

Evidence Brief: Facilitators and barriers in shifts to transdisciplinary learning in tertiary education settings

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Purpose: This brief synthesises current evidence on what makes a transdisciplinary learning initiative in a tertiary education context successful and transformative, and factors that make it a challenge or act as barriers. The brief aims to serve as a guide to the transdisciplinary component of the University of Auckland's Curriculum Framework Transformation initiative.

Background: In general, mobilising a shift towards transdisciplinarity within an organisation requires a good and connected team, effective team leaders, commitment, incentives, institutional support, sufficient time and funding, a commonly shared vision and goals, clearly negotiated roles and role rotations, effective communication, and measures to evaluate success, while barriers to this shift are reflected in contexts that lack these enablers (Choi & Pak, 2007). Additionally, this transition requires understanding the significance of real-world problem-solving for students' learning and the necessity for universities to establish partnerships that transcend the campus community (Budwig & Alexander, 2020).

For this evidence brief, we prioritised materials focused on facilitators and challenges in undergraduate-level transdisciplinary initiatives. However, we also included a select few highly informative articles focused on interdisciplinary education (considering its longer history) and one on a taught graduate course that offered relevant insights. Considering the limited number of published papers on this topic, we also included anecdotal information from faculty members of two Australian universities who have shared their experiences with us. The lessons learned from the experiences of preceding initiatives in this brief include those that attempted a university-wide implementation, such as the University of Tasmania and the Australian National University.

Key findings: Our findings are thematically detailed in Tables 1 and 2. Having these best practices and lessons-learned evidence base gives us an advantage to leverage on facilitators and pre-emptively implement measures to minimise hurdles. As experienced by other universities, the facilitating factors show that we are on the right track in some areas of progress (e.g., using a shared leadership approach and co-creating pilot courses). We have seen how our collaborative planning, decision-making and horizontal leadership result in a sense of shared ownership, commitment, and enthusiasm towards this transdisciplinary initiative. Through frequent and open communication, the pilot group members are developing a shared understanding of the need for transdisciplinary education, a shared vision around student learning outcomes, and have collaboratively decided on course titles that uniquely reflect Aotearoa's bicultural stance. Sustaining this sense of collegiality will be critical for the longer-term success of this initiative. We plan to establish ways to formally recognise efforts (a key facilitator identified in the literature). While time limitation is a barrier, released time signals formal recognition and enables relationship development and collaborations for co-creating curriculum and team teaching (other identified facilitators). Maintaining the present momentum would require institutional support. For instance, an enabling budget structure, sustainable staffing, logistical support, and sustained support for the ongoing development, evaluation, and administration of transdisciplinary offerings over the longer term.

Table 1: Structural and institutional barriers and facilitators to transdisciplinarity initiatives

Aspects	Facilitators	Challenges and barriers
High-level institutional support	Alignment with the University’s strategic plan and higher-level goals and initiatives (Bammer et al., 2023; Velez et al., 2022).	
	A move that is led from the top (Evans, 2015) and receives support from top-level leadership including, financial, time, and administrative investment (Chemi & Du, 2017; Lindman & Tahamont, 2005).	
	Having the chancellor’s support (B. Le Hunte & G. Kligyte, personal communication, August 24, 2023).	
	Recognition of efforts from the top (Lindman & Tahamont, 2005). “Faculty and staff need to feel that the institution supports their work and that their deans, chairs, supervisors, colleagues, and departments will recognize their efforts” (Lindman & Tahamont, 2005, p. 302).	
Ambition and commitment	Established ambition and commitment to transdisciplinarity (a track record of related research and education) (Bammer et al., 2023) and a pre-existing culture and history of transdisciplinary work among faculty (Evans, 2015).	Departmental territorialism in wanting to protect rights to their curriculum (Lenhart & Bouwma-Gearhart, 2022).
	Having a clearly articulated curriculum transformation plan and a specific set of feasible goals that consider the institution’s strengths and weaknesses (Lindman & Tahamont, 2005).	
	Willingness to commit resources to alter conventional education models, including rethinking teaching concepts, learning outcomes, and course delivery (Osborne & Dibben, 2017).	
	Clarity in faculty responsibilities in supporting teaching teams and maintaining a faculty balance in commitment to unit development and delivery (Osborne & Dibben, 2017).	
Funding	Incentivisation scheme through an ‘expression of interest’ process; incentivisation through funding for faculties and design advice (Osborne & Dibben, 2017).	Lack of incentives for transdisciplinary initiatives coupled with a reward structure that favours disciplinary deliveries (Evans, 2015; Imbruce & Prazak, 2020; Lenhart & Bouwma-Gearhart, 2022; Vanasupa et al., 2012).
		Imbalanced or unjust funding distributions during the development and delivery phases (Osborne & Dibben, 2017).
	Long-term investment, institutional commitment (Lindman & Tahamont, 2005; Velez et al., 2022) and sustained funding to further develop the curriculum (Chemi & Du, 2017).	Institutional declarations to advance transdisciplinary goals and values incongruent with funding decisions and other support structures to actualise those goals and values (Lenhart & Bouwma-Gearhart, 2022;

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Budget structure		Velez et al., 2022) and sustain ongoing delivery of co-taught programs (Imbruce & Prazak, 2020).
	Seeking external funding to support new course design (Imbruce & Prazak, 2020; Velez et al., 2022).	A voluntary model for delivering the course may not work as without sustainable funding, faculty may return to their disciplinary homes (i.e., their primary responsibility) at the end of the grant period (Imbruce & Prazak, 2020).
		Privatisation and models that situate “higher education as a business-like investment” can create pressures to seek external funding (Chemi & Du, 2017, p. 246).
	Restructuring budgeting so that “academic units receive funding for all courses taught by their faculty members, regardless of the course prefix or program with which the course is affiliated” removes the financial disincentive to transdisciplinary teaching and “increases the flexibility of the institution to create and offer new programs of study staffed by currently employed faculty members” (Evans, 2015, p. 78).	Performance budgeting models based on student enrolment numbers and faculty-to-student ratios introduce competition and undermine collaboration and co-teaching in transdisciplinary courses (Velez et al., 2022), produce tension and distrust between individuals from different academic departments, devalue teaching outside of disciplines, act as a financial disincentive to transdisciplinary teaching, and portray transdisciplinary teaching as a career risk (Evans, 2015).
Competition	Funding through a school-level rather than a faculty-level budget. Attaching expert staff to school budgets takes the financial pressure off Faculties (E. Lakey, personal communication, September 11, 2023).	
		Programs that encourage competition for additional “resources to ensure that both instructors of a team-taught course earn full unit credit” exacerbate the challenge of fostering a sense of community across departmental and college divisions (Vanasupa et al., 2012, p. 175).
Recognition	Just compensation and internal and external recognition signal the value of transdisciplinary efforts to those who do not yet fully understand its worth (Velez et al., 2022).	Insufficient formal recognition (financial, recognition of level of effort, promotion) undermines long-term commitment to co-teaching (Evans, 2015; Velez et al., 2022).
		The requirement to work with a high-ranked degree course (Bachelor of Creative Intelligence and Innovation) meant that the credit goes to the hosting faculty rather than the design team, raising the conception that it is better to be standalone (B. Le Hunte & G. Kligyte, personal communication, August 24, 2023).
		Non-recognition of and lack of rewards for “the extra effort and time required” for transitioning to transdisciplinary teaching can slow down

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<i>Effective leadership</i>	A shared leadership model that promotes a sense of shared commitment (Evans, 2015).	the process “as it is often initially concentrated in a few scholars that may get overloaded” (Rocha et al., 2020, p. 724). Hierarchal (Evans, 2015) or autocratic leadership (Vanasupa et al., 2012).
<i>Sustained leadership</i>	Project leaders’ support of the curriculum development process, curriculum co-development, organising workshops and meetings, demonstrating useful online tools, and reminding faculty of the project’s purpose and why transdisciplinary curriculum is different (Lenhart & Bouwma-Gearhart, 2022).	
<i>Communication</i>	Sustained support and leadership (Lindman & Tahamont, 2005). Effective communication with and between different faculties (Osborne & Dibben, 2017; Velez et al., 2022).	
<i>Transdisciplinary institution</i>	Establishing a transdisciplinary school (B. Le Hunte & G. Kligyte, personal communication, August 24, 2023) or an overseeing office with administrative staff support (Nanyang Technological University, 2023).	A designated transdisciplinary school (although seen as an all-of-university entity) could become set apart and seen as competing with other institutions; hence, it is important to visualise/foresee the possible interactions before committing to this model (B. Le Hunte & G. Kligyte, personal communication, August 24, 2023).
<i>Administrative systems</i>	Community of practice (established to coordinate coverage across courses) later formalised into an institute (Bammer et al., 2023). Willingness to evolve the University’s existing systems and infrastructure (Osborne & Dibben, 2017).	Resistance to creating new unit codes (Osborne & Dibben, 2017).
		Logistical hurdles and student management information systems that are unfit for transdisciplinary project requirements or course integration (Osborne & Dibben, 2017; Velez et al., 2022).
		Considerable efforts to convey the need to change from a conventional single-faculty identity to a university-wide transdisciplinary identity due to resistance to creating new non-faculty unit codes (Osborne & Dibben, 2017).
	Having a teaching measure (the teaching planning tool, which is essentially a massive spreadsheet) to calculate teaching hours (E. Lakey, personal communication, September 11, 2023).	

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Physical infrastructure	Flexible physical spaces (e.g. modular, mobile dividers, noise reduction barriers, furniture on casters) sufficient to meet course requirements beyond standard classroom spaces (Velez et al., 2022).	Insufficient flexible teaching spaces or unwillingness to share existing spaces (Velez et al., 2022).
		Logistical challenges in delivering courses to a large cohort of approximately 1,200 students each year (E. Lakey, personal communication, September 11, 2023).
		Geographical proximity challenges and limited mechanisms for collaborations between the institution and the community (Imbruce & Prazak, 2020).

Table 2: Programmatic barriers and facilitators to transdisciplinarity teaching initiatives

Aspects	Facilitators	Challenges and barriers
Understanding the need for curricula change	Understanding the need for transdisciplinary education (Velez et al., 2022) and situating the need for change “within its wider social, political and economical context” locally and beyond (Chemi & Du, 2017, p. 248).	
Creating a shared vision	Developing a shared vision or intent and expected outcomes for students (Bammer et al., 2023; Evans, 2015; Vanasupa et al., 2012; Velez et al., 2022).	Vision that is “imposed by fiat” (Evans, 2015, p. 85).
Professional development	Professional development opportunities to acquire transdisciplinary expertise and competencies (Bammer et al., 2023).	Lack of skills or confidence in teaching transdisciplinary curricula (Lenhart & Bouwma-Gearhart, 2022; Rocha et al., 2020) and not knowing how to work with “challenges” (B. Le Hunte & G. Kligyte, personal communication, August 24, 2023).
	Developing staff competencies in unit development principles and online delivery methods (Osborne & Dibben, 2017).	Lack of skills needed for course integration (Velez et al., 2022) and online teaching (Lenhart & Bouwma-Gearhart, 2022).
Design workshops	A weeklong planning workshop that includes “discussions of assigned readings”, “pedagogical techniques, classroom challenges, and collaborative teaching” (Lindman & Tahamont, 2005, p. 294).	Workshop facilitators must navigate complex power dynamics among participants and balance their roles as both seminar leaders and colleagues while helping participants switch from teaching to learning-mode, which may be influenced by factors like age and seniority at the institution (Lindman & Tahamont, 2005).

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Enabling creativity	A “creative design thinking workshop” that allows team members to experience and model cross-disciplinary thinking themselves to support the collaborative design of transdisciplinary modules (Allinson & Mahon, 2022).	Using predetermined institutional templates for course design can result in rigid, uniform designs that stifle imagination and creativity (Leal & Gonzalez, 2017).
Establishing a design team	A design team formed through voluntary participation (i.e., expressions of interest) (Allinson & Mahon, 2022). A group formed “through expressions of interest in an educational proposition with no dominant discipline base” meant that the “ideological positioning exerted a much stronger influence, leading to a values-based” co-created curriculum (Allinson & Mahon, 2022).	A design team of just two individuals spending two weeks in creating a novel four-year undergraduate transdisciplinary degree program is unlikely to lead to buy-in from others (Gray & Exter, 2023).
	Having a mix of disciplinary experts (E. Lakey, personal communication, September 11, 2023).	
	Having disciplinary experts with interdisciplinary insight to develop units (Osborne & Dibben, 2017).	
	Team members that are interested in and open to different approaches to course delivery and team teaching (Velez et al., 2022) and in meaningful collaborations in teaching with peers in other disciplines (Lenhart & Bouwma-Gearhart, 2022).	
	Faculty members with a desire to enhance knowledge, improve teaching practices and create curricula that would benefit students and result in career advancement for instructors (Lenhart & Bouwma-Gearhart, 2022).	
Start-up working group or community of practice	Establishing a working group (from different schools) to initiate and coordinate the curriculum reform and plan pilot course (Bammer et al., 2023; Chemi & Du, 2017).	
	Establishing a community of practice to coordinate coverage across courses (Bammer et al., 2023).	Challenges in coordinating to ensure breadth and depth of coverage are harmonised across courses (Bammer et al., 2023).
	Inclusion of student representatives in the working group (Bammer et al., 2023).	
	Establishing a design team that includes academic and service staff via an open call for volunteers can lead to a lasting and expanding community of practice (Allinson & Mahon, 2022).	
	Building a solid pedagogy base; establishing a reference group of academics and students to compile transdisciplinary experiences, teaching best practices, and expected student outcomes (Bammer et al., 2023).	Covering all transdisciplinary elements in depth may not be feasible (Bammer et al., 2023).

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Time	An understanding (among both implementers and evaluators) that new courses require substantial time and effort to design and implement (Velez et al., 2022).	Failure to recognise the required time investment presents a barrier to course innovation (Velez et al., 2022) and causes staff involved in preparatory work to become overloaded (Rocha et al., 2020)
	Patience and recognition that changes require time (Evans, 2015; Lindman & Tahamont, 2005; Velez et al., 2022). It cannot be achieved in a semester or an academic year (Lindman & Tahamont, 2005).	
Released time	Time and resources to collectively question, reflect on, and experiment with pedagogy (Lindman & Tahamont, 2005).	The time pressure of a limited number of months for a working group to complete the task (Bammer et al., 2023). Working within time constraints: juggling other commitments with no possibility to reduce workloads (Bammer et al., 2023).
	Released time to engage in ongoing activities needed to develop common ground (shared reality, culture, values) between colleagues of diverse disciplines – a process that builds trust, sustains collaboration and develops transdisciplinary identities and competence (Evans, 2015).	Funding structures that create imbalances or inequities in release time among different members of the team (Vanasupa et al., 2012).
Project support	Specifically hired administrative staff or highly qualified professional staff to provide project support to the working group (Bammer et al., 2023; Chemi & Du, 2017).	
Sustaining the working group	The working group could later be condensed in size to ensure sustainability (Chemi & Du, 2017).	
	Using technology to sustain collegiality, e.g. a listserv to discuss pedagogy on an ongoing basis (Lindman & Tahamont, 2005).	
Teamwork and collaboration	A supportive and well-knit team (Velez et al., 2022) based on horizontal relationships (Leal & Gonzalez, 2017) and collaboratively developed egalitarian roles and responsibilities (Vanasupa et al., 2012).	The existence of hierarchies (including implicit hierarchies) is detrimental to teamwork and collaboration (Imbruce & Prazak, 2020; Leal & Gonzalez, 2017; Vanasupa et al., 2012).
	“A true collaboration requires individuals to relate as equal co-creators with shared goals, rather than contracted agents who are serving someone else’s goals in exchange for a personal gain” (Vanasupa et al., 2012, p. 178).	Incongruence between intent to collaborate and the accustomed relationship dynamics within the partnership and failing to openly acknowledge how disciplinary habits influence the collaboration’s structure and dynamics (Vanasupa et al., 2012).
	Ability to work with “no clarity or hierarchy in the roles”(Leal & Gonzalez, 2017).	Challenges in clearly defining the roles of academic staff; requires clear guidelines (E. Lakey, personal communication, September 11, 2023).
Collaboration	Recognising that collaboration requires more than just “getting along” or “sharing information”; collaboration is “the common understanding that	

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Disciplinary mindset and hierarchies	evolves through dialogue, discussion and the formation of agreements or consensus” (Leal & Gonzalez, 2017).	
	Recognising that collaboratively designed transdisciplinary course content enriches educational products and “working in synergy with experts from other disciplines gives professionalism to the project that could not be obtained by working in a disciplinary manner” (Leal & Gonzalez, 2017).	
	Open-mindedness, willingness to acknowledge one’s own ignorance, and humility in learning from others, including learning from non-academics and creating a safe space for this to occur (Evans, 2015).	Disciplinary identities and viewpoints, e.g., “ways of knowing, views of reality, individuation, and methods for understanding” can directly contradict “transdisciplinary collaboration through the habits of mind that it instills” (Vanasupa et al., 2012, p. 182).
		Unawareness of embedded disciplinary hierarchies within the team and biases concerning the scientific approach (i.e. its superiority over human-centred approaches) that reflect a disciplinary mindset and a lack of self-evaluation to bring about the required awareness contributed to interpersonal conflicts, undermined collaborations, and affected engagement with non-academic partners (Imbruce & Prazak, 2020).
		Unwillingness to teach outside of disciplinary norms (Lenhart & Bouwma-Gearhart, 2022).
	Recognising the need to avoid power struggles and the need for compromise when deciding on the material to be taught (Leal & Gonzalez, 2017).	Challenges in determining educational content to be transmitted (Leal & Gonzalez, 2017).
		Faculty members from different disciplinary cultures unconsciously hold “very different beliefs about teaching, learning, the nature of knowledge, the methods of gaining understanding, interactions with students, and management of the project” (Vanasupa et al., 2012, p. 178).
Communication		A lack of awareness among faculty members of their differences in conceptualising design and designing pedagogy due to their cultural and institutional disciplinary boundaries in the early phase can lead to challenges in instructional alignment and strategies (Exter et al., 2020).
	Weekly meetings; frequent and open communication between team members (Velez et al., 2022) and communication that demonstrates patience, listening skills, and tolerance, leading to the development of a sense of camaraderie (Leal & Gonzalez, 2017).	

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Mutual learning	Communicating effectively using layperson’s terms, being open to dissimilar perspectives (Evans, 2015), and developing a commonly shared language (Lenhart & Bouwma-Gearhart, 2022).	Maintaining discipline-based specialised (exclusive) language (Evans, 2015), terminologies, norms and practices (Lenhart & Bouwma-Gearhart, 2022).
	Course instructors benefit from novel team collaborations through exchanging teaching experience and techniques, including online teaching methods, identifying new collaboration opportunities (Osborne & Dibben, 2017), gaining new pedagogical knowledge, improving teaching practices, and experiencing positive personal transformations and greater appreciation of other disciplines (Leal & Gonzalez, 2017).	Insufficient opportunities for cross-university collaboration and learning where academics can learn from each other about developing content, pedagogy, and assessment (Bammer et al., 2023).
Conflicts	“Prior to the initiative, ensure that collaborators possess a praxis of self-reflection about their own learning, epistemic viewpoints, and mental models. This practice increases the possibility that they will learn together throughout the process.” (Vanasupa et al., 2012, p. 182).	
	“Practice (or develop) the skills to monitor the group’s own progress and growth throughout the term and to work with conflict. Embrace conflict as the visible sign of differences in hidden assumptions and mental models. Allow the conflict to serve as the entry point into exploring each others’ views” (Vanasupa et al., 2012, p. 182).	
Staffing	Advancing transdisciplinary by “hiring and training of deep generalists who can serve to foster connections among disciplinary faculty and programs” (Evans, 2015, p. 83).	Faculty workload increases due to collaborations and planning and delivering new curricula (Lenhart & Bouwma-Gearhart, 2022; Osborne & Dibben, 2017) and the need to work outside of the semester to design the transdisciplinary course (Velez et al., 2022).
	Having casual staff and a full-time coordinator was more economical (B. Le Hunte & G. Kligyte, personal communication, August 24, 2023).	The initial model of co-creating the subjects with academics was costly (B. Le Hunte & G. Kligyte, personal communication, August 24, 2023).
		Graduate teaching assistants’ lack of capacity to manage the course’s complexity can increase teaching faculty’s workload (Velez et al., 2022).
	Employing fresh PhDs or near completions as part of a program to prepare them for academic life (E. Lakey, personal communication, September 11, 2023).	Students’ preference for content experts (e.g. at Assoc. Prof. level) creates a dissonance with hiring contract staff to teach, which is a casualised workforce model (E. Lakey, personal communication, September 11, 2023).
		Difficulty to get buy-in to teach into the discovery subjects (E. Lakey, personal communication, September 11, 2023).

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Team-teaching		Problems for hiring staff due to uneven enrolments, with 1,200 in semester 1 and 600 in semester 2. (E. Lakey, personal communication, September 11, 2023).
		Students not knowing who to go to because there are three teaching staff (E. Lakey, personal communication, September 11, 2023).
		Not having enough faculty members to make a long-term commitment to co-teaching leads to abandonment of the model (Imbruce & Prazak, 2020).
		Hidden labour that goes into co-teaching efforts can add up to substantial time (Velez et al., 2022).
		Lack of mechanisms to enable a more accurate accounting of the workload involved in team teaching (Vanasupa et al., 2012).
Community engagement	Funding to “hire a project manager who was well-connected and respected in the community, and well-versed in the approaches and goals of our course” (Imbruce & Prazak, 2020, p. 190).	Limited established mechanisms for collaboration community (Imbruce & Prazak, 2020).
	Consistent and skilled communication between course instructors, project manager, and community participants (Imbruce & Prazak, 2020).	The lack of sustained funding and senior faculty support for the community engagement component of the course led to its abandonment in subsequent iterations (Imbruce & Prazak, 2020).
	Having an established database of industry partners (800-1000 different organisations), starting small, and using a snowball approach and good publicity material to build this database. Hiring staff to manage the database and relationships, which includes signed contracts (B. Le Hunte & G. Kligyte, personal communication, August 24, 2023).	Academics’ lack of industry-related experience and established industry partners (B. Le Hunte & G. Kligyte, personal communication, August 24, 2023).
Review / evaluation	A one-year review and feedback from students and instructors can help identify issues for quality improvement (Osborne & Dibben, 2017).	
	Designing new evaluations that can measure specific transdisciplinary learning outcomes (Velez et al., 2022).	

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