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1. What do you teach?

I teach engineering students on the Product Innovation and Business Programme: Dynamics of Innovation, Masters Level, 3rd Semester and Innovation, Technology and Business, 1st Semester. My teaching is strongly inspired by my experiences in IT Product Design. Class size varies between 9 and 18.

2. What is your rationale for using active learning approaches?

Regarding the Masters Level course, those from an engineering education grew up in a world of right or wrong which to some extent is also necessary, especially in engineering of course. Here I try to get the students to grasp that in the practice of innovation we have to deal with diverse theories of innovation because we deal with complexity and uncertainty where we don't know what the outcome will be neither do we know exactly how to get there.

We try together to create an awareness that in practice many things are way beyond what we can measure or should meaningfully measure. If we teach the students a logic of "either-or", we end up with stereotypes, which are not conducive especially if you want to train students to be good engineers on the one side but also good innovators on the other. As teachers we need to help them to grasp and cope with the paradox of having to be precise and efficient in managing operations and explorative and effective for innovation.

The approach I use is dependent on their participation, what will not work and I also reject working like that is if students come to consume my teaching. I need their participation and reflection, the minimum I need is their reaction and the best I can get is their active reflection, surprisingly often that happens and there's a typical process.

It starts with a lot of rejection and inertia, leaning back trying to get away with "oh this guy does not really know what he is talking about, he's not an engineer and how can he, as a theoretical person, try to talk about practice". That's typically where I share my 15 plus years' experience in different businesses which for some leads to a change of opinion for others not, but they get curious at least they start asking. What also is a provocation to them is that in many instances I have to say I don't know when they ask and they are not used to that because typically their teachers do know the formula and how to apply it. In innovation theory that depends on the individual cases.

I slowly help them move from memorising to a more enquiry-based learning where not to only focus on the problem, whatever that might be, but the technology, the people and try to take a step back and say what is the context what are the relations we are dealing with in the particular situation? There's a lot about being a reflective practitioner, reflecting in action and reflecting on action. And sometimes I take it out of the situation because I notice for many people it helps enormously if they can work with their own reflections.

They get a typical lecture; this is always how we start. One lesson I learnt about in practice is it is very easy to talk about things and read about things and it's very different to do things. So I am trying to get them into the practice and after that lecture takes place they know that next is a development workshop where they work in groups and then it depends on the constellation of the class and I give something of a

guideline, for example there must not be two of the same nationalities or engineering backgrounds in a group so I try to achieve the greatest diversity and if possible not only male and female groups.

In preparation for the development workshop each group chooses one of five relevant articles and in class they get a different article to read. The idea is they learn how to read scientific articles and to extract the main arguments from the article. Then they present the new article to the class because another group has prepared the same article thoroughly at home so they have a strong opponent and they peer review each other. And I always encourage them to peer review each other on multiple levels, which means the content and the performance, they often say "What does that have to do with our education?" But in innovation it has everything to do with innovation because you need to persuade people with different backgrounds and different interests in a very short time of stuff that they are either not familiar with or they might have a different opinion. So they learn around the 2nd or 3rd iteration they are all into it. So the last one – if you look at the outcomes – typically is the best one. But if you look at the process the other ones are much more interesting.

And the third session is often too much for them in the beginning. Now I tell them we learnt about the theory, discussed the theory, reflected upon it so for the third session you need to present that theory and it can be everything except a PPT presentation. And I tell them they can dance it, build a sculpture, do a game or a comic strip or whatever they can imagine and whatever they feel most comfortable with as a visual representation of that theory and typically I see all these freaked out faces. And there is a lot of resistance but many of them realise that going through this process of turning theory into an experience slowly allows them to develop a much deeper learning a much broader understanding of what they are actually dealing with.

And my impression is that students who went through this are really wonderful conversation partners about theory and they can apply it in practice, they can look at something in the news and they can do all the lateral connections. What is also clear is that doing that work sometimes means that you lose people. You cannot force everybody to become good in this and I thought a lot about can we afford to lose someone but the point is doing it the way I do makes you very aware when you lose someone which at least allows you to engage with a personal discussion. While my own experience as a student was many people are lost and you have no chance to notice and they just basically exit listening they are there physically but their brain cells are not working. But it's not many, sometimes 1 or 2 who are lost. There was a student who wasn't really a typical student. He came from India and was working for Danfoss and he had a PhD in engineering. He thought he would like to get some extra training and somehow slipped into this programme. And I was like wow, that's going to be interesting. I could see his motivation and engagement increased enormously during the course and at the end of the course he came to me and said, "when I started your course I thought this was absolute rubbish but now I am so happy that I took it. It helps me in my every day work and it gave me a lot of ideas for how I can motivate my own children and colleagues to learn about new stuff."

I try to be very playful and open their minds and when they do peer review with each other that this is actually a safe ground, that nobody is failed because if they do a mistake here or there it's actually about learning from failure which is a tremendous chance because they will never be in such a safe environment after they have graduated and it takes some time but they typically get it. It's this typical dilemma that people get ideas theory wise and then there's this huge threshold of going into practice.

I would say every education that takes into account the social dimension is perfect for this approach and pedagogy. It would not fit where we have a clear right or wrong like biology, chemistry or physics however you could say as those fields are moving more and more to interacting with others so if you want to enable people to work together this approach could work.

My research and teaching are inter-related. I do not have the idea to make the students only good theoretical researchers my goal is yes definitely employability, it's all about practice being able to use that and from my perspective that includes innovation research.

3. And your rationale for using e-learning tools?
There are three experiments with e-learning tools to see whether there might be possibilities I didn't recognize so far. First, I started working with an interactive e-book I wrote that I hope helps me to 'flip-the-class-room'. It worked quite well in the first course where I used it in terms of the students really used it to prepare and thus engaged in more lively and qualitatively better discussions during class. Second, to shift information gathering to homework and discussion and reflection to class work, I just started to use wikis. The students work in groups and each group has a wiki as a collaborative workspace where they can collect and discuss data in face-to-face group work as well as over distance. Third, we use blogs as the platform where groups post their assignments and peer-review each other.
As a punch line my rationale is that I use e-learning IF it provides both the students and me with more quality time to dive into what we are working with.

4. How do you support the students with course assessment?
I don't grade the things in between, it's more how much effort or commitment they show but if a student submits a very poor final assessment and I can look back see very high commitment in class there might be several questions this might raise. There is now me and an internal examiner it used to be an external examiner where all the focus was on the final assessment or the keynote paper. The keynote paper is where they get 6 questions of which they have to choose 3 and they are questions which are comparably open for example. I try to formulate the questions in a way so the different students can come from different perspectives because I am convinced from my previous experience that it's both important to have breadth and depth, in the best case united in one person otherwise it's good to work together so you bring different dimensions.

5. Which formative assessment methods do you use?
Peer feedback goes through the course and tutor feedback as well with the intention that they will use that to improve their final assessment. It depends on the student if they use feedback formatively. But there is no meaning if we keep away all frustration from them because frustration is what they are going to experience 95% of the time so if they don't have any frustration tolerance they are probably in the wrong sector. So I try to be straight and fair, I ask them "what can you do about it?" Some are open to feed-forward and others are not and that of course is a conflicting situation and a discussion about this allows us to come to a consensus.

6. Are there any constraints or barriers which limit how you teach and engage students with learning?
Time is constraining because this research-based and research-informing way of teaching requires a deeper and more flexible preparation and it depends on careful relationship building which is additionally time-consuming. If the professional culture and identity mainly build on mechanistic principles of order, memorise and repeat that is a major barrier for creating an open-minded culture of inquiry-based learning. Another constraint is the inherent interdependence – if too many students boycott participation it is very hard to push this through. Some constraints are enabling and help me to keep critically looking at myself.