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Stimulation of deep learning and active participation of students during long and context rich lectures

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Introduction

Learning can be divided mainly into three approaches surface learning, deep learning and strategic learning. Apparently, the latter would be the most preferable approach every teacher would like their students to use.

Surface learning is an approach in which the students focus on the memorization of facts, which they consider to be relevant for the examination. Students try to pass with minimal efforts but best results regarding their grades. This kind of approach can be depended on several factors including for example extracurricular activities, which interfere with the amount of time which can be spend on learning for particular classes, anxiety and misinterpretation of the intended learning goals (ILOs) (Biggs & Tang 2011). This type of learning is more or less superficial and does not enable the students to understand the topic in a meaningful way.

Deep learning involves critical evaluation of the learned content and connection to previous knowledge. This approach thereby enables the students to process the information in a holistic way. Research has shown that using this learning approach results in long term retention of concepts (Bransford, Brown, and Cocking, 2000).

Strategic learning is basically a combination of surface and deep learning depending on time constrictions or large amount of information, which needs to be learned. If this approach is well in sync with deep learning it can be very efficient and productive (Burton et al., 2009).

Even though the deep learning approach is clearly the preferred form of learning some study fields require the memorization of certain terms and facts in order to be able to communicate and reflect on the subjects. One example for this is Anatomy in the field of veterinary and human medical science. One of the challenges of teaching anatomy is clearly the amount of terms, which need to be memorized and correctly attributed to certain organs and tissues. Learning theses terms is similar to learning the vocabulary of a language which needs to be learned. This kind of memorization of terms and facts is sometimes considered in a negative way with the surface approach of learning, but especially in medical and veterinary sciences it is an important stepping stone in order to achieve deeper learning by being able to connect these different body parts in a functional meaningful way and understand the importance of each puzzle piece of the body. This combination of learning facts and subsequently combing these in a meaningful way with function has been described earlier by Entwistle and Entwistle, 2003.

Nevertheless, it is important that learning in this particular field does not stop at the level of memorizing facts, but that a deeper learning approach is achieved as well by connecting the terms in a holistic functionally relevant way.

Aim

The aim of this project was to activate the students in terminology dense lectures and activate deep learning by linking terminology with function.

Course description

The course is a bachelor course for students studying animal science. The general aim of the course is to give broad overview over animal anatomy and physiology, with an emphasis on linking the structures of the body (anatomy) with the function of the body (physiology). Furthermore, students should be able to compare functional and anatomical differences between species. The variety of animals covered are mammals with a focus on farm animals including pigs, sheep, cows and horses; pets including dogs and cats; poultry, fish and exotic species like crocodiles and turtles

It is noteworthy that anatomy and physiology is taught by different departments and different instructors/lecturers. I will elaborate on potential problems with this later in the discussion part.

The course is divided into lectures and practicals, which cover the lectures content and where the students can dissect and observe the anatomical features of the different animal species.

Specific topics to be covered are:

- Anatomy and physiology of the muscular and skeletal system
- Anatomy and physiology of the circulation system
- Anatomy and physiology of the immune system
- Anatomy and physiology of the nervous system
- Anatomy and physiology of the digestive system
- Anatomy and physiology of the respirations system
- Anatomy and physiology of the skin and skin organs system
- Anatomy and physiology of the muscular and skeletal system
- Anatomy and physiology of the excretions system
- Anatomy and physiology of the reproductive system
- Anatomy and physiology of the fish and shellfish
- Anatomy and physiology of poultry

I have taught the lectures and practicals in anatomy for the nervous system and for the skin and skin organs. This project focuses on comparing different styles of lecturing. One of the biggest challenges was to deliver the amount of information in a format to the students, so they had a chance to process and understand the matter. More precisely it is very important, in order to meet the requirements for passing the course, to be able to connect the anatomical observations in a meaningful way with the function of the organ systems and the whole body.

Moreover, I am not a trained veterinarian, so I was also a bit out of my comfort zone even though I have learned zoology during my training as a biologist. Nevertheless, in the end this turned out to be an advantage since the other lecturers are veterinarians and have difficulties in scaling down the amount of taught details and expectations giving the fact that this was a course for animal science students on not for veterinary students. I will elaborate on this later in the discussion part.

Implementation:

1. The first lecture had duration of 4 hours in total covering the brain, spinal cord, the function of afferent and efferent signaling, as well as parasympathetic and sympathetic nervous system. I had access to the lecture of the previous year, in order to ensure that all the important facts will be covered. It was a huge amount of very detailed information, which was clearly more relevant for veterinary students. Since there was so much to cover I did not implement many student exercises during the lecture and gave a more frontal lecture with a few questions and breaks. Problematic was also that most of the material was dealing with the human brain as an example and I think it would be much more suitable to include several animal brains. Especially since we had a 4 hour practical the next day, where it was possible to re-discuss anatomical and functional matters directly having the animal specimen in front us.

2. During the 2^{nd} 3 hour lecture, which was covering the skin and the skin organs, I have implemented several student exercises where the students received a question regarding the just lectured content. They were encouraged to form little groups discuss the questions and come up with a group formulated answer. This lecture was also followed the next day by a 3 hour practical session looking at skin and skin organs in several species. For this lecture I had no insight into the previous year lecture and I only identified the anatomically and physiologically relevant topics myself, with ample of animal disease related examples.

After giving these two lectures I have handed out a questionnaire in order to inquire, which of the lecturing styles was the preferred one by the students, and if the exercises helped to stimulate deeper learning and better understanding of the topic.

Results

The questionnaire consisted of 4 short questions.

1. When you compare the lecture about the brain with the lecture about the skin, which one was more informative to you?

This question was aimed to identify if the students were able to process the information in a meaningful way and if they could handle large amount of facts or if less facts with more functional explanations were easier to digest and memorize able. This was meant to be as an indication if a deep learning process can be stimulated and which form of lecture is more successful for this aim.

2. For both lectures what did you think about the level of complexity?

   Brain:
   - Just right
   - Too complex
   - Not enough information

   Skin:
   - Just right
   - Too complex
   - Not enough information

   With this multiple choice question I wanted to estimate what level of terms and information the students are able to process in such a long lecture situation.

3. Do you prefer frontal lectures or do you like to have more breaks in form of student exercises?
   With this question I wanted to find out if the students find these exercises useful or if they actually prefer being simply told the facts.

4. If you have suggestions how to improve the learning outcome of the class please list them below.
   Here I wanted to see if the students have any other ideas or have experienced learning methods elsewhere which they considered helpful in order to achieve deep learning.

There were a total of 45 students enrolled in this class out of these 7 returned the questionnaires, which gives me a written feedback and possibility to discuss the project on the basis of 15% of students. This can clearly only provide a trend, since it cannot be excluded that the remaining students which did not participate have a completely different opinion.

Results for question 1:

All students agree that the lecture on the skin and skin organs was more informative. This lecture was less terminology dense and had more student interaction in form of exercises. Three students pointed out that the brain and CNS is a difficult and complex topic in general. One student wished for more structure in the CNS/brain lecture, like he/she experienced in the skin lecture.

In conclusion the CNS and brain lecture was too terminology dense and complex. It clearly needs to be restructured for the next year, but more intriguingly it also showed that the student exercises in the skin lecture clearly helped in understanding the topic and digesting the just learned matters. Therefore, it is inevitable that more student exercises are needed, combined with less complexity and clear outline of functional meaning.

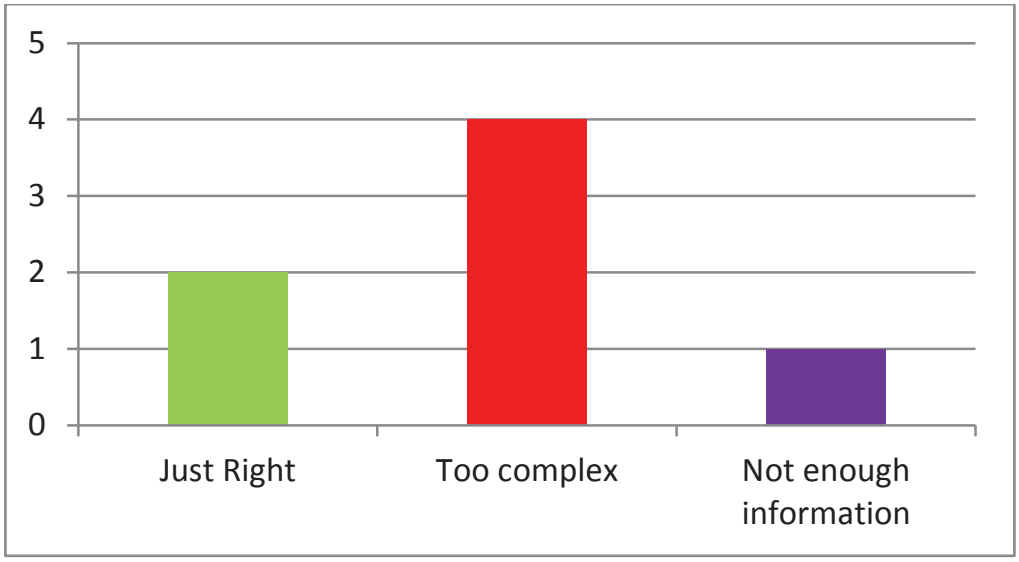
Results for question 2:

The results can be seen in figure 11.1. These results clearly show again that the preferred mode of lecturing is the less complex one with more student exercises.

Results for question 3:

Six out of the seven students, which returned the questionnaire, replied that they like the breaks in form of student exercises. One student mentioned that it is good for recapitulation of the lectured topic, as long as the correct answers are clearly shown at the end. For the sake of clarity I will therefore include an answer slide, which will be developed during the discussion with the students in the next year. Interestingly, two out of the seven students stated that even though they liked the student exercises, they do not want too many interruptions of the lectures caused by these exercises. This is in contrast to another student, who clearly indicated that more student exercises would be helpful in order to process the learned facts. Obviously, this is not a totally surprising discrepancy, since the level of basis knowledge and motivation to read up on the lecture topic beforehand varies amongst students. To be able to draw a clear conclusion here the end numbers of students, which had returned their questionnaire needs to be higher.

Brain:



Skin

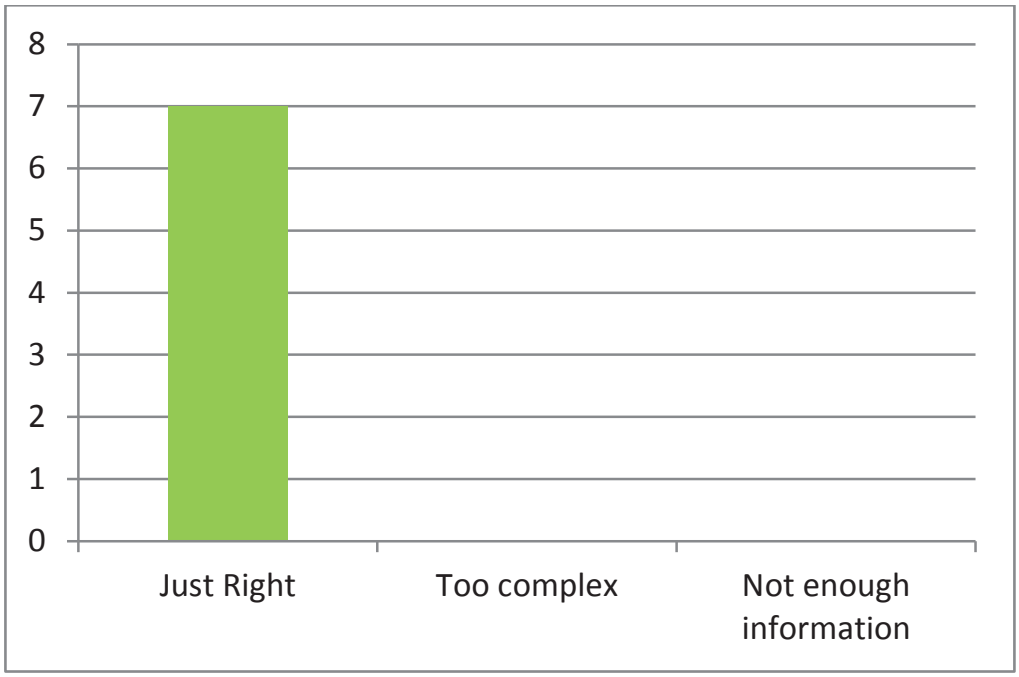


Fig. 11.1. Results for question 2.

Results for question 4:

Question four was more intended to pick the students brains if they have any ideas of alternative methods in order to involve them more in the lecture, or if they have experienced some student exercises in other classes, which have helped them to apply a deep approach of learning towards the lectured topics. Only two students had further comments on this. Both suggested the use of clickers to answer questions. I had considered this mode of student interactions, but I have opted out for two reasons. Firstly, I wanted to focus on the student exercises in small groups and secondly have I decided that the discussion amongst peers would stimulate a deeper learning approach better than simply clicking yes or no. One of the exercises I did was labeling all the different layers of the skin. Interestingly, this was one of the exercises which the students liked a lot even though I was a bit concerned that it is too simple since I just covered every single layer minutes before. Another point was that the students want more student involvement and more time for discussions, which clearly needs to be taken in consideration.

Discussion:

Firstly I have to say that this project was bit tricky, since I never have taught this class before. Moreover, I am not a trained veterinarian since I have studied biology. Therefore, I will also discuss some other observations I made during this class, which are not only strictly considering the two lecture styles and the issues with triggering the deep learning approach.

One of the biggest problems, but clearly the most important intended learning outcome is a meaningful combination of anatomy (structure) with function (physiology). These two clearly naturally intermingled teaching blocks are completely separated and covered by different departments and lecturers. Much to my surprise, was there little exchange or knowledge about the teaching between the departments. It became very clear that much more cross-departmental planning and discussion needs to be initiated for the next year.

Based on these starting conditions it was quite difficult to decide which amount of detail needs to be presented to the students and which are the most relevant functional events to focus on. Another factor of unnecessary confusion of the course was the language issue. The students have several books which are recommended as a basis for the class. These are

both Danish and English books. Problematically the students decide themselves which book appears to be more relevant to them, resulting in different terminology and depth of topics described in the books. According to my fellow instructors the students are allowed to use either Danish, English or Latin nomenclature. This was extremely confusing for the students, but for me as well. Especially in the practical sessions students approached me repeatedly and asked what are these structures are called in the other languages. They were very concerned about which terminology to use. It appears like this is an avoidable confusion, which makes the class more difficult to the students.

On the other hand a very positive attribute of the class was the combination of lectures followed by practical exercises the next day. This concept worked very well and the majority of the students were very intrigued by having the biological specimens in their own hands and the possibility to reflect upon the facts they have learned earlier in the lecture. This is clearly one of the strong parts of the course which induces deeper learning approaches.

The lecture part in the previous year was designed as frontal lectures with very little student interaction and it was very terminology rich. This was most likely caused by the fact that this master's class in animal science is novel and had been started in 2012. Most of the lecturers teach the veterinary students and have therefore used the lectures which are aimed at veterinary students for the animal science students. In conclusion the level of lectures is too detailed and terminology heavy. In general this raises also the question if a lecture like this is enough for the students to engage in deep learning approaches or if simply reading the text books would have the same effect. Therefore, I have decided to compare the frontal lecture approach with little to no student involvement to a lecture involving the students via exercises and group discussions. I have interrupted the lecture with three 15 minute student exercises. The questions were discussed in small groups during these exercises and presented in form of a group answers in the end. The questionnaire showed that the students overall preferred having these interactive exercises, which is not entirely surprising since it as anticipated that with more interaction and discussion of the topic a deeper understanding and ownership of it is stimulated.

Conclusion:

Student exercises clearly stimulate a deeper learning approach by actively thinking and discussing the topic. This also transfers a sense of ownership to the learned subject, which in turn leads to a positive attitude towards the learned topic.

Despite of student involvement it became also very clear to me that less is sometimes more. It is better that the students understand the most relevant topics in depth than being able to reproduce terminology without the holistic view of the subject.

Finally, it is also very important for the lecturer to keep things as simple as possible. “If you cannot explain it simply, you do not understand it well enough” (Albert Einstein).

All contributions to this volume can be found at:

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