**Supplemental table 1: Adjustment of the design**

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| **Design principle** | **Pilot (2 lessons)** | **Pilot 2 (8 lessons)** |
| **1: Lessons start with an ill-structured problem**  *Implementation*  *Considerations*  *Adaptations* | Every lesson starts with a complex task, a different ecological context is used for every task. The link between each task and relevant theory is explicated by the teacher.  The lessons were considered to lack cohesion. Contexts were used for student work on the complex tasks but not for student work on other part tasks. Furthermore, orientation on a new complex task and context was time-consuming.  We aimed to promote cohesion by 1) using one overarching ecological context for the majority of learning activities; 2) restructuring questions from Biology textbooks into part-tasks that incorporate the overarching context. To reduce time spent on orientation, we reduced the number of introductions of new complex tasks. | A new complex task is introduced once every 2-3 lessons. The complex tasks share an overarching context. Questions from the Biology textbook were adapted into part-tasks that fit the context. The link between each complex task and theory is explicated by the teacher during class discussion.  The use of an authentic ecological context was perceived as useful by students. However, students indicated that using the same ecological context for all complex tasks felt repetitive and was hindering their thinking process.  The same overarching context for two of the complex tasks was used, but a different ecological context was used for the last complex task. |
| **2: Students are instructed to generate questions**  *Implementation*  *Considerations*  *Adaptations* | Groups of 3 to 4 students are instructed to generate questions relevant to each complex task and formulate possible answers to the most relevant questions using their textbooks and online sources.  Students required a great degree of support to research sources and formulate possible answers to their questions.  The segment in which students are instructed to formulate answers to their questions was omitted. | Groups of 3 to 4 students are instructed to formulate questions relevant to each complex task.  For each complex task, all groups were able to generate multiple questions. Students regarded the process of generating questions as useful.  No adaptations. |
| **3: Question agendas**  *Implementation*  *Considerations*  *Adaptations* | Printouts of all three complete question agendas are provided after introduction of the first complex task. Students use question agendas to generate questions about the complex task.  By providing complete question agendas at the start, many ecological concepts were introduced at once. Students reported this to be confusing. The degree to which students used the question agendas varied considerably.  Promoting a more gradual introduction of relevant concepts by presenting more basic versions of question agendas at the start that are elaborated in the unfolding of the lessons. | Only the three main questions are presented to students at the start of the lesson series on separate Powerpoint slides. Questions are gradually added by the teacher during the course of the lesson series. Printouts of complete question agendas are provided to students after all questions have been covered.  Students were not required to actively use question agendas in class. The degree to which students perceived question agendas as useful and reported to have used question agendas for learning varied greatly.  Question agendas were integrated to a greater extent in the learning activities; we made the development of individual question agendas more student-guided. |