Abstract
During the last years the didactical model organizing purposes has provided important insights about how teachers work with moment-to-moment learning progressions in science teaching. In the present study, organizing purposes were used to plan a lesson within a context-based unit in Biology, in which the Ebola disease was the overarching context. The lesson was planned in two parts. In the first part, the students worked with a model that simulated the spread of Ebola; in the second part, the model was discussed and compared with the real disease. The analysis of the enacted lesson shows that the students’ experiences from the model were effectively used by the teacher to establish a learning progression towards the learning goals. This was done by eliciting questions, comparisons between the model and real diseases, and recalling specific situations that allowed students to use everyday experiences and scientific concepts. Moreover, by maintaining focus in the context of the unit, the teacher through these actions, constantly directed the lesson towards the learning goals.
INTRODUCTION

In this paper, we present an example of how the didactical model organizing purposes was used to plan and analyse students' learning progressions in a single lesson of a context-based teaching unit in Biology. The model of organizing purposes distinguishes between different purposes for teaching, the overarching purposes and the student-orientated purposes, with a close connection to students' previous experiences. In previous investigations, the model organizing purposes has been used as analytical tool to study students’ learning progressions and the teachers' role to scaffold the students’ learning (Anderhag, Danielsson Thorell, Andersson, Holst & Norling, 2014; Johansson & Wickman, 2018). Our contribution in the present study is to explore how the model can be used to plan science teaching. We studied how the planned purposes were enacted during the lesson and how the teacher, in moment-to-moment interactions with the students, established continuity between the different kind of purposes.

Learning progressions

In the last twenty years, the idea of learning progressions has emerged as one effort to meliorating the gap between our knowledge of students’ learning in science and how to make this knowledge useful for teaching. Learning progressions, commonly defined as the pathway “by which children can bridge their starting point and the desired end point” (National Research Council, 2007, p. 214) have explicitly been argued to constitute concrete tools for planning and execution of teaching as well as for the development of assessment practices. The majority of work on learning progressions has primarily concerned the development and validation of grand progressions within different subject areas. Common aspects in these studies have been to examine how students’ pre-understandings of scientific concepts or phenomena can be used to enable learning progressions (Duschl, Maeng & Sezen, 2011; Plummer & Krajcik, 2010) and how to successively work with progression by starting the teaching with basic parts of the subject, then putting the parts together as a whole (Stevens, Delgado & Krajcik, 2009). However, it has been suggested that primarily considering grand progressions overlooks the fact that teaching and learning occur in situated practices, in the interaction between the teacher and students and as a part of single lessons (Johansson & Wickman, 2011).

An alternative approach to the view of learning progressions as grand progressions, has been through the development of teaching sequences, which in some studies are described as components of learning progressions (Duschl et al., 2011). The development and implementation of teaching sequences has its origin in the 1980s and are built on research about teaching as well as students’ learning of particular scientific topics (Méheut & Psillos, 2004). In the design of a teaching sequence there is a focus on teaching and learning on a micro or medium-level (specific sessions or single topic sequences) within a particular topic area (Leach & Scott, 2002; Méheut & Psillos, 2004). There has been a tendency to evaluate the effect of various teaching sequences primarily according to the effectiveness of the including teaching activities in relation to the overall aims with teaching (Leach & Scott, 2002). A common way to assess the effect of a certain teaching sequence has been by using pre- and post-tests then comparing the results of the students. However, Leach and Scott (2002), highlight the role of the context and social interactions in assessing the effectiveness of different sequences. The authors specifically point at the teachers’ role in supporting the learning process, for instance by asking questions and how to respond to students’ talk. Also, Asoko (2002), stresses that teaching is dependent both on context and content and emphasizes the teachers’ role in “talking ideas into existence”.

In teaching sequences, the patterns of interactional exchange between teachers and students and the discourses for dialogues in the science classrooms have been revealed of crucial importance for part of the students’ learning progressions (Mercer & Dawes, 2014). The most common example of interactional exchange between the teacher and students is the IRE-dialogue, IRE (Scott, Mortimer & Aguiar, 2006; Mercer & Dawes, 2014). A classical IRE-dialogue follows the pattern Initiation-Response-Evaluation (Mercer & Dawes, 2014). The IRE-pattern, which firstly was described as IRF (F
stands for Follow up), implies that the teacher first initiates a question, whereby a student answers (responds) and in the third move the teacher evaluates (or follows up) the answer. Initially, IREs were associated to the use of closed questions as well as to questions to which the teacher knew the correct answer. Therefore, teachers firstly were suggested to avoid the use of IREs and reduce the use of questions in the classroom (Mercer & Dawes, 2014). However, Wells (1999) showed that the pattern does not necessary have to be linked to the use of closed questions, but it depends on how the teacher acts and evaluates the answers of the students. If the third move of the teacher opens up for the students to express their thoughts or give the students an opportunity to extend their answers it may affect students’ learning in a positive way. Scott et al. (2006) described two different discourses for dialogues in the science classroom; authoritative and dialogical discourses. The authoritative discourse refers to a teaching approach focusing on a school science point of view whereas a dialogical approach opens up for different perspectives and thoughts (Scott et al., 2006). The authors mean that a tension between the two approaches is needed to support meaningful learning of science. By using an authoritative discourse, the teacher introduces scientific ideas and a scientific perspective, while a dialogical approach engages the students in a dialogue and gives them an opportunity to express their everyday views of various phenomena. A dialogical approach also invites the students to use and explore recently learned scientific content and may function motivating for the students (Scott et al., 2006).

The lesson described in this article was a part of a context-based teaching unit in Biology. Previous studies have shown that if science education is put into a context that students recognize, the students become more motivated and interested in the subjects and more stimulated in their learning (Aikenhead, 2006; Bennet, Campbell, Hogarth & Lubben, 2005; Broman, 2015). However, working with a context-based teaching approach also entails challenges. Context-based teaching does not automatically result in learning progressions among students (Wickman & Ligozat, 2011) and such an approach raises new demands on teachers. To enable learning progressions among students it is important to establish continuity between the context and the scientific knowledge supposed to be learned (Johansson & Wickman, 2011) therein the teacher has a central role. Concerning context-based teaching there are earlier performed studies regarding different ways of working with such an approach (Bennet et al., 2005; King, 2012) as well as studies about the effects of students’ interest and motivation for science subjects (Bennet, Hogarth & Lubben, 2007). However, there is limited research about how learning progressions can be created in context-based teaching. Thus, a particular intention with our study is to contribute to more knowledge about how to link the context of teaching and the scientific content.

Organizing purposes

Based on a pragmatic perspective on learning and meaning-making Wickman and Ligozat (2011) and Johansson and Wickman (2011; 2018) suggested a new way to work with progression in the science classroom by defining progression as continuity between different purposes for teaching. A pragmatic approach implies a view that there is not a single way to achieve learning progressions but teaching and learning are situated and occur as part of specific activities in the classroom. Accordingly, the final learning progressions are built on students’ and teachers’ gradually and common acts during lessons (Johansson & Wickman, 2011; Wickman & Östman, 2002).

In order to give teachers tools for planning and reflecting on how a school science lesson or unit progresses Johansson and Wickman (2011; 2018) developed the didactical model organizing purposes. According to the model, planning for learning progressions in a particular activity in the classroom implies for the teacher to establish continuity between different purposes: ultimate and proximate purposes. Whereas the ultimate purpose can be seen as an overall goal with teaching, for example the teachers’ or the syllabus’ goal with science education, the proximate purpose is more student-orientated and has a meaning and purpose that students can see and recognize and it is possible for students to relate it to their own experiences. Proximate purposes can be planned in advance by the
teacher, but they can also develop spontaneously in the actual teaching situation (Hamza & Wickman, 2009; Johansson, 2014). If a proximate purpose is functional, it will become an end-in-view which directs the joint action of students and teacher during the lesson (Johansson & Wickman, 2011). The term end-in-view refers to Dewey’s description of purposes which function as the students, by using their everyday language and previous experiences, can participate in an activity in a purposeful way (Dewey, 1925/2013). In the activity students’ previous experiences are reconstructed and transformed in the new situation, resulting in consequences for the learning process among the students. This conforms to Dewey’s principle of continuity (Dewey, 1938/1997). Besides a pragmatic framework, the Joint action theory of didactics is a theory of importance for the development of organizing purposes as a model. This theory also emphasizes the joint action of the teacher and the students in the learning process and is based on Guy Brousseaus’ thoughts about adidactic and didactic situations in mathematics (Sensevy, 2012).

In the model organizing purposes, there are two key-roles for the teacher in order to secure continuity, i.e., progression, to occur in the classroom: (1) to arrange and design teaching activities that allow that proximate purposes become ends-in-view for the students and (2) actively establish continuity between proximate and ultimate purposes in the moment-by-moment interactions with the students in the classroom. Johansson and Wickman (2018) describe how the teacher, by talk and questions, guides the students towards the lessons ultimate purpose during teaching. This guidance is for instance done by linking the proximate purposes to the ultimate purposes during teaching, successively introducing scientific concepts of importance or inviting the students to use their previous experiences and language in relation to the new content. In another study using organizing purposes, Anderhag et al. (2014) show that an important factor to create continuity to the ultimate purpose is that the students’ have a possibility to connect the proximate purposes to their previous experiences. The study also exemplifies how the teacher supports the students towards the ultimate purpose by helping them to distinguish what actions are adequate in relation to the lessons’ ultimate purpose. As in these previous studies, we have used the model of organizing purposes to analyse how a science lesson progresses as well as how the teacher and students establish continuity between the different purposes. However, we also used the model in the planning phase of the particular lesson, with the aim of planning for progression.

Aim and research questions
The aim of this study is to show how the model of organizing purposes can be used in practice to plan and subsequently analyse learning progressions. We specifically studied how the model was used in practice to plan a lesson in a context-based science unit and how the teacher, in moment-to-moment interactions with the students, established continuity between the originally planned learning goals. Moreover, we examined how the planned proximate purposes were enacted during teaching. Our study is guided by the following research questions:

- How did the teacher work with the teaching purposes to plan the lesson and enact those purposes in teaching?

- How did the teacher and students establish continuity between the planned teaching purposes in the lesson?

Procedure
This section is divided in two parts. Under the first part (Ebola – the context of the unit) we describe the methods used in the study, the background of Ebola as an overall context and how the model of organizing purposes was used in the planning of the unit. The data for the present study come from
one of the lessons of the unit. Under the second part (Planning the lesson) we describe, in more detail how this particular lesson was organized and planned.

Ebola – the context of the unit
The study was performed as an intervention study in grade 8 in a Swedish secondary school in which a science class of 30 students aged 14-15 was followed during a context-based unit in Biology. During the last years, the science teachers of the school have developed teaching units characterized by a mix between an everyday coping and a science, technology and society emphasis (Roberts, 1988). An important characteristic of these units is that they have a well-defined and concrete overarching goal. In this particular unit, the Ebola virus disease was used as a context and the overarching goal was that the students, at the end of the unit, should be able to answer the question “Should we be afraid of Ebola?” in a qualified way. The background for choosing Ebola as a context was the interest and concern among students since the outbreak of this disease in some West African countries was one of the most important news at the time. The teaching was planned jointly by the ordinary science teacher and one of the authors (Lavett Lagerström) using the didactical model organizing purposes. As a first stage and based on the students’ questions and the goals in the Biology curriculum, related to virus and bacteria diseases and the body’s immune system, several ultimate purposes were formulated for the different lessons of the unit. Subsequently, from these ultimate purposes, more student-oriented proximate purposes were planned for each lesson. The unit totally covered 10 lessons of various lengths (75-150 minutes). Data for the present study come from one of the lessons of the unit in which the students modelled the spreading of the Ebola virus within a population. The lesson was structured in two parts: a model activity and a follow-up discussion. The lesson was recorded with a video recorder and several voice recorders. Talk from recordings was transcribed verbatim in their entirety.

Planning the lesson
During the planning phase, the lessons’ ultimate purpose was briefly formulated as the learning goal “to get an initial understanding about how infectious diseases spread”. The model activity, in which the students modelled the spread of Ebola infection using test tubes, was planned as an overall proximate purpose for the first part of the lesson. The activity was carefully planned before teaching to include several proximate purposes, with the aim of guiding the students’ actions towards the lessons’ ultimate purpose. Proximate purposes were, for instance, different actions during the performance of the activity and the use of various artefacts applied in the model. To model the spread of Ebola, two classes (the present class followed in the whole unit and a parallel class in the same grade) gathered for a joined lesson in the main hall of the school. The responsible teacher for the second class participated in the activity. At the beginning of the lesson, each student got a test tube with water (representing body fluids) except one student that got a transparent starch solution in the test tube (representing Ebola viruses). Then, the students mingled around and after a signal given by the teachers the students mixed the content of their test tubes to emulate the spreading mechanism of Ebola infection in real life (exchange of body fluids). After that, the teachers (acting as physicians in a check-point) used iodine to test the presence of starch in all the tubes and to assess how many students got “infected”.

In the second part of the lesson, the model activity was followed up by a whole class discussion in the classroom. Whereas the proximate purposes for the first part of the lesson were carefully planned in advance, the proximate purposes for the second part of the lesson were not articulated in detail, but intended as a dialogue with open questions to compare the test tube model and the spread of Ebola and other infectious diseases.

Analysing the lesson
Transcripts from the model activity and the following whole class discussion were analysed for continuity between the ultimate and proximate purposes for the lesson. In the conversations, the proximate purposes were identified in teacher-student interactions and dialogues. Then, we examined how
the proximate purposes worked as ends-in-view and how the teacher, together with the students, created visible continuity between the proximate and ultimate purposes. To study how continuity was established we used practical epistemology analysis, an analytical framework which can be used to examine continuity in students’ talk and actions (Wickman, 2004; Wickman & Östman, 2002). In our analysis we used the analytical concepts of practical epistemology analysis stand fast, relation and gap. The term stand fast has its origin in Wittgenstein’s use of the word and is applied on words or expressions that are used without hesitating or questioning in a certain situation. Words or expressions that stand fast can be used to create relations to something new for the students. The term gap refers to when the teacher or students noticing something that has to be explained, for example by using an explicit question.

In the following excerpt we exemplify the use of the analytical concepts gap, relation and stand fast to analyse a dialogue in the classroom directly after the model activity.

Excerpt 1

1. T: Okay then... what similarities are there between Ebola and our test tube model? So when you get infected... what situation represented the infection?
2. S1: When we mixed [The fluids of the tubes].
3. T: Yes. When you mixed the body fluids. There is a concept here which is about the time from when I get infected until symptoms are visible. What is it called?
4. S2: Incubation period.
5. T: Incubation period. Yes. It can vary a lot with different infections, but when it comes to Ebola, it is quite a big spread between 3 to 21 days I think. So, you can be infected without knowing, absolutely. Okay, more similarities between the test tube model and Ebola infection?

In the dialogue, the teacher (T) notices a gap by stating an explicit question to the students about similarities between the spread of Ebola and the model. In this gap the teacher firstly recalls the students’ previous experiences from the simulation activity and, secondly, challenges the students to fill the gap with relations to a specific term situation of the simulation (“the infection”). The word infection stands fast for a student (S1) and she establishes a relation to one of the experiences in the simulation (“When we mixed”). Thereafter, the teacher confirms the established relation, introduces new concepts (“body fluids” and “symptoms”) and notices a new gap by asking for the term which describes “the time from when I get infected until symptoms are visible”. Then, student S2 establishes a relation using the concept “incubation period”. In turn 5, the teacher establishes a relation between incubation period and Ebola and, for a second time, notices a gap by asking for more similarities between the test tube model and Ebola infection.

This short dialogue is an example of how the teacher actively establishes continuity between the ultimate and proximate purposes of the lesson. Firstly, by noticing gaps that explicitly link the model activity and Ebola infection; secondly, by successively introducing relevant scientific terms and scientific concepts and establishing relations between them, that guide the actions of the students towards the ultimate purpose of the lesson (“to get an initial understanding about how infectious diseases spread”). It is clear in this example how the questions addressed by the teacher became proximate purposes that work as ends-in-view for the students, that is, they promote participation in the dialogue using their language and earlier experiences.

**Results**

Our analysis show that the teacher worked with the proximate purposes in two ways during the different parts of the lesson. In the first part, the teacher used the detailed planned proximate purposes and introduced them for the students during the work with the model activity. In the second part of
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the lesson the proximate purposes were developed progressively by the teacher in the whole class discussion. The teacher did this work by recalling certain episodes and applications of artefacts in the model, and used them with new proximate purposes, such as questions of similarities and differences between the model and Ebola. During the whole class discussion, these questions opened up for a dialogue in which the students could use their previous experiences and knowledge in relation to how infectious diseases spread (the ultimate purpose of the lesson). Moreover, our analysis show that the planned and developed proximate purposes worked effectively as ends-in-view for the students and that continuity was established between the ultimate and proximate purposes of the lesson.

The results are presented in two parts. In the first part, Modelling Ebola disease, we describe our analysis of the first part of the lesson when students modelled the spread of Ebola virus. In the second part, Whole class discussion, we present our analysis of the subsequent discussion. For each part we provide examples of how the teacher worked with the planned purposes and those purposes developed during the whole class discussion and how they functioned as ends-in-view for the students. We also exemplify how the teacher and students’ worked to establish continuity between the different purposes for teaching. The excerpts which are presented in the results have been chosen to illustrate various ways for the teacher and students to establish continuity in teaching. However, the data material from the whole lesson contains more than one example of the different ways.

Modelling Ebola disease

The lesson started with a detailed description for the two participating classes, in which the two teachers went thoroughly the necessary instructions and materials to perform the model activity. Through the instructions the students were given the planned proximate purposes, in the form of actions during the performance of the activity and the use and purposes of artefacts applied in the model. The teachers’ started with an explicit explanation of the purpose of the model activity.

Excerpt 2

6. T: Today we are going to illustrate something. Imagine that you are 60 people living in an area in which a single person infected by Ebola arrives. We are going to make a sort of model of how that could develop and how it could look like. You are not going to feel symptoms of Ebola at all, so you don’t need to be worried.

By this explanation the teacher introduced the overall purpose with the activity (“...to make a sort of model”) as a way “to illustrate” the spread of Ebola disease.

The introduction was followed by an instruction of the purposes of physical artefacts and different actions in the model that were analogous to the processes of the Ebola infection in the reality.

Excerpt 3

7. T: Ebola spreads through the body fluids. This [test tube with liquid] represents your body fluids. Everyone is going to get a test tube […]
8. T: You are going to mingle and talk to each other until we call out” Stop”. Then you mix your body fluids with the person closest to you.
9. T: In countries with Ebola they have check-points […]. They measure the body temperature to see if they are feverish. Fever is a symptom of Ebola […]. That represents our check-point where we are going to control who got infected […]. We have our analytical method, we use iodine. The test is positive if it turns blue. Then you might be infected and are quarantined.

In excerpt 3 the students are given the purpose of using test tubes with liquid (an artefact) in the model activity, described by the teacher as representing body fluids (turn 7). Further, in turn 8 and 9, the purposes of two different actions in the model are presented, mixing test tube content which is
described as representing disease transmission, and detection of symptoms which is described as a check-point to control who got infected. Thus, through these instructions and explanations, the students were given different proximate purposes aimed to guide the students’ actions during the model activity. These proximate purposes were similar to the purposes planned in advance by the teachers.

The video recording from the first part of the lesson shows that all students participated in the model activity and they could enact the instructions given by the teachers playing their role with enthusiasm and sense of humour. According to the teacher instructions the students mingled around in the main hall. At a signal given from the teachers, the students gathered in pairs to mix the content of their test tubes. The procedure was repeated several times before the teachers using starch solution, assessed how many students got “infected” (Figure 1).

Figure 1. Modelling the Ebola disease. One of the teachers, wearing laboratory gown, acts as physician in a check-point. To assess if the student “got infected”, the teacher used iodine to reveal the presence of starch in the students’ test tube.

The students’ engagement and enthusiasm were also noticed at the check-point, for instance when one student described the test as “The moment of truth!” (turn 11) and another student bursting out “I got Ebola” when he tested positive in the check-point (turn 12).

Excerpt 4

10. T: [Test for the presence of starch for one of the students]
11. Student 1: The moment of truth!
12. Student 2: I got Ebola! [the test shows positive]

On the basis of what the students and teachers actually did, the sequence of different proximate purposes embedded in the model activity acted as ends-in-view for the students.

In the excerpts 2 and 3 it also become visible that the teachers actively tried to establish continuity to the lessons ultimate purpose “to get an initial understanding about how infectious diseases spread”
by relating the use of artefacts and different moments in the activity to the spread of the Ebola virus disease in reality.

**Whole class discussion**
In the second part of the lesson, the model activity was followed up by a whole class discussion in the classroom. In the dialogue, we identified nine occasions where the proximate purposes of the model activity were recalled by the teacher and used to establish continuity with the ultimate purpose of the lesson (“to get an initial understanding about how infectious diseases spread”). This was done by using new proximate purposes – questions and examples – that were not articulated in detail in the original planning, but elicited a discussion in the classroom that visibly revolved around infectious diseases in more general terms. In all nine occasions, our analysis evidenced that the new proximate purposes developed during the discussion effectively acted as ends-in-view for the students. The students were able to participate in the dialogue using their language and earlier experiences and relations were established both by the teacher and the students. Moreover, the dialogues revealed how the teacher constantly worked to redirect the discussion of the proximate purposes towards the lessons’ ultimate purpose. In excerpt 1, we illustrated how continuity between purposes was established by the teacher and students focusing in the similarities between the model and Ebola in the real life. In the following examples we show how continuity also was established by relating to students’ previous everyday experiences and contexts (Excerpt 5), focusing in differences between the model and reality (Excerpt 6) and finally, by addressing specific situations of the model (Excerpt 7).

**Relating to students’ previous experiences**

Excerpt 5
13. T: If you should compare the exchange of *body fluids* in the way you did with something else... could you find out any example? Discuss this in pairs.
14. S2: Well, if you eat a chocolate bar...
15. T: Yes?
16. S2: And it’s hot. The chocolate melts in your hands and you lick your fingers... and then you shake hands with someone.
17. S3: When you sneeze or when you cough, too.
18. T: So... if I sneeze right here, does it mean that I have exchanged body fluids with all of you?
19. Ss: Yes... No?
20. T: Ok. What more is necessary?
21. S3: Well, you need that it gets in other peoples’ *body fluid*.

By revisiting the concept “body fluids” and asking the students for examples of exchange of body fluids the teacher generated a new gap. Then, two of the students used their own everyday experiences (turn 14-16) and knowledge of transmissions of diseases (turn 17) establishing relations to exchange of body fluids. Afterwards, the teacher challenged the students with a new gap (turn 20) and one student is competent to use the new introduced concept body fluid to fill the gap (turn 21). In the dialogue it becomes visible how the students use and connect their previous experiences from an everyday context in relation to the new content.

**Differences between the model and the real Ebola disease**
Similarly, continuity between purposes was established in the discussion when the students were challenged to comment about differences between the model and the real Ebola disease:
Excerpt 6

22. T: Ok. More examples. Can you think about some difference between the model and the reality?
23. S1: Well, I think that it doesn’t spread so fast. And you don’t know if you get infected so quickly.
24. T: Yes, I would say that the disease frequency is lower in reality. How could you explain the concept of disease frequency?
25. S2: How fast it spreads.
26. T: Yes, how fast it spreads and how many get infected.
27. S3: But I read, I think it was in Aftonbladet [newspaper] that one [sick of Ebola] infects two and two infect four. That it’s what occur. So if you want to develop the test tube model you should mix for instance three tubes.

The dialogue between the teacher and the students shows how the teacher introduced a more sophisticated concept “disease frequency” (turn 24) and challenged the students to articulate a definition of the concept. One student establishes a relation to “how fast it spreads” (turn 25). The teacher confirms (turn 26) whereby another student spontaneously establishes a relation to the model activity using information from media (turn 27).

Recalling specific situations in the model activity

Proximate purposes were not only articulated as explicit questions about similarities and differences between the model and the Ebola disease in reality, but also recalling specific situations in the model activity. An example of such situation was the check-point where the students were tested for the presence of starch in their test tubes:

Excerpt 7

28. T: Ok, then we had the check-point that represents spots where in the reality you measure the body temperature to see if you are feverish. If you discover someone sick, then you place him in the hospital for observation. But it doesn’t need to be Ebola, but a common flu.
29. S4: That’s what happens in airports! As soon as someone has a temperature they place him in [observation].
30. T: Yes, especially certain flights must be checked thoroughly. Why is that, do you think?
31. S4: Because they can come from countries with Ebola.
32. T: So, why are airports so dangerous?
33. S4: Because it [Ebola] can infect many. It can infect the whole World.

The gap created by the teacher when recalling the check-point in the model was immediately filled by the student establishing relations to previous experiences (airports, turn 29). Then, the teacher redirected the conversation noticing two new gaps by asking why certain flights must be checked thoroughly (turn 30) and why airports are so dangerous (turn 32). Finally, the student fill the gap with a new relation (“...it can infect the whole World”).

Discussion

In this study we have shown how the didactical model organizing purposes can be used to plan and subsequently analyse learning progressions during a single science lesson. As a part of the context-based unit the concrete ultimate purpose for this lesson was formulated (“to get an initial understanding about how infectious diseases spread”). Using this ultimate purpose as a starting-point, the lesson was structured in two different parts. In the first part, the teacher used a sequence of proximate purposes that were carefully planned to perform the model activity with a large group of students in an engaging teaching. In the second part of the lesson the proximate purposes were not planned with
the same grade of detail, but more like an open discussion, that revolved around infectious diseases in more general terms. The analysis of the lesson shows that, with this plan in mind, the teacher successfully integrated these two very different teaching activities in a learning progression. Thus, the analysis of the students’ actions when they modelled the disease transmission showed that the planned proximate purposes functioned as ends-in-view for students, that is, the students were able to act according to these proximate purposes. Moreover, the students’ experiences of the enacted proximate purposes were merged into the discussion in the second part of the lesson. The analysis of this discussion evidenced how the teacher constantly worked with the proximate purposes from the model activity and used them with new proximate purposes to progress towards the ultimate purpose. By recalling the model and asking about similarities and differences between the test tube model and Ebola, the students were invited to use their previous experiences from teaching, but also to use their everyday language and experiences to cope with the questions. In this process the teacher successively introduced – and invited the students to use – specific scientific concepts such as body fluids, incubation period and disease frequency, related to spread of infectious diseases. By these scaffolding actions the students had the opportunity to talk about infectious diseases in a more general way and thereby became more competent in relation to the scientific content. In other words, the actions helped the students to achieve the ultimate purpose of the lesson.

The model of organizing purposes has been used in previous studies to explore and analyse learning progressions in science teaching (Anderhag et al., 2014; Johansson & Wickman, 2011; 2018). Consistently, these studies showed the importance of proximate purposes to function as ends-in-view for students as well as the significance of the teachers’ role to scaffold the students towards the ultimate purposes for teaching. The results presented here show similarities with the findings from these previous studies in terms of how the teacher creates continuity between teaching purposes. For instance, in a study of Johansson (2014) the teacher used a sequence of different kind of questions as proximate purposes to establish a learning progression with students working with an activity of science inquiry. However, by focusing in the planning phase, we show that the use of the model in this study can contribute to better understand the complex relationship between the planned content and the enacted teaching in the classroom. For instance, one of the most interesting aspects of the teaching revealed in this study was that the grade of detail in which the proximate purposes were planned by the teacher differed greatly in the two parts of the lesson. This suggests that the teacher can plan proximate purposes that direct the students’ actions in a very determined direction or let the proximate purposes grow progressively in interaction with the students, but still keeping these purposes fully functional in working together towards a learning progression.

Our study suggests that the model of organizing purposes can function as a useful tool for teachers in their concrete work in planning science teaching. It is a model with close connection to teachers’ daily work that offers the flexibility that a highly dynamic and contingent process as teaching in the classroom demands (Hamza & Wickman, 2009). Furthermore, approaching teaching in terms of organizing purposes allows the teacher to immediately follow if the proximate purposes work as ends-in-view, and when needed, modify them by moment-to-moment interactions in the classroom. In this context, it is important to point out that proximate purposes not only are a way to reach the ultimate learning goals, but something that the students also have to learn and master (Anderhag et al., 2014).

The view of teaching behind the model of organizing purposes show similarities with other teaching approaches described in science education (Leach & Scott, 2002). Leach and Scott (2002) described an approach of how to design and evaluate teaching sequences in which the concept learning demand is central. Learning demand is built on the identification and analysis of the scientific subject content, the students’ pre-understandings and previous experiences as well as a social-constructivist perspective on learning. Leach and Scott (2002) emphasize that it is central to identify the learning demand before planning a teaching sequence. From these learning demands, teaching
goals can be developed as the first step in the process of planning a teaching sequence. Thereafter, according to the teaching goals, various performances led by the teacher can be planned to make the scientific point of view available for the students. Leach and Scott highlight these performances as interactive involving both the teacher and the students. The model of organizing purposes also show similarities with the Joint action theory of didactics (Sensevy, 2012). This framework emphasizes the joint action of the teacher and the students in the learning process and is based on the idea of didactic and adidactic situations (Brousseau, 1997; Sensevy, 2012).

Several studies of science learning in the classroom stress the importance of the involvement of students in spoken dialogue and communication for the learning outcome (Mercer & Dawes, 2014; Scott et al., 2006). In the present study, the planned proximate purposes in both parts of the lesson invited the students to participate in joint action and communication during teaching. A closer look at the structure of the teacher-student interactions during the second part of the lesson shows that it partly reminds of a classical IRE-dialogue by following the pattern Initiation-Response-Evaluation (Mercer & Dawes, 2014). Yet, the teacher used closed questions to a limited extent during the dialogue and the third move of the teacher primarily opened up for the students to express their thoughts or give the students an opportunity to extend their answers. The students were also invited to share their knowledge with the class and connect their previous experiences with the new scientific content presented during the lesson.

According to the different classroom discourses described by Scott et al. (2006), the teachers’ actions during the first part of the lesson, when the students modelled the spread of Ebola virus, are consistent with a primarily authoritative discourse. The teachers gave a detailed description of the activity and explained how the different moments in the activity resembled the infection in reality. Even though the second part of the lesson contained elements of authoritative dialogue, where the teacher strongly directed the dialogue towards the scientific content (ultimate purpose for the lesson), the discussion was mainly characterized by a dialogical discourse where the students were invited to use newly gained knowledge and experiences as well as to extend and express their own thoughts.

An additional aspect to consider in this study was the use of Ebola as an overall context, and its role for supporting a learning progression in the lesson. A challenge in context-based approaches of teaching is to make the students’ experiences continuous with conceptual learning (Wickman, 2014; Wickman & Ligozat, 2011). By using Ebola as an example in the model activity and thereafter using questions about similarities and differences between the model and Ebola, the students had the opportunity to use new concepts and develop a better understanding about infectious diseases. Moreover, the analysis of the students’ actions during the model activity and their talk during the second part of the lesson clearly evidenced that the Ebola disease as context for teaching became a present element during the whole lesson. However, preliminary results (manuscript in preparation) for the whole unit suggest that establishing continuity between the Ebola disease as a context and other content areas in Biology included in the unit, was considerably more challenging.

**Conclusion**

In this article we have illustrated how the didactical model organizing purposes can be used in practice to plan and subsequently analyse learning progressions during a single lesson in a context-based teaching unit in Biology. Our analysis of the actual lesson showed how different planned proximate purposes were enacted in the actual teaching situation as well as how the teacher worked to support students’ learning progressions. Continuity was established between the different teaching purposes as well as with the context of the unit. The results of our study suggest that the model of organizing purposes can be a useful tool for teachers in their daily work in the science classroom.
References


