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Speaker 1: I think I think you're muted or I could hear you now.

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Speaker 2: OK. Sorry. Yes. Yeah. So yeah, the title of the project I was saying the title of the project. The title of the project is promoting higher order thinking skills for interdisciplinary research in engineering education. So the title says it all basically developing tools and strategies to teach and promote higher order thinking skills that are more important for complex, interdisciplinary research processes, especially in the context of engineering education. So as a part of this research, I'm gathering teachers input, especially teachers who are teaching in an interdisciplinary framework such as Atlas about their review and perception about higher order thinking skills, interdisciplinary research, and how do they perceive Uplay as is so on and so forth to formulate a foundational understanding of practice or teaching higher order thinking skills in in real life? Mm-Hmm. And that is the reason why I am collecting this data and trying to find develop a foundational framework as well. In parallel to theliterature review, I would try to formulate a framework for my further studies. Yeah. So my first question would be just the second take. Yeah. What is your perception on the importance of higher thinking skills in engineering education? Yeah, in general, it could be higher education. How do you see its importance and at what level? It varies, so on and so forth?

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Speaker 1: Mm hmm. So first, I think it's important to be very clear about higher order skills. So can you provide examples of higher order skills? Would it be like, for example, critical thinking or abstract reasoning? Yes.

00:02:02

Speaker 2: So my yeah, and my first question should have been it is a follow up question. What I had to give up is your view on higher order thinking skills?

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Speaker 1: Okay. Yeah. And so why? Why are higher order skills important for multidisciplinary education and engineering programs? Yeah. Well, we are training students who are expected to deal with complex problems. And I think the fact that students have to work with complex problems really needs really requires that they should also have skills to deal with this complex problem. So skills that I could think of as relevant for dealing with complex problems would be, for example, the ability to analyze the problem, to carefully think about the problem, its causes, its different components. Maybe it's different parts and to carefully think about what could be potential solutions to the problem. So I think if we go back to your original question, I would say higher order skills are really important for engineering programs or engineering students because for one, they are dealing with very complex problems and issues, and this also requires them to have the necessary complex skills to deal with these problems.

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Speaker 2: Thank you. Thank you very much. And that has been the case for most of my research as well, and it aligns very well with your view. So what is your definition of higher order thinking skills?

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Speaker 1: OK. For me, a higher order skills involve the ability to really work with very complex problems, to deal with very complex questions and issues, and to to have the ability to carefully reflect on the most appropriate solutions to those problems. Higher complex, higher order skills for me to include, for example, the ability to relate real world phenomena to insights in the literature for students, for example, to be able to explain real world problems using relevant theories from the scientific literature. And that would be, for me, higher order skills, too. Yeah. So the ability to use theories to make sense of societal or real world phenomenon to be able to critically analyze thing and to do to work with abstract concepts, those are higher order skills.

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Speaker 2: That's very nice. So considering what you suggested in terms of the higher the thinking skills that are relevant for their complex problems that are important, that as well in your own course, what kind of a specific skills you aim for. Hmm. And how do you kind of make the decision and how do you teach it?

00:05:45

Speaker 1: OK. Yeah. In my course, currently, I'm teaching a social science course in the first year level in both semesters. So in semester one, you have this course called behavioral science and technology. One of the goals of the course is for students to make sense of again, real world problems from a theoretical standpoint. And so within the course, for example, I would give them a very specific case related, let's say, to the technology adoption and more specifically, let's say. On the relationship between trust and technology use. So while I expect students to do in such an exercise would be for them to explain why trust matters in the adoption of technology and if, for example, you are trying to, let's say, encourage people to use a new technology which probably involves certain risk. An important thing for you to think about is like what should be the technology that should enhance people's confidence and trust in the technology. And so when you're trying to analyze the link between trust and technology, at least in discourse, what I expect my students to do would be to explain the relationship from a theoretical standpoint by, for example, using empirical data from previous research. So if they say, for example, that technology should be designed this way or for it to be trusted by users, then I would expect my students at least to think about what is the reasoning behind that? Why do you think the use of this specific cue in the technology or the specific element in the technology would be relevant for trust building? Now how do I teach it? Well, it's not really something that we explicitly teach. It is something that we, for example, when we deal or interact with the literature, we already implicitly tell students how you could use insights from the literature to make sense of, let's say, very real concrete cases.

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Speaker 2: OK, so if I understand correctly, the objective, at least in terms of skill for your course, would be to connect the world with these existing things and yeah,

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Speaker 1: or to make sense of the real world cases. From a theoretical standpoint,

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Speaker 2: from a theoretical standpoint.

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Speaker 1: So students should be able to really like make sense of what's happening in the world, like what's happening up there. You were saying relevant insights from the literature. So for example, if asked students, how can you explain this? The student must be able to provide an explanation from a theoretical standpoint. So it's not just like, I think, because of this, so I don't expect just opinions when trying to explain something. So the explanation must be a theoretically grounded. So that's it for me. For example, if the student could do that, if a student could make sense of a real world issue from a theoretical standpoint, then I would say that the student has possessed or student has a real world or higher order skill.

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Speaker 2: So, yeah, and for me, yeah, it seems like you have a complex, a skill that for me, at least from my own understanding, probably engulfs probably multiple sub skills. If it does,

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Speaker 1: yes, it also involves, you might say, different skills because the ability to use the theoretical insight to make sense of, let's say, a real world case also requires students to be critical in selecting, for example, let's say, the data that they will be using. I mean, there are so many possible explanations out there in the literature. So the student must be able to like, sift through, let's say this different data and maybe select the most appropriate or most sensible explanation. So it involves critical thinking already. So critical thinking is also part of that. And also like the ability to understand very abstract concepts because, you know, working with theories means that you must have the skill for obstruction. So, you know, concepts are the terms are there, but you must, as a student, understand what exactly those abstract concepts mean. So the ability to work with these abstract concepts is also, like you might say, a necessary skill for performing the the task of applying a theory to make sense of a real world case. So I agree that there are some skills involved in such a complex skill.

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Speaker 2: Great. So you said that you also mentioned that you teach them implicitly you. Would you say that the way you organize the course and the deliverables or the assignments automatically provide a framework in which that promotes development of such skills?

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Speaker 1: It does. So for example, when we are assessing the essay, students have to write for the course. We include, for example, a criterion pertaining to the use of relevant literature in the discussion or the ability to provide, well, sounded arguments. So are the arguments well founded on the arguments? or sound because this already displays the ability to critically think so. For example, if they're making, if they're advancing certain claims, I would expect them to provide. But to substantiate the claim with the most relevant data available. But again, data could be so many. And of course, students should not use all kinds of it, but they must, of course, preferably rely on data from the most reliable sources.

00:12:31

Speaker 2: Need agreed. Then do you also communicate, for example, you told me that the main objective in terms of skills, at least, is their ability to develop their ability to understand

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the real world from theoretical standpoint. You explicitly communicate this to students and expect them to develop.

00:12:55
Speaker 1: Yeah, so that skill is captured in one of the learning goals for the course.

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Speaker 2: Nice. And finally, what is your view or the kinds of skills that you think important, for example, that we haven't covered yet? If you covered it, you can probably refer back to your own onset if you haven't covered. What are the important skills that are needed for interdisciplinary research? As, yeah, as a practice. And for that, I think we will have to go for What is your definition of interdisciplinarity? Are interdisciplinary research is.

00:13:32
Speaker 1: Yeah. So you could, for example, contrast that with a mono-disciplinary research in which you focus solely on one discipline, like the kind of research done in the more traditional programs like, let's say you only do research on behavior. And so you just focus on one discipline, maybe from a psychological perspective. What a multidisciplinary discipline or research would mean, doing research into problems that could be addressed from various disciplines. So, for example. If I could do my if, I could give an example of my research on, let's say, the adoption of fitness apps. I think it has a very inter disciplinary component because I could approach it from a medical standpoint where health science standpoint, I could approach it from a psychological standpoint. I could I could approach it from the human interaction standpoint, but it could also be approached from a more sociological standpoint. For example, if I look into the effects of social influence on the adoption of fitness app, that would primarily be sociology. If I look for example, into the effects of, let's say, privacy issues, trust concerns, risk perception, that would be the more psychological standpoint. If I look into, for example, the effect of health needs, health concerns in relation to the adoption of this app that could be approached from a health science standpoint. So for me, a multi-disciplinary research involves the you might say the perspective of different disciplines to make sense of a specific research problem.

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Speaker 2: That's wonderful. Yeah, that was very clear for me. So in order to move towards the right to have multidisciplinary approach, what kinds of skills are crucial, do you think, for a student to develop? Yeah, researcher.

00:15:46
Speaker 1: Yeah, I I think one which would be understanding of the language specific to the different disciplines. So understanding, for example, the theories that are mostly used in different disciplines. So that's one being familiar with the concepts, the terminologies you might say, the assumptions and the theories in the different disciplines. That's one and another one would be understanding or at least knowledge of different methods that are typically used in different disciplines. For example, if you want to do this research from doing more human interaction point of view, you must have, for example, knowledge to do usability test. So user support best, for example, or if you want to do this research from a more psychological standpoint, you must be able to do really experiments designing experimental research or if you wanted to do this from a more sociological standpoint,

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maybe understanding the procedures, doing surveys, for example. So understanding the concepts and the theories at the same time and having that knowledge to perform the methods, the research method to use in different disciplines that would at least help in a student do a multi-disciplinary research.

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Speaker 2: Yeah. So that would mean that having domain specific methods, assumptions and theories. Yeah. Yeah. Having that knowledge, if you could find out some domain general skills, for example, that not that does not need to be, you know, specifically tied to discipline. But it is useful for a multidisciplinary approach in general. If you have yeah, if you could think of anything that comes to your mind,

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Speaker 1: does it have to be related, for example, to the content of the research? Or should this pertain to, let's say, processes, the processes? Yeah, because when we talk about processes, for example, especially if you're talking about doing interdisciplinary research. You you must have the ability to work with people from other disciplines, but I don't I don't know if that would be considered a higher ordered skill. So maybe it is a social skill, but not necessarily a higher order skill. So just for a process, but if you are talking about contents, for example, but maybe lacking this process again, I think it's also important for you to be comfortable with different types of materials. So the ability to work with different types of sources, regardless of the discipline

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Speaker 2: and the ability to work with the different sources, regardless of disciplines.

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Speaker 1: Yeah, for example, like you might be able to focus on psychology, but if you really are an interdisciplinary researcher, you must be able to work with, for example, materials in the domain of human computer interaction.

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Speaker 2: Indeed, indeed. Yeah. So I'm just going to push a little bit further. Hmm. Just because he beautifully said it, the ability to work regardless of the disciplines, actually with the methods and materials and content, we can think of any sub skills that is an ultimate goal. And if, like an acquired, it would be an excellent interdisciplinary research. Yeah, that any sub skill that comes to your mind are an important, if not even a skill, but an ability to sub abilities that you think are leading towards this final object.

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Speaker 1: Ability. I think being flexible would be one. I don't know, disability. I think it's a trait. Yeah, nice. I think if you're being flexible and adaptable, you could bend yourself like you're not to focus on just one direction.But you're capable of looking at different directions. I think it would be a some skill that would be relevant for this one.

00:20:03

Speaker 2: Indeed, indeed. And so you also you already mentioned this one. I'm just going to bring it back. The role of reflection in such research processes, how do you see it and how relevant it will be?

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Speaker 1: So the role of reflection? Yes. In the process? Yes. So what exactly is the question that

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Speaker 2: so reflection is a kind of a skill? So from a skill point of view, yeah, yeah. How do you think it is more suitable for Inter? It is more suitable for generally. Yeah. A lot of higher ducation processes. And what is your perception in terms of what its important role in interdisciplinary research practices? Hmm.

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Speaker 1: I think the different the different phases of research, whether it's mono disciplinary or interdisciplinary, requires some researcher to reflect on what he's doing, what is happening. So even from the very first phase of problem identification until the last point of making sense of the research results, it requires reflection. So I would say that critical reflection about what is being done about what is happening, about how things are moving, what problems are being encountered in the different phases of the research. This ability to reflect is so crucial because if you could not reflect on what you're doing or whether what you're doing is going in the right direction or not, if you would not, for example, reflect on what's going wrong with what you're doing. I think you would have a hard time dealing with, you know, problems that might arise. You might not be sensitive to the issues that might come up. It becomes difficult for you to make adjustments to to what you're doing. If you could not reflect on, let's say, at least in the research process, figured that reflect on what you're doing. It becomes difficult for you to make the necessary adjustments if they're necessary.

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Speaker 2: Indeed. Thank you and thank you very much. That's clear. So might you actually? I covered most of the things in a very short span of time, so I have only two are a couple of more questions left. So are you familiar with the concept of metacognition?

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Speaker 1: I've heard about it, but I would not say that I totally understand what it entails. So.

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Speaker 2: OK. Sorry. Yeah. The second question was the follow up question if yeah, if you had more insights and connaisance about the knowledge of the term, then I put have on the follow-up questions. But in general, yes, that is it for me, too. Yeah. I've gotten most of the things. No. Yeah, you got I got to my final one thing because that popped up in my head and I didn't write it down in the list of questions. How do you assess it? Of course we have criteria and grading rubrics in terms of skills, what major challenges you see to to assess and see that a student has sufficiently developed the kind of skill that we expect in your course?

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Speaker 1: Yeah, I think there are there are some skills that are really difficult to objectively assess. I could, for example, take the case of asking students to understand because there's the skill of being able to use theories to make sense of Real-World Case that that's something that we could assess based on, let's say, the quality of arguments of students.

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That's something that we could assess, but let me see. The critical selection of papers or materials for one's assignment, that might be something that's complex to do because you must of course, know all the material students use before you could say, well, you have used the most appropriate ones. And that's well, of course, that's possible if you know the field. . But if you if you know only a little bit about the field that you don't know so much about the literature, it becomes difficult to assess whether the materials used are of good quality, whether students were critical in selecting the material. So I guess that's one thing that would be really tough to assess.

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Speaker 2: Thank you. I thought so as well. I think one of the things that I also find it very difficult, especially for complex skills to accommodate in one format and try to have a scale for . to even quantify it. Yeah. So, yeah, let's see. That was also one of my concerns. And I think, yeah, we have come to the end of the interview with DR. Would you like to offer some more comments about the topic and some tips for my interviews and everything? Yeah, it's well, it's much appreciated.

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Speaker 1: OK, yeah. So what do I feel like? I missed in the questions you ask me. Maybe like what problems do people encounter when? When requiring students to develop those higher order skills. Mm-Hmm. So the difficulties and issues that teachers encounter when trying to develop those are order skills because I can imagine, for example, that some students may not really be buildd for that. Yeah. So yeah, that could be one one of the problems teachers encounter and maybe that students do like. What are the difficulties students encountered from the point of view teachers when when asking students to have this higher order skills? Mm-Hmm.

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Speaker 2: Thank you very much for these two additional questions. I'm just going to ask that right away, if you have, I should respond to this.

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Speaker 1: I should have not. I should have not asked. Well, typically it's yeah, one of the the difficulties that they encounter. Yeah, I think one of which would be like some skills might be too too difficult for, you know, depends on the level of students. Some students are equally OK with, you know, asking them that you that they should develop these skills and they could easily develop those skills. But for some students, it might take some time. So that could be a difficulty. In terms of like, how much time do you invest to the student, for example, to ensure that he or she has the skills? So there's one difficulty and maybe also like, you know, students resistance because students realize that, well, I don't have , I am not really and be a fast learner. So or maybe students. How do you say this? I have a different view of themselves, so there might also be resistance to like telling them you should have the skills or you should develop the skills, so it's not just the time it takes. To develop a skills, but also maybe we act on some resistance from students could be another issue there. So what are the difficulties that I think students encounter in developing those skills? Well, I think, well, you need to start somewhere. So if you're for example, teaching this higher order skills in the first year. You would normally encounter the typical reaction like, well, we haven't done this before, so, you know, we need guidance, we need time we

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need different resources to make sure that we're doing the right thing. And so as a teacher, then again. It results in you may be investing more time, more preparation to make sure that students can deliver what you're expecting them to do. Like, for example, using theory to make sense of Real-World cases. That's not something students do in high school. And so at a certain point when you have to start somewhere, and that's what that's what we do in the first year. But of course, that's for for some students, difficult to do. And so it takes some time. So maybe the first the first time they do it, they write the paper, you ask them, okay, makes sense of this case. Use theories. You would expect the quality of the paper to be not so good because they haven't. They haven't done it before. And then, yeah, then that's when you invest time by providing more feedback, by telling them what should be done differently. So yeah, I would say the fact that some students have to do it for the first time, that could be an issue.

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Speaker 2: I mean, I'm just curious if you when you give feedback. And how do you see the effect of feedback in relation to the time you invest in?

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Speaker 1: Yeah. For some students, for example, who deliver a work that I would consider to be not acceptable according to my expectations, I would provide, let's say, the the most elaborate feedback for them to be able to improve the work and so they could work with the feedback easily. So the next paper would really be an improvement in a way because they have taken the feedback seriously. But for some students, maybe a few of them, the quality of the second work would still be not really good. And so then again, they will fail that then you provide more feedback again, and then they do. And the third try again, it's really dependent on the quality of the students. Some students could easily work with feedback, especially if you tell them, Okay, this is how you should do it. And this is how things should be done. They could easily handle feedback, but for some students, that would be difficult. Or maybe that would be difficult.

00:30:43
Speaker 2: So the interview is taking a nice turn the tide didn't expect. So I'm just asking one one more question if you have yeah, if you think anything could help in this process as a tool or any external assistance, apart from your own intervention and feedback, what kind of things do you think would help?

00:31:06
Speaker 1: Yeah. Aside from my intervention, I think students could also learn from each other. So peer learning could be a useful tool, because some students are really good, as you know, the skill, for example, of working with theories. And so if students are given the opportunity to work with each other and maybe review each other's work and also to assess the quality of the work of somebody who is delivered it well and maybe ask the student who did not do it well to compare his work. That might be a good learning opportunities. So if you give them, for example, among other Imodel and this is a good paper, this is how the paper should have been written. You specify the good points. Yeah. And then you show it. Well, I think that's my intervention already. But I think students could also learn from each other. So maybe, maybe what we could do is they exchange work, look at the quality of their

deliverable and say, Well, this should have been done differently. So yeah, I think the peer learning process could also be a good intervention.

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Speaker 2: Indeed, wonderful, wonderful. Thank you. Thank you very much. Yeah, I've gotten much more comprehensive view on the process itself on how you do, and it's been very enlightening. And so, yeah, that is it from my side. If you have questions, if you have any further comments or questions, please feel free to ask.

00:32:41
Speaker 1: No, I don't have questions or comments I don't want.

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Speaker 2: Thank you. Yeah. Thank you. So who's stopping the recording? Yeah.