

Article

Understanding the Complex Role of Coaches in Transdisciplinary Challenge-Based Learning

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Abstract

Transdisciplinary challenge-based learning (T-CBL) has emerged as a transformative educational approach in life sciences and sustainability education, promoting the development of students as change agents. T-CBL engages learners from diverse disciplines in addressing real-life challenges—such as environmental, societal, and ethical issues—through collaboration with both academic and extra-academic actors. However, the role of coaches, who are often key academic actors within T-CBL, remains insufficiently defined and under-evaluated. In this study, 18 coaches from six T-CBL courses offered by an alliance of four Dutch universities were surveyed using a combination of baseline questionnaires and semi-structured interviews to explore their perceptions of their role within T-CBL. Coaches described their role as versatile and complex. Beyond assigning grades, they were responsible for providing feedback on group processes and individual students' development, including self-reflection, personal goal setting, and overall well-being. Support offered by coaches primarily focused on cognitive processes and social dynamics, rather than content-specific guidance. Regarding preparation for the coaching role, most coaches reported having received no formal training and expressed feeling insufficiently prepared. The findings indicate a need for further investigation into the role of coaches in relation to other actors involved in T-CBL, with the ultimate aim of identifying factors to consider in designing T-CBL courses, including determining which actors to involve and how to prepare them for their respective roles.

Keywords: transdisciplinary challenge-based learning (T-CBL); coaching strategies; professional learning; transdisciplinary education



Academic Editor: Göran Finnveden

Received: 19 July 2025

Revised: 15 August 2025

Accepted: 16 August 2025

Published: 22 August 2025

Citation: Ferrario, A.S.; O'Sullivan, G.; Pennings, H.J.M.; Salvatori, D.C.F. Understanding the Complex Role of Coaches in Transdisciplinary Challenge-Based Learning. *Sustainability* **2025**, *17*, 7579. <https://doi.org/10.3390/su17177579>

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1. Introduction

Rapid technological changes, pressing ecological challenges, and the demand for sustainable innovation mean higher education needs to prepare professionals for dynamic, transdisciplinary roles. This is essential for training all actors engaged in addressing significant societal and environmental challenges, such as those identified by the United Nations

Sustainable Development Goals [1–3]. Such training requires new pedagogical concepts to expose learners to diverse perspectives, multiple disciplines, and actors with real-life experiences of challenges, i.e., extra-academic actors with lived or professional experience of a challenge [4]. One such concept is transdisciplinary challenge-based learning (T-CBL). The term T-CBL has been described as social learning because individuals learn in interaction with various actors, thereby gaining new insights and resources that will lead them to changed practice and transformational potential [4].

Challenge-based learning (CBL) first emerged in 2008, when Nichols and Cator [5] introduced CBL as a framework aimed at helping schools to involve their students in tackling real-world, complex problems while also developing essential 21st-century workplace skills. The concept of CBL was to engage students with real-life challenges that necessitate teamwork and creative problem-solving. This concept was subsequently developed in the disciplines of engineering and sustainable development [6,7]. Events like hackathons and engineering competitions, often referred to as challenge-based innovation (CBI) projects, can be seen as earlier manifestations of CBL [8]. CBL has similarities to other educational concepts, including problem-based learning (PBL), project-based learning (PrBL), and design-based learning (DBL) because it seeks to engage students actively, allowing them to take the lead in constructing their own learning experiences [9]. CBL is often described as multidisciplinary [5,10] and existing literature frequently depicts its application within individual disciplines, particularly in science, technology, engineering, and mathematics (STEM), with an emphasis on socio-technical issues [3]. Furthermore, Leijon et al. [11] highlight that most research has concentrated on CBL, where student groups are coming from a single discipline and engaged in problems within their own discipline. O’Sullivan et al. defined the concept of T-CBL in the context of higher education to describe CBL that brings students and academic actors from multiple disciplines together with extra-academic actors [4] to address a societal challenge. This transdisciplinary network collaborates to identify a specific problem and co-create solution pathways to that problem. Transdisciplinarity includes the capacity for integration and actionable knowledge; these two aspects could be seen as the drivers for continuous renewal and political restructuring of universities using the knowledge created within and outside academia to solve urgent societal problems [12].

T-CBL creates collaborative dialogue that enables the exploration of significant real-world problems [13]. However, it is important to note the ongoing debates regarding the definitions and boundaries of pedagogical approaches to and definitions of CBL [11,14].

1.1. Roles in T-CBL

Within T-CBL, learners collaborate with their team and interact with both academic and extra-academic stakeholders. These actors have different roles depending on the T-CBL environment. Actors in T-CBL can vary but may include the course coordinator, academic experts, challenge agents, extra-academic actors, teachers, and coaches. Academic experts are actors within academia with in-depth disciplinary knowledge of the challenge; while the challenge agent is usually an extra-academic actor with the specific role to introduce a real-world challenge/question to work on [4,15] and provide feedback on the relevance and practical application of the proposed solution. This article uses the term extra-academic actor to describe those who are connected to T-CBL but who are external to the academy. Extra-academic actors bring direct lived or professional experience with a complex societal issue. The term teachers is primarily used in this article to describe educators who work with students in an academic setting. This role can vary significantly from prior expectations of this role [16]. In the course guide of the included T-CBLs, the

role of a *coach* was described as facilitator, focusing on the learning process and teamwork rather than the solution's validity.

1.2. The T-CBL Learning Process

The T-CBL learning process can be defined as a form of social learning where students engage with a variety of participants to acquire fresh perspectives and resources that develop new competencies and foster transformative growth [17]. It is a process where participants exchange ideas and experiences, discuss challenges, and in a team process create new understanding and propose interventions that can bring about change. This is achieved through continuous dialogue and collaboration [17]. Throughout the learning process, students aim to gather knowledge and expertise related to the problem in order to outline potential solutions. Students take ownership of approaching, evaluating, and synthesising the expertise needed to develop a solution within the context of the identified challenge [17]. This collective process of sharing and constructing knowledge can be considered 'networked learning'. The processes involved can be informal or formal [18].

The openness and complexity of real-world problems can sometimes lead students to lose focus and feel uncertain during the learning process [19]. Consequently, teachers can find they need to coach students—guiding, assessing, and mentoring them during the T-CBL process [9,20,21]. Within T-CBL literature, this has been described as a non-directive yet supportive approach that encourages students to engage in critical thinking and reflection while also facilitating inter- and/or transdisciplinary collaboration [19,22]. This has been described as coaching and those who perform this coaching role do not need to be content experts, but they do need to create a safe space for self-reflection [23].

1.3. Coaching

In general, coaching can be characterised as a structured, dialogic, and reflective learning process. Its increasing prominence reflects the complexity of societal demands and the individualised nature of different challenges. Nevertheless, a significant limitation is that, although its benefits are widely reported anecdotally, coaching remains poorly defined, and the body of empirical research supporting it is relatively limited [24,25]. Coaching has its roots in the fields of philosophy, education, psychology, sports training, and organisational development [26].

In education, coaching includes supportive behaviours aimed at enhancing students' active, self-regulated, and collaborative competence by providing psychological and emotional support [27,28]. The necessary support varies depending on learners' needs' and can possibly be gradually reduced over time, a concept known as scaffolding [29] and rooted in cognitive apprenticeship [30,31]. Scaffolding enables students to learn beyond their own capabilities with structured support from a more knowledgeable individual who provides guidance, supporting both the how and why of task completion [32]. The support is expected within the learner's zone of proximal development, which is the space where the learner is able to perform, but only with support from a teacher or a peer with more knowledge or expertise, thus, the area where the learner can develop, if guided [29].

1.4. Aim of This Study

This study aims to investigate the role of coaches within the portfolio of T-CBL courses developed by an alliance of Dutch universities between 2021 and 2023. It explores coaches' backgrounds, the perceived training and guidance they receive before engaging with T-CBL, the activities their role entails, the challenges they encounter, and the coaching strategies they consider successful within the T-CBL context. By providing evidence-based insights, this study seeks to deepen our understanding of coaches' roles in T-CBL, their contributions

to student learning, and their training needs, and to inform how institutions can develop and support the coaching role in the implementation of T-CBL.

2. Methods

2.1. Research Design

This study was conducted using an exploratory mixed-method approach through a combination of online questionnaires and semi-structured interviews with coaches working within T-CBL courses organised by an alliance of Dutch Universities. This study was approached from a pragmatist theoretical perspective, which prioritises identifying practical solutions to real-world challenges [33]. Narrative inquiry was chosen as the methodology to explore the stories, perspectives, and experiences of academic coaches, providing a deeper understanding of their role [34]. Narrative inquiry is a qualitative research approach that studies the stories people tell about their lived experiences, focusing on how individuals make sense of events and construct meaning in specific contexts. In this study, narrative inquiry allowed us to explore how coaches interpret, experience, and narrate their roles, challenges, and strategies within T-CBL, capturing not only what they do, but also how they perceive and emotionally engage with their work.

2.2. Context of the Study

All the T-CBL courses were organised under an alliance of four Dutch Universities. More information regarding the organisation and the educational offer is provided at <https://ewuu.nl/nl/> (accessed on 2 August 2025) [35]. The included T-CBL courses were accessible to students from different faculties and belonging to the alliance. A total of six T-CBL courses organised between 2021 and 2023 were included in this study: (1) Challenge A explored innovative solutions for patient-centred healthcare; (2) Challenge B aimed to create sustainable solutions for the dairy industry; (3) Challenge C addressed the development of health systems supportive of human and environmental health; (4) Challenge D explored strategies to create sustainable cities; (5) Challenge E focused on advancing research and production of medicine without the use of animal testing; and (6) Challenge F aimed to meet biomedical societal needs within the translational life sciences profile. All courses were offered in a hybrid format, combining online and in-person experiences. In 2021 and 2022, due to the COVID-19 pandemic, the T-CBL courses were delivered fully online. The official language of instruction was English.

Table 1 summarises the aims, duration, and academic target level of the T-CBL courses included in this study.

Table 1. List of the T-CBL courses and number of coaches interviewed for each course.

T-CBL Course	Sustainability Focus	Number of Coaches Interviewed	Academic Year(s) of Participation	Academic Level	Duration in Weeks
A	Develop innovative, patient-centred healthcare solutions	2	2021–2023	Masters	6
B	Create sustainable solutions for the dairy industry	4	2021–2023	Bachelor	15
C	Build health systems supportive of human and environmental health	4	2021–2023	Masters	6
D	Develop solutions to create sustainable cities	1	2021–2022	Bachelor	10
E	Advance research and production of medicine without animal testing	5	2021–2023	Bachelor; Masters	10
F	Meet biomedical societal needs (translational focus)	2	2021–2023	Masters	20

2.3. Participants

Forty-one coaches were invited to participate in the study; of those, 18 (13 female, 5 male) participated, answering both an online questionnaire and taking part in semi-structured online interviews. This study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of Eindhoven School of Education with protocol code ERB2022ESOE1. Informed consent for participation was obtained from all subjects involved in this study.

The questionnaire (Supplementary Material S1: Questionnaire) was designed to elicit an overview of coaches' experiences during T-CBL and the results informed the design of the interview questions. The questionnaire included questions on participants' affiliations, roles within T-CBL courses, professional background, and teaching and coaching experience. In addition, the questionnaire explored participants' coaching training and perceived guidance, main coaching activities, number of students per coaching group, number of coaching meetings, areas of students' support, students' assessment, confidence in the coaching role, satisfaction levels, and presence of challenges during their experience in T-CBL.

Semi-structured interviews were conducted after questionnaire completion to deepen the understanding of coaches' perspectives [36]. The interviews consisted of follow-up questions (Supplementary Material S2: Interview questions) aimed at getting a more detailed view of the participants' perspectives. Interviewees were encouraged to share further insights into the guidance and training received (e.g., Were you instructed on your tasks as a coach in the T-CBL course?), coaching activities (e.g., Could you describe your role as a coach within the T-CBL course?), and perceived successful practices (e.g., Could you describe an event with a student where you felt you were successfully coaching?). Additionally, the interviews explored challenges encountered in their roles (e.g., You indicated that you have encountered difficult situations in your role, could you elaborate more on that?) and sought suggestions for improving the coaching role in future T-CBL editions (e.g., Do you have any suggestions for improvement for future coaches?).

2.4. Data Collection and Analysis

Data were collected during the period December 2023 to March 2024. Participants were contacted via e-mail providing (1) an information letter, (2) a consent form, (3) a baseline questionnaire, and (4) the link to reserve a spot for the online interview. Online interview sessions lasted 40–50 min and were automatically recorded and transcribed via Microsoft Teams and the transcription revised by the primary researcher. The collected data were anonymised before analysis.

To analyse the data, a hybrid deductive-inductive coding strategy was used [37]. The *a priori* themes and inductively identified subthemes were analysed to uncover meaningful patterns across the phenomena under study [37]. As a first step, the *a priori* themes derived from the research questions were analysed using a top-down deductive approach. A structured coding template based on the *a priori* themes included: (1) coaches' training and guidance; (2) coaching activities during the T-CBL courses; (3) coaches' perspectives on effective coaching strategies in T-CBL; and (4) coaching challenges and suggestions for improvements. As a second step, we also identified subthemes within the *a priori* themes during the data analysis and inductively derived coding, then applied across the dataset. This approach allowed for a dynamic analysis, letting new themes surface naturally from the participants' responses, which were discussed among the two researchers, and then systematically applied to other interviews. The data were analysed independently by two researchers on a limited number of interviews.

3. Results

3.1. Background Information on Enrolled Coaches

The coaches interviewed had backgrounds in research ($n = 7$), research and education ($n = 5$), education ($n = 4$), with some an additional background in coaching ($n = 2$), management ($n = 1$), science editing ($n = 1$), and psychology ($n = 1$). Table 2 summarises the professional backgrounds reported by interviewed coaches.

Table 2. Professional backgrounds of interviewed coaches. Coaches are identified by a unique Coach ID, which is also used to attribute quotes in the Results section.

Coaches' ID	Background Information
3, 4, 10, 13, 14, 15, 16	Research
5, 8, 9, 18	Education and Research
1, 6, 17	Education
12	Education and Coaching
2	Research, Education, and Management
11	Science Editing
7	Psychology and Coaching

All coaches were invited to participate in the T-CBL courses through their professional network, and in a few cases ($n = 4$), coaches independently requested to join the T-CBL course. For the majority ($n = 15$) of interviewed coaches, the listed T-CBL courses represented their first exposure to T-CBL. For $n = 8$ of the coaches, this experience also marked their first time taking on a coaching role (also outside T-CBL); while $n = 10$ of the coaches indicated having prior experience as a coach. Most of this coaching experience was obtained outside the T-CBL context, such as in “supervising PhD students” (Coach 3), “supervising junior colleagues” (Coach 9), or “supervising lab trainees” (Coach 15). A minority ($n = 3$) had previously coached within related educational approaches such as project-based learning (Coach 2, 18) and problem-based learning (Coach 3). Only $n = 2$ of the coaches described themselves as experienced coaches.

3.2. Perceived Guidance During the Coaching Role

At the start of the T-CBL course, $n = 13$ of the coaches had not received formal coaching training. However, $n = 15$ of the coaches interviewed acknowledged receiving guidance on their coaching role and activities by the T-CBL coordinators and other professionals involved in the T-CBL (i.e., they had received training on the job).

For $n = 14$ of coaches, guidance on their role was provided mainly through written communication, in a form of a “document” (Coach 1), “coach guide” (Coach 6), a “booklet” (Coach 7), “handbook” (Coach 4), or a “manual” (Coach 8). Additionally, the coaches working in the T-CBL courses A, B, and F ($n = 8$) also experienced more practical guidance, for example, through “a workshop” (Coach 6), “a one-hour symposium” (Coach 4), or lectures that provided “tools” (Coach 11) such as guiding questions (Coach 14) and “some tips and tricks” (Coach 2).

A majority of coaches ($n = 11$) said that peer-to-peer informal conversations were a valuable resource as they created a supportive environment where experiences and challenges could be openly shared. Coaches described this process as “training on the job together with [...] intervention with colleagues” (Coach 18). Coaches 4 and 10 pointed out that meetings with other coaches early in the process were helpful for clarifying specific needs.

One-third ($n = 6$) of the coaches felt that they were not prepared enough for their coaching role. Almost half of the coaches found that expectations for their role were not clear ($n = 5$) or could be better explained ($n = 4$), while a minority ($n = 3$) did not express an opinion regarding expectations. One-third ($n = 6$) found expectations at the beginning well set. Notably, 50% of the coaches indicated they missed some information during the guidance; for instance, the overview on the T-CBL structure (Coach 14), deadlines (Coach 6), and most importantly, how to assess learners (Coaches 13, 15).

Half ($n = 9$) reported that their experience as coaches in T-CBL was mainly learning by doing. Half of the coaches identified a need for specific coaching training before entering their role in the T-CBL courses. This training was considered necessary, among other things, to clarify their role in T-CBL, to develop effective strategies and interventions, with real-life exercises and practical examples on how to manage group dynamics, cultural differences, and individual unspoken students' needs. Additionally, $n = 7$ of the coaches stressed the need for T-CBL specific training to become familiar with the specific course topic, actors involved, and expectations. Finally, other suggestions included creating a gallery of T-CBL projects to use as examples for coaching training and provide opportunities for follow-up development of the projects.

3.3. Coaching Activities

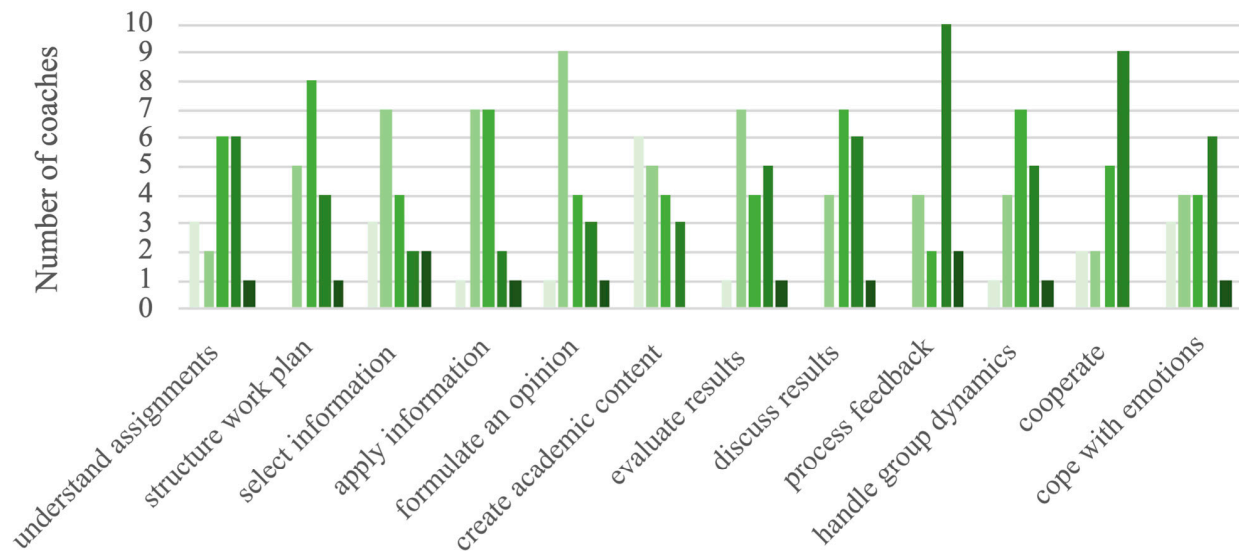
In most T-CBL courses, students were assessed based on a team track and an individual track [35]. All coaches interviewed played a role in the final group assessment by giving grades based on rubrics provided by T-CBL coordinators. Coaches met weekly ($n = 14$) or bi-weekly ($n = 4$) with their group of students. Half of the coaches ($n = 9$) considered the number of meetings sufficient to fulfil their coaching role, while $n = 5$ of the coaches indicated that more frequent meetings would have been beneficial.

Coaches also reported in which areas they specifically supported their students during the T-CBL course. Figure 1 shows the main areas of support provided by the coaches. Coaches reported that they predominantly supported students in understanding assignments, processing feedback, and discussing results. They also helped in structuring students' work plans. Moreover, the coaches were involved in social-emotional dynamics and cooperation of the group. Coaches described it as "guiding the process of collaboration" (Coach 13) and "empowering students to share expectations" on their roles (Coach 6) and make it explicit and contributions to the project (Coach 9). Coach 1 also stressed the importance of encouraging learners' meetings outside the project "to make sure that the group is collaborating and having fun" (Coach 1).

Coaches offered less support to students in content-related tasks, including creating academic content, selecting and applying relevant information, and formulating opinions; in fact, the teachers were not experts on the specific T-CBL topics and the students had access to academic and non-academic experts for each specific T-CBL course.

The majority of coaches ($n = 15$) reported difficulties during their experience in T-CBL. Some of the coaches described the challenges as being the unpredictability of projects ($n = 3$), the broad scope of topics involved ($n = 3$), and the insufficient content provided to students ($n = 5$). Suggestions were also made to align with other actors in T-CBL to provide complementary resources of relevant and specific tools ($n = 2$). According to interviewees, organisational challenges further hindered coaching practice, including difficulties with online collaboration ($n = 5$), schedule misalignment across institutions ($n = 4$), and fragmented communication across platforms ($n = 4$), suggesting a centralisation of communication channels ($n = 3$) and alignment of credits across different institutions ($n = 1$). Time constraints were also noted ($n = 3$), with many coaches advocated for more frequent and structured coaching check-ins to enhance effectiveness ($n = 8$); introduction

of mandatory in-person meetings ($n = 2$) and one-on-one coaching sessions with students ($n = 5$); and overall increment of coaching hours ($n = 3$).



Areas of support provided to students by coaches

Level of support 1 = very little 2 = little 3 = enough 4 = more than enough 5 = a lot

Figure 1. Areas of support provided to students by coaches in T-CBL courses (2021–2023). Data are based on responses from 18 coaches, who rated the extent of their support in each area on a scale from 1 (very little) to 5 (a lot). Each area of support includes feedback from a total of 18 coaches.

3.4. Coaches' Perspectives on Effective Coaching Strategies in T-CBL

Coaches were asked to identify coaching strategies that they perceived as successful for enhancing students' learning processes. These included specific situations or events in which they felt successful in their coaching practice. The eleven identified strategies were grouped into three categories, described in the following paragraphs and summarised in Table 3.

Table 3. Coaches' perspectives on effective coaching strategies in T-CBL, and number of coaches who described that strategy. Eleven reported effective coaching strategies were grouped into three categories.

Strategy Category	Effective Coaching Strategies	Number of Coaches
Induce ownership of the learning experience and help students feeling competent	Leave space for students to lead their learning experiences	16
	Encourage self-reflection by asking open-ended reflective and specific questions	15
	Empower students to develop their professional identity	12
	Facilitate development of new perspectives	11
Create open and safe emotional bonds	Non-judgemental active listening	16
	Create a safe space and build trust	12
	Facilitate teamwork and encourage cooperation	16
	Offer emotional and attitudinal support	15
Offer adaptive and just in time support	Guide learners via feedback, structural support, and practical advice, including expectation management	15
	Understand the appropriate level of support needed for students (balance guidance and freedom)	4
	Regulate support over time	3

3.4.1. Induce Ownership of the Learning Experience and Helping Students Feeling Competent

Most coaches (n = 16) identified leaving space for students to lead their learning experiences as an effective coaching strategy, as evidenced by responses such as: “it is important to allow learners to draw conclusions themselves about their own process!” (Coach 13) and “come up with [...] their own solution or multiple solutions” (Coach 14). Pro-active engagement of students in their learning is a key strength of T-CBL as highlighted by Coaches 2, 6, and 8, and “a coach should trust students’ capabilities!” (Coach 4), “take a step back and let it happen!” (Coach 6).

Encouraging self-reflection by asking open-ended reflective and specific questions was highlighted as a successful coaching strategy by n = 15 of the coaches. Coaches stressed the importance of inducing explicit reflection (Coaches 7 and 9) on group process and personal learning development, helping students to identify “their own problem!” (Coach 14), “to better themselves!” (Coach 6), and develop their “multiple solutions!” (Coach 14). To encourage self-reflection, n = 15 of the coaches highlighted asking students reflective and specific questions as an effective coaching strategy. A coach “asks the question behind the question” (Coach 12). Precise, detailed, and relevant questions are key, as “too generic questions [...] create a very low-quality feedback cycle” (Coach 16).

Among coaches, n = 12 highlighted that a key coaching strategy is empowering students to develop their professional identity. Coaches can play a vital role in helping learners transition from students to professionals, “taking it from an academic exercise to a real-life prescription” (Coach 16). This is one of the main goals of T-CBL according to n = 8 of coaches. Coaches should “assist T-CBL learners to become aware of their potential” (Coach 11), “recognise their professional profile” (Coach 7), and “identify available professional skills” (Coach 6). Beyond professional identity, effective coaching “helps students see their value holistically” (Coach 12), “unlocking their potential and boosting their confidence” (Coach 17).

According to n = 11 of the coaches, effective coaches also play a role in facilitating the development of new perspectives. Coaches should maintain “a helicopter view on their discussion” (Coach 13), “summarising” and “helping them to see it from a new perspective” (Coach 7) by helping them think “outside the box” (Coach 17).

3.4.2. Create Open and Safe Emotional Bonds

Non-judgemental active listening was identified by n = 16 of the coaches as a foundation of their effective coaching practices. As Coach 12 described, “coaching is primarily listening and observation”, and “with non-verbal communication key to observe the group’s working progress and personal development” (Coach 6). Within the process of listening, “it is important to avoid assumptions” (Coach 17) and be non-judgmental. Good coaching “starts with listening [...] and trying not to judge” (Coach 1).

Creating a safe space and building trust was identified as a successful coaching strategy by n = 12 of the coaches, as it guarantees an open connection between the coach and the learners. According to the coaches, it is essential to “build confidence” (Coach 8) and create a sense of security to “make the student feel safe” (Coach 1). To ensure a strong, trusting coach–learner relationship, several coaches indicated that “having dedicated time” (Coach 6) and “being approachable” is crucial for deepening connections and encouraging open dialogue with students.

Other coaches (n = 16) mentioned as successful coaching strategies facilitating teamwork and encouraging cooperation. Coaches described their interventions as “guiding the process of collaboration” (Coach 13) and “empowering students to share expectations”

(Coach 6). A coach should also encourage students to meet outside of formal project work, “to make sure that the group is collaborating and having fun” (Coach 1).

According to $n = 15$ of the coaches it was also important to offer emotional and attitudinal support.

3.4.3. Offer Adaptive and Just in Time Support

According to $n = 15$ of the coaches, a successful coaching strategy involves guiding learners via feedback, structural support, and practical advice, including expectation management. Coaches emphasise providing learners with “tools”, which includes assistance with time management, organisation, and problem-solving techniques. This structural support is particularly crucial for learners transitioning into unfamiliar self-directed learning environments, as highlighted by Coaches 6 and 12. The coaching “toolbox” (Coach 6) must be tailored to the individual learner’s needs, as highlighted by 50% of the coaches. As Coach 17 pointed out, it is essential to “support each student individually amongst the group project to make sure that all the students are able to achieve the learning outcomes of the course [as] different student groups required different roles of a coach” (Coach 17).

Understanding the appropriate level of support needed for students was mentioned by $n = 4$ of the coaches as an effective coaching strategy. Coaching requires: “finding that delicate balance between too much guidance and not enough” (Coach 10). Successful coaching implies “the ability to understand when to intervene” (Coach 15), as premature intervention can impede students’ learning “because failing is [...] essential in the whole process” (Coach 18). On the contrary, the participants should not remain too unguided because “in the end the goal is still for them to manage the project” (Coach 10).

According to $n = 3$ of the coaches, it is key to regulate feedback support over time. Support is mainly needed at the beginning and towards the end of the T-CBL course, $n = 3$ of the coaches reported. “We had a bit more structure at the start [...] and as the course progressed, it became less and less structured: we wanted them to be more and more independent”, explained Coach 16. Students must be also supported towards the end of the T-CBL, because is when there is a “drop in motivation and [...] energy” (Coach 12). According to Coach 17, it is a coach’s responsibility to guide students through the different stages, adapting the support as needed.

4. Discussion

The use of T-CBL has increased in higher education, enhancing students’ transversal competencies, understanding of sociotechnical issues, and engagement with industry and community partners, while integrating different disciplines and knowledge [11]. However, varied use of the term has led to inconsistencies in definition and conceptual clarity within the field [9]. Moreover, existing literature has yet to thoroughly explore the role of non-student participants in CBL, their specific functions, and their impact on student learning. T-CBL introduces new networks of participants into student education, potentially reshaping the roles of academic actors and influencing how students perceive their value [3]. In T-CBL, students learn from a wide variety of actors and in different ways [4]. Despite this, coaching has been identified as a crucial element for student learning [21] but yet, the perspectives of coaches in T-CBL are still under-evaluated and under-investigated [31].

Within the literature, there are, to date, few studies that examine the role of coaches in T-CBL. This study focuses on coaches’ perspectives, their background and prior coaching-related experiences, role definition, perceived challenges, and strategies for effective coaching. Coaches experienced their role as versatile and complex. Coaches were not only responsible for assigning grades but also for providing feedback on group processes and individual student journeys, including self-reflection, personal goal setting, and overall

well-being. Coaches indicated that support was mainly provided on cognitive processing and social dynamics, rather than content-related tasks. The role of coaches resulted in a complex, variable, and multiple-level job, according to coaches. These findings align with the studies by Pepin and Kock, van den Beemt, and MacLeod which highlight that teachers need to develop competencies in coaching and scaffolding for students [21,38].

Information collected on coaches' training and experience showed that, although the majority of enrolled coaches had previous experience in education, specific experience of coaching in T-CBL was rather limited; importantly, almost half of the coaches were undertaking their very first experience in coaching without previous training. During the T-CBL course, the coaches reported a certain confusion regarding expectations related to their coaching role and practice. This aligns with previous research demonstrating that both students and staff in T-CBL can experience feelings of uncertainty [39,40].

Most of the literature proposes that, within T-CBL, the role of the teacher shifts from an expert role to a coach who scaffolds learning and that this role evolution requires specific training [9,20,21]. A third of the interviewed coaches felt unprepared, with half of the coaches identifying the need for specific coaching training. The majority of coaches had not received formal coaching training. This lack of training could represent a barrier to coaching practice. In most cases, our interviewees were teachers involved in the role of T-CBL coaches. Coaching has already been associated as part of the teacher's role in higher education [41], and as already shown for PBL, coaching requires a substantial paradigm shift where the teacher is no longer the disseminator of knowledge but instead facilitates the process of learning [16]. Multiple studies on PBL have already shown that training teachers is critical for improving students' achievements [42–44]. The consensus on the significance of training is reinforced by literature beyond PBL. Research also indicates that the most effective teachers receive training in facilitation skills [45].

Although expectations seemed unclear, the coaches included in this study felt responsible for a complex list of possible support to the students, from emotional support to professional and personal development (Table 1). O'Sullivan et al. [4] found that the coaches who were assigned to the students' groups, were not highly valued by the students for their contribution—potentially, for example, because the coaching role was quite unclear for the students. By contrast, students relied on friends and family for emotional support throughout T-CBL [4]. The possible mismatch between the perspective of coaches and the learning experience of the students, is an area for further research. There is broad agreement in education and research that students need to be prepared to navigate an increasingly uncertain, complex, and dynamic world, where many of today's most urgent global challenges are multifaceted and not easily defined [46].

Transdisciplinarity has been cited by policy makers and universities as a necessary approach for tackling societal challenges [46]. To meet these demands, students but also teachers need a combination of broad, transferable skills such as critical reflection, leadership, adaptability, and resilience (horizontal bar) alongside deep, specialised expertise (vertical bar). This is summarised within the concept of 'T-shaped professionals,' a model introduced by Frenk et al., which emphasises the balance between versatile competencies and in-depth knowledge [47]. Although the importance of transdisciplinarity is well recognised, remarkably, the transdisciplinary learning process to date has not been studied much [4,12]. As a result, many transdisciplinary learning experiences such as T-CBL are created without much research guiding their design and execution. It is often not known clearly how the learning process works, what participants gain, or how best to design these experiences. Based on a review of the literature on transdisciplinarity, the recent article of O'Sullivan (2025) suggests that transdisciplinary practice needs two main abilities: integrating knowledge from different fields and creating actionable knowledge (closing the

gap between knowing and doing) [12]. These abilities should be part of the competencies of the educators working in T-CBL [12].

Shaping the professionals of the future asks for a deeper understanding of the learning environment where students, researchers, academic and extra-academic actors learn as a group to develop or enhance competencies to integrate knowledge and bridge the knowledge–action gap [12]. Therefore, more research is needed to design evidence-informed T-CBL education.

Further implementing T-CBL in higher education means supporting this transdisciplinary learning environment in which most probably the extra-academic actors will assume a more relevant role. Effectively managing external stakeholders with diverse interests and perspectives to tackle problems of societal importance necessitates a high level of managerial commitment and strategic coordination. Universities and organisations must navigate the complexities of balancing the expectations of students, staff, and external partners. This requires resources that currently our universities mostly do not have [39], and how the university, as an organisation, can better equip itself for the future, remains a core challenge for the present time [48,49].

5. Limitations

To test the broader applicability of these findings, future research should explore T-CBL programs in different institutions and include not only a larger number of coaches, but also the point of view of the students and the other actors playing a role within T-CBL. Most coaches had limited prior coaching experience and lacked formal training; thus, the perspectives provided were primarily those of novice coaches. As such, their perspectives might reflect early-stage learning challenges as they may not have fully developed the expertise needed to navigate complex coaching dynamics in T-CBL. T-CBL typically involves both individual learning trajectories and group-based projects, yet our findings did not distinctly address how coaching approaches might vary between these settings. Future studies should explore how these settings influence coaching strategies and their impact on students' development. Better defining and tailoring coaching approaches to individual versus group contexts could help refine specific models to meet students' diverse support needs.

Although the coaches' insights provide essential information about their roles and challenges, the absence of students' feedback limits our understanding of how these coaching strategies impact students' learning experiences and outcomes. Future studies should incorporate students' perspectives to understand how coaching affects their learning experiences.

This study provides an overview of coaches' perspectives within a specific timeframe, limiting us from assessing the development of strategies and challenges over time. To address this, longitudinal research following both groups across multiple T-CBL cycles could offer insights into the evolution of coaching strategies and their sustained impact on students' outcomes and professional growth.

6. Conclusions

There is broad agreement in education and research that students need to be prepared to navigate an increasingly uncertain, complex, and dynamic world, where many of today's most urgent global challenges are multifaceted and not easily defined [46]. Our findings support the need to further investigate the role of coaches in relation to the other actors involved in T-CBL with the final aim of identifying factors that must be considered before designing a T-CBL course, including which actors to involve, and how to prepare them for their respective roles in T-CBL. In particular, our findings underscore the importance of more clearly defining the relatively new role of coaches in education, and

of developing structured pathways to prepare professionals for effective participation in T-CBL environments.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/su17177579/s1>; Supplementary material S1: Baseline questionnaire. Supplementary material S2: Semi-structured interview questions

Author Contributions: Conceptualisation, D.C.F.S.; methodology, D.C.F.S. and A.S.F.; formal analysis, D.C.F.S. and A.S.F.; writing—original draft preparation, D.C.F.S. and A.S.F.; writing—review and editing, all authors.; supervision, G.O. and H.J.M.P. Funding acquisition, D.C.F.S. All authors have read and agreed to the published version of the manuscript. The original contributions presented in this study are included in the article. Further inquiries can be directed to the corresponding author: d.salvatori@uu.nl.

Funding: This research was funded by Ombion National Growth Fund “Centre for animal-free biomedical translation”(Ombion- CPBT), <https://site.ombion-cpbt.nl>.

Institutional Review Board Statement: This study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of Eindhoven School of Education with protocol code ERB2022ESOE1. Approval date: 18 March 2022.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The original contributions presented in this study are included in the article/Supplementary Material. Further inquiries can be directed to the corresponding author.

Conflicts of Interest: The authors declare no conflicts of interest.

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