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Speaker 1: But it.

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Speaker 2: Yes, we are recorded. So to begin with, as my research is concerned with higher to thinking skills, the title in itself is promoting higher order thinking skills for interdisciplinary research and engineering education. And so I would like to begin with higher order thinking skills. What is your definition of higher order thinking skills? How do you view them or how do you perceive them as a teacher, as a researcher?

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Speaker 1: I'm from the old school because I did my masters as educational science almost more than 20 years ago, so that was the start of the higher order thinking skills and this was also the start of that. And students that knowledge by itself is not enough. You know, you can teach students knowledge, you can even teach them separately from that competencies or even skills. But you have to make sure that they connect those two in different situations, you know, and they can apply it in situations that they don't recognize as the practice. The situation that they practice. So for me, higher order thinking skills are the skills that students need to continue learning, developing themselves and to connect and theory and practical information and also knowledge and skills. And in the beginning, we assumed that if we just tell them about it, it would be enough. You know, we we tell them or we just practice it, for example, it was like, Oh, you can even compare it. Not nowadays. Like if you give students test exam, you know, they expect that's the real exam is almost the same. So what did we teach them? You know, we didn't teach them to think we taught them how to make test. Yeah. And if the test is different, they get confused and they also get uncomfortable. Yes. And that's not a moment. You want them to be uncomfortable, you know, during the test. I mean, . I mean, we have moments. I think making students feel uncomfortable is a really good one to get them in their learning mode, but not at the moment that you test them. No, indeed. And in all those years that we already knew know what what it is and where we are heading, we are not really making enough progress, you know, by understanding because we are still giving that test and we are still expecting them to understand. So now, especially with the challenge based learning, the next step is that we try, we teach students how to learn. And I think that's, you know, that's also why I. They are not agreed with why I got my what my challenge based learning got my attention, you know, because it's important we learn what we learn, students how to learn. And the idea is different that the reason for that is if you if you do it in general, it's like becoming lifelong learners But I think it's more than this. I think it is that it's the only way that we can make sure of even, but that we can help them to understand and develop their high order thinking skills and and make use of them, you know, in a better way. Because we are able to do that. I mean, everybody at the end, but it takes too long or something.

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Speaker 2: Yeah, indeed. So just now, I understand, I think on a very general level, what you expect or understand better, by higher order thinking skills from students expectations. What kind of courses do you teach and how do you communicate and explicitly teach this in your own class?

Speaker 1: at first last couple of years. I only teach research skills. And yeah, and it's before I also taught economics because I have a double master degree But that's maybe it's more interesting in the research skills and of course, a lot of projects at the moment, a challenge based learning, a lot of learning how to learn. Maybe even I'm not calling it like that's that's developing skills. And yeah, how do I apply it. It's a combination between. Maybe I already answered it, you know, it's more like like learning, then what happens? For example, I always start with the question if they understand when knowledge becomes their knowledge and also because it's like when you tell me something, when you tell me something about what you know, it's not, it's not my knowledge, it's yours. So I will the next couple of days, if I would talk to somebody, I would mention your name because it's not. I mean, I'm not even sure there are two reasons, you know, one, because I'm not sure if it's true becasue its your knowledge, you know, so that's why I want to mention your name, because if it's not, you know, it was him. And the other way is because I don't know enough about it. It doesn't, you know, it's not my my specific topic and maybe even more. For example, if it's going to rain tomorrow, if somebody tells me it's going to rain tomorrow, unless I find out myself or I heard it first hand or I did something, it's I'm not sure. So I'm if somebody asked me, Do you know what's happened tomorrow? I will say, Oh, I heard from . So I always ask students, Do you know which part? Because if you do own knowledge one day, because else every sentence would be like referring to somebody else. ofCourse everything else I would still say, like, I think I heard that that person said that higher. And we don't. We talk from our own opinions. So and then they start. When they start thinking about this, and I give them an example, like whenever you tell your parents something you learned at school, you first you will say the teacher says, you know, because you know your parents, are not going to believe you just because you thought you were. You became an expert today. You know no so. And then what happens? What happens when? When is that moment that you don't mention anymore? Who told you, you know? And when they think about that , it's always something with like, Oh, when I looked up something. In addition, when I found my own, you know, like the weather, if I check the weather myself, then now I can tell something about it. I heard it this morning, rain, I'm going to look if it rainst. Yeah, it rings with only in the morning. So now I add something, and now I can see if somebody says, Do you know I'm not going to mention any more? The whole process from I heard this morning and then I looked it up. No, I'm just going to say, no, it's going to be raining in the morning. And that's what I'm trying to do with with the students. You know, I tell them I'm showing them all the time or no trying, trying to let them understand what happened and hope when they see what happens. Because the next step is, that's when they understand how it works for them. They can work with it and they can, because it's not for everybody the same. I mean, I I like to check it on the internet, for example, myself, somebody else would like to talk with two experts before they believe it, you know, or before they feel comfortable enough. So you when they when they get insight in how they learn. They can use it, and then I mean, especially in higher education organizations, you have all great people, there are no, no, no people here who don't want to be here. You know, it's not like secondary or high school or something like. So they they are interested in that. You no. And so that's how I would try to work. I always take them along with the learning process.

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Speaker 2: So the major overarching kind of learning goal is helping them understand how they learn and create a kind of self-realization process in terms of how they acquire knowledge and use knowledge. So do you do that through questioning? or Are you enabling them to question their own knowledge, our own process? Ah yeah,

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Speaker 1: it's a combination because it's not. The first step is the general knowledge about how learning occurs. You know, even if I teach economics, you know, it's just about how it's so general, then how it is with them. And it's all about questioning. We had last year we had a group of students and they one of the students got a grade like six. And he came up to us and you said, like, I want to do the retest. And we said, Oh, we don't have to retest, so how do you mean you don't have a retest? What is going on? I mean, we always have retest and it's a six. Yeah, but why should you retake? What would you have done different? I mean, I mean, you got all your chances. You know, you would have done that, right? So that I want to change this and this and then said, OK, then you have an eighth, an 8. I don't know how?. Yeah, this was your retest, you know, so it's like it's we are trying to get them a little bit uncomfortable, like guide them a lot without them knowing, you know, so like this is a really nasty example. I mean, we did it once. We will not do it again because it was too much of tension for the for the students. But it was like, it gives an example how we try to work with them. You know, it's not. Things are not always the same and things are unpredictable and we are not the answer to everything. And a retest is not the answer to everything. So always, we always ask questions instead of giving answers in the first time. And yet they already know, you know, I always use that five why principle. You know, it's just if they say, Can you get you? Please provide more materials. Why I dont have enough, you know, why don't you have enough that you didn't give me an enough? Do you think I didn't give you enough? Yeah, because maybe you want us to look for ourselves? Yeah, maybe. Why do you think I want you to look for it yourself? Mm hmm. Maybe because I learned more.

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Speaker 2: Yeah, great. Yeah, that's very interesting. Actually, I heard of that. Yeah, definitely. Yeah, I would have liked it as well.

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Speaker 1: If you ever worked with anybody who needs something from you, always for yourself, ask five questions and they probably answer them. I always say, if after five questions, you don't have the answer. I'm going to give it to you. But not before.

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Speaker 2: is indeed a great technique, actually. Thank you for sharing the best.

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Speaker 1: And you just say when they come to me, they say, I already did the five questions. You know, I ask you that. So that's also OK, you know?

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Speaker 2: Yeah, indeed. So my next question is actually a follow up to this previous one, you said. Yeah. you expect obviously certain types of behaviors from students in order to assess or establish that they have actually learned or reached where you want them to be? So what

kind of indicators that you look at them that informs you of their development, that they have indeed reached a level where they can, yeah, move into the next one?

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Speaker 1: Now, maybe it's even more complicated than that because not all of them get there. You know, and that's something that I, as an educational scientist, I struggle with, you know, because it's. When you have knowledge, I my belief is that everybody can learn anything if it's about knowledge. It's also why it's so vulnerable, you know, it's because I mean, you everybody can learn anything but in different timelines. You know, if I have to learn rocket science, it's going to take me like 50 years. You know what somebody else can learn in five years? So but in the end, you know, I think everybody can learn anything. So that's also why I think knowledge is not it's not what we're aiming for. You know, it's too easy. You know, it's it's the other regarding your question. I mean, I think that there are two questions. One is, can everybody can you determine a final satisfaction level and the objective and the second one is, is it possible for everyone to get there? So it's going to be difficult to answer that. And yeah, I think it's all about growth. But I mean, we have to give you a diploma. So it's not, you know, like take your time grow, you know, blossom live. And in twenty five years, you're there. I think that in some cases, especially for. Especially when it's about competencies and skills development, and I think there are two things, one is. We can give them insights so they know their strengths and weaknesses. If if you're not good in applying or like what you have, with challenge based learning is that scoping that that's finding the challenge, you know, the root cause analyses is very important. That's not something that comes naturally to everyone, you know, because you need really the problem solving skills and also a little creativity. And it's a difficult process and. It's if you know what your strengths are and your weaknesses, and you can work with that, so if you know you're not good, but you can know who is and how you can work together with them, but at the meantime, also learn something so not just give it to somebody else. And so it's about that process, you know, the learning process. And again, we're back at the challenge based learning and learning how to use learn, you know, giving them the skills to educate themselves from like, for me, that means that they get insights in. And they also and that's of course, Mieke's part, you know, the reflection, you know, do they know what they? Because for me, if you don't get there, it's not that important. If you know you didn't get there, there's only one way that you that you could make that I know you're not there and that is that you cannot see clearly. What's your what's your shortages or where are you which skill you lack t or that's it. It is difficult because you can't put it that easy in an exam or just point it out. So for now, I'm really hoping that Mieke starts her project and starts that because reflection is, I think is is going to be the answer her. And together with inside. Yeah, how do you know? Yeah, for some some parts, you can just, of course, put in an exam and what did what, for example, what we did in the last challenge project for us, it's was very important that they that they didn't assume that what's a challenge provider said was the problem was the problem. Know they have to find out, is it? Is it our problem? You know, should we solve this? So we worked a lot. And it was very difficult for them because we wanted to get that solution. But we said, no, that maybe there's not even a problem, you know, within weeks long. Just focus on what the problem is. And there was one group they couldn't. They just headed for that solution all the time. We had to get them back and back,

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and the other group was really like, OK, let's see what the strengths of this team. You know, we are interdisciplinary. What makes us different from other teams? Somebody else solve this if we solve it for this person did we just create a problem for somebody else. So it's about, yeah, it's just about basic educational design. I think, you know, learning objectives, disciplines and assessments if yeah, if students keep. Yeah, but the problem there is that you have the one who's designing the course should have some educational

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Speaker 2: training

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Speaker 1: now to react to to give you an end.

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Speaker 2: I totally agree. I totally. I think it gave me a lot of insights. I don't know. So that is already helpful. So don't worry. And it's something that can 'tbe easily answered as well as a question. And I know that I say posted there is no definitive answers. And yeah, yeah. So yeah, my next question is actually based on what you said is about nobody's reaching or not majority of them not able to reach the level expected level. What do you think prevents students from reaching that, achieving at the expected standards?

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Speaker 1: I think because we are we're learning and unlearning them through their whole life. Every all kind of things, and that means that we train them to not to learn but to calculate what they what we want them to learn or show. And. That's for students very difficult when you when you especially when we're talking about more skills and competencies and at the end of higher order thinking skills, I mean, it's it's up to them, but they're not used to that, you know, I always compare it with like when you have little children. I mean, if we if we enter a restaurant or a train, we will sit at a spot where nobody else is sitting. You know, I would never in a restaurant sit in a table. If you are there with your family and I'm entering their 20 empty tables, I wouldn't sit. You would be very surprised if I would sit there with my family like, you know, with 20 empty tables. But when I take my youngest children out somewhere in a train, they will pick a spot where somebody is already sitting. You know, because for nature, we are very social people, you know, it's like, Oh, that's that's much nicer. There's a job there, more warm. So let's sit there and you can have some food. Maybe I can get the food. No, you cannot. So we unlearn them all, those kind of things from their nature, their curiosity, their networking with people and also learning, you know? And I saw an experiment not even that long ago. It wasn't an experiment of long time, but there were like two groups of children from 15 months old and 18 months old. And they give them like this vegetable, very dirty vegetable, and they give them like a bowl of delicious cookies. So you imagine what they did. You know they eat the cookies, but they they were like testing if their own, if they trusted their own experience. So after that, the teacher, it's not the teacher, but the daycare employer. She was like putting your hands up like, OK, can you give me now some of those things? And they all give her the nice cookie because the experience that was great, you know, so I want to share my experience. Then they did the next thing they did the test again. But then they let the teacher take a bite of the vegetable and say, Oh, nice, nice, nice. Oh. And then we have the cookie for what you know, like that very just pointed it out very much. And they were like,

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OK. So then the 18 month old babies, you know, afterwards that features like holding up my hands and the 18 month old babies gave the ones who said, like, ooh, for the cookie, they gave her the vegetable. So even then, they were like privately experiencing the truth. This is nice. This is Dirty. They just noticed the reaction of the other one was born was becoming part of their experience because how can they doubt themselves? You know, they're so young. They know the cookies. Nice. And yeah, but they start doubting this and they gave it to them. But the 15 months old, they were like looking really long, but then gave, you know, like not buying this . It was. And that's a little bit, you know, that's it's it's not that simple because they get here at the university and we just tell them, you know, now we want you to learn like this, this believe that it's this. It's like 20 years mind game, you know, learning, unlearning, teaching and unteaching. And so we have and now we say, OK, we're going to make you uncomfortable. That's why I think becoming uncomfortable is the only way you can learn because it's it's bringing you back to your own, your own. You know, the only one who can trust is yourself and then you have to start over. But it's it's not pretty for them because they, especially students who enter the university, they had some pretty hard years. You know, they studied a lot and they knew they had to study, for example, exam exam. And then we say, OK, now we don't have a test exam, just just what do you think we want you to show us? And they really get, you know, so the question why? Why is it so difficult for them? Because it's it's 20 years unlearning, learning unlearning in three years or two years. Even if you're talking about the master's trying to get something that they that they, yeah, they unlearn. So what we teach them was to look at their step with the experiments I was just describing. We teach them to pay notice on what people want from you. So we trained them like a dog. What does my owner want me to do? You know, and then that's what I do. I mean, every dog knows. if he's allowed on the couch off the couch and when the owner is gone, he knows he does the other thing that he he learned and that's how we train our our students also over 20 years.

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Speaker 2: So probably than if I took it to the extremes your let's say view. Why they feel difficulties because of the education system in itself, what they trained them like using classical conditioning methodologies of conditioning them in a certain way that kind of makes it challenging when it suddenly they're exposed to this open environment where they needed to question and learn. Yeah, and would that be correct.

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Speaker 1: There's no one here who will feel because they don't understand and knowledge are not going to want to grasp it. Maybe they take a little longer or they need some additional focus. But there's not nobody at the end who will say, Yeah, the level was too high for my mom or my. I mean, they chose it. They know they can. So that's not the problem. The problem is the all the other things we expect from them.

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Speaker 2: Hmm. Indeed. Yes. Yeah, that is definitely true. What you said? It's just that we are trying to find it difficult to apply it in all the educational contexts. So I just wanted to gain a bit more clarity on that, in your view. So I know that I have motivation that I have to let it take math course or any cost. That is difficult. I have the motivation and I also probably have the qualifications. Even with that, in comparison to similar individuals like me, they probably

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succeed more than what I do. Then I find it a bit more. Yeah, I compare myself and then I see I'm not qualified yet, probably to do so. And that actually puts me in even in a bit more negative cycle that limits me.

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Speaker 1: But that's that is what I am talking about, you know, because it lets say that all the other things didn't matter and you didn't have that comparison with other you were just focusing on this. To justify this, you will get there, especially when you have your teacher to ask questions. But what are you doing there? When you're asking the question, you're asking, What do you want me? I mean, when you look at students, when they come to you with a question, they're not paying attention to the content of your answer. They're finding out what what you think about their question. So you're just trying to find out if they are heading in the right direction, you know? So that's even the most simple questions. There's we train them to pick up our signal, and that's where you get so and also your insecurity when you're looking at it. So that's all the part. I mean, if you took it all away that it doesn't matter, it didn't matter. You know, if they said to you, you just have to get this mock exam, it doesn't matter how often you take it, when you get it, what grade you just get pass or fail? No problem. The stress was gone. You will perform a lot better. But that's not, of course, how it's how it works. You know, you have. That's that's that. And. It is we have to make them a kind of flexible thinkers, you know, that's also that. Yeah. And I think that's you. I mean, you need knowledge without knowledge. You, you have nothing to apply. You know, I mean, so and you have nothing to connect. Indeed. Yeah, but you shouldn't. I think you can turn it around, you know, you just need that knowledge because there's nothing to do. You know, I mean, I need water to swim. I mean, without water. Yeah, I can. You can teach me everything about swimming. But if there's no water, and that's what I think, because people always say colleagues also like, you have skills, you know, what about? No, it's not that I'm not talking about knowledge because it's not important. It's it's really important. That's why I don't have to talk about it. It's there. You know, it's the foundation of everything. I mean, I'm going to a dentist who didn't have the education, you know, just the tools to talk to me or to apply some new, I mean, you know, yeah, that's not a discussion. I mean. And that's also a little bit part of, I think, the answer this it's not that anybody doubts that we need that content or that knowledge or it is that we. And that's the changing role of the teacher also. It's not that we just have to stand there and lecture, you know, we can videotape that and maybe we should sometimes whatever is good for students. But you also, you know, more focus on talking to students and comforting them and making creating a learning environment a real learning environment where they can learn. So not more like university environments, but really a learning environment. And that's a comforting them, but also preparing them for the uncomfortable times that are heading there. And yeah,

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Speaker 2: great. No. Thank you very much, Evan. It's definitely wonderful to listen to you. I think I would also lose track of it if I just want to know a bit more as well. So that's why I'm going onto the next question, especially with teachers. And I understand totally that the kind of atmosphere that we create an education system should be conducive enough to instill such behaviors and thinking in students. What could or what are the challenges, in your view for teachers in bringing that in making that happen?

Speaker 1: Now, I think it's. I think it's a little bit the same, you know, it's we have like. The teachers, they're already in this system like 30, 40, 50, 60 years, and they same, you know, they they also try to find out what the students, how they? you know I mean, if every student feels their flaws, they have a little bit of a problem. So they also were trained to work within the limitations. And we have like this accreditation system, quality assurance system. In higher education that works. Yeah, that that on the one hand, ministry says, like, yeah, we have to be more innovative and we have to have higher education futureproof and this and on the other hand, they send like every six years a couple of people and said, like, how is it possible that you have like 40 percent failing grades in class one? You know, why don't you have enough content knowledge in that? So I mean, they have the same struggle. And also the and especially academic I see there's a difference in scientific higher education schools and applied science because in applied science and hobby. They are more like they chose this job, you know, they chose to be teachers, so they're more open for teaching. And here it's just like, Yeah, okay, we have to teach also, you know, I'm very busy, but I have to teach so. It's also that they don't have the time and. Yeah. So I think that's a problem. It's not that they don't want to. It's that they also don't have the the skills and the insight that it's and I mean, I have discussed because I'm that part. You know, it's a challenge based learning task. I put on my desk that is like, I'm talking to a lot of teachers and they're they are really like, Yeah, but. I mean, what if I if I know? That they can do it. How can I make sure everybody knows they can, you know, so so it's all about assuring and and the system. And I always say, like, if you are expert on something, you don't need a written test to know if somebody can do it, you know. I mean, if I am only when I'm not an expert on something, I just have no idea. If somebody is an expert that I can't point out somebody else if I don't know what is. But if if I talk to another educational scientist I know or a student in that course, I know in 10 minutes, you know, so that's the first part. They also have to become comfortable. And of course, they have to do a test because you can't talk to hundreds and hundreds students to find out if they know everything. But they don't even know anymore. They don't even trust themselves anymore, like, you know, it's. And that's that's the thing. They're also in the system, so they have to. Yeah, I think that's also why I hope they have like this UTQ that all the teachers are following. We just did a pilot with it, with the then the organization who gives the UTQ fell in the same pitfall? You know, it was also like, No, we have to have like these hard targets. And so it just didn't work. The pilot didn't work. But the idea is like if you get new features, you also have to start there. You know, you have to make sure that that they feel comfortable. And I'm not sure how. Of course, that's the everybody's like, Yeah, but what happens with the knowledge that nothing happens? You know, it's he likes it. And then how do I know that everyone? So. Yeah. And they're not teachers, you know, they are they are scientists. Oh yeah, in their own discipline and they just teach, you know, that's they have somebody set their own son wants to be like in primary school. Just love to teach because they love the children. Secondary school teachers like to teach because they love the content and in higher education, teachers love to teach because they love themselves.

Speaker 2: Makes sense, indeed

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Speaker 1: a little bit the issue, but it's a funny one. But it is, you know, so it is already difficult for all the educators that chose education as their profession. But if you didn't?

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Speaker 2: Yes. Yeah. No, I can totally relate with that. One of the reasons why I want to become an educator myself. After having done engineering in a bachelor's program, I totally recognized the lack of pedagogical abilities in teachers. They are the experts in their field. There is no doubt about it. But when transmitting that knowledge, they found it very easy for students who are very receptive to their way of communication and that that for them, that's enough. And they didn't want to bother about the others which actually pushed me to actually education. So I totally can relate in terms of that. So your point of view would continues is professionalization and training and would help or any regulatory systems that make mandatory, such as UTQvin university places, is a solution. Or do you have any alternative suggestions in improving that?

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Speaker 1: Yeah, I think it's it's a two or maybe a four way street, because especially when you when you're older, you know, it's not that easy to do. I mean, if you're already that teacher who is just following his own path, you know, I mean, it's probably a waste of time to put a lot of things. So I think if you educate students, then you help them. I think that's where the solution is. If you I mean, we want students to become innovators, you know, that's that's the the thing that we have now like flexible, creative, and then we have to teach them to become like, you know, so and they can apply that immediately so they can request. I mean, we ask questions and also ask questions, you know, I mean, if he says it is like, this is, why is this like this, you know, easy for everybody like this? And why do you say this? And so and and we have to find a way that we change that system from inside out. So it's just the environment. We adjust the environments, and that's something you even started about, like offering the desk boards for what is going on, giving people inside. What are possibilities. Also, other technology tools, what can help, you know, like developing that, teaching students? teaching the general public because also the industry where we are educating students for they, we have to help them translate their concerns to education language because they say that they don't have exactly what we want them to, but they don't have the words, you know, to express what we have to not only do the work through work fields, committee for one special program, but also from educational point of view. You know whais that you're looking for and and how can we translate that? And because some professors are really open for this kind of input, you know, so it's it's going to be like a joint effort because it's not going to work and, for example, that UTQ That's great. But we have, like the teachers, is here an agreement between the four technical universities UTQ. I mean, I mean, they agreed that if they want some and there you go again, quality assurance, you have to have like this check box of.... So even the people who design. I mean, I'm part of the education learning and teaching center to your team. But I mean, I think we have maybe this is the place where we have to learn most, you know, I mean, it's so it's all there. And I mean, it's also the UT., I mean itself. You can't just put it in your strategy plans and then just say, OK, good luck.

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Speaker 2: Indeed.

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Speaker 1: I mean, so yeah, if you want to, this is a whole educational system change, and that's a little bit, I think why people are not are hesitating because like these higher order thinking skills, it's it's like here now for 10, 20, 25 years, we know. I mean, I found the newspaper article about one hundred forty eight years ago. From the netherlands you have this site, I always kind of a hobby. And it was like the text was like, We need to educate students to think critically. We don't need them to educate knowledge. I was I maybe I translate some and we'll send it to you. It's great. You have to read in English also. But and because the question was already there, but the system wasn't, you know, and and still the system isn't. So if we change everything. You know, but we didn't do it together, and we didn't do it at the same time. But we are still 148 years later still talking about that. They need to become critical thinkers and we didn't get there yet. And maybe we shouldn't do it like a part time job, like, OK, we have this content and education, and then we have this like developing skills and competence. It is still too much in the background, you know? And yeah, first, 60 years because people were afraid it was going to be instead of knowledge. But now I think they're starting to understand.

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Speaker 2: Well, I yeah, that does actually a mind boggling to see. One hundred and forty years ago, people talked about it. Yes, indeed. That would be great if we could just send that. So I think partly one of the reasons why we actually now more and created probably my assumption hypothesis is that the change in demand in the labor market about students are individuals with certain skills previously as opposed to in industrialization. Maybe we only needed knowledge and procedural understanding of things to contribute to anything. Now that demand is changing, we are much more now pushed and forced to change that, and I hope we'll get there with the joint efforts, as you mentioned. Um, so my next final question, our final topic is it will have two three questions is regarding interdisciplinary? Yeah, research. Um, as you know, you are now well-versed are also you embarking on challenge based learning, which involves a lot of transdisciplinary, interdisciplinary approaches? What is your definition for that matter, interdisciplinary research is and what kind of specific skills that are important that you think are neglected, for example, in UT or any other education systems, um, to be taught.

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Speaker 1: Yeah, I think that's inter-disciplinary is. It's something that you can only do when you have already some other skills, so you can really gain from. I don't think that in the bachelor, we use it in some, but I think it's not. It's not working there because you need, yeah. I won't get into that . the idea of interdisciplinary. I think it's a two way street. It's not only talking and working together with other disciplines, it's it's getting. Better or making better use of your knowledge? Let's start with quote, the best candle maker in the world would not have come up with electricity, you know, then you have your own discipline, you have your focus there, and that's normal. That should also be there. I mean, you know, but you will always find solutions in your own discipline, not because you are a stubborn you. You don't have the ability. But that's still if that are the only tools you have, you know, you

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have to handle, you have wax, you have like fire. I mean, I had another for all you have is a hammer. Everything looks like a nail, you know, it's like. And thats If the added value of interdisciplinary transmission is that you can open your minds to other tools and other disciplines and but also use your own knowledge to help other people. So that's something that is seems very simple, but is something that we almost never discuss, never talk about interdisciplinary, it's more like we can work on one issue with nine different disciplines, so we can, like end up with a bigger solution, not the better, you know, and that's that's what what I hope that we develop more, you know, we don't need bigger solutions. We need better solutions. And I maybe I can send that. Also, I read an article once about from Harvard. he wrote about the Nasa experiments that Nasa has like this serial? What goes up in the air? It became too hot and they couldn't. I don't know. They had to replace that material. So they they wanted to find another material. Already 10 years, the the research department spent 10 years working on this. I mean, count the costs and put out like a challenge. And then suddenly one dentist from across the country said, Oh, but we have this kind of material we use when we, I don't know, make it tooth or whatever. And then it's really like can stand all the heat you need. So if we can scale that up, then we have like and their problem was like they had like there was a contest from 100000 euros to something, but they said it was one day of costs. You know what I mean? One day just put it out there. And and that's of course, great. That's big. And that's something that's helped. But it's also smaller than that's, you know, if you need to keep an open mind and you need to be able to think about the ethical choices that you make or you or your company makes or you make in you research. You have to have that peer input from other disciplines because if you only if you're only with like minded people, you will only end up with like minded ideas. And challenge based learning is also about making the world a little bit better. Yes, saying if we are here, you know, and we are all with this great pile of bright people, you know, why not try to make this work a little bit better and then don't repeat ourselves all the time? So I think interdisciplinary is it's about really using your disciplinary knowledge and skills to search for solutions or added value in somebody else's business. It's not going to happen in The Bachelor, you know, for now, it feels more like we are heading there. And what skills do we need and what training? Yeah. All in the same direction, you know, a lot of. Concept mapping, looking and reflection. Yeah. You know, all your work. Yes, you are busy with. So it's up to you.

00:46:35

Speaker 2: Indeed. So I totally can also understand, obviously, if there is no content, as you said before, there is no water to swim. There is no use of learning how to swim, all the skills you need and tools, for that matter. So very, if there are any particular abilities that come to your mind apart from, let's say, disciplinary knowledge or expertise one has to gain in order to perform at interdisciplinary level. Obviously, you said a few few skills that are relevant, if there is any of that, is particular interest to you. But do you think it's quite important as a skill along with the disciplinary knowledge to in order to carry out multi-disciplinary, interdisciplinary practices?

00:47:21

Speaker 1: I think that there are two things. One is that that is the interdisciplinary, let's call it communication or teamwork. Mm-Hmm. That's we don't talk the same language. You

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know, if you have here like a technical faculty and you put them with social faculty , two aliens talking with each other and there's like we have like I can see they they work with materials, you know, for them, if it's three years old, so then it's really new. But if you mention that in the informatics department, there's three years you work with three years old, you know, you're like, like, wait, it should be three days old, you know, so even that, I mean, so we cannot expect that they just can communicate and work together because that so they need skills like some metacognitive, maybe even like. Yeah. So it's it's that's working together. Mm-Hmm. Yeah. And the other part is again. Skill to see yourself to be able to to value yourself in in a yeah, in a system, you know, like being. I mean, we're really busy letting students develop, showing us and. Where a problem is in a system, you know, and where, but they also have to learn where, where they are in that system and where their strengths and weaknesses are. So it's it's all about personal development.

00:48:56
Speaker 2: Great. Thank you. Thank you very much. I'm so glad that you touched upon metacognitive skills. I'm just going to finish it with that one. What is metacognition to you and what is its significance in current education in relation to CBL, interdisciplinary education, etc.? How significant it is.

00:49:15
Speaker 1: I think it's the only way out of this. It's the only way in. Maybe I should say, because for me, it's about skills that that are like above any discipline or beyond any discipline. You know, it's about the skills that we need to function well, on high level, you know much and maybe also on a low level. But let's talk about where we are now. So what what you need is to and it will be the starting point of everything, you know, because if you can't separate your own focus or personal view or your own discipline or whatever, or that one from the other one. Even with that example, children, if you can't, if you can't let go what the other one wants, if you can't take that distance and the fact, so? For me, it's about the transferable skills, you know, going beyond disciplines, going on a level that that we understand each other, that we can talk with each other. And then afterwards we bring in the knowledge and then you also can learn anything or be open for anything, you know? Hmm.

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Speaker 2: Yeah, great. Indeed. So I got that point. I mean, I just want to know what is your definition or how do you understand metacognition? And if I can have some,

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Speaker 1: you want a clear definition?

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Speaker 2: No, no, no, no, no. Not a clear definition, but just to your understanding, OK, even if it does at a very general level, obviously, I know that it will be related to the definition of what has been studied. I just would like to know how you perceive basically a quote or a definition, but more of your understanding.

00:51:12
Speaker 1: For me, I'm trying to translate how how it's for me how I would. I think it's more the. You you can. The. Yeah. This for the first time, I really don't have anything, so I do have

anything to say, but not not so clear. I don't know. I don't know what it is specifically for me. I mean, I know what I tell about it and what I hope it. It is so that it's that level of of. You know that higher level where we. Where it is beyond the the. Yeah, but I already mentioned beyond the discipline, so we are talking about skills like like for an example, maybe then you maybe understand what I mean. Or you can give words to what I mean, for example, if we teach problem solving skills with teach that from on a level which already because we we think that's good, you know, we we teach it on a level where they already can apply it in their own discipline, for example. But you also and it also limited the possibility with that because you already put them in that focus. So if you have like the opportunity to learn students, not the problem solving skills with the skills that they find out that they need problem-solving. Yeah. So then you really taught them something. So I, you know, for me when I'm talking about. And of course, I'm looking for my own discipline, educational science, but from educational science, I'm talking about that one level up. We don't even have to go beyond, you know, before we said, OK, we we showed him how you solve the problem. Then we said, OK, we teach them how to solve a problem. But now with the metacognitive we have to teach them, how they know if they haveto solve the problem.

00:53:47
Speaker 2: Yeah, that definitely gives me a clear picture. Thank you very much for that example. And yeah, I think that marks the end of the interview. And thank you very much for your participation. Is there any other thing that you would like to contribute or comment or remark?

00:54:04
Speaker 1: Yes, all the words I could come up with.

00:54:08
Speaker 2: Thank you very much. Thank you. Thank you very much for the very genuine participation and all, most open engaging interactions I've had actually for me and also enlightening. Having such discussions. So thank you very much once again. Thank you for

00:54:21
Speaker 1: your patience and your listening and for you. It was really nice. I'm looking forward to see what your study is going to be.

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Speaker 2: Indeed, I will make sure to keep all of you posted about the upcoming developments and any findings that I come across in between as well. So, yeah, thank you very much, and that's my pleasure to listen to you. So, yeah,

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Speaker 1: and we will be in contact with your other ideas and make sure you meet the right people who will meet with you and the other way around

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Speaker 2: that would be great. Obviously, we will be again coming back for many more discussions regarding different things. So, yeah, we'll keep in touch. Thank you very much and I have the nice afternoon bye bye bye.