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Socially shared regulation in transdisciplinary learning environments: Challenges, actions and influencing conditions

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Abstract

Transdisciplinary learning environments (TDLEs) bring together students from different disciplines and societal stakeholders to address complex issues. The differences between participants are valuable for knowledge integration but can also create challenges for collaboration, which ask for a shared regulation of collaborative learning. This study into Socially Shared Regulation of Learning (SSRL) in TDLEs in higher education explored what challenges students experience in a TDLE, how they regulate their collaborative learning in response, and which conditions influence the choice for SSRL. Seventeen students from 11 disciplines participated in a twenty-week higher education module. Data were collected through questionnaires (n = 13) and semi-structured interviews (n = 9). Differences in commitment and workstyles were mentioned as the most experienced challenges. Students used SSRL, co-regulation of learning and self-regulation of learning to address these challenges. Socially shared monitoring and addressing challenges seemed more common for challenges in progress, task distribution and maintaining sufficient contact than for repetitive or social challenges, such as unequal contribution. Additionally, beliefs about self, group or school can negatively influence SSRL. Insights from this research highlight the importance of supporting students in jointly identifying, discussing and addressing challenges in transdisciplinary collaboration and may contribute to development of SSRL-enhancing interventions.

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Introduction
Contemporary societies face complex challenges related to sustainability, security, health, and social inequality (Horn, 2023; IPCC, 2022). Addressing these issues requires transdisciplinary collaboration, as they exceed the scope of single disciplines (Bernstein, 2015; Conner, 2022; Horn, 2023; Oonk et al., 2022). Such collaboration integrates diverse forms of knowledge, including experiential knowledge from societal stakeholders (Lang et al., 2012). The level of stakeholder involvement varies, from being consulted to leading initiatives (Bammer, 2019).

Collaboration is defined as a joint effort toward shared goals through mutual interaction, co-construction of ideas, shared decision-making, and integration of participants' knowledge and skills (Dillenbourg, 1999; Järvenoja et al., 2025; Stahl & Hakkarainen, 2021). Transdisciplinary collaboration specifically involves participants from various academic and societal backgrounds working together to generate insights or solutions to complex societal issues (Bernstein, 2015; Conner, 2022; Horn, 2023; Lang et al., 2012; Oonk et al., 2022).

A key strength of transdisciplinary collaboration lies in the differences between participants; for example, differences in disciplinary background, goals, communication styles, and experiences (Horn, 2023; Pohl et al., 2021). When positively harnessed, these differences enable knowledge integration: the creation of new meaning through connecting previously unrelated elements. This process involves jointly defining problems, sharing and re-evaluating knowledge, and engaging in reflective dialogue, as result of which new understanding and solutions can arise (Pohl et al., 2021).

However, such diversity also introduces situations in which differences, for example in perspectives, approaches or goals, must be bridged to achieve effective collaboration (Cronin & Weingart, 2007; Horn, 2023; Morse et al., 2007; Van Den Bossche et al., 2010). When bridging differences is difficult, it creates a challenge for the group, causing misunderstanding, tension or conflict, or demotivation (Cronin & Weingart, 2007; Harris et al., 2009; Horn, 2023; Järvenoja et al., 2013; Klein, 2017; Morse et al., 2007; Van Den Bossche et al., 2010). The risk of challenges increases with the number and salience of differences among participants (Cronin & Weingart, 2007; Hadwin et al., 2018b; Horn, 2023). Without effective mechanisms to manage challenges, opportunities for new insights may be lost (Horn, 2023; Souto, 2015).

Due to these challenges, transdisciplinary collaboration is not easily done and requires explicit training (Brown et al., 2015; Di Giulio & Defila, 2017; Godemann, 2006); higher education plays a crucial role in this (Horn, 2023; Mossman, 2018). Both theoretical instruction and experiential learning within transdisciplinary settings are necessary to enhance transdisciplinary collaboration skills (Horn, 2023; Pennington et al., 2021). Consequently, transdisciplinary learning environments (TDLEs), where students from different disciplines and societal actors co-engage in complex problem-solving, are increasingly implemented in higher education (Daneshpour & Kwegyir-Afful, 2022). During experiential learning in TDLEs, students experience the misunderstanding, tension or motivational problems caused by the challenges resulting from difficulties in bridging the

differences which are associated with a diverse range of participants. Effectively addressing these challenges is a crucial transdisciplinary collaboration skill. Therefore, transdisciplinary collaboration can only be learned if groups are taught effective mechanisms to manage challenges (Horn, 2023).

In TDLEs, regulating collaborative learning is essential for managing the challenges arising from participant diversity. According to the regulatory model of Hadwin et al. (2018b), regulation of learning can happen in the form of self-regulation (SRL), co-regulation (CoRL), and socially shared regulation of learning (SSRL). SSRL refers to group-level regulation of cognitive, motivational, emotional, and behavioural processes toward a shared goal. It involves collective task exploration, goalsetting, decision making and task execution, monitoring, and adjustment (Järvelä et al., 2013). SRL involves individuals managing their own engagement in learning and collaboration, such as adjusting own goals or attitudes (Hadwin et al., 2018b). CoRL is the transitional support of regulatory processes, where individuals or (digital) tools guide others' regulation, such as SRL and SSRL (Panadero & Järvelä, 2015). In the case of transdisciplinary collaboration, the individual offering the co-regulatory guidance can be either someone outside the group like a teacher or a consulted expert or someone inside the group, like one participant helping the other or the whole group. CoRL by someone inside the group, and SSRL, although both a process within the group itself, are different from one another. CoRL involves regulatory activities from one group member to support another group member or the group, while SSRL involves a group process in which group members collectively participate in regulation (Järvelä et al., 2013; Panadero, 2017).

While all three forms are important, SSRL is particularly critical in TDLEs. It is associated with better outcomes and higher participant satisfaction, especially as group heterogeneity increases (Hadwin et al., 2018b; Lin, 2018; Panadero & Järvelä, 2015). SSRL unfolds in four phases: task perception, goalsetting, execution with monitoring and adjustment, and evaluation, each influenced by internal and external conditions (Greene & Azevedo, 2007; Hadwin et al., 2018b; Panadero, 2017; Winne & Hadwin, 1998). Conditions can be related to the individual, including knowledge or beliefs, to the task and context, including time or complexity, and to the group, including trust (Hadwin et al., 2018b). Understanding these conditions is essential for supporting SSRL in TDLEs, as they can either facilitate or impede effective regulation and, by extension, collaborative success.

Research aims

Despite its importance, SSRL remains underexplored in TDLEs. Little is known about the specific challenges participants face in forming a shared task understanding, forming goals and executing plans, or how they address these challenges collaboratively. Even in mono-disciplinary settings, the influence of conditions on SSRL is not fully understood (Panadero & Järvelä, 2015; Rogat & Linnenbrink-Garcia, 2011; Wijga et al., 2023).

This study aims to fill this gap by examining how SSRL occurs in TDLEs, what challenges participants encounter, and how individual and group conditions affect regulatory processes. Insights from this research can inform the development of interventions to enhance SSRL, enabling transdisciplinary collaboration and knowledge integration in solving complex societal problems.

The following three research questions are addressed in this study:

RQ1. What type of challenges are experienced by participants in TDLEs?

RQ2. What type of regulation is chosen by participants in TDLEs in response to the different challenges?

RQ3. What individual and group conditions are associated with SSRL in TDLEs?

Methodology

Participants

A total of 17 students participated in a 20-week elective module in higher education in the Netherlands, academic year 2024-2025. The transdisciplinary learning environment, TDLE, was part of this educational module. Students participating in this study (12% women, 88% men, M_{age}=22.3, Min_{age}=19, Max_{age}=28, sd_{age}=2.45) studied at three institutions in the Netherlands and one abroad, namely Korea. They came from 11 disciplines in the economic and technical domain; for example, computer science, business IT and management, and human resource management. Thirteen of the seventeen enrolled students completed the questionnaire and nine of those participated in the semi-structured interview. Participation in the research was voluntary, and students provided informed consent. The study was approved by the Ethics Committee of the University of Applied Sciences, where this study was conducted: document number 24.017.

Design

In this exploratory study, both qualitative and quantitative data were gathered among students to identify the challenges experienced, the type of regulation chosen, and individual and group conditions, that influence SSRL.

Context

This research took place in a TDLE, that was part of a 20-week elective on campus educational module within higher education, academic year 2024-2025. The overall objective of the education program was about learning consultancy skills in the context of complex societal issues. The didactical approach was based on the (Virtual) Action Learning method (Dickenson et al., 2010). This educational concept gives students a major role in shaping their own learning goals and learning path, based on a baseline measurement and final assessment criteria of a consultant's competence profile. The individual and group assignment and the weekly on campus lessons were in service of the personal learning goals. Collaboration skills were part of the competence profile and needed to be developed and demonstrated. Students gathered evidence to illustrate the level of mastery of the competence profile in a portfolio. Evidence from both the individual and the group assignment could be used for this purpose. Module assessment consisted of an assessment of the level of mastery of the competence profile and was based on the content of the portfolio and an individual oral presentation. The product of the group assignment was not separately assessed. During the group assignment, three groups of four students and one group of five students worked together with societal actors, among others (citizens, municipal officials, and community centres), on issues related to sustainable living, living longer at home, poverty and exercise, and nature education. Students were given the opportunity to indicate their preference for one of these four themes and were placed in their preferred subject area. Guidance was provided by a client, once a week, and the teachers, every other week. The client was the first point of contact for the assignment, provided an initial explanation, and supervised

the progress. Participation of societal actors took place based on consultation (Bammer, 2019). Students decided how and when consultation took place. They also had complete autonomy in deciding how and when they met to work on the assignment.

Measures: Questionnaire for students

In this study, two questionnaires for students were used (the combined version is included in Appendix 1). As Table 1 shows, the first questionnaire consisted of five questions about the context and five questions about individual and group conditions. The five conditions were chosen because they are known to influence regulation in monodisciplinary contexts (Brown & Mcilroy, 2010; Kazemitabar et al., 2023; Neroni et al., 2024; Poort et al., 2020). The first author developed these questions, which were then discussed with the second author and adjusted where necessary. The questions were intended to familiarise students with the concept of conditions. Completeness in possible conditions was not the goal, because the conditions would be the focus of the interviews.

The second questionnaire was the complete version of the Adaptive Instrument of Emotion Regulation, AIRE (Järvenoja et al., 2013). AIRE was developed to measure student's personal goals, perceived challenges, mode of regulation of these challenges and results on the personal goals (Järvenoja et al., 2013). To make the questionnaire suitable for the transdisciplinary setting, the objectives 'making a social contribution' and 'learning to collaborate (transdisciplinary)' were added in the section about the personal goals of the participant. Table 1 gives more elaborate information about the amount and type of questions and the response options of the questionnaires. Both were composed in English and administered digitally, through the Qualtrics application (Qualtrics, 2024).

Table 1. Overview of important characteristics of the two questionnaires in the current study

Questionnaire	Theme	Subject	Question type	Number of items
1-Context & Conditions	Context	Field of study	Open	1
		Educational institute	Open	1
		Age	Open	1
		Gender	Multiple choice	1
		Group assignment name	Multiple choice	1
	Conditions	Experience with previous groups	Four-point Likert scale	1
		Confidence in the group	Four-point Likert scale	1
		Perceived competence in content	Four-point Likert scale	1
		Perceived competence in collaboration skills	Four-point Likert scale	1
		Perceived competence in dealing with challenges in collaboration	Four-point Likert scale	1
2 -AIRE	Goals	Major goal	Open	1
		Other important things	Four-point Likert scale	15
		Most important other things	Multiple choice	2
	Perceived challenges	Occurrence of fourteen different challenges	Five-point Likert scale	14
		Most important challenges	Multiple choice	2
	Mode of regulation of these challenges	Occurrence of eighteen different behaviours per important challenge	Five-point Likert scale	36
		Other behaviours per important challenge	Open	2
	Results on goals	Goal achievement	Four-point Likert scale	3
		Role of the group in goal achievement	Three-point Likert scale	3
		Satisfaction	Four-point Likert scale	1
		Remarks	Open	2

Measures: Semi-structured interview with students

To form a more comprehensive picture of which individual and group conditions play a role in SSRL, the questionnaires were supplemented with semi-structured individual interviews. The interview guide (Appendix 2) consisted of two parts: 1) description of the group assignment and the approach the group used, and 2) the one or two main challenges, actions taken and the individual and group factors that played a role in choosing these actions. Interviews were conducted by the first author, who played no role in the education program. The interviews were held in Dutch; six online and three in person. The resulting statements were verbatim translated into English.

Procedure

At the beginning of the module, the research was announced by one of the teachers during a lesson on location. Work on the group assignments started in week three and lasted until the final assessments. The subject, purpose, approach and important topics related to informed consent of the research were explained in week 12. Questionnaires were completed in week 16 during an on-site lesson. Completing the questionnaires required approximately 15 minutes of the students' time. The one-hour interviews with students, three in person and six online, were conducted in the last three weeks of the module. Final assessment took place in the last two weeks of the module.

Data analysis

Because of the exploratory nature of the study and the small sample, descriptive statistics in SPSS 29.0.0.0 were used to examine the results of the questionnaire. For research questions 1 and 2, mean, median, IQR, minimum, maximum, and standard deviation were calculated per challenge and per regulatory action.

Analysis of participant interviews was done according to Hycner's steps (Groenewald, 2004; Hycner, 1999). After conducting the interviews, all interviews were automatically transcribed and then checked and anonymized manually by the first author. After that, the two parts of the interview were analysed. The first part about the description of the group assignment and the approach used was included in the context description. The second part about the two main challenges, actions taken and the influencing conditions was coded deductively in Atlas-ti, based on a preliminary coding scheme. This scheme consisted of the categories of challenges used in the AIRE (Järvenoja et al., 2013), the categories of regulation (Järvenoja et al., 2013; Panadero, 2017), the main categories of conditions (Hadwin et al., 2018b), and examples within these main categories (based on Hadwin et al., 2018b). The first interview was coded independently by three people: the first author, the second author specialized in the field of transdisciplinary education, and a third researcher specialized in self-regulated learning. The second interview was coded by the first and second author. After coding the first interview, as well as after coding the second, differences in coding were discussed, and the coding scheme was adjusted accordingly. Adjustments in the coding scheme concerned an expansion of the examples of conditions and one adjustment in the 'categories of regulation' for those actions that, based on the information, could not be clearly categorized in one of the categories of regulation. After discussing the divergences, sufficient agreement in coding was reached, and the remaining interviews with the students were coded by the first author alone. The results will be presented in the next section.

Results

RQ1: Type of challenges experienced by students in TDLEs

Students' perceived challenges in TDLEs were mapped using the AIRE questionnaire and the semi-structured interviews. The questionnaire asked about the occurrence of 14 different challenges and the two most important challenges. During the interview, students were asked to name the one or two biggest challenges of the group.

Table 2 shows the descriptive statistics of the occurrence of the 14 challenges from the questionnaire. Medians of 10 challenges were 2, meaning they were experienced as a very small challenge. The highest median score was 3, meaning these challenges were experienced as a small challenge. These challenges were 'Different styles of interacting', 'Different personal life circumstances or commitments', and 'Distraction by some people'. Participants were not only asked to indicate on a 5-point Likert scale the extent to which the 14 challenges listed in Table 2 had arisen, but also to identify in two multiple choice questions which two challenges they considered to have been the most significant (Appendix 1). As most important challenges, students mentioned 'Different personal life circumstances or commitments', 'Unequal input in the team activities', and 'Problems with accents and/or level of language proficiency'.

Table 2. Number of respondents (N), mean, median (interquartile range between brackets), standard deviation, minimum, and maximum as a function of challenge type

Type of challenge	N	Mean	Median (IQR)	Std. deviation	Minimum	Maximum
Different goals	13	2.31	2 (1.5-3.0)	0.947	1	4
Different priorities	13	2.23	2 (2.0-3.0)	0.832	1	4
Incompatible styles of working	13	2.31	2 (2.0-3.0)	0.855	1	4
Different styles of interacting	13	2.92	3 (2.5-3.0)	0.954	1	5
Problems with accents and/or level of language proficiency	13	2.08	2 (1.0-3.0)	1.188	1	4
Lack of connection	13	1.77	1 (1.0-2.5)	1.013	1	4
Differences in commitment to the team effort	13	2.38	2 (2.0-3.0)	0.961	1	4
Different standards of work	13	2	2 (2.0-2.0)	0.577	1	3
Unequal input in the team activities	13	2.31	2 (1.5-3.0)	0.947	1	4
Distraction by some people	13	2.54	3 (2.0-3.0)	0.967	1	4
Different ideas about what we should do	13	2.08	2 (2.0-3.0)	0.760	1	3
Differences in understanding of the concepts/task	13	2.15	2 (1.5-3.0)	0.899	1	4
Different conceptions of how to organise the work	13	2.31	2 (2.0-3.0)	0.855	1	4
Different personal life circumstances or commitments	13	2.69	3 (2.0-3.0)	0.947	1	4

During the interviews, the nine students mentioned a total of 18 different challenges that occurred during groupwork according to their opinion: lesser involvement by one of the participants (7x), different goals (2x), different work styles (2x), unequal contribution (2x), unequal contribution because of personal circumstances (1x), personal circumstances of

one of the participants (1x), different work standards (1x), different ideas about approach (1x), and distraction by one of the participants (1x), illustrated by the following quotes:

Lesser involvement:

> Yes, getting together and working together on those Tuesdays and Thursdays was difficult, and we all had our own work and things to do alongside our own projects, so the motivation to make progress with this was quite low [...]. – student 2

> The fact that people didn't turn up on time when we'd arranged to meet [...] We'd usually arrange to meet quite early, around 11 o'clock, but then I'd be there and usually student X as well, and some people would sometimes turn up very late [...]. – student 3

Different work styles:

> Do we want to meet up often outside of class? Do we want to meet up in person, or what arrangements do we make for handing in sections? Are we going to do everything together, or are we going to split it up? I think that was the main difference. – student 1

Seven of these challenges were specifically related to the transdisciplinary nature of the learning environment. These challenges regarded the goals or involvement of the client or stakeholders and challenges due to different ways of working or approaches used within involved disciplines. In some cases, different students brought in the same challenging situation. Sometimes they used the same name for the challenge, but it also happened that they used another name; for example, one participant called the limited presence of a fellow participant "lesser involvement" and another student from the same group called it "unequal contribution". In the end, a total of 10 different situations were mentioned.

In summary, based on the questionnaire and the interviews, different amounts of participation, due to "lesser involvement", "personal circumstances", "unequal input" or "distraction", and "different working or interacting styles" were the most experienced challenges.

RQ2 Type of regulation chosen by students in TDLEs in response to the challenges

Information about the chosen type of regulation was gathered from the AIRE questionnaire and the semi-structured interview. The questionnaire asked about the occurrence of 18 different behaviours per mentioned important challenge. Each student chose two main challenges, and mean scores over those two were calculated per behaviour. The mean scores were analysed with descriptive statistics as described in the method section. During the interview, students were asked to name the one or two biggest challenges of the group and the actions taken to solve them.

Questionnaire

Table 3 shows relevant descriptive statistics regarding the occurrence of 18 different behaviours in reaction to challenges. There were differences in the mean and median scores. Students indicated that they made most use of the self-regulatory-actions "I tried

to accept the situation, realizing that some people were prepared to put in more work than others “, “I tried to become more flexible”, “I tried to understand that the others were not simply trying to be difficult but they had different goals/priorities etc." and of the SSRL-action “We decided to sort out the situation together and found a way to complete our work in the best possible condition”.

Table 3. Number of respondents (N), mean, median (interquartile range between brackets), standard deviation, minimum, and maximum as a function of the type of behaviour in reaction to a challenge

Type of behaviour in reaction to challenge	N	Mean	Median (IQR)	Std. deviation	Minimum	Maximum
I convinced myself that it could actually be a good thing, because…	13	1.808	1.5 (1.00-2.50)	0.83	1	3.5
I tried to become more flexible.	13	3.077	3 (2.75-3.75)	0.862	1	4
I told the others that we needed to accept that some people were prepared to put in more work than others.	13	2.423	2 (1.75-3.25)	1.037	1	4.5
I interacted only with the group members who had the same priorities/working style etc. as me.	13	1.808	1.5 (1.00-2.50)	0.947	1	3.5
I tried to understand that the others were not simply trying to be difficult, but they had different goals/priorities etc.	13	3.039	3 (2.00-4.00)	0.967	1.5	4.5
I told the others we all needed to be more flexible to find a compromise/solution for this situation.	13	2.346	2.5 (1.50-3.25)	1.008	1	4
I tried to accept the situation, realising that some people were prepared to put in more work than others.	13	3.192	3 (2.75-3.75)	0.778	1.5	4.5
I tried to explain to others that we needed to understand different goals/priorities etc.	13	1.923	1.5 (1.00-2.75)	0.886	1	3.5
I told someone that it would be better if they did not contribute much.	13	1.539	1 (1.00-2.00)	0.803	1	3.5
I tried to convince someone that the others were not simply trying to be difficult and that we could sort out the situation.	13	1.808	1.5 (1.00-2.25)	0.902	1	4
I told someone to change their priorities/working style etc. or face the consequences.	13	1.808	1.5 (1.00-2.50)	0.855	1	3.5
I decided to contribute only the strict minimum.	13	1.5	1 (1.00-1.75)	1	1	4
We realized we had to reconcile our goals/priorities etc. and bring them closer to one another.	13	2.808	3 (2.25-3.75)	0.947	1	4
We tried to achieve the majority’s goals/priorities etc.	13	2.423	2.5 (1.75-3.25)	0.932	1	4
We resolved the situation by compromising to accommodate everyone's goals/priorities etc.	13	2.692	2.5 (2.25-3.50)	0.969	1	4
We decided to sort out the situation together and found a way to complete our work in the best possible conditions.	13	3.154	3.5 (2.25-4.00)	1.197	1	4.5
We sorted out the situation by agreeing that some people would not contribute much.	13	2.039	1.5 (1.00-3.25)	1.233	1	4.5
We accepted that different members had different goals, and we had to organize our work accordingly.	13	2.962	3 (2.25-3.75)	1.108	1	5

Interviews: SSRL

To reiterate, during the interviews 18 different challenges were mentioned. The extent to which challenges were jointly identified and acted on varied over the mentioned challenges. In one of the challenges, i.e. different work standards, joint identification and action was almost absent and two of the challenges, i.e. different ideas about approach and one of the personal circumstances, were almost fully jointly identified and solved to the satisfaction of the group. All other challenges lay somewhere in between: they were partly jointly identified and/or jointly resolved. Statements of students 1 and 4 show respectively an example of complete joint identification, followed by a complete jointly decided on action, and absence of joint identification and action:

> I thought in the beginning that this [coming to an agreement about the used approach] would never be a problem. [...] So, when we started the assignment, we were just going to do it this way. And then they [other students in the group] said:' shouldn't we do this and do that'. [...] That actually came out after just a few days when we started that the ideas were different. – student 1

> So yes [...] I didn't get angry or anything, I'm not good at that either, but I often just did it myself when nothing happened. – student 4

Joint problem identification, discussion or joint action was mentioned frequently in case of challenges in task allocation and progress or experiencing insufficient contact with each other. This is illustrated by the following statement about joint action for differences in working styles:

> When we used our first approach, that is, not always meeting [...], we found that we didn't really understand each other's pieces. We didn't know what others did. One time I did something double, because I didn't know someone had already done it. Then we came to the conclusion: can't we meet physically or online? [...] So, we started meeting then. That felt so good and we could do so much more. – student 1

This contrasts with challenges in terms of an individual's contribution, contact with client or external stakeholders, or challenges which recurred or for which a deployed action did not work sufficiently. In those challenges, SSRL seemed to happen less frequently, discussion was postponed or CoRL within or from outside the group was needed. Chosen solutions were not always satisfactory for all students. The following statement of student 6 illustrates the postponed action in difficulties to get in contact with the stakeholder. An alternative action was only taken after CoRL by one of the teachers. Additionally, student 5's quote shows a situation of a recurring challenge in terms of involvement of a fellow student, in which part of the group decided not to discuss the problem anymore and work around it:

> Halfway through the semester, we decided to broaden the assignment, adapt it and look for a client, who could help us further, who would be involved. We discussed that very much with the group: we can't go on this way, what do we want, [...] what is possible, what do we want to do with the time we have left? – student 6

> So, at one point we thought: we can be difficult about it all the time, but it's best we make the best of it together. There are plenty of tasks that that person can do as well. Which then might be a little less big or difficult. – student 5

Interviews: CoRL

In the interviews, students referred to multiple forms of CoRL in relation to experienced challenges. First, CoRL by teachers was mentioned, for example mirroring, which is reflecting observable behaviour back to the group, monitoring progress, giving tips on the used approach, giving examples on content and providing behavioural norms or alternatives. CoRL by teachers often led to SSRL by the group afterwards. The following statements give examples of these different kinds of CoRL by teachers.

Mirroring by a teacher:

> And we have often been told also from the module's teachers that we need to show more initiative. – student 5

Monitoring progress by a teacher:

> [...] We were just making way too little progress with our assignments actually. So, after a talk with the teacher, and also a bit from the other teacher: hey guys you don't have anything [...] – student 9

Tips from a teacher about the approach used:

> That happened after we talked to the teachers. So, they had indeed indicated: make the manifesto specific so that this does not happen again. – student 7

In addition, challenges regarding CoRL took place within the group: from one participant to the whole group or to an individual participant within the group. A participant could, for example, share own experiences that could benefit the group or could encourage progress or contact within the group. Besides that, one participant could help another participant by discussing personal circumstances, offering support for experienced problems or by giving targeted assignments when certain individuals under participated or had specific expertise.

Encouraging progress by making a schedule for the group:

> [...] What I had done was schedule dates earlier in advance and that we just scheduled deadlines. – student 7

Giving targeted assignments to fellow students:

> If I know of that a person has a little to do or would be very good at something, then I would dare to give that [task] specifically to that person. – student 6

Offering support to a fellow student:

> I did talk to that person from time to time. Offered my support a bit. And also just said: just come to me with questions. I'd rather spend a bit more time helping you, that it's all just fine [...]. – student 6

Finally, CoRL by external stakeholders was mentioned, by utilising their knowledge in case of knowledge deficiency, via tips received or when asking for help on follow-up actions. For example, student 6 consulted someone outside the group because of an experienced knowledge gap:

> For example, I myself talked to a real estate manager from the municipality. To obtain knowledge about such a specialist direction a bit. [...] – student 6

Interviews: SRL

To a limited extent only, SRL was mentioned in the interviews when addressing challenges. When referred to, it was about: adjusting one's beliefs about a group member, arriving later for appointments, increasing one's efforts, closing one's own knowledge gap and leaving tasks to others. The following statements show self-regulatory actions mentioned in the interviews.

Arrive later for appointments, because others were often late:

> If they wanted to meet, I wasn't going to make sure I was punctual anymore. Because they weren't there anyway. – student 3

Increasing own efforts when there was not enough progress:

> [...] I didn't get angry or anything, I'm bad at that too you know, but then I often just did it myself when nothing happened. – student 4

Leaving some tasks to others:

> It's a bit difficult for myself. I've mainly let someone else do that. – student 8

SSRL, SRL and CoRL in interviews and questionnaire

The results from the questionnaire and the interviews show that students use SSRL like actions, in case of challenges. In addition to these SSRL like actions in the questionnaire, students mentioned the use of self-regulatory actions, such as "I tried to accept the situation, realising that some people were prepared to put in more work than others", to solve challenges more frequently than co-regulatory actions, such as "I told the others we all needed to be more flexible in order to find a compromise/solution for this situation". During the interviews, on the other hand, co-regulatory actions were mentioned more often than self-regulatory actions. In addition, joint problem identification, discussion or joint action seems to be more likely in case of challenges in task allocation and progress or experiencing insufficient contact with each other, than in case of challenges in terms of an individual's contribution, contact with client or external stakeholders, or challenges which recur or for which a deployed action does not work sufficiently. Finally, CoRL by teachers seems to result more often in SSRL by the group afterwards than CoRL by others.

RQ3 Individual and group conditions associated with SSRL in TDLEs

During the interviews, the students were asked about their own or the group's response to the two biggest challenges and the factors that determined this response. This revealed individual and group conditions that promote or hinder SSRL.

Individual conditions

Mentioned individual factors, which promote SSRL, were beliefs, goals, feelings, previous experiences and knowledge. First, promoting beliefs were about the person themselves, such as their responsibilities, or about their behaviour, such as the most suitable behaviour in a situation, or about what the person saw as most effective in, for example, approach of the assignment or collaboration. The beliefs of student 1 about how to collaborate or interact with others promoted joint discussion and action, when differences in approach of the assignment were detected:

> [...] but you also want to listen to someone else's ideas and vision towards something so I did always want to go to this idea because I knew inside that this would be the best, but we also didn't want to cut someone off saying this is not the right way, because his idea could also be good or her idea could also be good. - student 1

Student 7's beliefs about the most effective way to collaborate promoted SSRL, as did students 3's beliefs about his responsibilities:

> We just thought, it's best to just make some ground rules. - student 7

> We are also quite far along in education, so you have to kind of figure it out yourself and just make it [a problem] clear [to the group] yourself. - student 3

Second, goals seemed to be a promoting factor if they concerned passing the module. This is illustrated by the following statement of student 3:

> So, then we were actually like, if we still want to pass, we have to start saying something about it now, otherwise we just won't pass. – student 3

Third, SSRL promoting feelings appeared to come in different forms: being relaxed, having enough of something or fearing the consequences of not addressing the challenge. This quote by student 9 shows how feeling of 'having enough of it' helped the group in jointly addressing the problem:

> Because otherwise we kept going after it. I think I speak for all my group: that we were a bit fed up with [...], to put it crudely. – student 9

Fourth, knowledge, especially awareness of differences in knowledge and insufficient knowledge of the content, was mentioned as promoting SSRL. Knowledge gave student 1 the courage to initiate SSRL about a problem he saw, and being aware of the differences helped student 6's group jointly discuss how to use those differences best:

> [...] I would only do that when I'm sure it's right. So, I would also only do it when I know a lot about it myself. – student 1

> Then we will look at who is best suited for that and how we can use our specialties. – student 6

Finally, previous good experiences with an approach also seemed to promote SSRL. In previous groupwork, student 1 experienced the importance of taking time for and jointly discussing the approach, which promoted SSRL in the current group:

> But I think mainly experience from previous assignments and seeing the importance of starting the assignment well. – student 1

Besides the above-mentioned promoting factors, several individual hindering factors for SSRL were referred to in the interviews. These were related to beliefs, previous experiences, motivation or interest, goals, knowledge, strengths and weaknesses, and feelings. First, hindering beliefs were about the person themselves, such as opinions about certain behaviour, or their behaviour, such as the effectiveness of actions, and about school or the assignment, such as expectations. For example, student 4's beliefs about discussing challenges or giving feedback informed his decision to keep silent about the problems he experienced, and student 9's beliefs about expectations of school, which were shared by others in the group, hindered the group in jointly discussing alternatives for a reoccurring problem:

> [...] I think I don't find it nice to get angry at people. Anyway, at school I think it's stupid to do; I don't know, why really. – student 4

> I think that's because, of course, it does remain a school assignment. And often when you get an assignment from school, that's your assignment. And then you can't choose yourself of, oh, but I want to do something else. So that usually doesn't work. – student 9

Second, previous experiences could hinder SSRL when some group members were not familiar with a suggested method to approach the assignment or when a person had a good previous experience using CoRL instead of SSRL, like the statement of student 7 illustrates:

> I also just did that in the previous groups: then I also just brought people out; come here for a moment, what's going on, and then I'll just have a talk. – student 7

Third, the goal to deliver the best result possible and lack of motivation or importance hindered SSRL in the mentioned challenges. Student 6's statement shows how the desire to achieve the best results motivated him to use CoRL instead of SSRL:

> I'm fairly performance-oriented, so I would find it a real shame if that was taken away a bit [...]. I could see that could possibly happen, hence my intervention to try and keep a bit of order. – student 6

Fourth, strengths or weaknesses could have a hindering effect on SSRL in the mentioned challenges. Students' own strengths could result in them taking initiative to do something themselves and experiencing strengths in others could lead to a problem not being discussed collectively but rather being addressed through a specific question to the student concerned. Weaknesses, for example social shyness, could hinder a student in taking action within the group. This is illustrated by the following quote:

> But I think it's [avoiding interaction] mostly that I'm also a bit socially awkward. – student 4

Finally, feelings of fear played a hindering role on SSRL, which is shown by the quote of student 4. He decided not to discuss a problem because of the fear that it would cause the others to do even less:

> That fear that someone will then do even less or something, so to speak. – student 4

The various individual conditions identified above were mentioned in one or more of the 18 challenges discussed. Table 4, based on these qualitive interview data, shows in how many of the challenges the conditions played a promoting or hindering role. The most common hindering individual conditions were beliefs, previous experiences and lack of motivation and importance, and the most common promoting individual conditions were previous experiences and wanting to pass the module.

Table 4. Overview of the number of challenges in which an individual condition influencing SSRL is mentioned

Individual condition	Promoting	Hindering
Motivation		5
Goal	3	2
Knowledge	1	1
Strengths and weaknesses		2
Feelings	3	2
Previous experience	3	4
Beliefs	5 different beliefs in 4 challenges	15 different beliefs in 9 challenges
Other	3	3

Group conditions

Besides individual promoting and hindering factors, multiple group factors that influenced SSRL were mentioned. SSRL promoting group factors were beliefs, effectiveness of the group and group norms. First, promoting beliefs were mainly beliefs about the whole group, for example being sure that the group would support the action. Second, the effectiveness of the group seemed to be a promoting factor of SSRL when the effectiveness of the group was insufficient to pass the module. This is illustrated by the following statement by student 3. Finally, groups norms consisting of openness and helpfulness supported groups in SSRL, as is shown by the quote of student 9:

> We were pretty far into the project by then and not a whole lot of work had been done. So, then we were actually like, if we still want to make it, we have to start saying something about it now. – student 3

> I think because everyone helped each other if there was something and also when a message was sent, so no one ignored each other, everyone responded right away [...] – student 9

Students also mentioned group factors that hindered SSRL. These were beliefs, unfamiliarity of group members, poor effectiveness of group or its members, group norms and previous experience. First, hindering beliefs were often about feelings of a fellow student or of the entire group. Student 6 mentioned that he did not address a problem in the group because he thought there was too much irritation in the group and one student would feel uncomfortable:

> And I don't think that that person would have been very comfortable with the group discussing this either. – student 6

Second, unfamiliarity of the group members or lack of cohesion would hinder SSRL, as illustrated by the quote of student 6:

> I think I didn't have such good contact with the rest of the group at the time. [...] I think if there had been a bit more cohesion, that would have helped. – student 6

Third, poor effectiveness of one group member was more often hindering, and the poor effectiveness of the whole group was more often promoting SSRL. When one group member attributed less direct assignments for that person were used, like student 6 mentioned:

> I mentioned earlier that there were two people who often picked up a bit less. I have often given them specific tasks, so to speak. – student 6

Fourth, hindering group norms were mostly related to maintaining the good atmosphere, as illustrated by the following statement:

> But we thought [...]: it's best we all just make something of it together. – student 5

Finally, previous experience as a hindering group factor for SSRL involved a previous experience with the current group or one participant in it, as is shown by student 3:

> [...] Well, if one time doesn't work, a second time isn't going to work either. Just left it like that, it was fine like that." – student 3

Table 5, based on the qualitative interview data, shows in how many of the 18 cases the above-mentioned group factors played a role. The most common hindering group conditions were beliefs, unfamiliarity, poor effectiveness of group member and group norms, and the most common promoting group conditions are poor effectiveness of group and beliefs.

Table 5. Overview of the number of challenges in which a group condition influencing SSRL is mentioned

Group condition	Promoting	Hindering
Unfamiliarity/ bad connection		3
Familiarity	1	
Previous experience	1	2
Beliefs about group or individual	2 different beliefs in 2 challenges	8 different beliefs in 5 challenges
Poor effectiveness group(member)	5	3
Group norm	2	3
Other	1	7

Discussion

This study aimed to gain better understanding of the challenges experienced in transdisciplinary learning environments (TDLEs), how they are addressed and the individual and group conditions that promote and hinder SSRL in these environments.

Quantitative and qualitative methods were combined, and attention was paid to SSRL, SRL, as well as CoRL. This enabled a broad perspective in this exploratory study. This research starts to fill the gap in knowledge about SSRL in TDLEs, which despite of the importance of SSRL in this context exists. Additionally, it contributes to the knowledge about encouragement and support of SSRL, including jointly addressing challenges caused by differences among participants in TDLEs. This understanding is important for developing appropriate SSRL-enhancing interventions that help transdisciplinary groups address challenges jointly and thus better use participants' differences for solutions to complex societal issues.

Regarding the experienced challenges in TDLEs (RQ1), results show that different amounts of participation, different goals or involvement of stakeholders and different work styles were the most experienced challenges. Seven of the 18 mentioned challenges were specifically related to the transdisciplinary nature of the learning environment. These challenges regarded the goals or involvement of the client or stakeholders and challenges due to different ways of working or approaches used within involved disciplines. The finding that students struggle with unequal amounts of participation is in line with previous research in non TDLE-groups (Hassane, 2025; Hogenkamp et al., 2021; Van Woerden, 2024). Additionally, challenges caused by different goals or involvement are previously mentioned in literature about transdisciplinarity (Kurris et al., 2026).

Regarding the way the challenges were addressed (RQ2), firstly results show that that students in TDLEs use SSRL, CoRL and SRL in case of challenges. This is in line with previous research in non-transdisciplinary groups (Järvenoja et al., 2013). In the questionnaire, students more often mentioned the use of SSRL and SRL in solving challenges and during the interviews, SSRL and CoRL were more frequently mentioned. This difference can be explained by the fact that the questionnaire only asks for CoRL within the group, student to student. CoRL of teachers or other external partners was not part of the questionnaire. During the interviews, however, CoRL of teachers was mentioned in many of the challenges.

Secondly, the results show that joint problem identification, discussion, and joint action are more likely in response to certain challenges than others. These joint regulatory activities occur more frequently when group members experience insufficient contact with each other or difficulties related to task allocation or progress, and less frequently when challenges concern an individual's contribution, contact with clients or external stakeholders, or recurring issues for which earlier actions have proven insufficient. Previous research confirms the finding that students do not always jointly discuss and cope with a challenge (Hadwin et al., 2018a; Hogenkamp et al., 2021).

Thirdly, the results indicate that CoRL by teachers often results in SSRL by the group afterwards. That CoRL can lead to transition to SSRL is known from previous research (Hadwin et al., 2018-b), as well as that CoRL by teachers is important (Panadero et al., 2015; Sharma, 2024). CoRL by teachers seems to give students the confidence or tips needed to discuss the challenge.

Regarding the individual and group conditions that influence SSRL (RQ3), results show that previous experiences, such as a positive experience with a jointly approach, personal goals, such as passing the module, personal beliefs, such as the conviction that the group will support your action, and insufficient effectiveness of the whole group are important promoting factors for SSRL. On the other hand, previous experiences, such as a good

experience with CoRL or SRL, and personal beliefs, such as opinions, beliefs about effectiveness of personal behaviour, school, feelings of a student or the whole group will hinder SSRL. The same holds true for personal goals, such as striving for the best results or experiencing lack of importance, lack of effectiveness of an individual in the group, and lack of familiarity or cohesion. The impact of beliefs and previous experiences on collaboration is found in other studies (Brown & Mcilroy, 2010; Järvela et al., 2018; Singh & Muis, 2024; Sobocinski et al., 2022). The relationship between familiarity of the group and learning behaviour is also mentioned in previous research in non-TDLEs (Singh & Muis, 2024; Van den Bossche et al., 2006). However, the relationship between familiarity and learning behaviour seems complex: on the one hand, knowing each other seems to lower the threshold to discuss challenges, but at the same time it seems to increase the desire to keep a good atmosphere within the group and thus seems to reduce critical exchange (Van den Bossche et al., 2006). Although, based on the interviews with the students in the current study, familiarity with the group seems to be especially a promoting factor of SSRL, one participant also reports a lack of critical exchange. This may suggest that the dichotomy identified in previous research (Van den Bossche et al., 2006) may also have existed within the context studied.

Some limitations could have played a role in this research. First, this research took place in a relatively small group, as often still is the case within TDLEs. This small size may impact generalizability. However, mentioned challenges overlap with previous research in other group contexts.

Additionally, retrospection, as was the case in this study, has a risk of bias. This study reduced this risk by identifying challenges at several points in time and in different ways. The results show that even during the interview at the end of the module, students mention challenges from the beginning of the module. At first glance, the answers to the questionnaire and during the interviews seem to differ. There also seem to be differences in challenges mentioned between students within a group. However, as illustrated with examples in the results section, further questioning revealed that different names are used for the same situation or challenge during the interviews by different students of one subgroup. This was also previously reported in research by Järvenoja and Järvela (2009). The differences between the questionnaire and the interviews can probably be explained in the same way. Therefore, the interviews were an important addition for properly mapping the challenges.

Future research

This research found a difference in use of SSRL based on the type of challenge experienced by groups in TDLEs. The cause of this difference was not investigated in this study. It could for example be due to the experienced level of difficulty of a challenge, lack of skills to address these challenges (Van Woerden, 2024), or certain beliefs or previous experiences. Further research to explain this result is necessary.

Additionally, further research is needed on how to support joint identification, discussion and action in case of challenges, especially because students experience difficulties in jointly facing them. Results show that beliefs and previous experiences influence SSRL. Based on the interviews previous experiences and beliefs often are not shared with the group. However, literature shows the importance of understanding and externalising internal processes for SSRL (Järvela et al. 2018, Sobocinski et al., 2022). Therefore, the role

of becoming aware and sharing beliefs and experiences should be included in further research on supporting SSRL.

Finally, familiarity plays an important role in TDLEs. However, further research is needed on crucial facets of familiarity, that foster a good balance in exploiting the differences, lowering the threshold for discussing challenges and yet remaining critical with each other.

Practical implications

The findings of this study have several practical implications for students, teachers, educationalists and project supervisors involved in TDLEs. First, the data suggests that a quantitative approach might present a different picture of the type and magnitude of challenges that students perceive than a qualitative approach. Specifically, in our study, the quantitative data suggested that students encounter few challenges, whereas a different conclusion emerged from the qualitative data. Hence, when examining challenges in educational practice it is advisable to use multiple sources of evidence, and not to rely on quantitative data only.

Second, when supporting groups' SSRL, it is advisable to invest, early in the collaboration process, in understanding each other's goals, expertise, experiences, working preferences, and contextual constraints. This might help groups make productive use of their diversity and anticipate potential difficulties.

Third, the results also indicate that coaching by teachers through mirroring, promoting monitoring of progress and process, discussing behavioural norms and providing tips on approach or content, when necessary, promotes SSRL. When teachers also focus on the involved personal and group factors that determine whether a group regulates itself jointly, they can encourage effective socially shared regulation of learning.

Finally, while coaching, teachers should remain attentive to situations that may require more targeted intervention, such as declining engagement, misalignment of goals, or recurrent challenges that groups are unable to resolve independently. Engagement can be seen as the quality of cognitive, emotional and behavioural effort that group members devote to the activities that contribute to the group goal (Poort et al., 2023). Because reduced or unbalanced engagement is also reported as one of the most common challenges, the results point to a need for greater focus in education and research on developing appropriate supportive environments that help reduce this challenge or support groups in coping with it. Such environments may include structured reflection moments, teacher support aimed at discussing participation and contribution patterns, and monitoring tools that help groups collectively identify and address imbalances in engagement.

Conclusion

In this research, different or disproportionate amounts of participation, different goals or involvement of stakeholders and different work styles were mentioned as the most experienced challenges in the TDLEs. Students seem to find it particularly difficult to jointly identify, discuss and act in case of challenges in terms of an individual's contribution, contact with client or external stakeholders, or challenges which recur or for which a deployed action does not work sufficiently. This lack of jointly solving these challenges hinders the use of participants' differences for solutions to complex societal

issues. Therefore, further research on supporting joint identification, discussion and action of challenges is necessary. Based on this research, personal beliefs and previous experiences can either be promoting or hindering depending on the exact content. Because of the impact these factors have on SSRL, it is important to share and explore them in the group. Therefore, support of becoming aware and sharing of these beliefs and experiences should be incorporated in research about supporting SSRL.

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Appendix: Challenges in Transdisciplinary Learning Environments Questionnaire

Consent

This survey is part of the research on how to jointly regulate/address challenges that arise in transdisciplinary learning environments as a group. Transdisciplinary learning environments are learning environments like the one you are currently engaged in. The research is led by ..., from the research ....

The aim of this research is to gain insight into the challenges that arise in transdisciplinary learning environments, the way in which they are regulated/addressed and the factors that influence this regulation. The research results are used to improve such learning environments.

As part of the survey, you will also be asked if you are willing to participate in an interview later. This interview will help us to properly identify the factors that play a role in regulation/addressing the challenges. This is important to properly improve learning environments.

Your participation in this study is voluntary, and you can stop your participation at any time. You don't have to answer questions you don't want to answer. The information you share in this survey is only accessible to the researchers involved. We are committed to protecting your privacy. Research results that are shared outside the study will be anonymized. This means that they cannot be traced back to individuals in any way. Research data may also be used anonymously for follow-up research.

Do you have any questions about this research? Please contact the researcher Sascha van Kuppeveld, smhf.vankuppeveld@avans.nl.

If you have specific questions about the handling of personal data, you can also contact our Privacy Officers via privacy@avans.nl, stating the name of the study and the research leader.

Do you consent to the processing of your data in the manner described above?

- ○ Yes
- ○ No

Interview

This research consists of this questionnaire and an interview. The interview will help us to properly identify the factors that play a role in regulation/addressing the challenges. This is important to properly improve learning environments. We hope you will participate in the interview as well.

If you do so, please mention your name and e-mail address, so we can get in touch with you and prepare the interview.

If you don't do so, please mention 'no'.

_____

_____

_____

A. INTRODUCTORY QUESTIONS

1. At which institution of (higher) education are you studying?

_____

2. What field of study are you following?

_____

3. What is your age?

4. What is your gender?

- ○ Female
- ○ Male
- ○ Other
- ○ I don't want to share

5. Which subgroup did you participate in?

- ○ Name project 1
- ○ Name project 2
- ○ Name project 3
- ○ Name project 4
- ○ I don't remember the name of my group assignment

6. Feeling of competence

	very limited	limited	good	very good
I experienced my level of competence at the content needed for this group assignment as:	○	○	○	○
I experienced my level of competence at the skills needed to collaborate as:	○	○	○	○
I experienced my level of competence at the skills needed to regulate (identify, address and deal with) the challenges during collaboration as:	○	○	○	○

7. Experience with groupwork

	very negative	negative	positive	very positive
My experience with previous group work was:	○	○	○	○

8. Confidence in group

	very small	small	medium	large
My confidence in the group, I worked with during this group assignment, was:	○	○	○	○

B. WHAT WAS IMPORTANT TO YOU IN REGARD TO THE GROUP EXERCISE

This section comprised section A of the AIRE (Järvenoja et al., 2013). An example of a question is:

1. What was your major goal regarding this group assignment?

_____

_____

_____

C. WHAT CHALLENGES DID YOU EXPERIENCE AS A GROUP?

This section comprised section B of the AIRE (Järvenoja et al., 2013). An example of a question is:

2. Please indicate below what you think was the first biggest challenge in your group

- ○ Our goals for the project were different.
- ○ We had different priorities.
- ○ We seemed to have incompatible styles of working.
- ○ We seemed to have different styles of interacting.
- ○ One/some people had problems with other students' accents and/or level of language proficiency and thought it was difficult to work with them.
- ○ People in our group did not connect very well with one another.
- ○ One/some people were not fully committed to the group effort.
- ○ People had very different standards of work.
- ○ Group members did not have equal input in the team activities.
- ○ Some people were easily distracted.
- ○ Our ideas about what we should do were not the same.
- ○ We differed in our understanding of the concepts/task.
- ○ Our conceptions of how to organise the work varied.
- ○ We had different personal life circumstances or family / study & work commitments.

D. HOW DID YOU ADDRESS YOUR GROUP-RELATED CHALLENGES?

This section comprised section C of the AIRE (Järvenoja et al., 2013). The questions in this section depended on the two biggest challenges chosen. For both biggest challenges participants were asked how their group addressed the challenge. An example is:

1. How did you address your team-related challenge: A. Our goals for the project were different?

For example - one/some people wanted to get a high grade and others were just happy to pass - one/some people were so interested in the work that they wanted to invest a huge amount of time but others were not as interested /keen. In light of this, did you or your group do any of following in order to deal with the challenge:

	Did not happen	Happened rarely	Happened occasionally	Happened frequently	Happened very frequently
WHAT I DID 1. I convinced myself that it could actually be a good thing, because...	○	○	○	○	○
2. I tried to become more flexible.	○	○	○	○	○
etc.	○	○	○	○	○
WHAT WE DID AS A GROUP 1. We realised we had to reconcile our goals and bring them closer to one another.	○	○	○	○	○
etc.	○	○	○	○	○

E. Final reflections (AIRE, Järvenoja et al., 2013)

This section comprised section D of the AIRE (Järvenoja et al., 2013). An example of a question is:

3. Now at the end and overall, how personally satisfied are you with this group assignment?

	Not satisfied at all	Moderately satisfied	Very satisfied	Fully satisfied
How personally satisfied are you with this group assignment	○	○	○	○

Appendix 2: Interview Guide

1. Welcome
    a. Meet and introduce
    b. Explanation of the research and purpose of this interview
    c. Approach, duration and topics of the interview
    d. Informed consent and the opportunity to not answer if you do not want to.

2. Short description of the group assignment and the group's approach

3. The two main challenges for the group working on the group assignment: For each challenge:
    a. Describe the challenge in your own words?
    b. How did that challenge become visible/noticeable to you?
    c. What did you feel when experiencing that challenge?
    d. What did you think about it?
    e. What did you do in response to it?
    f. Can you explain how you came to that choice?
    g. What played a role for you in making that choice:
    h. Individual aspects: e.g. feelings, thoughts, goals, what you consider important, previous experiences, confidence in your own abilities etc.
    i. Group aspects: e.g. confidence in entire group, experience with group or individual group members etc.
    j. Is the challenge temporary, permanent or unresolved with the actions taken?
    k. What would have helped to resolve the challenge permanently and completely?
    l. What aspects or parts of the minor helped your group address this challenge jointly and what aspects or parts of the minor hindered addressing this challenge jointly?
    m. What might have helped you and your groupmates to jointly address the challenge?
4. Closing
    a. Any additions of interest
    b. How was it to participate in the interview
    c. Brief explanation of the follow up
    d. Thank you

Welcome	
Meet and introduce	Welcome. We are glad that you would like to participate in this interview and make time for this. Introduction.
Explanation of the research and purpose of this interview	For research purposes, it is essential that participants confirm that they have been informed and that they consent to the use of their data. To this end, we require a form of informed consent. During the presentation in the minor and in the written information you received either during the minor or with the invitation to the interview, I provided you with details about the research. In these materials, you were able to hear and read about the aim and approach of the research, how the data will be processed, and so on. In brief, the following was included: The aim of the research is to identify which factors influence whether a transdisciplinary group tackles a challenge – such as a difference in interaction styles – as a group as a whole. The results of the research will be used to improve learning in such learning environments and groups. The questionnaire focused on the challenges you experienced and the actions you and the group took in response. The interview will explore what influenced the choice of those actions. Everything you say during the interview will be used solely for research purposes. Data will not be traceable back to you. Results will only be shared in anonymized or pseudonymized form to improve education and to report on the research. Do you have any further questions about this information and the Informed Consent form?
Approach, duration and topics of the interview	The interview will last an hour, during which we will first address the two biggest challenges in the group, in your opinion, and the actions you and the group have taken in response. I would like to look with you at what determined what actions you took. Then I'd like to look with you at what the key factors from within yourself and the group are that determine whether you address a challenge as an individual or as a group. I will elaborate more on that later.
Informed consent and space to not answer if you do not want to	Refer to the informed consent form: already received or to be filled out before starting the rest of the interview. Please know that you do not have to answer any questions you do not wish to answer, and that you always have the right to stop. We would like to record the interview. We need your consent to do so. That is why I would like to ask you this question now, before the interview begins: Do you consent to this interview being recorded?

Assignment	
Short description of the group assignment and the chosen approach	Could you please confirm once again, whilst the recording is running, that you agree to the interview and its recording? Right, let's get started. You participated in project … Could you briefly describe the project? Could you briefly describe your approach to the project? Could you describe who else was involved apart from you and your groupmates?
Challenges	
For each important challenge	What were the two most important challenges for your group, in your opinion? I would like to look at both. Let's start with the first one: Describe the challenge in your own words? How did that challenge become visible/ noticeable to you? What did you feel when experiencing that challenge? What did you think about it? What did you do in response to it? Can you explain how you came to that choice? What played a role for you in making that choice: Individual aspects: e.g. feelings, thoughts, goals, what you consider important, previous experiences, confidence in your own abilities etc. Group aspects: e.g. confidence in entire group, experience with group or individual group members etc. Is the challenge temporary, permanent or unresolved with the actions taken? What would have helped to resolve the challenge permanently and completely? What aspects or parts of the minor helped your group address this challenge jointly and what aspects or parts of the minor hindered addressing this challenge jointly? 12. What might have helped you and your groupmates to jointly address the challenge?
Closing	
Any additions of interest	Are there any topics that have not been covered that you would still like to add or you consider to be important to the study?
How was the interview for you	How do you personally look back on the interview? Do you have any tips for improving it?
Brief explanation of the follow up	As indicated in the introduction, the interview will be transcribed (typed out) and analysed along with the questionnaires to gain more insight into that what influences addressing challenges as a whole group in transdisciplinary learning environments. Knowledge gained will then be used to improve the learning environment. Do you want to receive the results?
Thank you	I want to thank you very much for your time and openness. Good luck in continuing your education.