they encountered during planning and how they solved these problems, experiences had by individual groups can be transformed into public content to be learned. Such organized reflection on experiences had during planning, moreover, may also contribute to the different opportunities for learning having a greater probability of really hitting the level of learning, such that the knowledge actually is used by the preservice teachers in their future planning.

Another way would be to modify the instructions for the planning phase given to preservice science teachers in line with what was discussed above concerning the openness of the task. Consequently, based on this study we are now involved in modifying the conditions for the microteaching task with a new group of preservice teachers and in close collaboration with the teacher educators in order to study how their deliberations and reflections develop differently through two additional cycles.

Although we do not claim that the present study captures all aspects of the potential learning observed during these preservice teachers’ conversations, we think that the results provide important insight into different conditions and opportunities for reflection during the different phases of microteaching. Bell (2007) noted that preservice teachers often considered the purpose of the reflection following the teaching phase to be an evaluation of their teaching skills. She suggested that teacher educators need to devalue the focus on skills and instead emphasize a play between self and imagined and possible others in order to create opportunities for preservice teachers to develop both a reflective practice and their teaching abilities (p. 38). Our results suggest that teacher educators may have yet another possibility of supporting their preservice teachers’ reflective practice, namely, to explicitly address and make use of the ample opportunities for reflection that also occur during the planning phase.
References


