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Hybrid Learning Environments: Merging Learning and Work Processes to Facilitate Knowledge Integration and Transitions

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HYBRID LEARNING ENVIRONMENTS: MERGING LEARNING AND WORK PROCESSES TO FACILITATE KNOWLEDGE INTEGRATION AND TRANSITIONS

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This paper has been prepared by Ilya Zitter and Aimée Hoeve of the Centre for Expertise in Vocational Education and Training (ecbo), Utrecht, in the Netherlands. It provides background analysis for the Innovative Learning Environments (ILE) project. It discusses the concept of 'learning environment' and develops that of 'hybrid learning environment;' it offers a framework to analyse and design hybrid learning environments, and it applies this to specific VET examples.

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ABSTRACT

This paper deals with the problematic nature of the transition between education and the workplace. A smooth transition between education and the workplace requires learners to develop an integrated knowledge base, but this is problematic as most educational programmes offer knowledge and experiences in a fragmented manner, scattered over a variety of subjects, modules and (work) experiences. To overcome this problem, we propose a design approach and shifting the educational focus of attention from individual learners to learning environments. The broader notion of learning environments facilitates transitions by establishing horizontal connections between schools and the workplace.

The main argument of this paper is that combining or connecting aspects of school-based settings only is not sufficient to ensure learners will develop an integrated knowledge base. The concept and examples of "hybrid learning environment" show how formal, school-based learning and workplace experiences can be closely connected. The paper offers a framework of four coherent perspectives that can help to understand the complex nature of such environments and to design hybrid learning environments: the "agency perspective", the "spatial perspective", the "temporal perspective", and the "instrumental perspective". The framework is applied to three cases taken from vocational education in the Netherlands to describe what hybrid learning environments look like in contemporary educational practice.

RÉSUMÉ

Le présent document traite de la délicate transition entre les études et la vie active. Pour vivre cette transition dans de bonnes conditions, les apprenants doivent disposer d'une base de connaissances intégrées. Or dans la plupart des programmes éducatifs, l'acquisition des connaissances et des expériences se fait selon une approche fragmentée en une multitude de sujets, modules et expériences (professionnelles) déconnectés les uns des autres. Pour remédier à ce problème, nous proposons une approche conceptuelle et le passage d'une méthode centrée sur l'apprenant à une méthode centrée sur les environnements d'apprentissage. Se placer dans une perspective, plus large, d'environnements d'apprentissage établit des parallélismes entre l'école et le monde du travail, ce qui facilite la transition de l'un à l'autre.

Le principal argument défendu dans ce document est le suivant : se contenter d'associer ou de connecter uniquement des cadres axés sur la scolarité ne suffira pas pour garantir que les apprenants développeront une base de connaissances intégrées. Le concept «d'environnement d'apprentissage hybride » et les exemples de son application sont la preuve qu'un lien entre l'apprentissage formel dispensé dans les écoles et les expériences acquises dans le milieu professionnel. Ce document décompose le concept en quatre perspectives cohérentes susceptibles d'apporter un éclairage sur la nature complexe de ces environnements et de faciliter la conception des environnements d'apprentissage hybrides : la « perspective des acteurs », la « perspective spatiale », la « perspective temporelle » et la « perspective des instruments ». Cette décomposition est appliquée à trois cas empruntés à l'enseignement professionnel au Pays-Bas pour montrer comment se concrétisent les environnements d'apprentissage hybrides dans la pratique pédagogique d'aujourd'hui.

HYBRID LEARNING ENVIRONMENTS: MERGING LEARNING AND WORK PROCESSES TO FACILITATE KNOWLEDGE INTEGRATION AND TRANSITIONS

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1. Introduction

The emergence of hybrid learning environments is driven by changes in educational practice. Established educational practices are changing: established roles, resources and locations are being altered, extended and replaced. Cognitive apprenticeship (Brown, Collins and Duguid, 1989), situated learning and legitimate peripheral participation (Lave and Wenger, 1991) are approaches that, in different ways, are attempting to break the encapsulation of school learning (Engeström, 1991 in Zitter, De Bruijn, Simons and Ten Cate, 2011). Why are educational practices changing? We as a society of politicians, citizens, parents, teachers and company representatives strive for different learning outcomes to meet the demands from the knowledge-based economy as part of changing demands in society in general. Educational institutions seek to facilitate the process of learners to become competent, lifelong learning professionals able to cope with societal developments. To do so, established educational practices are fundamentally changing their relationship with their environments (Simons, Van der Linden and Duffy, 2000; Tynjälä, Välimaa and Sarja, 2003).

A core problem underlying the above changes is the complex and problematic nature of the transition learners are required to make from education to the workplace (Tynjälä *et al*., 2003). Studies show a gap between what is learned and what is required of competent professionals in an ever more complex world (Baartman and De Bruijn, 2011). Learners are expected to integrate different types of knowledge, for example, formal knowledge, work process knowledge and practical knowledge. Developing an integrated knowledge base is a lifelong learning process across different situations, such as school, hobbies and part-time jobs, in both formal and informal settings (Schaap *et al*., 2011). At the same time, this integrated knowledge base has to be applicable and up-to-date (Simons *et al*., 2000).

To facilitate the transition from education to the workplace and equip learners to deal with the demands of the current workplace as part of wider society, our focus is on the changing relationship between educational institutions and professional practice: the emerging forms of collaboration between schools and work and on novel modes of integrating learning and working processes to ease the transition from school to society and the workplace in particular so as to benefit from the strengths of each.

2. Hybrid learning environments

In this section, the concept of "hybrid learning environment" is introduced and defined, and the design perspective on learning environments is discussed.

2.1 Learning environments

The archetypical context of learning is the classroom. However, due to changing educational practices, the stricter concept of the classroom is supplemented by the broader concept of a learning environment. There is a general consensus in the learning sciences that the context of learning matters and that learning is somehow situated in a setting (Engeström, 2009). Situated theories of learning in particular emphasise the social, collective and contextual nature of learning (Lave and Wenger, 1991). The notion of

a “learning environment” as a broader setting than a classroom, as the context in which learning is situated, has become widespread.

As one of the cornerstones of the concept of learning environments we can introduce an equivalent concept of “curriculum” which can be defined in its most basic form as a “plan for learning” (Van den Akker, 1999). Goodyear (2001) presents a more extensive definition and states that “a learning environment consists of the physical and digital setting in which learners carry out their activities, including all the tools, documents and other artefacts to be found in that setting. Besides the physical and digital setting, it includes the socio-cultural setting for such activities.”

A variety of interpretations of the concept of learning environment can be found in the literature. In some of these, the focus is on the role of information and communication technology (ICT), as in the “innovative learning environment” (Kirschner, 2005), which should have the necessary technological, social and educational affordances to provide opportunities to learn. Similar is the “collaborative learning environment” which responds to societal trends by increasing the focus on open-ended problem-solving tasks via heterogeneous, distributed teams using Computer Supported Collaborative Learning (CSCL) technology (Beers, Boshuizen, Kirschner and Gijselaers, 2005). Some concepts are more encompassing, like “powerful learning environment” (Könings, Brand-Gruwel and Van Merriënboer, 2005) that take the intended learning processes and learning goals into account.

In this paper, the focus is on learning environments that cross the traditional school boundaries into working life. Establishing horizontal connections outside of school is considered by many as important (*e.g*. Billett, 2011). Dumont and Istance (2010) distinguished seven core “principles” for designing learning environments with practitioners and decision-makers in mind. One of these principles is to “promote horizontal connectedness across activities and subjects, in- and out-of-school”. Research shows that learners are engaged in more complex forms of learning with a conscious drive toward a better integration of learning and working (Järvelä and Volet, 2004). Others also stress the importance of engaging students in solving real-world problems or ill-defined professional tasks that are complex, realistic and challenging to invoke active learning processes (Könings *et al*., 2005; Baartman and De Bruijn, 2011).

Relevant research is being carried out in the Netherlands, where more traditional out-of-context practical and theoretical lessons are increasingly replaced by internships and workplace simulations (Jossberger, Brand-Gruwel, Boshuizen and Van de Wiel, 2010). In Finland there is research on joint developmental projects in collaboration with working life, that provide interesting starting points for reducing the gap between school and work (Tuomi-Gröhn, 2007). Similar work is being carried out in Australia where “providing students with experiences in practice settings to assist developing their knowledge required for effective professional practice is growing and widening trend across Australian higher education” (Billet, 2011). Billet (2011) argues that it is increasingly expected from education to provide students with access to and engagement in authentic instances of practice, referring in this case to “work integrated learning” for providing students with experiences in practice settings to assist them to move more effectively into their selected educational practice.

The above research moves from formal, school-based learning processes in the direction of learning in the workplace. The movement the other way is also becoming more and more widespread. The relevance of workplace learning is widely recognized in the United Kingdom, for instance, and Unwin (2009) points out that learning in the workplace is embedded within work activity and that “workplaces exist, of course, to produce goods and services”. In contrast, formal, school-based learning processes have formal qualification as their main goal. Fuller and Unwin (2004) advise to move forward to expansive workplaces in which learning is regarded as part of work and supported by appropriate supervisory and managerial processes.

In this paper, we take it one step further. Instead of merely combining, connecting or joining aspects of learning in school and experiences in work settings or the other way around by expanding workplaces with learning features, we are interested in how they might be *integrated and merged*.



Figure 1: Integrate and merge: interweave learning and working processes

Figure 1 shows the contrast between school based and work based learning. School-based learning is on the left side. This type of learning can be characterised as intentional, organized in a formal curriculum, with predictable outcomes and with a focus on explicit knowledge and generalized skills. On this side of the dimension, learning tasks are constructed to facilitate knowledge acquisition and knowledge is considered as a commodity that can be acquired, transferred and shared with others (Sfard, 1998). Pedagogical practices aim at de-contextualised knowledge, symbol manipulation, mental activities with a focus on individual learners. There is a separation between theory and practice and between knowledge and skills.

Work-based learning is positioned on the right hand side. This type of learning can be characterised as unintentional and informal, and the outcomes are unpredictable. The focus is on tacit knowledge, contextualized action, *e.g.* tool use and collaborative learning. On this side of the dimension, learning takes place in realistic settings and learning is characterised as becoming a member of a professional community (Sfard, 1998). Pedagogical practices treat competences holistically, there is little separation between knowledge and skills, and instead the aim is to develop seamless know-how.

Over the last decade, school-based learning has become more informal with forms introduced such as authentic assignments, project-based learning, and in-school mini-enterprises. At the same time, informal learning was formalised by means of recognition of prior learning and the use of portfolios (Tynjälä, 2008). This has led to a process of cross-fertilisation leading to new forms of learning that integrate aspects of both formal and informal learning. Our focus is on the latter forms of learning that aim to *interweave* learning and working processes to benefit from the strengths of both formal, school-based learning and real-life experience.

2.2 Learning environments from a design perspective

We take an explicit design perspective. In general, one can distinguish between the analytical or explanatory sciences and the design sciences (Collins, Joseph and Bielaczyc, 2004; Van Aken, 2005). The analytical or explanatory sciences are trying to understand how phenomena in the world can be explained and focus on pure knowledge problems. The design sciences have as their main interest the development of valid knowledge to support the design of solutions to field problems by competent professionals dealing with educational reform (Van Aken, 2004). In the context of this paper, this means educational professionals.

As a possible solution to bridge the gap between educational research and practice, a new methodological approach was introduced focusing on so-called “design experiments” (Brown, 1992) and “design science” (Collins, 1992), and has since received growing attention (Sandoval and Bell, 2004).

Other related terms include "design experimentation", "design-oriented research" and "design-based research" (The Design-Based Research Collective, 2003).

One of the main motives for initiating design research in educational sciences stems from the desire to increase the relevance of research for educational policy and practice (Gravemeijer and van Eerde, 2009). Design research meets the aim of addressing theoretical questions about learning in context, that is, to study learning phenomena in the real world and go beyond narrow measures of learning (Collins *et al*., 2004 in Akkerman *et al.* 2011). Educational design focuses on finding solutions to a problem. Its outcomes can vary from optimal or alternative solutions to a set of design principles or guidelines with which an optimal solution can be reached (Van den Akker 1999). As object of design, we choose learning environments and more specifically: those aspects of learning environments that can intentionally be planned and designed by educational professionals who have the role, for example, of educational designer, curriculum developer or innovator.

Van den Akker (1999) distinguishes three forms of curriculum representations: (1) *intended*: the underlying vision of a curriculum and the intentions as specified, (2) *implemented*: the interpretations by its participants and the actual curriculum in-action, and (3) *attained*: the learning experiences and outcomes of a curriculum. These three forms can be applied to the concept of hybrid learning environments. The plans and designs of a hybrid learning environment (*intended*) are interpreted by its participants and implemented to become a hybrid learning environment-in-action in the form of the socio-cultural setting in which participants carry out their activities (i*mplemented*) and which leads to the desired learning experiences and learning outcomes, namely competent, lifelong learning professionals able to cope with societal developments (*attained*).

A design perspective provides added value since the concept of a learning environment is broader than the archetypical classroom. In the classroom, the agents and roles are clear: the teacher enacts the role of expert and the students enact the role of learners to acquire knowledge. The space is mainly physical and has a familiar set-up. The instruments are usually the whiteboard and various paper materials, such as, books, articles and written assignments. The temporal perspective consists of, for instance, a schedule of hourly lectures. When this setting is broadened into a learning environment and crosses the boundary into the workplace, it becomes much more complex. Engeström (2007) notes that design research in the educational sciences has shifted the focus of attention from isolated individuals to entire learning environments or learning ecologies, (Akkerman, Bronkhorst and Zitter, 2011). It becomes necessary to design the learning environment in advance and align all the different elements and perspectives into a coherent and adaptive whole.

We should note Engeström's view (2009) that is critical of the concept of "learning environment" as an over-simplification. He states that the "plethora of attributes" (like innovative, collaborative, powerful, real-life) are used to "sell a wishful image of future learning in which all good qualities of human interaction come true" and fosters the naïve expectation that designing such a learning environment will automatically lead to the intended learning outcomes. Though Engeström makes these remarks about computer-supported learning environments, they have a broader relevance. We are mindful of this criticism and apply the concept of "learning environment" carefully, as we believe it does have added value by broadening the notion of archetypical classroom situations when discussing educational practices.

2.3 Defining hybrid learning environments

The above overview included research into various experiments and developments with non-traditional learning environments. We need suitable concepts to understand and discuss these developments in both educational research and practice. These include the concept of "hybrid learning environment". This concept was developed in close participation with educational practice of higher education and higher

vocational education. As a follow-up, it is now applied in the context of senior secondary vocational education in the Netherlands. In parallel, design-based research was carried out, to lay the theoretical, scientific foundations for designing hybrid learning environments (Zitter, 2010; Zitter, Kinkhorst, Simons and Ten Cate, 2009; Zitter, De Bruijn, Simons and Ten Cate, 2011; Zitter *et al*., 2012; Akkerman *et al*., 2011)

We can start with the "learning environment" part of hybrid learning environments. As Goodyear (2001) defined it: "a learning environment consists of the physical and digital setting in which learners carry out their work, including all the tools, documents and other artefacts to be found in that setting. Besides the physical and digital setting, it includes the socio-cultural setting for such activities". We can also agree with Van den Akker (1999) and distinguish the physical and digital setting with its tools, documents and artefacts, which can be intentionally planned and designed in a specific educational context, and the socio-cultural setting in which learners carry out their activities which emerges from this intentionally planned and designed environment.

What of the "hybrid" part of the concept? To understand hybridity, one needs to acknowledge different modes of learning. In general a broad distinction between two modes of learning can be made: learning situated in an educational environment that is based on formal, intentionally planned educational activities and learning situated in a workplace environment that is mostly informal in nature (Tynjäla *et al.*, 2003). The educational environment tends to focus more on individuals, while in a workplace environment the focus is more on activities, often carried out in a team or within an organisational structure. Learning in schools usually has an emphasis on mental activities, while in a workplace the additional use of different tools and instruments is quite customary.

We can formalise this by using the following two dimensions (see Figure 2): (1) *acquisition-participation* and *constructed-realistic.* These two dimensions give four quadrants in defining hybrid learning environments, (Zitter, 2010; Zitter *et al*, 2011; Zitter *et al*, 2012):

1. constructed-acquisition
2. constructed-participation
3. realistic-acquisition
4. realistic-participation.

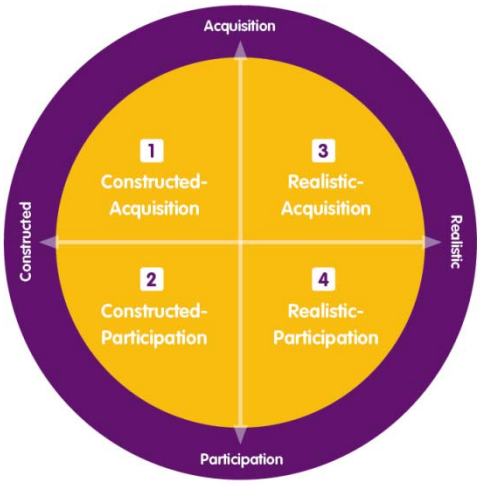


Figure 2: Two dimensions and four quadrants

The first dimension has on one side the knowledge acquisition metaphor, in which knowledge is considered as a commodity that can be acquired, transferred and shared with others. On the other side is the participation metaphor, characterising learning as becoming a member of a professional community (Sfard, 1998). The acquisition side of this dimension corresponds with the theories from cognitive traditions, while the participation side corresponds with social/cultural traditions.

The second dimension is constructed-realistic. This dimension characterises how realistic learning tasks are. Constructed settings are characterised as low-fidelity: the rich reality of society, and specifically of professional practice, is reconstructed. Moving towards the realistic-side of this dimension, constructed settings can become of higher fidelity, for example, by involving simulation technology, internal employees or outside actors to enact roles like client or patient. Moving to the right-hand side of the dimension are realistic settings that closely mirror the real professional context; they may actually be completely realistic. In such settings, learners are immersed in real problems from actual professional practice. At the right-hand, learners may be situated in an actual, real-world workplace setting.

These two dimensions form four quadrants, each with specific types of situations. For example classic lectures to present explicit theoretical knowledge fit in the constructed-acquisition quadrant. Discussing or presenting work experiences to enable tacit knowledge to be made explicit fit in the realistic-acquisition quadrant. Group assignments or simulations go in the constructed-participation quadrant. In the realistic-participation quadrant are the most realistic situations, such as working for actual, external clients from within a school-based setting, as well as working side-by-side with professionals in real-life workplaces.

The two-dimensional model with four quadrants (Figure 2) can be mapped onto the one-dimensional model (Figure 1) as followed. In general, formal learning in school-based settings is constructed (Quadrants1 and 2). They can focus more on acquisition (e.g. classic lectures) or on participation (e.g. group assignments). Workplace learning takes place in realistic settings (Quadrants 3 and 4): besides learning by doing (Quadrant 4), implicit knowledge can be made explicit by, for example, thinking aloud, explanations from senior professionals or reflective meetings (Quadrant 3). However, in the workplace, classic theoretical, instruction sessions and skills trainings are also customary (Quadrant 1) or more applied workshops and simulations can take place (Quadrant 2). In sum, the two-dimensional model with four quadrants is a richer model and offers additional perspectives to the classic theory-practice dichotomy.

The above framework can be used to operationalise the hybrid nature of learning environments. For a learning environment to be considered hybrid, each of the four quadrants should be represented. Moreover, the four quadrants need to be aligned with each other. The key here is to interpret the dimensions acquisition-participation and acquisition-constructed as *variables* instead of strict opposites. Hybrid learning environments should intentionally be planned and designed in such a way that each side of the dimension can gradually and seamlessly convert into the other side. Hybrid learning environments should be adaptive in nature. Both sides of the dimensions should be used to adapt and adjust the environment to suit the developmental process of learners.

3. Decomposing hybrid learning environments

Planning and designing hybrid learning environments is not an easy endeavour. Previous research suggests that it is helpful to further unravel the concept of hybrid learning environment. The first step is to analyse the professional tasks which constitute the content of the learning environment, which can be decomposed into smaller units. For these smaller units, we adopted the authentic or related whole task concept. We should distinguish a "task" from an "activity". Wisner (1995, as cited in Goodyear, 2005; in Zitter, 2010) says: "tasks are what managers set - they are the prescribed work. Activity is what people actually do. Educators set tasks. Learners interpret the specifications of the task".

3.1 Decomposing into authentic tasks

The "authentic task" is one of the basic elements of the powerful learning environments model.

> "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 and Leeman, 2011: 697).

These authentic tasks are in line with the "whole task" concept at the backbone of the "Four Component Instructional Design" (4C/ID) method (Van Merriënboer, De Clark and De Croock, 2002) in which the learning tasks are "concrete, authentic, whole task experiences". Kirschner, Martens, and Strijbos (2004 in Zitter *et al*., 2009) characterise tasks on a dimension with, on the one end, more traditional school tasks which are well-structured, well-defined and short, and, on the other end of this dimension, authentic tasks: "real life problems that are mostly ill-structured and/or wicked and generally need team effort to solve them".

The whole-task approach analyses a learning domain as a coherent, interconnected whole and then teaches it from more simple, yet meaningful wholes that are representative for the whole domain to increasingly more complex wholes. Van Merriënboer, Kirschner and Kester (2003) argue that the whole-task approach solves three basic problems in education, namely: (1) *fragmentation*, indicating that students are often not able to combine the many pieces they have learned into coherent wholes; (2) *compartmentalization*, indicating that students have difficulties integrating acquired knowledge, skills, and attitudes; and (3) *low transfer of learning*, indicating that learners are often not able to apply what they have learned to new problems and new situations.

The authentic tasks of a learning environment come from a professional domain, such as process technology (technology case), the hospitality industry (hospitality case) or sports and leisure (sports case). A learning environment can be unravelled into separate authentic tasks for analytical purposes but must remain part of an intact whole. Authentic tasks have to be sequenced and connected to weave together the

realistic work processes and learning processes that are the fabric of a hybrid learning environment. When authentic tasks are sequenced, the following should be taken into account:

- sequencing is needed to develop from peripheral to full participation;
- tasks are sequenced from low accountability (little risk involved when making errors) to tasks with high accountability (full responsibility).

Sequencing often has pedagogic qualities and purposes, analogous to designing curricula in educational settings (Billett, 2006).

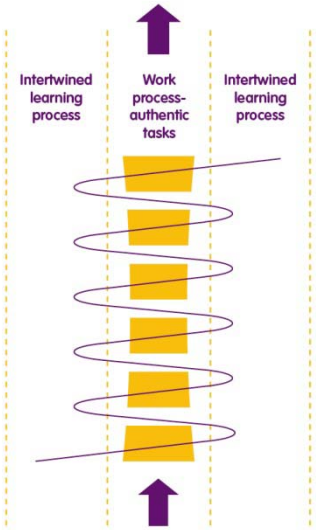


Figure 3: Authentic tasks and intertwined learning process form the backbone (Aalsma, 2001)

The working process consisting of interlaced authentic tasks and intertwined learning processes form the backbone of hybrid learning environments (Aalsma, 2011), see *Figure 3*. The learning process moves in and out of the work process. At times, learning takes place simultaneously with carrying out an authentic task (*e.g.* learning by doing or by modelling more senior colleagues in Quadrant 4). At other times, learning takes place near working (*e.g.* stopping the work for a short theoretical intermezzo in Quadrant 1, practicing a specific skill in an authentic assignment or simulation in Quadrant 2 or stopping the work to engage in collaborative problem-solving in Quadrant 3). Learning can also be further away from the working process (e.g. frontal, formal training in Quadrant 1 or a simulation assignment in Quadrant 2).

3.2 Decomposing with four perspectives

After decomposing the content of a learning environment using the "authentic task" concept, a different kind of decomposition can take place as a next step in the design process by distinguishing four perspectives (Zitter, 2010; Zitter *et al.*, 2011; Zitter *et al*, 2012):

- *Agency* perspective, to study the roles enacted by the agents or participants.
- *Spatial* perspective, to study the physical and digital spaces in which the tasks take place.

- *Temporal* perspective, the timeframe as relevant to the tasks.

- *Instrumental* perspective, the boundary objects that are instrumental to deliver the intermediary and final results of the tasks.

The above four perspectives are adopted from different theories and models. Foremost, we aim to keep the perspectives as generic as possible, instead of imposing a specific school of thought. Also, the perspectives are meant to establish common ground so that generic and portable concepts are preferable to highly specific ones. Finally, they should be simple and at the same time expressive, to appeal to a wide target audience (Zitter *et al*., 2009).

The selection of the four perspectives grew out of Goodyear's (2001) definition of a learning environment. Two of the perspectives, namely, the *spatial* ("physical and digital settings in which learners carry out their activities") and the *instrumental* ("all the tools, documents and other artefacts to be found in that setting") are derived from that definition.

We also adopted "activity theory". We kept the elements from activity theory that are about design, namely, objects or goals, instruments and outcomes, and merged them into the instrumental perspective focused on boundary objects (Zitter *et al*., 2009). The concept of "boundary objects" represents an analytical perspective, focusing on objects that facilitate coordination, alignment and integration of the various activities of individuals of the involved communities (Schmidt, 2000 and Schmidt and Wagner, 2004 in Zitter *et al*., 2009). The *agency perspective* was adopted from so-called "collaboration scripts" (Kobbe *et al.*, 2007; Kollar, Fischer, and Hesse, 2006 in Zitter *et al*., 2009), from which the concepts of participants, roles and groups were taken and merged into the instrumental perspective. The *tempora*l perspective was also adopted from collaboration scripts, though in that model, timing is part of what they call "method" - which role is carried out, which activities, at what moment in the process. We elaborated "at what moment in the process" with all other aspects of time, such as available time, time-outs, pausing, deadlines, and so on.

The above four perspectives have been used during applied research in the domain of higher education and vocational education and training (VET). They meet the criteria as mentioned earlier: they can be used with existing models and do not impose a specific school of thought. They also help to establish common ground and can appeal to a wide target audience (teachers, educational developers and coordinators).

The Agency Perspective. The agency perspective aims to provide a clear picture of who is active in a hybrid learning environment. Agents enact the significant roles: they may be students from different disciplines, educational staff (teachers, trainers, coaches), external practitioners from professional practice and external clients, patients or representatives of target audiences. Participants enact specific roles, whether educational roles, such as learner, domain expert, tutor, coach, observer and peer-assessor, or work roles such as junior or senior employees, or managers. In hybrid learning environments, all relevant professional roles are designed. The professional roles should be multi-professional and diversified in terms of seniority (multi-level). Different individual actors can enact the same role, which leads to different enactments. Roles can be enacted by teams of actors, which leads to different team enactments. Actors are either expected to enact single roles sequentially or multiple roles within the same time-frame. Roles can be more encompassing, like "manager" or more narrow and specific like "observer during this sales meeting".

The Spatial Perspective. The spatial perspective makes explicit where the learning takes place; it studies the physical and digital spaces of a hybrid learning environment. The challenge from a hybrid learning environment perspective is to mirror an authentic workspace and at the same time provide suitable

spaces from the educational point of view. Spaces need to be designed for different purposes, for both acquisition and participation. The spaces should not be either/or but should afford different functions to gradually merge and blend. Therefore, there need to be spaces suitable for the work processes in question. These working spaces should also accommodate acquisition activities, for example, observations, quick discussions, thinking aloud, reflective dialogues, collaborative problem solving, direct instruction or theoretical interludes. Near the work spaces should be other multifunctional areas, for example, for lectures, group work, presentations, meetings or individual study.

The digital spaces should also accommodate both working and learning processes. They should be suitable for knowledge acquisition for easy reference afterwards or self-study, for example, by offering structured learning resources, reference material and professional tools. On the other hand, digital spaces should be designed for participation by facilitating collaborative processes within the environment and facilitate interaction with outside professionals and outside communities of practice (Zitter *et al*., 2012).

The Instrumental Perspective. The instrumental perspective aims to clarify which tools are used to facilitate the learning of the participants in a hybrid learning environment. This perspective encompasses the artefacts which are instrumental to deliver the intermediary and final results of the tasks, such as checklists, handbooks, formats, protocols, professional tools, computer software. These artefacts refer to the broad range of instruments, tools, objects and devices that support learning and work processes. Artefacts support the routines of a community of practice (Pentland and Feldman, 2004).

The challenge in hybrid learning environments is to identify the so-called "boundary objects". Boundary objects facilitate the interaction between actors with different viewpoints - for example, actors from different professions - and help to connect heterogeneous information (Star and Griesemer, 1989 in Zitter *et al*., 2012). A suitable boundary object can be a professional object that requires interaction with participants enacting different roles, while these interactions take place in both physical and digital spaces. Such objects require learners to articulate in different forms and for different audiences. By selecting objects which are used in professional practice, explicit connections can be made with working life. These objects help learners to cross the boundary from school into their future professional community.

The Temporal Perspective. The temporal perspective aims to answer the question: when does the learning take place? This perspective may look into all aspects of time such as: the available time, sequencing, timing, accelerating and decelerating, all relevant to the tasks in question.

In professional practice, tasks and work processes have a certain duration, a specific available time, and planned deadlines; in educational settings, these time elements can be manipulated and constructed. For example, time can be accelerated or slowed down. Acceleration can be applied to compress a lengthy work process to fit a limited time slot, which enables the learner to experience a whole work process instead of isolated parts of it. When time is slowed down, pivotal elements of the work process, such as snap-decisions, intricate procedures or machinery, can be analysed more slowly and in detail. Other time aspects relevant to hybrid learning environments are: pausing, rewinding, time-outs, time-pressure, and deadlines.

The temporal aspects also concern the sequence of learning and working tasks. In hybrid learning environments, the sequencing can be planned for and designed up to a certain point. The sequence of working and learning processes also emerges from the daily developments and may differ from learner to learner. Monitoring the overall development and complete coverage of all relevant learning and working tasks for individual learners, regardless of the followed sequences, is crucial in the design of hybrid learning environments.

4. Three cases

During the last decade, several forms of hybrid learning environments have been developed in Dutch vocational education and training (VET). In vocational education, the traditional out-of-context practical and theoretical lessons are increasingly replaced by internships and workplace simulations (Jossberger, Brand-Gruwel, Boshuizen and Van de Wiel, 2010). Examples of hybrid forms are teams of learners working on real-world problems from external customers, in-school companies and teams of learners that function as "shadow-crew" next to a regular working crew. The three cases below are real, and provide (part of) an educational programme at the level of senior secondary vocational education in three different domains, *i.e.* process technology, the hospitality industry, and the sports and leisure industry.

Even though these cases are drawn from vocational education, they provide insights that support the design of similar solutions in other educational contexts as the concepts and perspectives discussed in this paper are certainly not unique to vocational education. As Billett (2011) states: "It is likely that much of the lower levels of conceptual knowledge, facts and concepts, and deeper forms of understanding, characterised by rich associations and links, will be learnt through engagement in activities outside of intentional learning experiences within education institutions. The concepts and perspectives presented help to realize learning environment in which formal education activities can be interwoven with experiences in any kind of practice setting such as work, but also civic engagement." (p.10)

4.1 The Technology Case

The technology case is situated at the grounds of an educational institute providing senior secondary vocational education (14,000 students). The technology case offers five study programs: three in process technology and two in marketing and sales. Currently, there are about 50 students (growing to 70-90). This learning environment also offers work placements to students from other study programs, to students from other similar educational institutes and to external students from higher education. This learning environment is set up as an operational factory with a production line to purify and bottle water. In addition, there is a marketing and sales department to market and sell the bottled water with custom-designed labels.

Agency perspective: In this case, the professional roles are multi-professional and include process operator (three levels), production coordinator, marketing and sales and plant manager. It is also possible to diversify the roles in terms of seniority. In this case, one can distinguish starting operators (first-year students) and experienced operators (second-year students). There is also a number of educational roles, such as assessor, peer-assessor, various domain experts, facilitator and learner. Two main guidance roles are explicitly designed, namely the so-called "learning master" (in charge of the learning process) and the "work master" (in charge of the working process). The first is responsible for the facilitation of the learning processes of the students by organising reflection and theoretical workshops. The second guides the students in the working process by giving feedback on their practical skills, providing skills training, guide collaborative problem-solving etc.

Spatial perspective: In the technology case, the main space is set up as a factory with a production line to produce purified bottled water. Right next to the production area, there is an area with tables and screens to stand next to. These can, for example, be used for compact theoretical interludes or demonstrations of machine-parts. At the other side, there are glass spaces in which various elements of the production line are simulated. The stairs from the production area lead to the workspaces of the marketing and sales department and the multifunctional spaces upstairs, which can be used for presentations, workshops, group work, meetings or individual study.

Instrumental perspective: The production line with the machines is the most prominent instrument in

this learning environment. In the design of this learning environment, specific attention is paid to the machinery. Most of these machines have see-through exteriors and can be opened easily. These features are unlike machines in working factories, where the insides of machines stay hidden and only the more qualified and experienced workers are allowed to open them. An example of a boundary object in the technology case is the planning board. On the planning board, the work activities of both the production floor and the marketing and sales department are tuned and related to the customer specific requirements. In other words, it connects the different actors both within the learning environment (the process operators and marketing and sales) and outside (suppliers and customers).

Temporal perspective: An example of the temporal perspective is that in this learning environment a production run can be stopped when needed, to allow the learners to carefully analyse a problem that occurred with the machinery and collaboratively work towards a solution for this problem.

Quick win: Usually, redesigning hybrid learning environments is a long, drawn-out process requiring major effort. However, in many hybrid learning environments, quick wins may be identified. Quick wins help to get the process of redesign started and provide results in the meantime. They can also help to overcome resistance which often emerges during redesign processes.

For this case, the quick win can be identified from the instrumental perspective. Though the machinery is well-designed, the paper and digital artefacts can provide quick wins. For example, during the quality control process, learners in the role of quality controller are expected to gather various kinds of data, *e.g.* the number of produced bottles and the amount of waste. Currently, the forms to report these data are not standardised. Standardisation of the quality control forms, which could also be enriched with explanations and theory, could help to intertwine learning in the constructed-acquisition quadrant with working in the realistic-participation quadrant.

4.2 The Hospitality Case

The hospitality case is situated at the grounds of an educational institute offering senior secondary vocational education (14,000 students). This learning environment offers nine study programmes in total (both school-based routes with full-time education and work-based routes with part-time education). There are about 280 students: a mix of chefs/head cooks, (co-ordinating) host(ess), and entrepreneur hospitality in training. This learning environment houses three different outlets - a lunch room, a health-food bar, and a formal restaurant - and caters to different types of events (both in-house and outside).

Agency perspective: In designing this learning environment, specific attention is paid to the multi-level aspect. The organisation of the professional roles is in the form of pyramids. First-year students are organised in teams of eight junior professionals. Second-year students coordinate a team of eight students. Third- and fourth-year students manage two coordinating students and therefore manage sixteen students. In this environment, professional roles include hostesses, cooks, outlet managers, receptionists and stock management. Besides the professional roles, there are also the familiar educational roles, such as domain expert, assessor and peer-assessor. Representatives from the business side play a crucial role in the assessment process.

Spatial perspective: The spaces of this learning environment mirror working spaces in reality, there are reception areas, kitchens, storage spaces, a large lunch room, a formal restaurant, a café-style health-food bar, and regular work spaces with computers. These spaces are open enough to allow more constructed tasks, for example, by using them for theoretical interludes or direct instruction interspaced with working. Besides, there are spaces tailored to acquisition activities while being near to the work spaces for easy interchanges.

Instrumental perspective: In all the work spaces of this case, the various professional tools and instruments can be found, such as professional kitchen equipment, glassware, and high quality ingredients. An example of a boundary object can be found in the kitchen. In different places, suspension files are hanging off the walls. These files contain step-by-step instructions on how to carry out work processes using terminology from professional practice. They also contain relevant background material on topics like hygiene for easy reference. Such artefacts support both the work process with work instructions and the learning process by offering underlying process and theoretical knowledge.

Temporal perspective: In the hospitality case, the temporal aspect is designed for in different ways. Various forms of time pressure are deliberately applied. The lunch room kitchen has to service large numbers of customers in a short time-frame (lunch time), requiring learners to collaboratively deliver high quality service in a short time period. The formal restaurant seats groups of people and requires high quality service in the evenings, which helps learners to get accustomed to the irregular work schedules of the hospitality sector.

Quick win: In this case, the quick win is to align the constructed-acquisition quadrant with the realistic-participation quadrant more strongly. Connections could be made, for example, by (the temporal perspective) pausing the work process in realistic work spaces in order to collaboratively solve a problem, thinking aloud by senior professionals, or by providing just-in-time knowledge as theoretical intermezzo.

4.3 The Sports Case

The learning environment of the sports case is a multi-functional centre offering various sports facilities (swimming pool, gymnastics, volleyball, basketball, fitness etc.), physiotherapy and wellness facilities and is situated next to an upper vocational secondary school. Students from different study programmes, like sports, business administration, nursing, health, welfare and social care, and ICT and communication, work and learn together in this learning environment. About 150 students from (upper) vocational secondary school and about 25 from higher education go through the intake and application process to be matched with a suitable working and learning arrangement. The core of this learning environment is the real-life business setting offering various sports and leisure services to actual customers. The learners from the sports case work next to the regular employees. Having all these learners working side-by-side with the regular staff gives this business the opportunity to offer extra services to more customers.

Agency perspective: The organisation of the professional roles is both multi-level and multi-professional. This learning environment includes a broad range of professional roles, such as sports instructors, administration staff, facility management, physiotherapists, ICT and communication. All these roles can be specified in terms of seniority and expertise. In the design of educational roles, explicit attention is paid to working professionals also enacting educational roles and close collaboration with educational professionals of the different programmes that the learners come from. In this learning environment, the guidance of the students is the responsibility of a heterogeneous team of teachers and representatives of the business side.

Spatial perspective: The spaces of this learning environment are real work spaces and educational spaces are added. In some work spaces, there is also room for more constructed, acquisition tasks, for example on the wall of the gymnastics area, there are white boards for theoretical interludes.

Instrumental perspective: The different sports areas are equipped with suitable sports equipment. In the other professional spaces, professional tools and instruments can be found, such as ICT facilities with necessary business software, materials for physiotherapy, and so forth. Specific attention is paid to the design of CSCL facilities to allow students to learn just-in-time.

Temporal perspective: Time aspects are also designed, for example by providing more time for certain tasks or by working with more people on tasks than strictly necessary.

Quick win: In this case, a quick win may be seen in how agency perspective could be designed for more elaborately. Currently, not many educational roles are designed. A wider variety and more specific educational roles could be introduced. For example, learners could be assigned the role of "observer" and be equipped with a hand-held video-camera. The observer would afterwards provide feedback and make implicit aspects of the work process explicit. The observer role could be extended with the role of peer-assessor.

Table 1: Case Highlights

	Technology case	Hospitality case	Sport case
Authentic tasks: backbone	An operational factory to purify and bottle water, complete with the production line and a marketing and sales department is constructed on school grounds.	Three different outlets, namely, a lunch room, a health-food bar and a formal restaurant, including a reception and storage areas are constructed to service different types of customers.	A real-life business setting offering various sports and wellness services to actual customers forms the basis.
Agency perspective	Multi-professional roles: technical roles (process operators, maintenance) are combined with commercial and management roles (marketing and sales; plant management).	Multi-level roles: pyramid structure with senior students coordinating junior students.	Students enacting different roles work side by side with employees of the business at the core of this learning environment.
Spatial perspective	Factory work spaces with multifunctional spaces close by (theoretical interludes, simulations etc.)	Hospitality spaces, open enough for quick discussions or direct instruction; state-of-the art demonstration kitchen and other multifunctional spaces.	Close to the areas for customers (a broad variety of sports and leisure facilities) are multi-functional spaces for meetings, self-study and group work.
Instrumental perspective	An example of a boundary object in the technology case is the planning board. On the planning board, the work activities of both the production floor and the marketing and sales department are tuned and related to the customer specific requirements.	An example of a boundary object can be found in the kitchen. In different spots suspension files are hanging on the walls. These files contain step-by-step instructions on how to carry out work processes using terminology from professional practice. They also contain relevant background material on topics like hygiene for easy reference.	The different customer areas are equipped with suitable sport equipment. In the other professional spaces professional tools and instruments can be found, such as, professional ICT-facilities with all the necessary business software, materials for physiotherapy and so on.
Temporal perspective	The production line can be paused to allow learners to analyse errors and for collaborative problem solving.	Time pressure is deliberately created in the form of for example the hectic lunch service.	Time pressure is diminished by having more participants than strictly necessary to carry out the work.
Quick wins	Instrumental perspective, mainly the digital and paper artefacts, for example, standardise the quality control forms and enrich with explanations and theory.	Temporal perspective to align constructed-acquisition quadrant with realistic-participation quadrant more strongly. For example: pause work process for collaborative problem solving or just-in-time knowledge.	Agency perspective, a wider variety and more specific educational roles could be introduced. For example: learners could be assigned the role of 'observer' and be equipped with compact, handheld video camera.

In the above table, the different foci of the three cases are showcased. Indeed, hybrid learning environments manifest in many different varieties. One size definitely does not fit all. Furthermore, a key feature of hybrid learning environments is capacity to adapt. A hybrid learning environment should be designed in such a way that participants are able to adapt the roles, spaces, artefacts, and time elements to suit their needs.

4.4 The Four Quadrants Applied to the Cases

In the previous section, the four perspectives were used to unravel the hybrid learning environments of the three cases and identify "quick wins". In this section, the two dimensions and four quadrants are applied to each case.



Figure 4: Four quadrants of technology case

In Figure 4, four situations of the technology case are positioned in the four quadrants. As example of constructed-acquisition (Quadrant 1), the tables situated right next to the production line are shown. Each week, different theoretical themes are scheduled. When there is a suitable moment in the work process to deal with a topic within these themes, the "'work master" and learners step out of the production area for a theoretical intermezzo. The simulation of the water purification tanks is shown as example of constructed-participation (Quadrant 2).

This simulation is situated in one of the glass workspaces, so the real equipment mirrored in the simulation is still visible. Often, problems occur during production. The "work master" often stops the production line to engage the learners in collaborative problem-solving (realistic-acquisition, Quadrant 3). The production line itself is shown to represent realistic-participation (Quadrant 4). The production line is shown from above, from the level where the multifunctional spaces and the marketing and sales workspaces are located.



Figure 5: Four quadrants of hospitality case

In Figure 5, four situations of the learning environment of the hospitality case are shown. There is a classic frontal lecture situation (constructed-acquisition, Quadrant 1), though it should be noted that the lecturer in question enacts multiple roles as he is also a senior professional and role model in the kitchen as chef with numerous years of experience in Michelin-starred restaurants. To practice specific skills, such as knife skills, there is a training kitchen for simulations and authentic assignments (constructed-participation, Quadrant 2).

During service hours, extra time is planned to explain various aspect of preparing the food (realistic-acquisition, Quadrant 3). One of the realistic spaces, namely the lunch room, is shown as example of realistic-participation (Quadrant 4). This space is also suitable for theoretical intermezzo's (Quadrant 1) or thinking aloud by senior professionals (Quadrant 3).



Figure 6: Four quadrants of the sports case

In Figure 6, four situations of the sports case are shown. The constructed-acquisition (Quadrant 1) is mostly situated in the school itself, which is next door to the sports and leisure centre where most of this learning environment is situated. To enrich the daily work, learners have to carry out more complex assignments in the context of their work such as planning a special event or making the monthly duty-roster, (constructed-participation, Quadrant 2).

Right next to the sports areas there are multi-functional spaces used for collaborative problem-solving or reflective meetings (realistic-acquisition, Quadrant 3). As example of realistic-participation (Quadrant 4) - the swimming pool - is shown, where a student is teaching a group of children while a senior professional is observing from the bench beside the pool.

5. Concluding remarks

This paper focuses on hybrid learning environments as a means to overcome the problematic nature of the transition between school and work in its wider societal context. In the past decade, the notion of a learning environment as the setting, the context in which learning is situated has become widespread. In this paper, we follow Goodyear (2001), who presents an extensive definition and states that a learning environment consists of the physical and digital setting in which learners carry out their activities, including all the tools, documents and other artefacts to be found in that setting. In addition to the physical and digital setting, it includes the socio-cultural setting for such activities. A learning environment is considered hybrid if it incorporates both acquisition and participation processes, as well as constructed and realistic situations. We want to stress that it is important to interpret the dimensions of acquisition-participation and acquisition-constructed as variables – scales - instead of polar opposites. Hybrid learning environments should intentionally be planned and designed in such a way that each side of the dimension can gradually and seamlessly convert into the other side. This allows the interwoven learning and working processes to benefit from the strengths of both formal, school-based learning and from realistic experiences

in the workplace. In contrast to contemporary forms of workplace simulations, work-integrated learning and so on, which aim at connecting aspects of learning in school and learning in work settings, hybrid learning environments seek to *integrate and merge* learning and working.

Naturally, situations from each of the four quadrants can also take place in different learning environments instead of in a single, hybrid learning environment. Such dispersed situations can have hybrid characteristics, but are strictly speaking not a hybrid learning environment according to our definition. Learners could develop an integrated knowledge base by engaging in learning activities of four quadrants dispersed across different settings. We argue that this may not sufficient as it imposes the full responsibility for the integration of different learning activities in different settings on the learner. The pivotal point is that learners have to be supported and scaffolded to connect the learning outcomes of each of the quadrants; only then they will be able to merge learning outcomes and work experiences into an integrated knowledge base.

To come to terms with the complexity of hybrid learning environments, we propose to further unravel the concept by first analysing the professional tasks. We argue that a hybrid learning environment consists of interlaced authentic tasks and intertwined learning processes from each of the four quadrants separately and the quadrants in deliberate conjunction (the back bone). These tasks and processes trigger all kinds of individual and collective activity, namely, enactment of the designed roles (agency perspective), usage of designed physical and digital spaces (spatial perspective) and handling of the offered instruments (instrumental perspective), according to the designed time-aspects (temporal perspective). To some extent, triggering these mechanisms or processes will be as intended, or they will be adapted to suit the situation and learner(s) in question, while the remainder will be unintended. So, both intended and unintended learning experiences and outcomes may be attained.

The concept of hybrid learning environments provides one important answer to the problematic nature of integrating different types of knowledge and experiences in answer to the high demands of our knowledge-driven society. As such, the described developments showcase possible directions into the future.

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