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Student-activation during lectures as a *Process* to elucidate the *Presage* of students and facilitate the learning *Product*

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Introduction

One-way flow of information from teacher to students encompassed in the traditional lecture format may not always promote optimal student learning. Exercises that activate students are a way to break the lecturing monotony and may also enhance student learning by presenting the subject in a different form and by stimulating deep learning and self-reflection (Prince 2004, Dahl & Troelsen 2013). Deep learning depends on establishing concepts or understanding ideas while making links to what is already known as opposed to rote learning, where information is forcibly stored in the long term memory by repetition (Entwhistle 2009).

The 3P-model is a conceptual framework to analyze how teaching can support and promote deep student learning (Mørck & Rump 2013), and focuses on teaching activities and what the students should do to promote deep learning approaches (Prosser & Trigwell 1999). The 3 P's stand for *presage* (characteristics and previous experiences of the students and teacher), *process* (students approaches to learning and teachers approaches to teaching), and *product* (the learned outcome of teaching for the student) (Prosser & Trigwell 2006). Because a clear link between the student's perceptions of their learning environment and their approach to learning has been established (Trigwell et al. 1999, and references therein), a fourth P, *perception*, is sometimes included.

According to the 3P-model, learning can be viewed as a conceptual change in the relation between a student and his/hers view of the world (i.e. by providing nuances and expanding the previous view of the world)

(Prosser & Trigwell 1999). The initial worldview is very much dependent on the already learned skills of the student, and when teaching it is often useful for the teacher to know the starting level of the students at the onset of teaching to adjust the teaching accordingly (Biggs 2003). The students may also benefit from directly assessing their starting knowledge prior to teaching specific subjects, because assessing their initial knowledge of a subject make it evident what new knowledge they have gained. Exercises during lectures that assess the starting knowledge of students then serve a dual purpose of (1) breaking up the monotony of the lecture format, and (2) helping the students to clearly identify what they have learned during the lecture - the learning *product*. This project explored whether such student-activating exercises make it easier for students to identify what novel information they have acquired and how the new knowledge adds to their previously acquired knowledge.

Method

Approach

The experimental approach consisted of two types (A and B) of activities that were tested during two lectures.

A. A multiple-choice type of question to rate their overall knowledge of the subject on a five-point scale (Figure 14.1), for example: "how much do you know about frogs?" This question assessed the students' own perception of their preliminary knowledge of the subject that was about to be taught in the lecture. The students were asked to answer the same question with the same possible answers again at the end of the lecture. The idea being that by directly showing how the students' own assessment of their gained knowledge (presumably) increased during the lecture would help them identify the learning *product*.
B. Prior to covering specific subjects within lectures, the students were asked subject specific questions either in the form of interactive multiple-choice questions (using the software *Shakespeak*) or specific questions that were first discussed in pairs before a teacher-led discussion among all students concluded and provided the correct answers (See appendix A). The idea here being that the students were asked to reflect (*process*) on the specific subject using their preliminary knowledge (*presage*), in order to better identify their learning *product*.

Finally, after each lecture the students were asked to (1) evaluate their learning outcome of the lecture, (2) if the small exercises benefitted their learning outcome, (3) if the small exercises helped them identify what new knowledge they had gained, and (4) if their overall view on the subject had changed (See appendix B).

Course description

Student-activation exercises were tested during lectures given in the course *Diversity of Animals and Plants* for first-year BSc. students studying *Natural Resources*. The course has a workload of 7.5 ECTS and is evaluated by a four-hour written mainly closed-book examination. The course provides an overview of plant and animal diversity with an emphasis on the classification and identification of the Danish flora and fauna. Like many other subjects this is a large subject to cover in a 7.5 ECTS course, and the main objectives of the course is to provide the students with a framework to classify plants and animals. The exercises in this course focus on species identification of plants and animals and the students learn how to use identification-keys. The course thus consists of elements that are low in the SOLO taxonomy of learning (Biggs 2003), i.e. list, define or describe, in addition to more relationel elements such as an understanding of animal and plant classification that are medium on the SOLO taxonomy (i.e. explain or use).

Implementation

In teaching block four, Spring 2014, the course *Diversity of Animals and Plants* had 75 registered students. During two lectures student activiation activities of type A and B described above where implemented. The topics of the two lectures were *Fish* and *Amphibians and Reptiles*, respectively. For both 90-minute lectures, this was all the information on these two subjects that were presented during the course. It is the first time the students' encounter these topics in the *Natural Resource* first-year curriculum, but I argue that everybody know something about e.g. fish and frogs making these topics ideally suited to link prior knowledge (*presage*) with the taught material using student-activation exercises during the lectures (*process*) to increase the learning *product*.

In the first lecture on *Fish* the first slide presented the students with a multiple-choice question asking them to rate their knowledge on fish,

which were repeated at the end of the lecture (question type A). In addition a question type B were included in the middle of the lecture to have student activation exercises spread out more evenly during the lecture.

For the second lecture on *Amphibians and Reptiles* the question type A were omitted based on the experience from the first lecture, and only type B questions were included during the lecture.

Results and Discussion

This project explored whether student-activating exercises that assess students' preliminary knowledge prior to being taught the subject make it easier for students to identify what novel information they have acquired and how the new knowledge adds to their previously acquired knowledge. This is encapsulated in the 3P-model of student learning (Prosser & Trigwell 1999, 2006), which provided the theoretical framework to explore possible correlations between students' awareness of their preliminary knowledge and the learning outcome.

Question		Start	End
A	I'm an Ichtyologist!	1	3
B	I know a lot oabout fish, for example how their skeleton and muscles are build	0	19
C	I know some about fish, and sometimes i go fishing, diving, or I keep fish tanks	7	3
D	Fish tastes nice and lives in water	17	2
E	Fish, what is that?	1	1

Fig. 14.1. Number of student votes at the beginning and end of lecture 1 on the five questions meant to assess student preliminary knowledge.

Specific activation exercises that asked the students to assess their preliminary knowledge were implemented in two lectures attended by 41 and 56 students, respectively, in the course *Diversity of Animals and Plants*. There was no significant difference ($\chi 2 = 0.01, df = 1, p = 0.914$) between the two lectures in number of students that answered that their learning outcome were in complete accordance (54% and 58%, respectively) and

somewhat in accordance (37% and 42%, respectively) with the content of the lectures. This shows that similar proportions of students had the same experience of "understanding" the taught subjects in the two lectures.

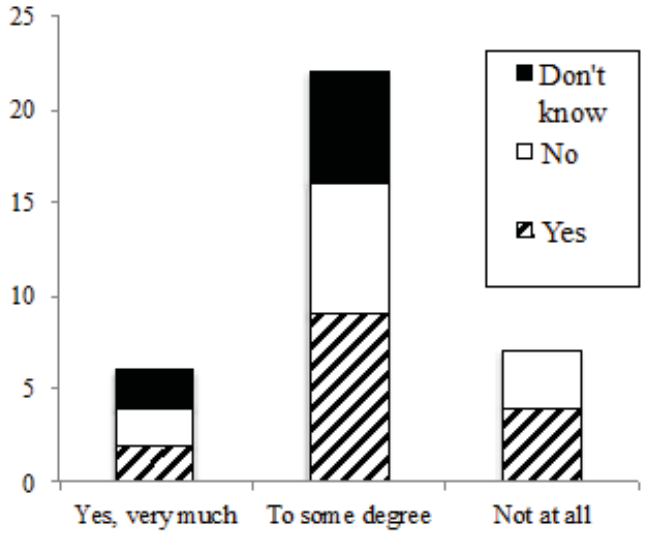

Fig. 14.2. Number of student answers to the question: “Did it help your learning outcome to assess your preliminary knowledge at the beginning and again at the end of the lecture?” in lecture 1 (N = 35; 85%). Crossed, black and white markings denote answers to the question: “Have your view on fish changed because of this lecture?”

In the first lecture the students’ initial knowledge about the topic (fish) was assessed at an unspecific meta-level by asking the students how they would rate their knowledge on the subject (Figure 14.1). The students enjoyed this exercise and it spurred interest and created a good atmosphere in the room. Revisiting this question at the end of the lecture also gave the maybe obvious result, that the students’ perceived themselves to have learned something during the lecture (Figure 14.1). However, the evaluation of the lecture revealed that most students felt that assessing their preliminary knowledge did only improve their learning out come to some degree (Figure 14.2). In the second lecture the question at the onset of the lecture meant to promote self-reflection was therefore omitted, and instead questions were used just prior to covering specific subjects. The didactic phases of these questions were similar: devolution (teacher presents a question framing the ’didactic environment’), action (students think on their own), formulation (students discuss among themselves), validation (stu-

dents present solutions during teacher-led discussion), institutionalization (teacher presents official knowledge and relate to the general themes of the subject) (Christiansen & Olsen 2006). The approach used here is a common way to activate students during large classes by having them discuss with their neighbour for a few minutes before discussing the answers with the entire lecture hall.

Having the exercises prior to covering the specific subjects in the lecture served the additional purpose of making the students aware of their preliminary knowledge when trying to solve the assignments. From the evaluation of lecture two it was clear that many students were encouraged to assess their starting knowledge (Figure 14.3). After both lectures the students were also asked whether their general view on fish and amphibians and reptiles, respectively, had changed. Interestingly, the students' perception of the two lectures differed markedly. In the first lecture where the majority only felt that the initial assessment had helped them to a certain degree (Figure 14.2), there was no significant difference between students that answered yes or no to whether the lecture had changed their view on the subject ($\chi 2 = 0.33, df = 1, p = 0.56$). In the second lecture where most students' agreed that the exercises made them think a lot or somewhat about their initial knowledge on the subject significantly more also said that their view on the subject had changed ($\chi 2 = 5.2, df = 1, p = 0.013$). The formulation used in the question: "...changed your view..." is not very precise and it is possible that students understood the meaning of the phrased question differently. However, the subject of these lectures, well-known animal groups of fish, amphibians and reptiles that most people have some form of acquaintance with make it reasonable to infer that the student answers imply a general change in their view on them.

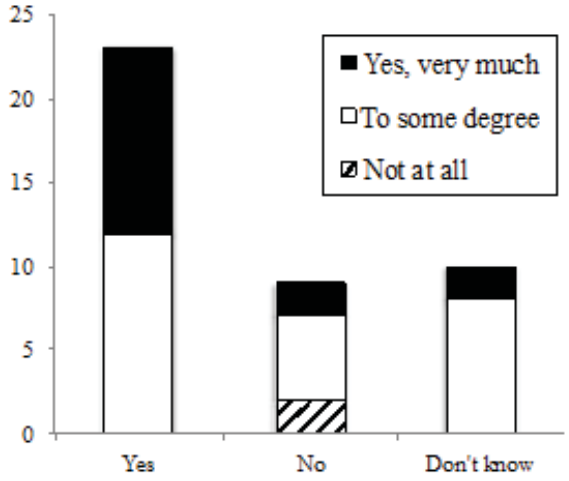

Fig. 14.3. Number of student answers to the question: "Have your view on amphibian and reptiles changed because of this lecture?" in lecture 2 (N = 43; 76%). Crossed, black and white markings denote answers to the question: "Did the two preliminary exercises make you think about how much or little you knew about the subjects beforehand?"

A change in the students' perception of the subject is at the heart of the 3P-model where the interplay between deep learning approaches and changes in the students' view of the subject is emphasized. It is therefore tempting to conclude that the results of this study, at least in lecture two, is in agreement with the 3P-model. By asking the students if their view on the subject had changed the intention was to obtain their subjective perception of the taught subject, which is one of the important parameters that change when facilitating deep learning according to the 3P-model. However, it is often stated that students' own evaluation of their learning outcome is unreliable because they lack the necessary background knowledge and overview of the subject to adequately judge their own skills (Horst et al. 2013). This creates a conundrum where on one hand the aim is to alter the students perception of the subject to facilitate deep learning but at the same time the students own perception is unreliable as a measure of how effective this approach is. One solution would be to continue with this type of initial assessment exercises during the full length of a course and then evaluate exam results, which in theory should be devoid of perceptive bias (Horst et al. 2013). Another possibility would be to have exam-like questions at the end of lectures to let the students themselves and the teacher evaluate the learning outcome. Finally, this conundrum may be trivial because the main focus is on having subject-relevant student activation exercises that

the students (and the teacher) perceive as a help to make them aware of what gaps in their knowledge they had beforehand and how the taught subject helped fill these gaps. In other words, if the students have the feeling these type of exercises help them assess their previous knowledge - maybe they actually do just that.

Conclusion

The 3P-model provides a usable theoretical framework for testing questions of how to improve student learning, and student activation during lectures is a good way to diversify teaching methods and maintain the students' interests throughout lectures. Apart from the didactic purpose of presenting the subject in different forms and contexts, this project indicate that questions during lectures formulated and used appropriately is capable of inducing self-reflection over the extent of students' own initial knowledge. However, whether such student self-reflection also leads to a higher learning product and induces deep learning cannot be unambiguously concluded from this study.

A Example of subject-specific questions in amphibians

- What does frogs/toads eat?
- What does tadpoles eat?
- Does frogs/toads and tadpoles have long or short intestines?

B Example of questionnaire to evaluate lecture 2

Marker ud for det svar der bedst beskriver din oplevelse af forelæsningen.

1. Hvordan oplevede du dit udbytte af forelæsningen i forhold til forelæsningens indhold?
    - Ikke i overensstemmelse
    - Nogenlunde i overensstemmelse
    - I fuld overensstemmelse
2. Hjalp det på dit overordnede faglige udbytte at have en lille aktivitet om padders føde og tarmlængde og generelle krybdyrkarakterer inden selve gennemgangen af stoffet?
    - Overhovedet ikke - det gjorde ingen forskel
    - I nogen grad
    - I høj grad
3. Fik de to indledende aktiviteter dig til at tænke over hvor lidt/meget du vidste om emnerne på forhånd?
    - Overhovedet ikke - det var bare irriterende
    - I nogen grad
    - I høj grad
4. Har dit syn på padder og krybdyr ændret sig på baggrund af denne forelæsning?
    - Nej
    - Ja
    - Ved ikke

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