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00:00:02
Speaker 1: Yeah, yeah, great. So, yeah, the

00:00:04
Speaker 2: doesn't sound just show on my screen, by the way, it record it anyway. Oh yeah. Now I would start it. Yeah, now she's correct. Nice.

00:00:13
Speaker 1: So can you briefly introduce about yourself and what do you teach in the xxx program?

00:00:21
Speaker 2: Yeah. So I'm a physicist. Up to 15 year, 20 years ago, I was mostly in physics research or chemistry research. About 10 years ago, I joined xxx, and that was also for me switch when I switched to teaching almost full time, leaving my research to one day week. And so I always been teaching on the boundary on the interface of chemistry and physics, I have been teach a lot physics chemistry courses in the chemistry department. And I'm also teaching physics courses, mainly fluids and heat. I've also taught for a long time thermodynamics. So the core courses in engineering for Russia, I mean, the other task I have done tutoring, mentoring, ants and so on assessing. So at present, I'm mainly teaching fluid mechanics and heat flow.

00:01:27
Speaker 1: Thank you. Thank you very much. So my first question would be, what is your perception? Or definition for that matter of higher order thinking skills in the context of your teaching.

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Speaker 2: Well, higher order, I'm I'm not sure how it is defined. Of course, your question to me, how I will define it thinking is it's a big word. I think so. Thinking skills is how can you have skills about students think? Think? What I try to teach an atlas and I'm not sure if you can teach it, but I try to teach is to teach them short skills and then related to modeling skills. So the topic I teach. I try to do that partly, in the context of research and modelling, and you could say that if I compare this to how I teach in the regular programs, it's just a domain knowledge. So understanding the laws of physics, I'd be able to make exercises to get the right answer, answer and less on open-ended problems. So in ATLAS we have more open, you try to have more open and the problems are basically problems which have no ceiling with respect to how difficult you will make it. And then you have to apply some modeling skills. Otherwise you get nowhere and you have to put this more difficult problem in some kind of framework where you can see how complicated you make it. And this framework we call modeling framework. And you could say that's this disclosure related to research, of course, the whole modelling idea. So I could say that these are the higher order skills as compared to regular teaching. If you say that these are higher order thinking skills, I'm not completely sure to what, what, what I should think of thinking skills so that

00:03:31
Speaker 1: yeah, so if I understand correctly, this understanding of higher order thinking skill comes from your teaching of the course, which is about modeling or teaching, modeling and

research skills, which you perceive as a form of higher thinking skill or higher order skills of that matter. if you cannot define thinking skills.

00:03:55
Speaker 2: Yes. Yeah.

00:03:59
Speaker 1: Would you have any basis, theoretically basis for modeling skills or research skills that you can refer to? Is this this view stems from your experience?

00:04:11
Speaker 2: the view stems from my experience and and that's also. I think if you do well in research, you kind of know you kind of have these research skills. Also, I work together, my thesis advisor and theprofessor now in the group, they're top, really, really top. I mean, close to the Nobel Prize level and so they both won the. it's called the Spinoza price in the Holland, its the biggest prize on research. And date, I learnt a lot from them how to do research, how to think in terms modelling. Both of them have never looked at any theoretical basis of their research. I'm certain that they don't have any. They never thought. I've never looked at modelling skills as some theory, but you first have to learn before you can do the research.

00:05:11
Speaker 1: OK. That's yeah, that has been my experience as well. So most of the times it is because probably filed related skills, a lot of the skills, and it's really difficult to have any theoretical basis. And also the practical experience, as you said, provides more, yeah, training and opportunities to develop such skills. So if I can push it a little further. What do you if you can reconstruct the overall modeling skills into skills? What kind of skills do you expect from your students to be able to successfully do modeling?

00:05:51
Speaker 2: Yes, I just yeah, there's one thing that came to my mind, which is also high order think skills, how they'll touch upon that later. So. Yeah, right. Well, there are a few modeliing skills, and I mean, I, of course, also discussed with Mieke Boon at some point her b and K model and and of course has many things I recognize in that model, which I would also indicate as key in the formal modeling skills. If not, I give feedback on students in modelling. It's not just not so much a rigid frame of modeling, so you shall do this. And that's a first. It's not rigid kind of points. You have to go through a bit more. A kind of attitude and attitude is first to simplify to see what what is key, what is the essential things I learned from my promoter. I learned that if you want to understand something, you should take things away, not add things. So you should take things away until you feel that it should take away this particular part, then actually, it doesn't work anymore. And then you kind of hit upon the key issue of your problem. The key? What's the key supporters? And then once you've indicated that you could start with it, understanding that and then build up again. So that's that's so it's kind of daring to simplify my notions of students want to make it extremely difficult. So they they actually think that if they put in everything, it's getting better and better. Typically, I have an example of the cooling of a coffee cup where they try to model it in a way that's to take everything into account which. And it gets a big equation. And I think, well, then whereas what I like to learn is that. from this, you don't learn anything, so you learn first how it's what is the most simple way that you can describe. So Simplification is, for

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me, a key issue which many students find extremely difficult to dare to simplify the thinking. If you simplify, you kind of I don't do it correct or something like that. And if you don't simplify it, you do. If you make it more extensive, you do it better. And for me, but that's my patience physicist is that understanding is always key. So to understand why things happen, not to get the right answer, but to understand to get the relationship as well. The second thing is that they. Learn, too. And that's really, I think, more sports. Of course, everything links together, it's reflecting on the results, and that's also what you just find extremely difficult. So they get an answer and you don't even think about if it's correct or wrong or if it makes sense or so on and they get the number out. And they say, well, put everything in, show the number should be correct. And so a second thing is that they'll learn about what they've done about the validity of it and adjust it so it's reflective of ourselves. I mean, a bunch of the research is very obvious. These kind of things that you're when you get a number, if they do research, you write a complicated call to your theory, you get a number out. You're always the first thing you do is to to distrust it. You say I certainly made the mistake, so I'm not trusting this number. So you've got to check everything. And that's a frame. Also, frame of mind. I'm not sure if that's a higher order thinking skill, but it's kind of a frame of mind that you always distrust what you're doing that does. So it was for me this to be the basic ingredients and the old. All the other things come kind of follow the dish because if you know which simplifications you make, you also think of what you could add if you know if you find the wrong answer, you could think of if you made too many simplifications once it's close together. I'm not sure if this is the level you want to enter the answer to your question. All but this is basically into modelling.

00:09:53
Speaker 1: No, I mean, it is not about me what I want. I think I want to understand what is your perception? So whatever you provide would be what I need.

00:10:05
Speaker 2: Well, for me, it's the key thing. What for you would be interesting because it's about teaching higher order skills. I order thinking skills. I'm always wondering if you can teach them. That's for me, the key thing. So first, doing research or doing modelling, if you think of this as a higher order skill. Which is something which came slowly with me and with other researchers, and the question for me always have been can you teach it? can you speed it up. So can you basically get students this kind of notion, this kind of perhaps higher order skills within a span of one or two or three years by teaching them the theory for instance and framework as well. So I'm I'm not certain I'm so I could say that's. The way I learned today is the slow way. with good research you could say about that. I'm not necessarily mean that that's the best way. Mm hmm. So that's what it makes me. The key question, but it's also central to. Can you teach it to?

00:11:05
Speaker 1: Mm hmm. And I think that is the question would be answered by the end of my research.

00:11:11
Speaker 2: Exactly. And you have to be careful then, if you do not. If you if you assess students on this, if they have the skills, if you basically do not assess what you put in because then you're by default, you get out what you put in. So if you teach students, if you're a good

teacher, today should do this, this isn't it. And you teach them that you drill them, a train them. And in the end, to do all this, then you can say, Yeah, she'd do all this. But it's not actually mean that they are good researcher. It's only that they exactly do what you told them. And that's I find it's always very difficult for this kind of thing. So if someone tells you, I remember someone taught students to write a good research proposal and a good research proposal had exactly these four issues. And then they later assessed ifdef for it. You should have said yes, they have it OK. And then the conclusion, OK, they can write a better research proposal now. No, they can, but they can do actually do what you told them. So and that will be I. I would be interested to know how you would test if to get better skills independent of what you taught them. Excuse me. Yeah.

00:12:26
Speaker 1: So, but I am very much on the same side of it because I do not intend to teach applications basically such as becoming a researcher are becoming a modeler. But in cases they would like to do such activities, it should not be that difficult for a student when they engage in such activities. So that is the overall agenda or point of research is to create some sort of teaching supporting systems in which they can acquire skills that are transferred and applied across domains. And that comes handy. And as you said, there are certain things that comes with experience, comes with practical engagement with the subject. That definitely needs them.

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Speaker 2: I said there's one thing which I kept in mind be higher skills, which actually are even more relevant to your because this is really on on how to do research and modeling. And again, it touches upon this. But this kind of that's it also touches with this. What you just discussed is that I will say that the higher order skill and that also refers to a bit interdisciplinarity. Let me explain if you if you do physics, if you for instance do fluid mechanics or you learn all the courses, you learn all the equations and the laws, and so on you solve problems and then you do fluid mech they do electromagnetism is a completely different subject, but it's about the flow of water and other one It's about electricity. And if you study the subject at some point, you'll start to recognize things, you start to see that things are similar, that equations are similar. And that's a show that also the solutions to questions are similar. I mean, this is a famous quote by, Richard Feynman, the physicist who says "the same equations have the same solutions". And so the key thing is that once you've done this, so. I was first told fluid mechanics and electricity mechanism, but then another topic, and at some point you can't see the similarities is that the basis a lot of the basisare same that means that also a third time in the fourth time you can do it quicker because your sheet is structured and many steps are the same. So what's interesting is that once you have this idea that we had the idea in the faculty, not in ATLAS ithe other faculty, why don't we do this from the start, shall we? We teach students the basic principles and then just show them that one. One particular way of , one example of it or one representation of this will be fluid mechanics, another representation would be would be electricity magnetism. But you first teach them the same basic things, and somehow that didn't work out just student didn't get it. And I think this would really be a higher order skill. I think you should go. It's kind of maybe you call it beta literacy or something like that. So it's things that you recognize are similar across the discipline, but it's very difficult to teach them a priori. You can only see a

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posteriori that actually there are lots of commonalities between things I could say. I would say this is a the higher order, higher order thinking skill of the natural sciences. And I am also convinced that you cannot teach them a priori. But then you can go one step further. If now, compared to interdisciplinarity aspects, are there the higher order skill and higher order thinking, which are the same across the disciplines and so are there commonalities between, for instance, physics and biology? that they have the same kind of ideas and effects. You can also use it, and maybe you have seen this movie of cambridge, University College London there he calls it. What do you call it again? It's got a name. I've got a name he calls it thinks like he gave evolution as an example, evolution has been developed in the field of biology. But you can also use evolution in different disciplines. You have an evolution of ideas. System thinking also comes from one discipline, but you can also apply system thinkingd to order. And in my own field and entropy, it's really it's really a big concept in thermodynamics. But entropy, you could also use in other domains. So you could say that this is a higher order thinking in terms of entropy. I could say that's a higher order thinking skills. But you can actually use for students that they understand what it means. In one subject, they can make headway in other subjects by applying the ideas that were developed in one subject. So you could says that's for me really higher order thinking skills, which also interdisciplinary. Well, just interrupt me if I'm going in the track that you don't want.

00:17:36
Speaker 1: No, no, no. It was it was very insightful actually to. Yeah, if I would like to actually go back because, yeah, I got a lot of points and I just would like to make sure I understand correctly what it meant. So when you say simplification in the very beginning of this question, when you started answering, you consider the ability to simplify is something of a higher order abilities. could simplification to be understood as synthesis. Are these two things different for you?

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Speaker 2: A synthesis. Could you explain that since I know this is mean, that's not what you mean by it's

00:18:12
Speaker 1: a synthesis of probably is able, it's not only my definition, but in just literature and everything. If you have so many things your ability to condense all of this information and formulate a one coherent explanation that represents the phenomena.

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Speaker 2: I see what you mean. I'm not certain if this would hold for the natural science It cannot, just for the social sciences because in the natural sciences. Suppose that I would understand the topic very well and. And I know all the all the aspects, all the angles and so on, and then I would have to explain to someone in two minutes what it is about. That could be a synthesis, because basically everything you condense in basically a few simple. I'm not sure it works like that. in the natural sciences, I'm actually, to be honest, I. That's a difficult question. I would have to think about this a bit longer, to be honest, not just. But I see a point what you're making, there is a difference. I think in in this simplification and simplification that you use to understand it and simplification that you use for instance to explain afterwards. I feel that these are two different things and. Yeah, I can't answer it now.

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Speaker 1: No, it's just not at all, thank you. So then again, you mentioned about reflection. The ability to reflect is a key aspect, and we also refer to that as a frame of mind than a skill. Could you elaborate, why is it that you perceive it as a frame of mind? And can we teach a frame of mind to students?

00:20:19
Speaker 2: Yes, I think you can teach a frame of mind to students. And I think this is something you can easier teach than actually lets say, what I just refer to as the higher order ID behind different subjects in science. For instance, I think that reflection you can drill students in. I think you can really try to drill this. So always think about the number, always distrust the number. If you get a number out. Always think about it. Suppose if you do something and you get an outcome, you get five, then the first question that you ask yourself is exactly five or five plus or a little bit or actual. So that's a frame of mind that you can persistently teach that you can be persistent on to teach students. Yeah. So but I will say this not a higher order skill. It's really it's really it's really more of a research skill i think.

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Speaker 1: Along the same lines around the same topic of reflection, you mentioned that students often don't reflect before finishing, for example, that they're checking what they have produced is correct or not. So it's basically a check before final finishing, before finishing the process or assignment or submitting it. The student has to do. Do you think a reflection? Is the right way to describe it in that, for that matter? Can you define reflection independent of the context that you mentioned from your own view? How do you perceive reflection? What is the definition that you have?

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Speaker 2: Reflection is that you? Maybe could a reflection be. I would think of it in the context I describe you is that you step back from it. And you look at it, not within the framework how you derived it somehow. If you know what I mean. So because they you remain within your line of thinking I did this and this steps and therefore got this answer and you can answer then to kind of step back and look at this answer and maybe you think, could I have gotten this answer in a different way or does it makes sense? Or if I do this kind of thing, if I make my input twice as big, will the outcome be twice as big? But for me, this kind of thing. So it's kind of bit independent of the way you. I could say that that will be a reflection. Yeah, but it's also. It could be putting into context, maybe that's also also a reflection. So what students have to do in an assignment for me to get so much energy, it's so much energy that you ask yourself, how much energy is this? I mean, is this energy which is stored in your phone? in your cell phone? could you charge your cell phone with it? Or actually someone gave an answer, which was actually more than the whole energy position of the world in 10 years? So it's it's so clear that was wrong. So what I'm saying is that to put it into context, what this is, what does that number mean? And that's I think it's part of reflection. But then again, I don't think this is the higher order skills you're after. This is really details on the on. But I would say in general say that reflection will be to step back from it. And so, you

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Speaker 1: interestingly, the kind of idea that thinking skills that I'm aiming for has all of it's

in combination. So the proportion varies but reflection is kind of one of the common thread that connects most of the higher order thinking skills that I actually kind of do research and study on. So, yeah, partly more or less, we touch upon all the time with reflection, even with what you've just described and problem-solving. If I can say just to elaborate a little bit, if I say problem solving, I think reflection is one key aspect in problem solving to check, especially when you what you suggested for students. So that is something relevant for me. Thank you for offering your insights regarding that.

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Speaker 2: I must say one thing, I don't know this is social science and natural science. You also like to train students. That's when you have a problem before they solve it. they think of what answer to expect. even without solving it, if you know that if I ask you how to spend. I know you expect it to drop and, you know, expected drop it in the tenth of a second, atleast for me you have some idea And so that gives you already a framework, a boundary, something that's very closely related to reflection. Because basically, if you solve something, if you do something, then you check later on if it was what you expected. That's also kind of refection. And I can imagine the social sciences also something suppose you want to I don't know. You want to investigate the effect of advertising things on people's behavior or something or these kind of things. Then beforehand you also I think you should have some idea what it does and if it's what kind of impact it will have even before you're going to research. And I think that would also be an essential part of reflection

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Speaker 1: hypothesis based on what we observe.

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Speaker 2: It's a hypothesis, but you're exactly what you say, it's a hypothesis so in the into frame of modelling that would actually be the hypothesis. It's very rarely that you, although occasionally you do something but which you have no idea what to expect.

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Speaker 1: Mm hmm.

00:26:29
Speaker 2: Exactly. So that's kind of kind of funny, of course.

00:26:34
Speaker 1: Mm-Hmm. And finally, before I go on to the next question I wanted to touch upon the point that you mentioned about interdisciplinary research or the ability to find relationships among concepts and equations in different disciplines. And you said that cannot be taught a priori, but only a posteriori so. Can I say or can I ask that the ability to recognize patterns be talked in general, but then without proper data or knowledge on disciplines as students will not be able to find any pattern because he or she does not have any information to combat and find pattern on? Do you perceive that we can teach such pattern recognition independent of subjects? Are it always comes with subject? It's always dependent on the content.

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Speaker 2: That's a kind of question I can only answer from my experience and not from knowledge of how people how human minds work and if they could learn it as a principle. So

psychology would probably have something to say about this. That my answer would be biased because I'm I'm a strong believer of getting to know things via concrete examples and I think it was Albert Einstein who said that learning by example is not just a way of thinking. He said learning by example is not just one way of teaching, it's the only way of teaching. So something like that, he said. And so my answer would be that you would have to have some you have to make a tangible. So you have to see how this concept which, take entropy it is very abstract. Or evolution? Perhaps also, it's a very abstract, is a very abstract concept. So if I just teach you without any reference to where you could use it, what entropy is, then then it would remain so fake that I am not sure if students would feel would understand what this would mean. It would mean the highest probable that yeah, that. I don't even know how to frame it in an abstract way. However, if you give examples so how you would use it if you play a card game or explain where you see it, or if you see people behaving in a way that you see also entropy maximum entropy laws happening or you see them happening. I mean, I see them happening. Actually, there are exactly the same laws of physics, which which are dictating how people behave as big groups as how I see that you behave yourself in a card game or how how basically in my fields how molecules are behaving exactly the same. same underlying ideas. So I feel that once you see it in one example, you really understand it, then you can start recognizing it in other examples as well. That's that's my own. That's my personal belief. But I cannot give any support to this.

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Speaker 1: I totally understand. But thank you. Thank you so much for sharing with that me. And so with that, I finish kind of the first most actually the kind of the topics of my interview of the questions. The second aspect, which is a very secondary aspect, but would be interdisciplinary research. So first, what is your definition of interdisciplinary research? And after that, what are the kinds of skills do you think are significant for doing interdisciplinary research in terms of thinking skills?

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Speaker 2: Yeah. Maybe just but the question you could have emailed me before, if it was I was just asking What is your definition of interdisciplinary research, interdisciplinary skills and it's an interdisciplinary.

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Speaker 1: research practices, the skills that are significant are needed, prominent for students to be able to conduct a practice, interdisciplinary research and engage in interdisciplinary academic practices.

00:31:09
Speaker 2: Now, for me, it's interdisciplinary skills. is to. I think there are two aspects and also in relation to what we've been developing in ATLAS I feel if you want to be in, let's say if you want to be an interdisciplinary scientist, maybe what would you learn, maybe that's that's that gives a framework. I feel that you should, and that's also what we have been trying to do in ATLAS but not completely, succeeded I think it's that you should be literate in both. So you first would learn the language of both subjects even apart. So not not directly jumping together, making together but First, learn what's the language of social science and what's the language of natural science? To be honest, when I joined Atlas, I didn't know a lot about social science. I didn't understand the real thinking. I didn't understand how research

was done in social science. To my surprise, it was done in a very different way than It is done in natural sciences. They put emphasis on different things, of course, and you could say natural sciences via a bit easier because we have all our laws you can build upon, which are certainly true. And so that makes also social science. You kind of don't have solid background of the laws, which are valid, these kind of things. But I feel that I can only compare them, when I know them both. So I can only think about being an interdisciplinary scientist if I if I know them first. So it would for me to start with, call it, I would call it literacy. So becoming literate in both domains and once you're literate, you could also kind of, first of all, you could understand each other. So if and if you become an interdisciplinary scientist doesn't necessarily mean that you know all the disciplines, they can basically do all this atleast you can talk to someone from a different discipline. But then if you can speak his or her language, that helps a lot. So literacy is important, also you can then identify what are the commonalities and what are the differences. And I think once you can pinpoint these, then you are becoming a true disciplinary interdisciplinary scientist.. That's what I would say. That will be higher or level. Aspect of being an interdisciplinary scientist, as you can, indicate the commonalities and the differences, and if students could do that, that would be would be amazing. I think

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Speaker 1: that's great. Thank you so much. Yeah, for answering this immediate as you've said, it's not that easy to reflect immediately spontaneously on these topics, but thank you for trying. Yeah. Have you wanted to say something martin?

00:34:15
Speaker 2: No, no, no, actually, the connection was lost for a moment.

00:34:19
Speaker 1: OK, sorry. Are you able to hear me now?

00:34:22
Speaker 2: Yeah, yeah.

00:34:23
Speaker 1: So my final question would be your teaching practices, actually. So now that we have discussed about what you can kind of focus on in terms of higher order thinking skills in your course. And we also discussed on what is your view on interdisciplinary research and related skills and also deeply on higher order thinking skills. What kind of teaching methodologies do you implement to develop explicitly such skills that is obviously independent of the content that you teach? They are intertwined, but the skills need certain strategies to be developed. So what kind of practices do you use to teach? And if you have any assessment techniques that enablesor that gives you an objective view in students development? Would you share any?

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Speaker 2: First, as a teacher by the teaching methods I use, I actually I'm not so concerned either am I teaching about the interdisciplinary aspects. So I'm it's. The difference is that the I teach in ATLAS is that, I think they should learn this literacy, they should become aware of what's typically of be the sciences, and they should learn quickly because maybe afters one year they go into social sciences and then they have only had a few courses and exercises in

these courses. You still want to convey to them that that's kind of the essential aspects of Natural sciences. So I tend to put more emphasis on this as compared to my teaching in the chemistry department where they will learn it anyway, there are their for four years. And they do a master and so on. So they have all the time to learn the skills to go back to scientists, so it should be quicker so. But in terms of methodology, I'm not a methodological teacher. This meaning to say that I do it based on intuition. So to be honest, so I don't read what's educational scientists have thought about what would be the best way of learning. Thinks so. So having said this, how I teach them to become a beta scientist is indeed what we discussed in the beginning, so focus on modeling, reflection. way of thinking how how I mean all the aspects which I feel that you should have that kind of, you should have developed when you are a master students in physics. This kind of notion you have of how, how you, how you go about solving a problem in physics or in chemistry, what kind of. So I try to condense these and to take them out and to try to. In kind of a crash course, put him into the subjects I teach the first year. Now see what I mean? its not completely your answer, but that's to you. Ask that, but you ask about the typical methodology of teaching. If you would say if you would have to think of it, it would be problem based learning or challenge based learning with these kind of buzzwords which are very popular now. But they are the key actually to this kind of interesting. Maybe when we started Atlas, we are all experienced teachers. We had just pro-McCain myself with teaching the natural sciences. And actually, we are thinking of kind of doing it the way we always did it, but then maybe a little bit more polite and so on. And and then we thought to ourself, Hold on, we are now teaching in a new college and teaching a course we have to do it differently. And so then we started to think of indeed have completely problem based learning. So have our teaching around a few bigger assignments. And if you could solve this assignment, this big assignment, the basic, you should learn all the physics that's needed instead of following all the physics. So. So did this, and this was also a few of that was think that they should learn to think as a physicist that this would help them more as that you just start with the basics of the book and the questions and more freely and more questions to show them. So simply. Yeah. So that would be old fashioned now. Now, I think that's problem based learning and challenge based learning is not something really radically new. That said, we also realized that for us, it was quitenew at the time. Yeah.

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Speaker 1: I think. Pretty much along what I wanted, but my question was more directed in problem based learning, or in project based learning. If you have certain tools, our way of teaching the expected skills other than the exercises that you provide, but you clearly mentioned that you actually do it on an intuition basis. But is there an example or an on average? Do you use certain strategies? Apart from the overall project based learning methodology, which obviously contributes towards the development of the skills that you mentioned. any explicit techniques in terms of?

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Speaker 2: No. But I'm not sure if it's actually learning to cause mean. I'm not sure which techniques you're referring to because the teaching is not so difficult. It's I mean, it's for example,

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Speaker 1: I can give you an example, probably to give an example from academic sorry from social sciences point of view in terms of academic writing or critical thinking, I led students to read an article and then post three main differences and and advantages and disadvantages, and critically engage with another student about those points based. And I try to do that on a weekly basis, especially to develop the critical argumentation skills and find critical points other than subject knowledge and the principles that I think this is a specific way for me to kind of instill critical thinking and argumentation. Likewise, if you think for modeling skills that you do, certain exercises that you know contributes towards the major skill that you think is important,

00:41:12
Speaker 2: and as for the exercises I do, but I feel this kind of kind of an implicit in the problem based learning is indeed that you, you let you, that you go through them through the modeling cycle to give an example that then I teach in class. I just give. I just I just started to question if you put a balloon up in the air, how how high will it go? That simple, simple question and I ask them to get an answer within one minute. I just want an answer. And then I ask them, Why did you get adventure? And so what's what's so badly that they have to make some simplifications because you have to, which you have to answer one minute. So and then you've got to build up, now your concept is correct. And how could you now improve this? And if you if you want to have more precise , how you build it up. So this building up? It's implicit in my teaching, actually not from the beginning, which I do in the later years. And so all the assignments are also in there. So I ask them to specifically go through cycles that they first do it simple and then try to add things

00:42:21
Speaker 1: Nice. Nice. Thank you. This is I. This is what I actually I wanted to know. I mean, how how you mean basically how you teach in itself is a kind of a methodology that enables such thinking, etc..

00:42:32
Speaker 2: Well, they find it difficult, but it's quite interesting because if you go it in the assignment to find it difficult to, again not to jump at the most, it's just beginning, but then you start simple that you force yourself to start simple that you just think of. It's the most simple way to get an answer quickly that they find it very difficult. And that's what I'm saying. That's that's I would say that simplifying things is something they find difficult. So that's something if it's just implicit in my teaching, so. Yeah.

00:43:04
Speaker 1: So again, I'm I wanted to finish it now, but then you kind of reminded me of the important aspect in terms of difficulties, students, obviously when you teach a group of students or a class full of students, that is not always the case, that everybody attends the same level as you intend or expect. So what kind of difficulties do you think students face in terms of acquiring the modeling skills that you expect to teach in your class? Commonly occurring difficulties for students to acquire such skills.

00:43:41
Speaker 2: Yeah, that's kind of a good question. That's that's a that's that's an interesting

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question. Because if I think of students when they. Find it difficult to do it for various reasons. It's kind of interesting, as some shows have a very good it's some have extremely good intuition of physics. You feel that get it, but they have kind of problems in doing the technical aspects to solving equations. And some students are kind of very equipped in technical aspects in mathematics and they kind of have lousy intuition. So it's basically that kind of surprise. It's quite got mixed. So as a teacher, maybe that the key to teaching to understand what I find difficult. So what? What actually what? Maybe that's the most key part to understand what hurdles students have, and each student has a different hurdle. And I'm honestly convinced that if you are an extremely smart teacher, you don't see the hurdles that students have. I mean, obviously, student, I was not particularly good at physics. I struggle to lot of these things and so on. But I feel also through the struggle. I kind of recognised of struggle of some students thorugh my own struggling. So and sometimes you yeah, it's maybe that's the key. So to see where to bear, each student struggle is a different issue. And as a teacher, maybe it takes time that you you kind of have developed all kind of you've seen all these struggles and you recognize them and you can help them with. So I show that again, answering your question, I think it's it's fine.

00:45:25
Speaker 1: I just wanted to know your view, but there is no right or wrong answers.

00:45:29
Speaker 2: So no, what is question? Because in my answering, I kind of lost track of your initial question that you asked.

00:45:38
Speaker 1: Indeed, indeed, I mean, I. I thought if I could be that if you had some ideas on on an average in my class, most of the time students will find it difficult to do this task based on their background because they don't come from basically a, for example, a natural science background. or Mostly students who are very interested in social sciences not able to do that kind of observations, for example. But if you said that the individual differences has different causes, which is very true and factual, and I do myself recognize in my class that's very recent. So it is likely that not very possible to do too easily abstracts data from. Yeah, every year that the new group of students.

00:46:30
Speaker 2: I there is one skill on a scale which is not highly skilled, but it's more it's more and maybe more abstract or it's not. It's not a content skill. It's what I find the students that and for me, if, if, if you can talk about research for me, there's one word which connects to research and that this dare to do things as researchers should dare to step in the unknown. You should dare to take anunOrthodox ideas as well. And students have a tendency to to be safe and to remain within the framework that you understand and know, and also also my phd students they remain to the framework of the article, say, from reading and so. But I find it difficult for them to learn and at some point. You're here and you have to go there and there's some wall in between which you find difficult and you can't solve it, and somehow you have to go through it, you have or around it or whatever, you have to do something to get there and this kind of thing that you have to solve it no matter what you have to get out. That's kind of a that I feel that's that is difficult to learn (teach) to students.

transcript

So you could still say it's a skill, a skill to to have to to advance, even if if you feel there's no advancement possible, something like that.

00:47:54
Speaker 1: Yeah, that may maybe the the categorization would be different. I wouldn't really call that as a it's a skill, but rather an attitude. No matter what I can have to get through, that is the only goal. So, yeah, the the classifications.

00:48:11
Speaker 2: But it's somebody I mean, it's an attitude I could agree with. I'm not sure of this that you could say that's being reflective and critical of negotiation attitudes. I'm not sure if being critical skill and how well do you think critical skill or attitude or

00:48:30
Speaker 1: critical thinking is actually a skill? The because the attitude is that I have the skill, but I have to put it in use whenever I make decisions. So that is how the classification I do. Basically, if I can have the attitude of approaching a problem with reflection and critical view, it does not mean that I have the skill to do that. Maybe I can try every time, but I may not be able to do it at the best.

00:49:02
Speaker 2: Yeah, but I would say that that's being critical. I feel it's more an attitude that sense because a lot of things fall off, and if you're critical, you also reflect on it. If you're critical, then you also that's how also you doubt your numbers. I mean, it's kind of an attitude that you have that you constantly doubting what you're doing. And I feel this more and attitudes, which comes with a lot of skills to support us attitudes or to to work this attitude. I think it's almost right for vocabulary because for that reason, I just a simple physicist, but it's I feel I feel

00:49:34
Speaker 1: as you are, you are a great teacher. So the classifications and the ideas are more valuable than you think. For me, actually. So thank you. And a final question for teachers. What is limiting teachers like you or anybody else for that matter, or helping students to acquire such skills? And what could help them to overcome such limitations? If you have some limitations?

00:50:00
Speaker 2: I'm yeah. Limitations for me are that mean just the students should have a willingness to learn that. So if that if they are not and they should have a certain level and understanding so the difference between students is.. you can do more if all the students are on the same page. If you understand, I mean the class. So that's that's it for me, a hurdle which I find is, to be honest, the bigger hurdle than the teaching itself. Another issue. Oh yeah. That's more a hurdle which I have the teaching itself, and that's also that's why I'm a bit critical on methodology. I think that each teacher is different and each teacher should be allowed to do it's his or her way. And so I would be very unhappy as a teacher and feel I could not teach as well if I get some kind of framework, how I have to teach. So, yeah, if so, each teacher should develop social skills and so rigid framework to organize your classroom teaching. For me, be end of the fun and teaching. And and my and my and also being good in

teaching. And because it teachers also use intuition that you can do you can do different things, you can use your intuition and so on.

00:51:32
Speaker 1: I totally agree. Totally agree with you. Yes, I'm almost through the interview. I'm sorry for the extension. I think I planned it for 45 minutes and then through interactive session, I was actually pushed to do more questions. I'm really sorry about it. Final question would be, do you, are you familiar with the concept of metacognition?

00:51:52
Speaker 2: No.

00:51:54
Speaker 1: OK. Yeah. But you are familiar with your responses, what I observe, it's just the terminology that because of the differences and disciplines that you have. That is the only thing that I wanted to know. Yeah, otherwise. Yeah, this interview has been very enriching, interesting for me to listen and even to elaborate myself financial topics. So thank you very much for contributing.

00:52:17
Speaker 2: You're all welcome to come back. I enjoy talking about teaching so and how you all are going to come back. Or maybe a coffee break. And we'll be things.

00:52:28
Speaker 1: That would be fantastic. Thank you very much, I'll keep you posted of the progress they are regarding the progress of my research as well, and we can see each other soon as well in person, hopefully. And if you have any suggestions or comments the final questions that you want to ask, please feel free.

00:52:45
Speaker 2: No amount, not now. I'm OK. I think I said what I think? Yeah, it's a I think I believe so.

00:52:54
Speaker 1: OK, OK, thank you. Thank you so much, Martin, for your precious time and wonderful insights and have a very nice evening and see you soon.

00:53:02
Speaker 2: Same for you. OK, have fun in India hopes. Have a safe journey back, I hope at some point. Yeah, yeah.

00:53:09
Speaker 1: OK, thank you. Bye bye. Bye bye.