Boundary Crossing Within Hybrid Learning Environments in Vocational Education in the Northern Netherlands

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Abstract

In an attempt to answer the call to take on a key role towards sustainable development and to adapt to a changing labour market, educational institutions are realizing that traditional ways of teaching are not sufficient anymore to satisfy the expectations of both students and the broader society. Driven by sustainability and circularity transitions vocational education institutions in the north of the Netherlands are adapting new educational concepts such as hybrid learning environments and forms of integrated learning. Meanwhile there is a growing interest within educational science regarding the concept of boundary crossing and the learning potential this holds, especially for vocational education. This thesis investigates how hybrid learning environments within a vocational education context in the north of the Netherlands are facilitating boundary crossing as well as teaching a boundary crossing potential. For this literature research into the concepts of integrated learning, boundary crossing, and hybrid learning environments was conducted. This was contrasted with the results of a series of semi-structured interviews with educators from vocational education from the north of the Netherlands, who had set up hybrid learning environments at the institutions, was held. The studied found that despite only existing for a couple of years the hybrid learning environments showed high levels of integrated learning, however subsequently expected high occurrences of boundary crossing could not be identified. Rather than being the place where boundary crossing takes place, hybrid learning environments were conceptualized as spaces in which boundary crossing can be practiced in a safe environment and boundary crossing competences can be taught. Given the limiting nature of state-mandated requirements, future research should be of transdisciplinary nature itself and include both educators, students, educational scientists as well as educational policymakers.

Keywords: Hybrid learning environments; boundary crossing; integrated learning; boundary objects; vocational education; transdisciplinary teaching

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Boundary Crossing Within Hybrid Learning Environments in Vocational

Education in the Northern Netherlands

Over the last two decades there is a growing awareness that in order to tackle the great challenges the world faces, education is an important enabler and fundamental part of sustainable development. This is evidenced among others on a global level by the UN Decade on Education for Sustainable Development (ESD) and the subsequent ESDfor2030 Roadmap (UNESCO, 2014; UNESCO, 2020) or on a national level by the broad support for the Whole School Approach for Sustainability (SME, 2022) or the emergence of organisations such as Cooperatie Leren voor Morgen (Cooperatie Leren voor Morgen, n.d.). However, especially on regional level in the northern Netherlands we have seen this through the establishment of a sustainability focussed faculty of the University of Groningen (Rijksuniversiteit Groningen, 2018), the establishment of SPARK the Movement, a shared educational programme of Frisian tertiary education surrounding sustainability and circularity (SPARK the Movement, n.d.), or the growing number of practor- and lector-positions pertaining to sustainability in education (Practoraten.nl, 2023). Along with the growing need to include sustainability in education, there is a growing consensus that traditional teaching methods and learning environments are not sufficient to transmit the skills and mindset needed to engage with these complex transitions (Evans, 2019). Furthermore, this increasingly complex and interdisciplinary world will not allow for the linear career paths for which we used to educate and will lead to the fact that the students of today will switch between different disciplines or fields (Smit & Tremethick, 2013). While switching between different disciplines or fields or between school and work has traditionally been seen as an obstacle to be overcome, a growing body of literature surrounding the concepts of *Boundary Crossing* and *integrated learning* suggest that exactly when moving from one practice to the other (boundary crossing) or combining them in various ways (integrated learning), this holds a special learning potential (Akkerman & Bakker, 2011;

Helmane & Briška, 2017). Especially within VET education, boundary crossing is receiving increasing attention as a means to reconceptualize our learning. Relating to this there is also a growing body of literature about the establishment of hybrid learning environments within VET education, where theoretical and practical information are interwoven with each other (Bouw et al., 2019; Bouw, Zitter, & de Bruijn, 2021; Bouw, Zitter, & De Bruijn, 2021; Cremers et al., 2016). In this research I will explore the current state of hybrid learning environments within VET education in the northern Netherlands and look how the concept of boundary crossing unfolds within a hybrid learning environment. I argue that a hybrid learning environment plays both a role in providing an environment in which boundary crossing can be practiced while at the same time form a boundary object which supports different ways of integrated learning surrounding real life and often sustainability related issues.

Literature Review

Defining Concepts within Educational Sciences

Given that within the field of learning sciences there is no straightforward definitions of various emerging concepts such as hybrid learning environments (see the difference between (Chen & Chiou, 2012) and (Zitter & Hoeve, 2012)). On the one hand hybrid relates to the merging of digital and analogue spaces, while at the other hybrid learning environments are spaces where theoretical and practical education become intertwined. In this paper when referring to hybrid learning environments I am referring to the latter, following the conceptualization by Zitter and Hoeve (2012). Similarly, this is the case for the differences, overlaps and interrelations between the concepts of multidisciplinary, interdisciplinary, and transdisciplinary (Choi & Pak, 2006; Fenwick, 2006; Helmane & Briška, 2017). As Fenwick (2006) states some experts are even unhappy when asked to define the concepts they speak about: *One said flatly, "I won't define learning – it should be clear in how I describe my study". Another said, "Don't ask me that question!".*

However, in order to ensure readability of my paper and traceability of my argument, it is necessary to outline in what way I understand the concepts I am using in this paper.

Multidisciplinary, Interdisciplinary, and Transdisciplinary

Starting with the concepts of multidisciplinary, interdisciplinary, and transdisciplinary I find that defining these concepts not only is relevant within learning sciences (Helmane & Briška, 2017). The need for clear definitions of these concepts is also growing within for example the fields of sustainability science (Stock & Burton, 2011) or health research (Choi & Pak, 2006). Across these fields they are seen as distinct, but related, indicated often by the overarching term of integrated-learning or -research (Helmane & Briška, 2017; Stock & Burton, 2011). In these cases, they are also seen on a scale of integration, where multidisciplinary ranks as a low level of integration between disciplines, interdisciplinary as a medium level and transdisciplinary as highly integrated. Choi and Pak (2006) agree that these terms indicate different points on a continuum, however also contend that the higher the level integration, the nature of the outcomes of a respectively multi-, inter-, or trans-disciplinary approach is changing. In their own words a multidisciplinary approach (2 + 2 = 4) is comparable to a salad bowl, where individual elements remain intact, and an interdisciplinary approach (2 + 2 = 5) is comparable to a stew, where different elements are merged, while a transdisciplinary approach (2 + 2 = yellow) is comparable to a cake, where different elements have together formed something entirely new.

Accepting all this, in this paper I will follow the conceptualization of Helmane and Briška (2017), as their conceptualization focusses on an educational context which is most suitable for my research. An overview of distinctive and common features of each concept can be found in Table 1.

Summarized one can describe *multidisciplinary teaching/learning* as a learning concept which focusses on a specific theme or topic, which relates to different disciplines but

Table 1. Common and Distinctive Features in Approaches to Integrated Teaching/Learning

	Integrated teaching/learning		
	Multidisciplinary	**Interdisciplinary**	**Transdisciplinary**
Commonalities	Includes more than one subject Pretends to be more effective than learning each subject separately Builds a holistic system Students are active learners		
Basis for integration	Topic	Skills and concepts common for two disciplines	Actual social/ economical/ cultural/ ecological problem from actual life
Connections	Topic has interconnections with each discipline.	Processes and concepts of one discipline help to develop understanding about the other one	All disciplines have particular sense in life context
Focus	On specific subject knowledge and skills Subject-oriented	On student's skills development Student-oriented	On complex problem-solving meeting values and actual needs of society Problem-oriented
Aim	To obtain new knowledge easier	To indicate, use and develop particular general skills	To solve a problem, using content knowledge and skills
Results	Understanding the topic from perspective of different disciplines. Disciplined do not influence each other Routine expertise	Concepts and skills of one discipline change the methods of other discipline. Adaptive interdisciplinary expertise	Innovative solutions of a problem by developing the content and tools of different disciplines
Learning outcomes	Different discipline knowledge and skills	Deeper levels of conceptual coherence, varied set of reasoning and meta cognitive strategies	Life skills and understanding the sense of learning
Starting point	Relation of concepts and processes of one-subject to the topic	Reflecting students' skills and competences – possessing and lacking ones	Questioning in order to indicate the problem – reflecting students' life experience and world actualities
Decisions	What content must be learned? Common topic for particular period	What concepts and skills are necessary for me – my needs, interests, competences?	Which skills and content can help to solve the problem?
Feedback	To what extent did I learn the content?	Which my skills are developed?	How my learning helped to resolve the problem?
Cooperation	Student–teacher Student–student	Student–teacher Student–student Teacher–teacher	Student–teacher Student–student Mutual cooperation of all teachers School–community
Critics	Structured, closed set of knowledge	Individualism, lack of interest in actual knowledge	Complex content and activities

Retrieved from Helmane and Briška (2017).

does not cross the boundaries of these disciplines. *Interdisciplinary teaching/learning* focusses on the overlap between different disciplines and similar concepts or processes that are part of multiple disciplines. It frequently crosses the boundaries of different disciplines.

Transdisciplinary teaching/learning aims to strongly integrate different disciplines by focussing on real life problems. Rather than crossing boundaries between different disciplines, it aims to blur/resolve these boundaries all together.

Boundaries and Boundary Crossing

As already seen when discussing different integrations of disciplines, we naturally arrive at the boundaries between these disciplines. This could simply be the line dividing different fields of study, up to the difference between the fundamentally different character of the school and the work field. In general, we could state that we encounter boundaries all throughout our lives due to sociocultural differences between different aspects and areas of our society. However, when discussing integrated learning, we see that especially at these boundaries there seems to be a learning potential (Akkerman & Bruining, 2016; Akkerman & Bakker, 2011; Bakker & Akkerman, 2017). In order to conceptualize boundaries as a concept which holds a valuable place in a learning process, boundaries are not merely the dividing line between two fields, but a barrier which would not naturally permit passage. Therefore, after analysing the existing literature on boundary crossing Akkerman and Bakker (2011) define a boundary as *a sociocultural difference leading to discontinuity in action or interaction. Boundaries simultaneously suggest a sameness and continuity in the sense that within discontinuity two or more sites are relevant to one another in a particular way.*

To understand the claimed learning potential that these boundaries hold, we need to look at what happens when we approach these boundaries. Alsup (2006) gives us an example from teacher education, where a student teacher faces different pedagogical values at the secondary school where they are teaching versus those pedagogical values that prevail in the teacher education programme they are following. This difference of values would prevent teachers from both domains to collaborate or work in both domain, which therefore constitutes a discontinuity in action or interaction. At the same time both domains are concerned with

teaching and pedagogical values and therefore this discontinuity is relevant. This means that this difference of values constitutes a boundary.

However, this student teacher is due to their schoolwork present in both domains meaning that they must *cross* this boundary when moving from one context to another. This can lead to struggles when the learned pedagogical values cannot be sufficiently applied in their schoolwork or when their experiences with the schoolwork do not align with what they learn in their teacher education programme. At the same time, due to their different background they can bring new innovations or perspectives to the school where their working and their different experiences at the school can help them sharpen their understanding and view of what they learn in their education. This ambiguous nature due to boundaries being both-and as well as neither-nor phenomena, creates what Akkerman and Bakker (2011) describe as a "sandwich effect" for boundary crossing people. One can see this visualized in Figure 1 where the overlapping area contains the patterns of both circles (respectively horizontal or vertical stripes), representing a both-and phenomenon. However, at the same time the intersection of the two patterns forms an entirely different pattern and thereby differentiating it from either area, representing a neither-nor phenomenon.

Figure 1. Visual representation of the ambiguous nature of boundaries. *Own visual.*
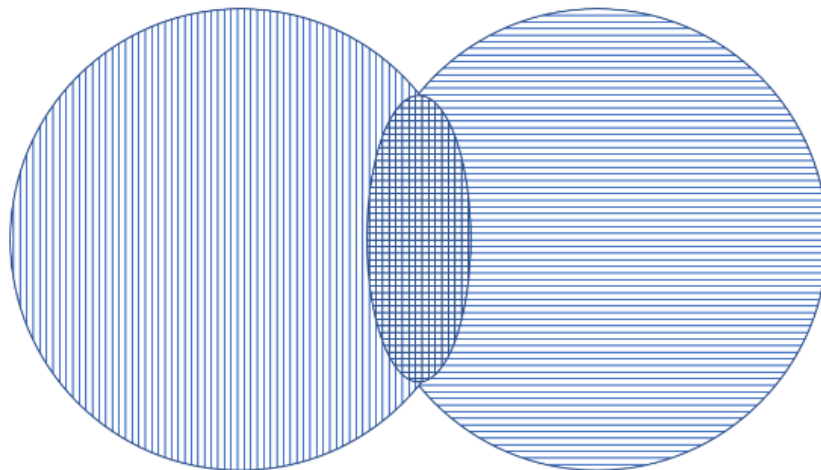
Because of this ambiguous nature, these people at the boundary both enact and strengthen this boundary as well as blurring it. The former they do by being in each of the domains different from the majority, thereby being symbolic for differences with the respectively other domain. The latter they do by bringing a part of each of the domains to the respectively other and integrating this with general context there.

Boundary Objects

Next to people crossing these boundaries, various studies describe the role of *boundary objects* which are objects that

> *both inhabit several intersecting worlds and satisfy the informational requirements of each of them… [They are] both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites. They are weakly structured in common use, and become strongly structured in individual site use.*
>
> (Star & Griesemer, 1989)

As such boundary objects are artifacts that exist, or at least can exist/are recognized, in both domains on either side of a boundary and as such can connect different actors from both worlds with each other. In the words of Star and Griesemer (1989), they form a "means of translation" in places where actors from different domains meet and collaborate.

However, Akkerman and Bakker (2011, p. 141) also describe that boundary objects never bridge this gap just by itself and *can never fully replace communication and collaboration.* Several studies note that these objects only hold a boundary crossing function in specific contexts or in the presence of additional information and that they can lose their boundary crossing function over time (Barrett & Oborn, 2010; Lee, 2007; Lutters & Ackerman, 2007; Pennington, 2010).

A similar situation goes for the learning potential of these boundary objects. As Williams and Wake (2007) note, they often can take on the form of a black box, in which they might still perform a boundary crossing function, however may only provide learning opportunities when recognized as a black box and opened up.

Learning Mechanisms of Boundary Crossing

Let us now dive deeper into the learning potential of these boundaries. Akkerman and Bakker (2011) discern four different mechanisms that take place at these boundaries and which enable learning. These are *1. Identification; 2. Coordination; 3. Reflection; and 4. Transformation.* In a later publication they investigate the learning potential of boundary crossing in specifically vocational education, they look closer into these learning mechanisms and complement them with their own data and examples from vocational education and training (Bakker & Akkerman, 2017).

Identification concerns itself with making clear where boundaries between different positions, practices or domains lie, and making sense of these differences and what they mean for one's own identity. This identification happens mostly along two separate processes. The first being *othering. E*stablishing one's own identity or practice, by pointing out the differences to other, but relating identities. Next to othering we speak about *legitimizing coexistence*. Often following the demarcation of a different group from one's own through othering, the legitimacy for existing together is sought. By actively having to identify one's own practice, role or identity, students get a better understanding of what it is they are doing and make more salient what exactly they need to know or be able to do in a respective position.

Coordination is mainly relating to creating or maintaining a collaboration across the boundary. The processes at play here roughly relate to either processes that enhance communication between different sides of the boundary or to processes that make moving across the boundary easier. Among the first we can find the need for *a communicative*

connection between different actors as well as *efforts of translation* between both sides of the boundary. Relating to the latter coordination entails *enhancing boundary permeability* as well as *routinization.* What should be noted is that in all of these processes the role of boundary objects often is mentioned. These boundary objects can either fully/partly become the means of communication and/or translation as well as become a means of enhancing the permeability of the boundary as well as strengthen routinization by facilitating/supporting the boundary crossing of actors of both fields. As opposed to identification, coordination is not aimed at reconstructing the boundary, but rather at transcending it.

In the *Reflection* mechanism the role of *perspectives* is key. Going a step further from identification, when actors start to reflect, they can define and formulate their own perspective on both their own as well as other practices or domains. In turn they can then also contrast this with the perspectives that others have of the respective disciplines. This we call *perspective making*. On the other hand, when critically examining the perspective of others on their own practice or domain, they can learn new things about themselves, which is called *perspective taking*. This can help actors to better understand their own and other's practices and can help in aforementioned coordination mechanisms. Similar to the coordination mechanisms boundary objects can play a big role in facilitating or assisting the *reflection* mechanism.

Lastly the *Transformation* mechanism occurs when, potentially due to influences of the other three described mechanisms, significant changes in practices occur. These changes can either occur within practices or domains but can also result in the emergence of new practices in between them, at the boundary. There are various processes that will lead to transformation. In order to manifest profound changes in a practice or domains, there first needs to be a *confrontation* with a problem or threat occurring. This means that not only a problem or threat needs to be present, but that actors within the field or domain also recognize this as such and engage with it. Often a direct response that follows this confrontation is the *recognition of*

shared problem space. With this recognition one accepts that the problem is something that should be addressed across the boundary and at the same time this recognition can give a direction to the intended transformation. When recognizing this shared problem space and deciding to collaborate within this space a third process emerges: *Hybridization.* Here elements of both domains come together and form something that is different from the mere sum of the original elements. This can take shape in form of new tools or concepts but can also lead to the emergence of entirely new practices or fields. To achieve real transformation this hybridization then should be followed by what is called *Crystallization*. Here the hybrid elements created at the boundary need to become their own independent object or concept and subsequently need to be implemented into existing practices or domains in order to make a real impact. Already here it can be seen that transformation goes a lot further than other learning mechanisms at the boundary and Akkerman and Bakker (2011) also note that especially this crystallization is rarely realized. While one could speak of transformation at this point already, there are two more processes that are relevant in order to maintain the transformation and especially preserve the boundary crossing potential. These are *maintaining the uniqueness of the intersecting practices* and *continuous joint work at the boundary*. Both of these suggest that transformation is not aimed at resolving the boundary, but rather at reaping its benefit and by the same process reinforcing the boundary to be able to keep reaping its benefits in the future.

When we contrast these learning mechanisms with the earlier explained approaches to integrated learning, we can state that with growing levels of integration more of the aforementioned learning mechanisms become relevant. For multidisciplinary learning both identification as well as reflection are most relevant, while when moving towards interdisciplinary learning in addition to these two, also coordination starts to play a bigger role. In order to also achieve transformation, one will need to take a transdisciplinary approach, which naturally will utilize each of the other learning mechanisms too. When one understands

integrated learning in a broad sense as learning which draws from different disciplines, one could draw from the previous analogies between the learning mechanisms and the different forms of integrated learning, that the higher the level of integration, the closer to the boundary one moves.

Locality of Boundaries

Having discussed boundaries and its learning potential in a broader sense, it is important to define which boundaries specifically we are looking at in this thesis. Akkerman and Bakker (2011) discern different boundaries based on the places where the boundaries occur. They differentiate between 1. *boundaries within work, 2. Boundaries within school, 3. Boundaries in everyday life 4. Boundaries between these domains.* While the majority of studies analysed by Akkerman and Bakker fell within the first category, the last category, especially the boundary between school and work, is of most relevance to this thesis.

While this difference between work and school, and especially the movement of people between the two, has be conceptualized in various ways such as the *transfer of knowledge from one domain into the other* (Jackson, 2011; Säljö, 2003), various scholars prefer to use the concept of boundary crossing to analyse what happens when (VET-)students move between school and work settings (Bakker & Akkerman, 2017; Konkola et al., 2007; Tuomi-Gröhn & Engeström, 2003). Given that VET students regularly move back and forth from school- to work-settings, this makes boundary crossing an interesting concept through which to analyse the learning potential of integrated learning.

Hybrid Learning Environments

Lastly, I want to present a clear definition of what I refer to as a hybrid learning environment. Various definitions exist for this name and various other names exist for the concept I am referring to (Chen & Chiou, 2012; Park & Son, 2010), but I am following the conceptualization from Zitter and Hoeve (2012). Here a hybrid learning environment is

conceptualized along two dimensions. The first dimension deals with the question whether a learning environment is either constructed or realistic. In a constructed learning environment, the context in which the learners are educated is designed by the educator with a specific learning outcome in mind. In a realistic learning environment, the context is defined rather by the 'outside'-world and influenced by a variety of external factors.

The second dimension is defined by the intended 'goal' of the learning environment. On the 'acquisition'-side of this dimension there is a focus on gaining or acquiring knowledge, usually a specific and predefined set of knowledge. On the other end of this dimension, the 'participation'-side, the exact outcome is secondary and can differ, as the focus is on 'experiencing' and participating in a setting in which one ought to work later. Here the intended goal is much less on acquiring a specific set of knowledge, but rather on familiarizing oneself with the necessary skills and relevant nuances as well as present norms and values in the field of work.

Figure 2. The four learning situations in hybrid learning environments
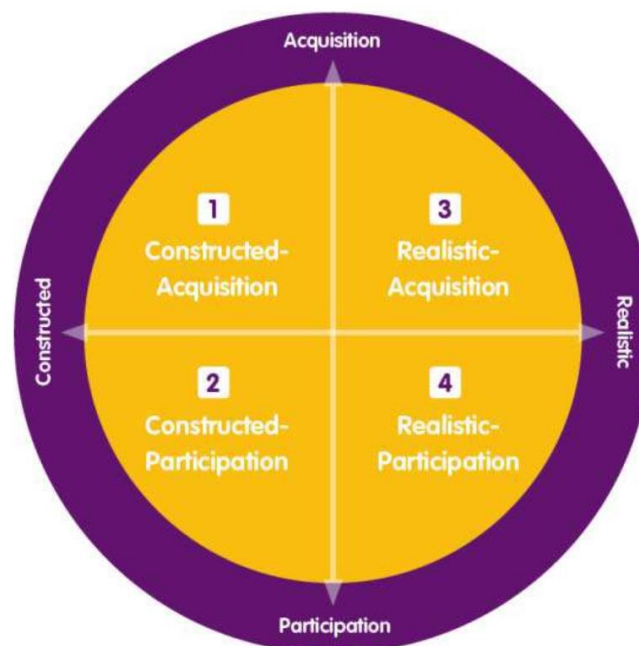
Retrieved from Zitter and Hoeve (2012).

When overlaying these two dimensions and mapping them on a two-dimensional grid we can identify four separate learning situations which are 1- Constructed-acquisition, 2- Constructed-participation, 3- Realistic-acquisition, 4- Realistic-participation. This is visualized in Figure 2. A hybrid learning environment should enable all four of these learning situations, as well as align them with each other.

Authentic Tasks

In order to achieve this a hybrid learning environment makes use of *authentic tasks.* Authentic tasks are

> *preferably performed in realistic contexts. Tasks not only involve the application of instrumental skills but also more general competencies such as arranging, planning, and organization. Authentic tasks are assignments taken from vocational practice. These assignments might need to be re-designed to be accessible to learners (e.g., divided into component parts or sub tasks) but the complexity of reality should remain an essential feature of the tasks"*

(De Bruijn & Leeman, 2011) as cited in (Zitter & Hoeve, 2012)

In a hybrid learning environment these authentic tasks are structured and positioned in a way that makes it possible for the learning process to seamlessly interweave working on these tasks with moments to step out of them and focus on more theoretical ways of learning. This is visualized in Figure 3. This gives educators the possibility to bring their students easily from one learning situation into the other. For example it is easy to go from a situation where students are working on the authentic task at hand by themselves or in groups (quadrant 4) and easily stop the work to provide a brief theoretical lesson (quadrant 1), to point an at that moment occurring problem and explain the causes and solutions (quadrant 3) or to go over a specific skill necessary in a certain situation and have students practice this (quadrant 2).

In order to study these hybrid learning environments Zitter and Hoeve (2012) decomposed these into 4 different perspectives. Namely the *agency perspective,* the *spatial perspective,* the *instrumental perspective,* and the *temporal perspective.*

Figure 3. Authentic tasks and intertwined learning processes.
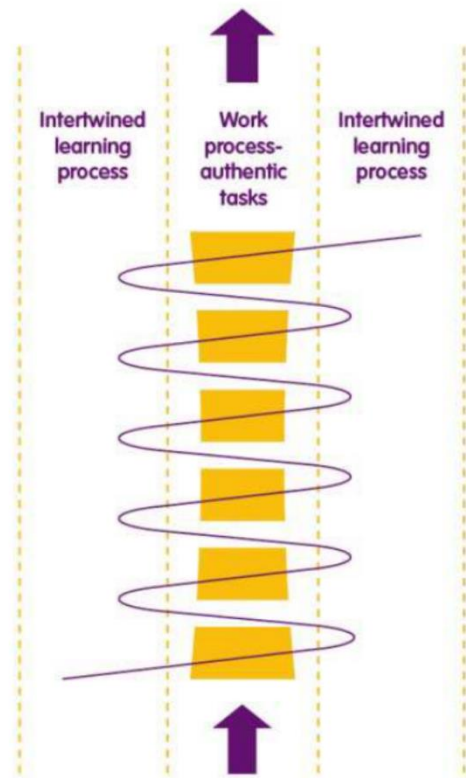
Retrieved from (Aalsma, 2011) as cited in (Zitter & Hoeve, 2012).

When wanting to make the different elements of a hybrid learning environment visible in order to better understand it or to make it communicable next to identifying the authentic tasks of the learning environment one should answer the questions: Who is active in the learning environment? Which roles do they play? (T*he agency perspective*). Where does the learning take place? Are they physical or digital? What purpose do they serve and are they adaptable? (*The spatial perspective*). Which tools and artifacts are used within the learning environment? What is their function? (*The instrumental perspective*, this one is strongly related

to the use of boundary objects). Lastly, when is learning taking place? Is there artificial time-pressure due to deadlines or is more than sufficient time made available on purpose? (*The temporal perspective*).

When taking these into account, a hybrid learning environment can be taken apart and studied, with the aim of understanding as well as the wish of improving the way in which learning takes place within them.

Having presented and laid out the different models of looking at learning in between theory and practice, this is sufficient to understand and relate the different models to each other. Keeping these three perspectives in mind I carried out semi-structured interviews with educators from different vocational education institutions in the north of the Netherlands in order to answer the question: How are hybrid learning environments within a vocational education context in the north of the Netherlands facilitating boundary crossing as well as teaching a boundary crossing potential?

Methodology

Research setup

To gain a better understanding of how and in which forms integrated learning and hybrid learning environments are already being implemented in Vocational Education in the north of the Netherlands a series of semi-structured interviews were conducted. Furthermore, the aim was to draw insight from these interviews regarding the forms and to which degree these hybrid learning environments are utilizing the learning potential of boundary crossing.

Rather than proving the effectiveness of different educational approaches the goal of this research was to shed light on the processes, complexities and difficulties that arise when schools open up and either start to send out their students and teachers to collaborate with local businesses and organisations or invite these businesses and organisations into the school.

Special attention was therefore given to the personal experience of the educators themselves, as well as their motivations and observations when implementing new forms of learning.

Participant recruitment

Participants were recruited from within my own professional network, with help of my supervisor and a colleague of mine. Through my work for SPARK the Movement, a shared educational programme of all Frisian tertiary education institutions regarding circularity and sustainability, I have been in contact and in collaboration with various educators working on innovative forms of education, especially within the north of the Netherlands. Various of them could be described as hybrid learning environments.

All participants were teachers or coordinators of different forms of hybrid learning environments in different vocational education institutions. Of the four participants, three were teachers with different extra roles. One was project leader and educational coordinator sustainability related programme aimed at building an interface and shared space between the school. Even from different roles, all were main responsible for a project/educational environment/subject, in which students work with external business or organisations on real life questions. Even when in slightly varying degrees all of them were involved in the set-up of these projects from an early stage onwards.

Notably, only one of the participants had been working in education for more than 10 years now. Two of the participants were previously working in the business sector and started working in education respectively 9 and 4 years ago. The last participant was still at the start of their career and started working in education 4 years ago after completion of their master's degree.

The geographical scope was limited to the northern Netherlands, comprising of the three provinces of Friesland, Groningen, and Drenthe. However, eventually only interviews with

participants from Friesland and Groningen were conducted. Between these two provinces the participants were evenly spread with two working on Friesland and two working in Groningen.

Data collection and Analysis

With these participants semi-structured interviews were held of which took between 45 and 65 minutes each. 3 out of 4 interviews were conducted in person, with the remaining one being conducted via Microsoft Teams. The interviews were recorded for the purpose of transcribing them later, however neither the recordings nor the transcripts are shared outside of the research team.

For the purpose of the interview a guide was developed based on the current literature on the concepts of boundary crossing, integrated learning and hybrid learning environments. This can be found in Appendix A.

The interviews were conducted in Dutch as this was the preferred language for all of the participants as well as the main language in the learning environments the participants worked in.

The recordings were transcribed using an online transcription tool and subsequently checked manually. This was paired with the first round of analysis and relevant highlights in the transcript were applied.

In a subsequent round of coding the transcripts were labelled as concerning the *intention, implementation, or outcome* of the hybrid learning environment. This could also lead to certain passages labelled double. After this the text passages from all interviews concerning *intention* were combined. Idem ditto for the passages concerning *implementation* or *outcome*. These combined documents were then scanned for reoccurring themes between the different interviews. Based on these themes all transcripts were analysed again, relevant passages were identified and coherence or disagreement between different participants was further worked out.

Methodological limitations

Given the small sample size of this research it is difficult to draw any universally valid conclusions regarding hybrid learning environments or learning potential of boundary crossing from this. However, given that within these four interviews the participants themselves shared multiple different examples of hybrid learning environments in their schools and the goal of this research is rather to provide a teacher's perspective on the topic, I believe it can still provide a valuable contribution to the current research.

Furthermore, this focus on the teacher's perspective addresses a second possible concern regarding the validity of this research. Given a pre-existing acquaintance with three of the four participants, one could wonder whether the answers are biased towards what they believe I would have liked to hear. Given the focus on the teacher's perspective, which was reiterated at various point during the interview, this was not deemed too much of a problem as there was therefore only a limited scope of answers which could considered to be "courtesy answers". There might have been a tendency to overreport on the positive sides of their projects. However, given that there was already a selection bias towards up and running hybrid learning environments, there is no pretence that this research provides any conclusive evidence regarding hybrid learning environments.

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Results

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Intentions

Although all four participants worked in different fields of vocational education and even within their own institutions the different hybrid learning environments had their differences, especially when it came to the motivations to set-up hybrid learning environments there was significant overlap. All participants mentioned the wish to adapt with the hybridization of their education to current and future developments of both society and the

labour market. All reported a growing focus on practical knowledge and skills. Especially soft skills such as collaboration, reflection and flexibility were mentioned multiple times by different participants. In line with this, all four participants attempted with their hybrid learning environments to give students more responsibility and more agency about their own learning process. This took on different forms such as working in groups were students in their 3rd or 4th year were responsible for supervising/supporting the 1st or 2nd years in their group. However, at one educational institution this went so far that in principle a group of students themselves were responsible for the entire hybrid learning environment. This included acquiring the projects for their fellow students, keep in contact with the businesses that provided questions for these projects and to organize workshops or classes in case additional knowledge/information was required by any of the students working in the hybrid learning environment at that time. Teachers were available to support or take over if necessary, but by default students were responsible.

Next to the perceived learning potential of giving the students higher levels of responsibility, while still in a relatively 'safe' school setting, all participants mentioned that this also leads to a significant increase in motivation of students. The motivation of students was mentioned across the board to be one of the main drivers behind the setup of hybrid learning environments. Two of the participants also framed their setting up of hybrid learning environments within the general aim of their institution to stronger engage with sustainability and embed it in their education. One of the participants specifically mentioned the wish to be able to work with the newest digital innovations in their field as one of the core drivers of setting up the hybrid learning environment.

Implementation

When it came to the specific implementations of the hybrid learning environments there was a bigger difference between the different educational institutions. Although it must be

mentioned here that 3 of the 4 participants talked about multiple hybrid learning environments, which between them had difference as well.

However, what most of the different learning environments that were mentioned had in common that they almost always worked in groups of multiple students, often also mixing students from different backgrounds or students who are at different moments in their studies. All participants also mentioned the changing role of teachers in light of these changing learning environments. Where teachers previously were mainly knowledge experts, in these hybrid learning environments their role changed to that of coach or facilitator. While multiple of the participants reported that this change also led to uneasiness and uncertainty, however after a period of acclimation they also saw the positive sides of it. One participant said: *"... it took me at least a year before the teacher told me: 'I thought I would hate this, but actually it is really fun.' Exactly because you don't know what is coming and you can just say: 'I don't know, go figure it out. Have a look on google and then please come back. Because I also don't know'"*. This is a feeling that was also echoed by other participants, although they also mentioned that teachers still enjoyed teaching in a more classical sense, that there should be a balance.

As all of the projects were either still in their pilot or in their starting phase, multiple participants also mentioned that it is still very much a work in progress and that they are also continuously changing and improving things about the learning environment.

Difference could be observed when it comes to the temporal as well as the spatial dimension of the different learning environments. While some of them were short-term intensive projects, ranging in length between 2 days to 2 weeks, others were longer-term trajectories that usually take up between 10 and 20 weeks. When it comes to the places where the projects were carried out there are vast differences between the projects. Where some projects were mainly carried out within the school, usually in designated spaces with necessary equipment for the specific field, where the external stakeholders could visit, others happened

largely at the location of the external stakeholders. However, in all cases there was a certain amount of flexibility in this. For example, when the locality was mainly school-based the project might include a site visit at the external stakeholder or an external stakeholder might come to school to give a guest lecture or for a kick-off in case the majority of the project happened at their location. Others even had a specific space managed by the school, but away from the main school locations, that were specifically designated for these hybrid learning environments. However, all of them emphasized the role the location and the physical environment played in bringing students and stakeholders on the same level, to make them equals and partners in the project. This goal was also mentioned multiple times as an integral part to the success of these projects.

While all of the projects included possibilities for theoretical intermezzo's, on demand workshops or classes (elements of a hybrid learning environment), some even attempted to align other theoretical classes or other parts of the curriculum, such as language or math classes, to the project at hand. Yet, this was only possible for a small number of projects or sometimes happened 'accidentally'. Depending on this sometimes the hybrid learning environment could also be substitutionary to the formal curriculum and the state-mandated learning outcomes. Most of the projects were therefore complementary to the formal curriculum, providing either additional depth or breath to the topics and themes in the formal curriculum.

This tension between new teaching practices and the formal requirements was also mentioned at other times, for example as a limiting factor when wanting to implement hybrid learning environments. Because the real-life tasks at hand are not always plannable, one institution makes use of theoretical cases to satisfy the formal requirements. While they aim to make these projects as similar to those carried out in the hybrid learning environments, they notice lower levels of motivation in their students and view these as having less learning potential. This can also be a source of frustration. At the same time this tension is seen as a

reason for scepticism from other teachers towards the concept of hybrid learning environments. However, all participants acknowledged that this is a new way of working and a new paradigm through which to look at education, which is time consuming, not always within the skillset or the formal training of the teachers and can therefore be scary and demanding, they all emphasised the overwhelmingly positive from students as well as those from teachers coming around after all as well. As for the tension between hybrid learning environments and the formal curriculum one participant mentioned: *The inspection taught me that if you have satisfied students, that find the learning that you are offering very pleasant, so if there is a high student satisfaction, the inspection will be the last one to criticize you for working so flexibly with your students.*

Another participant emphasised the importance of a shift of mindset in the following words: *The mindset changed. The mindset of teachers, the role of teachers turned 180 degrees. From knowledge expert to more of a facilitator, organizer, and coach. That is a mindset which is not anymore internally oriented but externally oriented. If you're externally oriented, then you are also accepting that the things are differently plannable. That there can be unexpected things, that something moves in a certain direction and that you have to get into the stream, instead of that you control the stream.*

Outcomes

Reported outcomes of successfully implementing these hybrid learning environments are various. The earlier mentioned higher motivation and engagement were brought up more often and were by one participant also linked to lower drop-out rates. Another participant also mentioned the role hybrid learning environments can play in empowering especially VET-students, which according to the participant were often stereotyped as *being demotivated, only wanting to eat at MacDonalds and shop at Primark and finding learning not a lot of fun.* In their opinion a traditional school environment rather triggers this stereotyping and is not very

conductive to an active learning mindset, while letting them work on real projects, trust them that they are able to do so successfully and trust that they are able to handle complexity is very well received by students and proves to be effective.

Similar thoughts are also shared by the other participants who note that while students find working on real life questions and with real businesses maybe a bit scary, but eventually very rewarding. While VET-students spend traditionally a lot of time doing internship, where they also work on real life questions within real businesses, one of the participants mentioned that hybrid learning environments feel a little 'safer' for the students, which makes it easier to assume that responsibility. This is in line with an often-reported divide between 'school' and 'work', in which students assume very different identities. Whereas at school they *walk around like little kids because they think that is allowed,* at their internship they are *the adult they actually are*. Hybrid learning environments are reported to break-up and diffuse this division leading to motivated students, while teachers are still closely involved and able to support or steer the development.

However, next to this mindset shift, multiple participants also report that this way they simply have more time to have students practice certain skills they can only learn by doing. Without the hybrid learning environments this would be more difficult as there are norms for 'supervised educational time' in which internships are not included. Because in hybrid learning environments there are still always teachers involved, they count into this supervised educational time while still providing students to practice various skills. In general, all participants report that hybrid learning environments have a big focus on competence development. However as one participant pointed out this development does not only focus on professional competence, but also very much includes personal and civic development. While this was not stated as explicitly by other participants, they did emphasize the broad range of learning outcomes and the focus on soft skills.

Lastly, all participants reported about the occurrence of 'side-products' of the hybrid learning environments. This could range from friendships or collaborations between students from different years or studies to the engagement of and connections between various business in the field till the interest from the press in certain developments. Furthermore, the participants reported the connections and interactions with the businesses and organisations in their sector as a great way for teachers to learn new skills or to keep up to date with developments in their fields.

Discussion

When comparing the responses shared by the participants with the different educational paradigms presented one of the first things that springs in the eye that the level of integration is very high for all of them. While they also report some multi- and inter-disciplinary approaches in their broader education, everything they describe within the hybrid learning environments they have set up can be labelled as transdisciplinary. If we contrast this with the argument presented earlier in this paper that higher levels of integration of education mean probably more boundary crossing behaviour.

However, this is not something that particularly came back in the interviews themselves. Certainly, students had to deal with new or unfamiliar roles, modes of working and interactions and at several times processes were mentioned that can be linked to the different learning mechanisms identified by Akkerman and Bakker (2011). Yet, there was little mention of back-and-forth movement across boundaries and the amount to which the learning mechanism can be identified within the results is not fully in line with what could be expected based on the degree of integration that was present in the described learning environments.

This could have multiple reasons. Firstly, this can be due to a reporting bias, as the interview was more geared towards the design of the learning environment itself and solely

included teachers or educational coordinators. The interviews were more geared towards their own experiences than those of their students. Furthermore, a conscious decision was made to not explicitly mention boundary crossing or the other theoretical frameworks during the interview itself, which might also have led to an underreporting of the occurrence of boundary crossing within hybrid learning environments.

Another cause could be that there indeed weren't very high occurrences of boundary crossing especially *due* to the high level of integrated learning all these hybrid learning environments displayed. Because this high level of integration within this hybrid learning environment the boundaries had become so diffused that crossing this boundary lost some of its relevance. While this cannot conclusively be stated on the basis of my research, this would have significant implications on the way we view the learning potential of hybrid learning environments. Future research will be necessary to shed more light on this, but this could follow various lines of thought.

First, there is a possibility that these boundaries are still very much in place within hybrid learning environments, yet there is a necessity to make them more explicit in order for them to fully unfold their learning potential. Possibly the hybrid learning environment in this case acts as a boundary object and as a black box as described by Williams and Wake (2007). This would make the boundary crossing learning potential contingent on recognizing the hybrid learning environment as a boundary object and paying special attention to this. In that case future research into the learning potential of boundaries within hybrid learning environments are necessary with a specific focus on the design principles underlying this hybrid learning environment.

Second, if these hybrid learning environments when set up successfully, effectively create a new space on that boundary which goes beyond being merely a boundary object. This might have happened when teachers and businesses collaborated and engaged as boundary

crossers in the setup of the learning environment and effectively achieved *transformation* at the boundary and created indeed a domain that is not school anymore nor is it practice.

This could have different consequences. It might be possible that after achieving this transformation, boundary crossing simply is not the right theoretical framework anymore to analyse the learning potential of these hybrid learning environments.

However, when we assume that boundary crossing requires a certain competence before it can effectively utilize the inherent learning potential as is being suggested by recent research (Oonk et al., 2022), maybe we should reconceptualize hybrid learning environments as spaces where boundary crossing can be taught, rather than that is the place where boundaries indeed are crossed. This would be in line with the responses from participants that hybrid learning environments provide 'safe' spaces in which students can practice and experience working with external stakeholders. Having spaces in which boundary crossing competences can be taught or practices, would be of great value to VET students and institutions, as the reported goals of the VET institutions are strongly correlating the reported learning potential of boundaries according to the literature.

This becomes even more attractive when we take into account that hybrid learning environments are far from the only occasions in which VET students have to cross boundaries over the course of their studies. Also in 'traditional' vocational education there is a growing trend towards more integrated education (Bouw, Zitter, & de Bruijn, 2021; Putra et al., 2022; Wildeman et al., 2021), which will likely lead to more situations in which students become boundary crossers. Especially in light of the reported strong divide that students themselves make between 'school' and 'work', it might be valuable to sensitize students to the process of boundary crossing, as otherwise there is a potential risk that instead of boundary crossing the student just slips into entirely different identities depending on whether they are at school or at work and thereby mitigating or even negating the learning potential of boundary crossing.

While more research into the occurrence of boundary crossing within hybrid learning environments is necessary, these considerations as well as the responses of the different participants shows the relevance of taking on a holistic approach to the design of the entire study programme of VET students. However, as of now the formal requirements are mentioned by various participants as hindering this. So, in order to effectively implement hybrid learning environments in a way that they can be used to teach boundary crossing competences which can be utilized later on in the study programme as well as in the later career of the VET student would require a fundamental rethinking of our current vocational education system and should be a collaborative effort by educators, educational scientists as well as educational policymakers.

Conclusion

The degree to which current approaches to hybrid learning environments are facilitating specific boundary crossing behaviour is difficult to identify on the basis of the current study. However, it seems that they are already, despite only being a development of the recent years, highly effective in blurring boundaries as well as engaging both students and businesses. Based on the results, it could be hypothesized that rather than stimulating boundary crossing behaviour, hybrid learning environments are more suitable for teaching boundary crossing competences that can be applied in other contexts in vocational education where VET students have to cross boundaries. Especially given the fact that the learn potential of boundary crossing according to the literature is in line with the goals that the vocational institutions have set themselves when it comes to the development of their students.

However, to gain better understanding of whether, how and when students cross boundaries while working within hybrid learning environments more research needs to be done. Furthermore, this research should include a strong focus on the experiences of students working and learning in hybrid learning environments themselves, as this was outside the scope

of the current study. Broadening this scope and also including the perspective of external stakeholders as well as more critically investigating and reflecting upon the design choices that were made when setting up the hybrid learning environment, would greatly advance the knowledge in this field.

It is important to keep in mind that next to the reported success in relation to students' motivation and external engagement, the set-up and development of these hybrid learning environments was also paired with frustration about formal, state-mandated requirements as well as scepticism from managers and colleagues. Therefore, it is advised that future developments in this field are not undertaken in isolation by only teachers or educational coordinators, but rather are a collective effort by educational scientists, educators, external stakeholders, educational policy makers and of course students themselves. Maybe this might even be a great authentic task to take on collectively within a hybrid learning environment or these different stakeholders have to cross some boundaries in the process. That way we might even advance the current state of vocational education -and- learn something in the process.

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Appendix A

Interview guide

- Can you tell me something about yourself, what your role is and what you think is important as an educator/why you are an educator?

- Can you briefly outline the learning environment you're working in/which you have designed?

    o Who else is part of these learning environments/are these all people that are involved in the learning environment?

    o Where do students follow these classes? Is it here or also elsewhere? In what situations would they go elsewhere?

    o In what way are students supported in this learning environment? What tools are they given?

    o How long are they part of this learning environment typically? Is it a continuous process or are there different aspects to it?

- How does this learning environment differ from the school at the one hand or a "normal" internship at the other?

- How do you connect things that happen in this learning environment with either the school or the field?

- Do you observe any differences in the students in this learning environment as opposed to "normal" teaching?

- Why do you find it important to work within such a learning environment as opposed to a "normal" teaching environment?

- When you started within this/ with setting up this learning environment, how did that go?

- Are there any things you would still like to share?