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Innovation processes as a method to facilitate deep-learning?

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Background

Innovation. During the recent years, innovation has become increasingly important to the political agenda and has now also reached the universities. Repeatedly, we are told that if Denmark should manage the ever increasing global competition we should strengthen our knowledge level and our abilities to be innovative. As an example, the University of Copenhagen does now have a section for Research & Innovation with 30+ employees and a new appointed professor with focus on innovation. Furthermore, the University has created a blog called 'innovation and entrepreneur ship in education' which provides an array of inspiration, ideas and methods that can be used in teaching. But can this also be relevant from a learning perspective?

Different approaches to learning. Surface learners are focusing on memorizing what they think they are supposed to know in order to pass the exam, which therefore normally only includes the lower level of Bloom et al. (1956) taxonomy or the uni-structural category in the SOLO-taxonomy (Biggs & Collis 1982). In contrast, deep learners are students that have an intention to understand, to grasp, to internalize, to link different kinds of information and put them into perspective (Millis 2010). Deep learning is the intention for far most of the courses at universities, and in general one would say that the later the courses are placed in the study program the further up in Blooms and the SOLO-taxonomy the learning outcome should be.

Characteristics for deep learning. A task force from the University of Waterloo (Ellis et al. 2011) compiled the following list which includes the characteristics of students that use approaches to deep learning:

- retain knowledge and apply it in new and different contexts
- focus on relating ideas and making connections between new and prior knowledge
- come to see concepts, ideas, and/or the world differently
- engage in independent, critical, analytical thinking in a quest for personal meaning
- regulate themselves as learners
- rely on intrinsic motivation to learn
- engage in active learning by interacting with others and the course material in their learning

Many different teaching approaches that facilitate deep learning have been proposed including Meyers & Nulty (2008) principles that *engagement* of students in teaching will result in more active/deep learning.

It is my suggestion that the methods and ideas that are used in innovative processes can create teaching sessions that can fulfill most of what are characterized by deep learning as mentioned above. Innovation processes in teaching may therefore not only be relevant to fulfill the political agenda and strategy of the University, but also be a very useful teaching tool that can promote deep learning.

The teaching session

The setting. I am course responsible for Animal Parasitology (15ECTS) which is the last mandatory course before the master thesis project in the study program 'Master in Parasitology'. Students are therefore soon finalizing their master degree and their understanding is expected to be at an advanced level, i.e. the qualitative level (relational and extended abstract) in the SOLO taxonomy. This year 11 students attended the course and the present teaching exercise was placed at the end of the course. As part of the course, the students are introduced to different parasites of domestic animals and they learn different ways to diagnose and quantify these parasitic infections.

The aim. The students should learn and try to go through an innovation process and come up with new ways to diagnose parasitic infections.

The teaching. Two hours were allocated. Nine of the 11 students attending the course participated in the teaching and 5 of the 9 students were from the Nordic countries. Two groups of 4 and 5 students were formed in a way so they were as heterogeneous as possible regarding their gender, nationality, and educational background.

During the course, we have had several group exercises and 'two and two' discussions but as this exercise was somehow unfamiliar to the students (and to me as well!) extra time was used to set the scene and introduce the students to the exercise, and for me to get to know whether they have prior experience with this kind of exercise. We all had to move out of our comfort zone to conduct this exercise. Likewise, before each new step/exercise as described below they were carefully instructed in what to do.

Then I explained the 'rules for brainstorming' (see A appendix). Despite that many said that they have tried to brainstorm before, only few know and follow the rules which hamper a proper process. It is therefore important to use a couple of minutes to go through these steps.

I started with a 'warm up exercise'. Individually, they were given 3 minutes to come up with as many bad ideas as possible in whatever field. E.g. 'selling sand in Sahara', 'free speed limit for cars in towns', 'selling parasites to the farmer'. After that they were allowed 5 minutes to share their bad ideas in the group. Then they should agree on one bad idea (e.g. by using 'dot voting') and move on with that one. They were then given 3 minutes individually to come up with as many good reasons how this bad idea actually could be turned into a good idea, and was then given 5 minutes to share their ideas. Then each group was given 5 minutes to share their bad idea with the other group and how and why this bad idea actually was a good idea.

The exercise (more in line with the course). The students were given 5 minutes to brainstorm on ideas and ways to make new diagnostic tools within animal parasitology. On their own, each student should come up with as many ideas as possible and then select one which he or she would continue to work with. This idea was put on an A3 paper and they were then given 1 minute to present the idea to the rest of the class. Then they had 'brain-walking' where they circulated in the class having 1 minute at each of the

other fellow student's ideas. They should add as many ideas (using 'post-it' labels) to their fellow student's project as possible during that 1 minute and then move to the next. After that, each project idea holder had time to look at all the inputs – to organize them and consider if they could use some of them. Then they should develop a diagnostic test, i.e. how it should work and best if they could support this process by drawings, figures etc. on the A3 paper. At the end, each student presented his or her project idea to the rest of the class.

I had some oral feedback in the class and the students were asked to fill out a questionnaire (see B appendix).

Observations, Feedback and Reflections

General. Only one had not tried to work with brainstorming and idea generating processes before and 7 had used it during their education (high school and/or university).

When it comes to activating the students I think it is rare to see the students so engaged and activated as during this exercise. Each student had time on his/her own to think and work independently but was also active in the other fellow students 'projects' by contributing with ideas and knowledge. There was lots of positive interaction among the students. Things were going on in a positive and open atmosphere.

The opening exercise turned out to be very important for several reasons. First, even though some of them had tried to work with brainstorming before, the 'non-judger' idea during brainstorm was new to many and helped them to speak out. Secondly, several of them mentioned that it was interesting that even bad ideas could be turned into good ideas, which encouraged the students to actively participate. Thirdly, it created a relaxing atmosphere due to the funny and crazy ideas and lastly they tried the process from 'ideas to product'.

Written responses from the students

Activation of knowledge. All responded that the exercise had activated their knowledge, but from the responses I can see that they have not been aware of how much of their knowledge they actually used during the exercise. If you do not know the lifecycles of parasites and which kind of

molecules/parasite stages you might be able to target/measure then this exercise would be impossible to conduct. It will therefore be good to clarify this aspect to the students next time, both for them to be aware of, and as it is motivating to acknowledge what you have learned. This could be done by giving examples from their work/products on how they have activated their knowledge.

One student responded: 'it activated because you were not afraid of suggesting all of your ideas', which may be one of the good things with such an exercise, as it is crucial for the learning process to dare speak out (activate existing knowledge). Another student responded: 'I had to use my mind thinking intensively on a specific problem – that´s the best way to learn how to solve it yourself' supporting that such kind of exercise activates knowledge and promotes deep learning.

Learning outcome. The primary learning outcome the students reported was to be open minded and not critical to others ideas, e.g. 'It forced you to think out of the box and being positive (often people are only giving negative critics)'. So one can say that this is a very important lesson to learn, not only at the university, but in life in general. Interestingly, no one mentioned anything about diagnosing parasites. . . (which was the second learning outcome), so at least from the written feedback the major learning has been from the 'warm up exercise', maybe because the outcome was more surprising and the exercise more fun to conduct.

However, from the oral feedback several of the students also mentioned that it was interesting that they within this short time frame were able to develop new ideas and possible new diagnostic tools. I also see this as an important outcome as the students get an idea of that they can contribute and generate new knowledge which is stimulating for learning and motivates the students to learn more.

Teaching method. All but one responded that they find the exercise relevant as a teaching method, but mostly as a 'generic tool' and not specific to the course. This is maybe one of the main problems and issues when it comes to innovation; it is not part of the intended learning outcomes. Their responses may however also reflect that I have not been clear enough on the expected learning outcome of the teaching and how this exercise supports that. I should have made it clearer to the students how the different activities actually support the intended learning outcomes.

In addition, in a 15 ECTS course I think that there should be room to learn this kind of generic scientific skills (supplementary skills) as their competences as scientists are their knowledge, but also the ability to put this knowledge into action by producing new ideas and products. One could argue that it then should be put as a learning outcome for the course, but I do not think it is needed just as the ability to work in groups not are included either as it is not the main focus of the course. In addition, if it was, it would be hard to assess…

But whether this exercise facilitates the learning process when it comes specifically to diagnostic tools is harder for me to assess and may have been a too ambitious a goal to set…, but see my reflections below.

Other reflections

As this kind of teaching was new to the students I found it important to clearly explain what it all was about, i.e. the aim and outcome of the teaching, form and content and explicit told them that they might be brought out of their comfort zone.

I should have ended up by summarizing the learning outcomes. I could have showed them that they had not only generated a lot of ideas and new ways to produce diagnostic tools but also (maybe in each case) underlined how they have activated their knowledge.

One student suggested having this exercise earlier in the course which sounds like a good idea. Both to promote this way of thinking and to facilitate discussions in the class as most of the students responded that it helped them to speak out and not to be critical about others people's ideas.

Some of my 'general aims' for the students at this course are that they learn to work in a scientific and independent way, and that they learn to reflect on their knowledge and come up with solutions to specific problems – both on their own and in collaboration with others. This exercise supported that

Conclusions

Even though I cannot conclude that the used innovation processes enhanced deep learning it holds the potential to do so, as it includes all the characteristics associated with deep learning as mentioned in the beginning of this

document and here supported by quoting the students responses for each point:

- ‘bad ideas can become good ones’ (retain knowledge and apply it in new and different contexts)
- ‘. . . , more like widening the thought processes’ (focus on relating ideas and making connections between new and prior knowledge)
- ‘you get another view on stuff’ (come to see concepts, ideas, and/or the world differently)
- ‘teaches you how to be analytical on your own but also with others’ (engage in independent, critical, analytical thinking in a quest for personal meaning)
- ‘Yes, in the way that one gets an indication on what to investigate further. . . ’ (regulate themselves as learners)
- ‘. . . relevant for the professional life’ (rely on intrinsic motivation to learn)
- ‘it activated [knowledge] because you were not afraid of suggesting all of your ideas’ (engage in active learning by interacting with others and the course material in their learning)

And finally this response from a student:

‘An exercise like this opens your mind and helps to investigate new ideas, which are crucial in a teaching/learning process’.

Innovation processes may therefore facilitate deep learning but it is very important to find suitable problems and areas to work with which may be a difficult task. But if possible, innovation processes holds the potential to both produce students that are more innovative and are deep learners.

A

Brainstorming rules:

- Defer Judgement – Don’t judge your own ideas or those of others
- Go for volume – 100 better than 10
- One conversation at a time – focus
- Encourage wild ideas – the crazier the better
- Build on the ideas of others – leverage perspectives
- Stay on topic – stick to the “how” problem
- Be visual – communicate your ideas for teammates by sketching (Source: D.school, Stanford University) (taken from http://innovationenglish.blogs.ku.dk/metode/classic-brainstorm)

B

Student feedback on ‘Innovation process - bring knowledge in action and ideas to life’

Have you tried to work with brainstorm and idea generating processes before (yes/no)?
If yes – in what settings/where?

Do you think the exercise was relevant as teaching method (yes/no)?
If yes – why?

Do you think the exercise activated your knowledge (yes/no)?
If yes – in which way?

What was your learning outcome/what did you learn from the teaching?

All contributions to this volume can be found at:

http://www.ind.ku.dk/publikationer/up_projekter/2014-7/

The bibliography can be found at:

http://www.ind.ku.dk/publikationer/up_projekter/

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