Re-imagining teaching in online environments

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Series Preface

This publication entitled 'Re-imagining teaching in online environments' has been prepared for inclusion in the Research in Higher Education Practices Series, developed by the Higher Education Research Unit in the Department for Learning and Philosophy at Aalborg University. It is part our intention with this series, to produce timely syntheses of research on higher education topics of international importance.

This booklet provides a synthesis of research findings specifically on the topics of Rich Environments for Active Learning as a scaffold for e-learning, blended learning and flipped classroom approaches. It includes key theoretical models that help to unpack the complexities of teaching online. The authors of this publication are Associate Professor Andrew Cass and Docent Susanne Dau, who have studied online higher education learning environments. With a

focus on applicability of theoretical pedagogical ideas the booklet presents scenarios on how to plan and transform teaching ideas and materials so the reader can easily reconsider those for his or her own teaching.

In this series we are mindful that suggestions or guidelines for practice need to be responsive to educational settings and contexts. The booklet is therefore presented in a way that readers can consider the suggestions for their own practices and find suggestions for further reading.

Lone Krogh and Kathrin Otrel-Cass,
Series Editors

"It completely changed my classroom practice too, I now play the video with the sound off and speak to them [students] my stories". One theme identified was that teachers felt less need to provide highly detailed information to their students and that the video production resulted in them concentrating on providing key points and then facilitating support to the students finding detailed information themselves.

From a paper presented to the AAU Visual Pedagogies Conference, 2018.

Introduction

Technologies and diverse Internet and communications tools (ICT) offer the possibility to re-think educational practices. These technologies add new opportunities to construct and design teaching and learning in new delivery modes, to provide more individualized and collaborative learning tools, processes, and assessments. e-Learning, Blended Learning, and Flipped Classroom have emerged as pedagogical responses to change that support students individualized and collaborative learning processes. There are also theoretical pedagogical elements that have been added to the conceptual frame of the REAL model which will be introduced here.

This booklet aims at building on the readers' knowledge about Blended Learning, Flipped Classroom, and the design of such processes structured by the REAL model. It provides the reader with a design model and resources for the construction of lessons and courses at higher education institutions. The booklet a raises awareness of how to adopt, implement, and act in educational practices where e-Learning, Blended Learning, and Flipped Classroom (e/B/F) are more commonly practiced. The booklet introduces the 'Rich Environments for Active Learning (REAL)' framework to address the increasing face to face time of teacher interactions in these educational practices. The booklet also introduces a teaching planner for lesson design useful in any of these practices. The 'Wave Teaching Planner' is a flexible lesson design tool that teachers can implement in a variety of teaching situations. It allows for more flexible planning of tools related to goals, methods, materials, and environment. Hence, it extends the booklet series from the use of a specific tool e.g. Gnaur and Hüttel's (2016) description of Podcasting.

The first part of the booklet will define the main concepts underlying the learning design of which the REAL model is founded. Thus, the conceptual foundation of e-Learning, Blended Learning, and Flipped Classroom, are followed by a description of the REAL model. Thereafter, the teachers' role is addressed, and some significant artefacts are presented for the planning of courses and lessons ending with an introduction to the wave teaching planner, an aid to lesson plan design. Finally, some research validated examples and anecdotes are revealed to illustrate the didactic design process, ending with considerations of goal setting related to REAL. The booklet's separate parts intend to offer a framework, tools and ideas for implementing this understanding to modern higher education teaching practices.

The theory behind the Rich Environments for Active Learning framework

Blended Learning activities are known to improve students' performances and offer flexible learning environments (Dau, 2015). Nevertheless, many teachers face challenges in their

planning of learning design, especially when it comes to structuring e-Learning, Blended Learning, and Flipped Classroom design (Arkorful & Abaidoo, 2015; Dau, 2015; Noesgaard & Ørngren, 2015). For instance, teachers seem to avoid changes that disturb their traditional teaching practices (Noesgaard & Ørngreen, 2015) and they may experience difficulties in finding the relevant balance between face-to-face and e-Learning activities and lack a clear structuring of students' learning activities (Dau, 2015). To address these challenges of working with blended learning the REAL model is introduced as a basis for the planning of blended learning courses. Thus, the booklet's main question is; how teachers can design a rich environment for active learning? This question is examined on the basis of a constructivist approach, that is based on the premise that students and teachers interact in the construction of knowledge (Larochelle, Bednarz, Garrison, & Garrison, 1998). Moreover, knowledge is regarded as a process of construction with a focus on context and multiplicity in the interpretation and acquisition taking place (Steffe & Gale, 1995). Accordingly, the learning design process needs to support teachers in their planning and action concerning their pedagogical approaches in technology-rich environments. Thus, the intention is twofold as it strives to support teacher's pedagogical planning and activities with both a social constructive rationale and technological tools in use. The booklet offers a particular design method for teachers that sup-

ports these intentions. Specifically, the booklet will introduce teachers to Rich Environments for Active Learning (REAL) as this learning design model has been demonstrated to help teachers working on pedagogical interventions founded in a constructivist approach (Buckley, Gavey & McGrath, 2011). The REAL model offers the opportunity for teachers to combine the engagement of students working in a real life setting with authentic problem solving, by working with a structured design process. This fosters high level thinking, interactions, collaborations, and realistic task performance (Grabinger & Dunlap, 1995).

Before providing a description of REAL, we will investigate the constitutive theoretical elements framing the REAL model, respectively, e-Learning, Blended Learning, and Flipped Classroom.

e-Learning

E-Learning has its origin back in the 1960s where it emerged in different sectors including education (Nicholson, 2017). In the research literature it is difficult to find a common definition of e-Learning, since it appears in many different forms as well as with different and varying applications, processes, and learning methods (Arkorful & Abaidoo, 2015). Furthermore, a review by Noesgaard and Ørngreen (2015) about the understanding of the effectiveness of e-Learning revealed that there are diverse definitions,
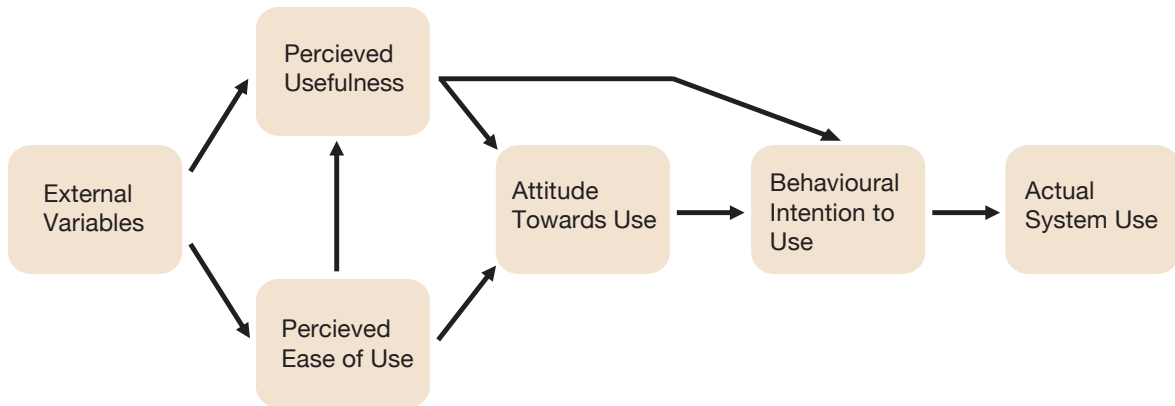
Figure 1:Technology Acceptance Model (Davis, 1986)

adding further challenges to the meaning of the e-leaning concept and thus leading to misunderstandings. However, most definitions include the existence of online deliverable modes, online courses, and technology supported learning independent of time and place (Cheng, 2011; Engelbrecht, 2005; Nicholson, 2007). E-Learning can be slightly misleading, as it is a matter of instructional design rather than a matter of learning. Also, the pedagogical foundation seems to point at the concept as considerate of how the technology can be delivered with the attention to make people and, in this case students, learn through their knowledge constructions. Nevertheless, studies point at different elements of consideration when adapting e-Learning. For example, the Technology Acceptance Model (TAM model) (Davis, 1986) has been widely

used, as it addresses central matters for student's participation and activities in e-Learning courses (see figure 1.).

TAM aims at explaining technology adaption behavior. TAM includes different elements; from the left in figure 1, the element of external variables addresses the outside factors, and respectively the users perceived ease of use and the perceived usefulness. These perceptions influence the user's attitudes toward the use of technology (the element in the middle of figure 1) and thus the behavioral intention to use the technology. Finally, this determines the actual use of technology (last element to the right in the figure). Thus, TAM offers an overview of the elements to take into consideration when planning an e-Learning course. A recent qualitative meta-analysis (Abdullah & Ward, 2016), includ-

Figure 2: Key factors influencing learning effectiveness
(Noesgaard & Ørngren, 2015)

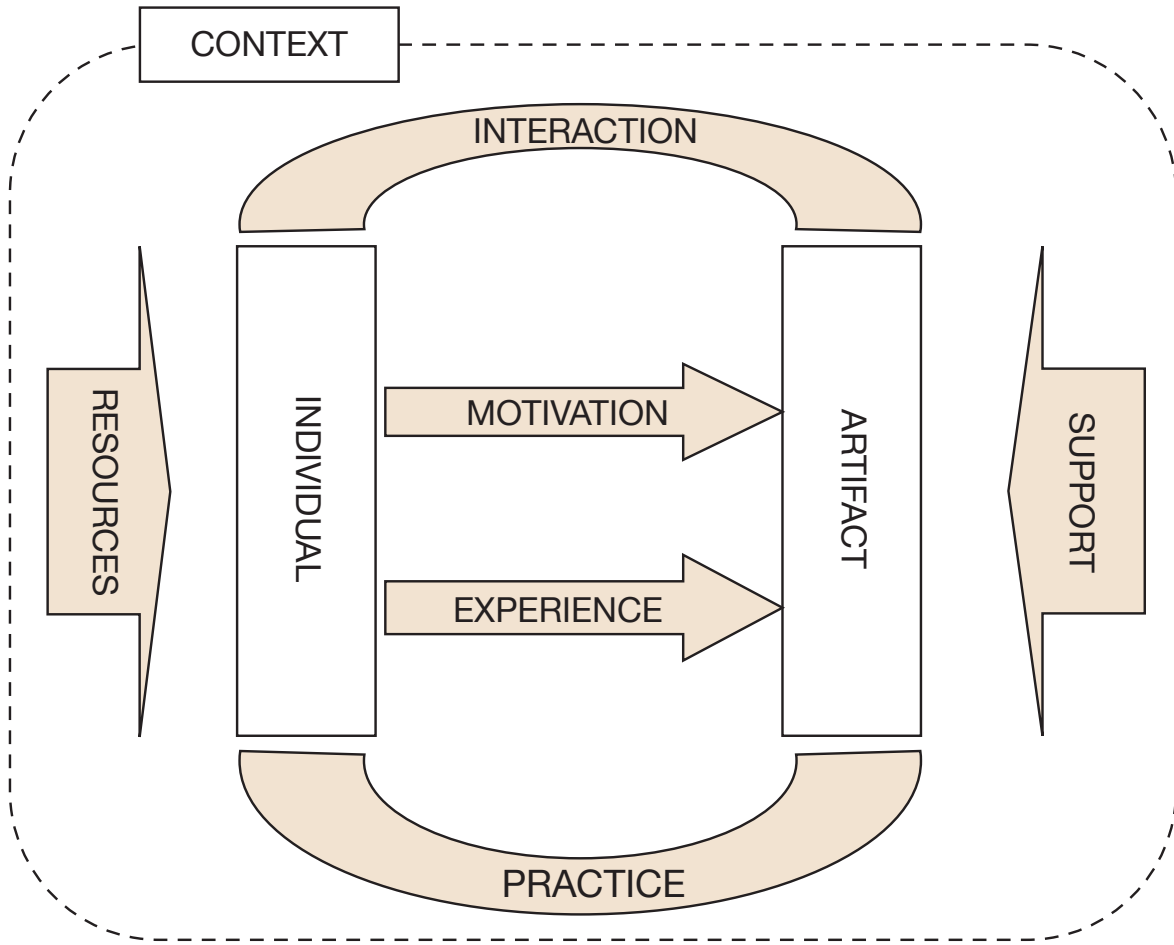ing more than 100 papers, reveals the most common external factors of TAM respectively; self-efficacy, subjective norms, enjoyment, computer anxiety, and experience. These factors should therefore be considered in the planning of any e-Learning course. Furthermore, the findings from the review of key factors influencing e-Learning effectiveness (Noesgaard & Ørngreen, 2015) should also be considered. These factors include the goals and the factors illustrated in figure 2.

Figure 2 illustrates the context as a frame and the key factors influencing effective e-Learning are marked with grey colour. The context should include a resourceful and supportive environment as external influences Illustrated in the centre of figure 2 is the motivation and experience of the individuals acting with the artefact, were the interaction with teachers, peers, and the opportunities to practice affords the e-Learning. Moreover, real life practice relevance also seems to afford the effectiveness of e-Learning. The model in figure 2 can be supportive for planning an e-Learning course with a high degree of effectiveness. The models in figure 1 and 2 both seems to support the central principles from the Technological Pedagogical Content Knowledge model (TPACK-model) developed by Mishra & Koehler (2006) where the three dimensions of respectively; content, pedagogy and technology. The dimensions are presented as interrelated and context specific. The TPACK model has been developed to frame the complex interaction be-

tween teachers, content knowledge and ICT (Otrel-Cass, Khoo & Cowie, 2012). The TPACK model has had a substantial influence of e-pedagogy and teachers planning of and use of ICT to facilitate learning processes, acknowledging the importance of didactical consideration in the use of e-learning and it is stressed that the TPACK model has a high-impact advance in teachers training (Moreno, Montoro & Colón, 2019).

Blended Learning

Blended Learning might be regarded as a relatively new approach. However, Blended Learning can be traced back to the beginning of the 1900's and the mail distributed correspondence courses. The form and the media in use have nevertheless changed.

Today, Blended Learning is associated with a complementary mix of face-to-face and online computer mediated instruction. Garrison and Kanuka define Blended Learning as: "the thoughtful integration of classroom face-to-face learning experiences with online learning experiences" (Garrison & Kanuka, 2004, p. 96). They also stress that there is complexity in the integration of the two modes and a huge challenge in the implementation, as there are unlimited variations of designs, implementations, and challenges, as applications vary depending on the context.

Blended Learning is a blurred concept aligned with many and overlapped concepts. For in-

stance, Computer Supported Collaboration (CSCL), Computer Supported work (CSCW), Computer Mediated Communication (CMC), Networked Learning, and Flipped Classroom are approaches that are roughly consistent with Blended Learning, even though they are subsets of a larger milieu (Dau, 2015).

The word 'blended' in Blended Learning is often confused as it refers to a process where different ingredients are mixed in a way where you cannot separate the one from the other. Also, the concept of learning can be a problem, as Blended Learning is typically defined as the combination of different instructional modes in an educational design. Hence, learning is something that must take part in such environments, but the definition does not describe what is going on among students or how they adapt and learn. Oliver and Trigwell (2005) have underlined that: "What is actually being addressed are forms of instruction, teaching, or at best, pedagogies" (p.17) and they suggest the Blended Learning should be redeemed in the sense of looking into the how students learn in Blended Learning environments. Based on a longitudinal study, Dau (2015) has proposed that, among students participating in a Blended Learning environment, learning can be defined as wayfinding, where mobility, sociality, spatiality, emotionality, interaction, identity, and structure frame the wayfinding process. Most of today's Blended Learning approaches are founded in constructivism, social constructivism, connectivism, and experience-based learning. However, it is revealed that the borders between formal and informal learning are blurred in Blended Learning environments (Dau & Ryberg, 2014). This supports the idea of accentuating the metaphor of wayfinding to the learning process.

In this booklet we take a departure from the understanding of a Blended Learning environment by looking into the learning approach and design of such environments. Hence, we regard the concept of Blended Learning to be focused on learning instead of instructional practice which is a departure from the sense Garrison and Kanuka (2003) describe Blended Learning.

Garrison and Kanuka (2003) describe that the use of a Blended Learning environment offers several benefits and combinations for scaffolding a dynamic learning environment. However, they stress that any approach to planning a Blended Learning course must begin with considerations of the various specific and contextual needs and the available resources. This includes both the physical and online environments. Garrison and Arbaugh (2007) have described a conceptual framework called 'Community Of Inquiry' to unpack the practice of online learning (figure 3). Their framework illustrates the design elements that must be clarified in the planning of an educational experience. A central dimension is the teaching presence. The teachers´ interaction with the student in online environments are crucial for the success of the e/B/F course. It demands for the teacher to care-
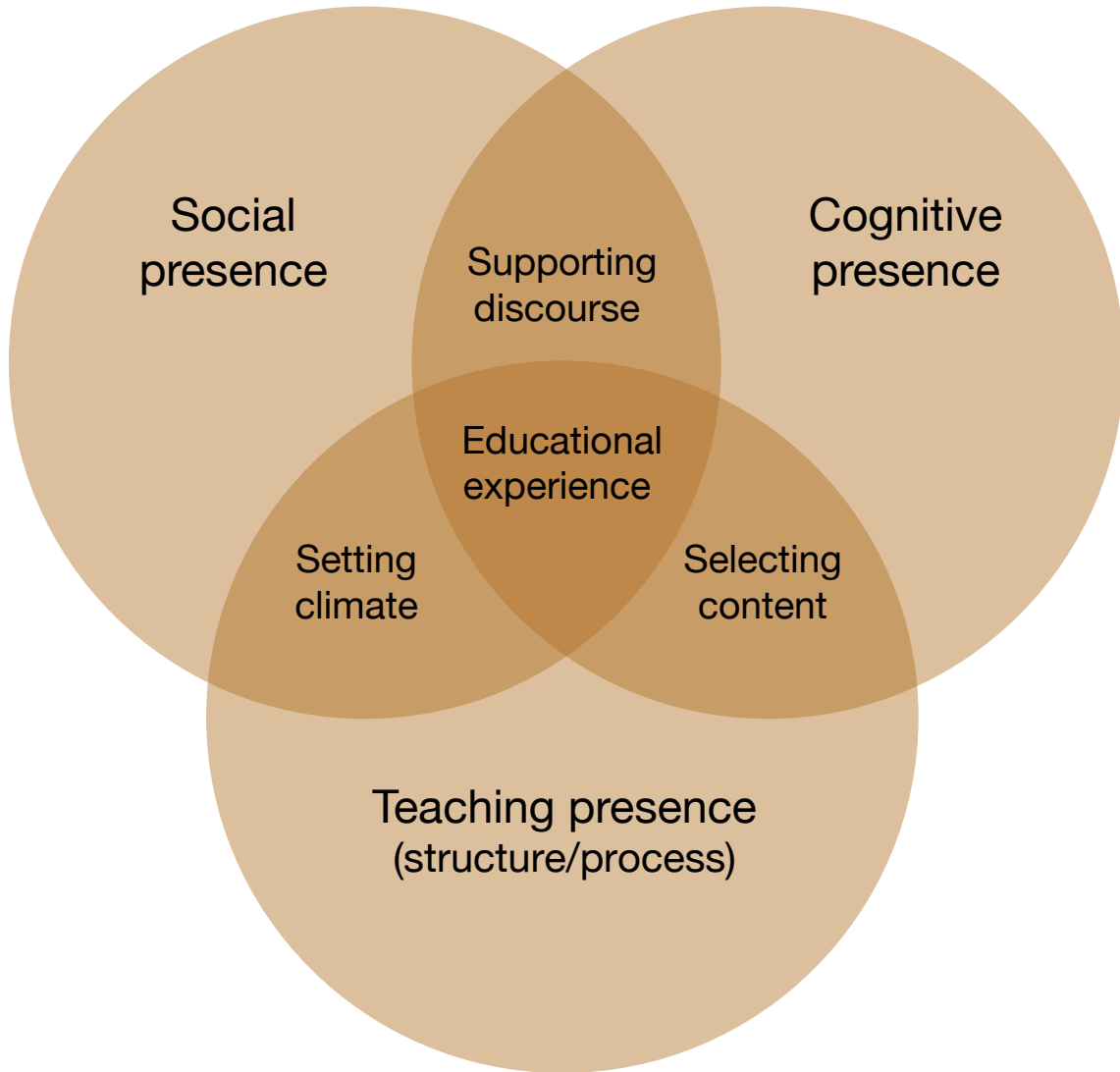
Community of Inquiry

Figure 3: Community of Inquiry Framework (Garrison & Arbaugh, 2007)

fully select the relevant content, setting and the climate. The two other dimensions include the facilitation of the cognitive and the social presence, which are important elements in the learning process. Those two types of presence are facilitated by a supporting discourse (figure 3).

The idea behind the community of inquiry (figure 3) is to create a learning environment that supports the students' learning experiences and development. This is in accordance to the idea of supporting students' wayfinding. The Community Of Inquiry (COI) framework aims to support the creation of a climate where curious, collaborative, and critical students can develop knowledge and experiences together with their peers and teachers (Garrison & Arbaugh, 2007). The main ideas of designing a Blended Learning environment are; that it needs to address the element framing a COI, it facilitates wayfinding and it should clarify the roles of the student and teacher. In addition, the design should influence and control the use of technology, motivations for action, management of the infrastructure and settings - all while delivering content (Glud, Buus, Ryberg, Georgsen, & Davidsen, 2010). The most important learning goal should be the main guide for the design, because students and teachers need to know the purpose of the journey. This guidance might be facilitated by feedback processes and peer-feedback. The REAL model draws on the notion of feedback, which forms also a strong element in the concept of Flipped Classroom.

Flipped Classroom

The 'Flipped Classroom' is affiliated with blended teaching concepts and has strong similarities with our understanding of Blended Learning, in the sense of the use of Blended Learning environment. The Flipped Classroom model aims to re-think the traditional division between online and physical education, expanding the understanding of different deliverables' contextualization. (Bishop & Verleger, 2013). In other words, the Flipped Classroom model seeks to create new conditions for the face to face interaction between teachers and learners. Flipped Classroom is a pedagogical approach that support student-centered learning and students engagement (Gilboy, Heinerichs & Pazzaglia, 2015). According to Tainter, Nilson & Wong (2017), the Flipped Classroom follows a processual frame:

> "In this paradigm, students first gain exposure to new material individually, usually via reading or watching videos, which provides a distinct advantage for learners who perform at different paces. Class time is then used for learning-centred activities that build on the pre-class work rather than the traditional instructor-led lecture sessions. The overall effect is to ''reverse'' or ''flip'' the way in which material is presented to students" (p. 188).

In practice however, the flipped elements can appear in many forms including different activities like quizzes, video instruction, podcasts, assignments, conceptual discussions and more.

The difference between face-to-face and e/B/F

Before applying the e-Learning, Blended Learning, or Flipped Classroom, we will map the significant differences between the face-to-face learning environment and the online environment (Nyvang & Dau, 2013; Dau, 2015) in relation to collaboration, project work, instructions, and tasks. The latter includes assignments, quizzes, and assessments. Table 1, overleaf.

When designing e/B/F, the teacher must clarify the purpose, the expected outcome, and the processes involved. From there, the teacher can make a choice of using relevant deliverable modes. Table 1 can guide the teacher. If the main elements of consideration are placed at the right column the teacher might select a purely online course, but if includes both columns, then either Blended Learning or Flipped Classroom might be a useful solution. However, the considerations of supportive elements illustrated in figures 1, 2, and 3, and REAL, must be taken into consideration. Moreover, addressing the pedagogical approach, learning theory and feedback forms is relevant when considering any teaching plan, and for some this will be a paradigm shift from a lecture based class

Pedagogical approaches, motivation and feedback

Pedagogical approaches are framing the instructional practices carried out in any teaching situation including e/B/F environments. In this booklet we have framed our understanding by social constructivism. Social constructivism is based on an understanding that social and individual knowledge processes are interdependent and co-constructive (Palincsar, 1998). Social constructivism draws on the pedagogical understanding and ideas framed by Vygotsky, Bruner, Bandura, and others. The foundation of social constructivism is rooted in an understanding of reality as constructed through human activities and knowledge as socially and culturally constructed. Thus, learning is also a matter of socially constructed activities (Kim, 2001). However, socially constructed activities and knowledge development is conditioned by the individuals' motivation (Vygotsky, 1978). Motivation can be both intrinsic and extrinsic. Intrinsic motivation is when people are motivated, engaged, and have a personal interest driving the needs and personal curiosity. In contrary, extrinsic motivation is afforded by the environment e.g. by supporting the persistence and the behavior of people through grades and marks, for example (Docan, 2006).

Both intrinsic and extrinsic motivation are involved in a broader understanding of feedback. The broader definition of feedback is suggested by Boud and Molloy (2013) in their description of feedback. They suggest a rethinking of feedback:

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Table 1: Overview of the difference between face-to-face and online learning design.

Learning design element	Face-to-face	Online
Collaboration	Physical Situated Embodied Include direct eye contact Include socio emotional Include touch and smell	Virtual Distant Visual or written Flexible Asynchronous or synchronous
Project work	Verbal and socio emotional clarification Embodied facilitated communication and discussion Writing, reading, and remediating the content together in the physical setting Collaborative or cooperative commitment	Cooperative Structured by the setup Progression is documented and visible Asynchronous writing and discussion Commitment is weakened
Instruction	Interruptive and contextualized Body-language supplementing content Changeable in situ Direct clarification possible	Precisely Visually afforded
Tasks	Peer-to-peer, group or individual in situ Commitment to peers and teacher is given priority Direct clarification possible	Mostly individualized Visual or text based Quality of the work is clear and documented

"1. From an act of teachers to an act of students in which teachers are part (from unilateral to co-constructed; from monologue to dialogue),

2. From the almost exclusive use of teachers to that of many others (from single source to multiple sources),

3. From an act of students as individuals to one that necessarily implicates peers (from individualistic to collectivist),

4. From a collection of isolated acts to a designed sequence of development over time (from unitary items to curriculum)" (p. 20).

Adding this broader perspective of feedback to an active learning environment thus includes a shift in the mindset of teachers and students where the students take an active part in their own (and their peers') continuous assessment. The teacher becomes a facilitator supporting the formative feedback and the continuous learning process in different settings and contexts. Hence, feedback becomes a matter of, in situ, co-construction between; teacher, student, their peers, and others. In this booklet's description of feedback, this understanding will supplement the more extrinsic motivational element such as grades and marks acknowledging the strength of both interventions. More social constructivist types of feedback and the more behavioral types

of initiatives act as stimuli for participation by rewards or scores. With this framing we will now turn to the description of the elements in a rich environment for active learning (REAL).

Rich Environments for Active Learning (REAL)

The previous section discusses modern learning approaches and introduces teaching environments that are flexible in regard to presence in a classroom, time of participation, and asynchronous participation. With all this diversity, new techniques are employed and one educational strategy that can promote critical thinking skills and create active learning is what we refer to as Rich Environments for Active Learning (REAL). At its core, education in a REAL is based on constructivist values such as collaboration, reflectivity, and engagement (Lebow, 1993). In this chapter, we will unpack this acronym further.

The definition provided by Grabinger and Dunlap (1995) in their foundational paper on REALs 'A definition' proposes that "REALs, are comprehensive instructional systems that evolve from and are consistent with constructivist philosophies and theories" (p.5). The constructivist approach in learning environments places the learners in the center of the learning process. This refocus enables students to feel self-efficacy (Bandura, 1977), autonomy, and responsibility for their own learning (Piaget, 2013). In order to make this function, some broad principles such

as promoting study and investigation within authentic contexts and encouraging the growth of student responsibility, initiative, decision making and intentional learning increases in importance. Some of the literature refers to the utilization of dynamics, interdisciplinary, and generative learning activities that can promote higher-order thinking processes (Grabinger & Dunlap, 1995). A major part in this constructivist approach is that feedback and assessment is both time consuming (i.e. one-2-one instead of one-2-class) and requires a commitment to flexibility and motivation. Moreover, REALs can promote critical and reflective thinking if located within a problem-based environment of instruction (Lebow, 1993; Savery & Duffy, 1995). Thus, the REAL system extends other simpler models e.g. the TPCK model´s three forms of learning pedagogies (Mishra & Koehler, 2006). In the following we will unpack the acronym REAL.

R.E.A.L. - Rich

In this context, we refer to a 'rich' environment as one that is flexible and diverse from the student's perspective. Any learning environment will suit some students more than others depending on the student's perceived ease of use, the perceived usefulness, and the student's experience and motivation. The diversity of personality types, existing knowledge and skills leads to any system based on constructivist principles to benefiting some students more than others. This can be combated by paying attention to creating a learning environment that is rich allowing for a diversity of interactions. A learning environment implies a space or place that includes the learner and the setting where the learner 'acts' (Wilson, 1996). The fact that these settings can be virtual and even asynchronous and still be a rich environment is a function of space that the teacher creates for this interaction.

At Wilson's (1996) time there was little chance he would preconceive the diversity of the virtual space afforded by modern ICT in the classroom, however the principles are still relevant. In fact, he already makes the case that a learning environment "seems fuzzy or hard to define" (p. 5) and arrives to the following definition

> "a place where learners can work together and support each other as they use a variety of tools and information resources in their pursuit of learning goals and problem solving activities" (p. 5).

Using this as a base leads to the realization that the modern ICT environment creates these spaces in social media, collaborative documents, and chats. The goal for thinking about these spaces is to try to match learning goals with the potential afforded to the students by a variety of ICT, existing skills and knowledge.

Rich environments typically have a variety of tools and phenomenaria, and place control of the environment in the hands of the learner. The

challenge to teachers who are interested in exploring new possibilities with a REAL approach is that they find themselves in a place where they have to transition from classical teaching formats to those where they have to rethink their teaching approaches through the use of ICTs. The final section provides the reader with a worked example of how to make the transition from a presentation style lecture to a REAL.

R.E.A.L.- Environment

The modern Higher Education Institute (HEI) in the Danish context is still classroom based, and in a majority of cases, is still based on a presentation-style lecture. The rooms provided for teaching in a Danish HEI are commonly modern office space, with a white/blackboard, projector, and desks arranged in rows before them. Some teachers create rich environments by modifying the space and the lesson design according to their needs, however, these teachers are often the early adopters and innovators. Aldunate and Nussbaum's paper (2013) shows that while nearly 75% of teachers identify themselves as innovators or early adopters, only 34% invest more than the median amount of time in using technology. The Handbook of Design Research Methods in Education reports a meta-analysis result of 2.5% of participants as innovators and 13.5% of early adopters (Kelly, Lesh, & Baek, 2014). This implies that while ICT in the classroom affords a wide variety of different environments only a small percentage of teachers are using them. Moreover, recent studies reveal that the use of technology is highly associated with the teacher's pedagogical beliefs (Fives & Gill, 2014; Tondeur, van Braak, Ertmer, & Ottenbreit-Leftwich, 2017).

An environment can be virtual, such as a chat room or moderated discussion board, which is unconnected to the school in any way except the fact that the students choose to use it. The key to unlocking the diversity of environments is the learning and lesson design. Making learning goals the center of the teacher's presentation so the student has a deep and nuanced understanding of them. As mentioned before in this chapter and several of the booklet's in this series, once the student is keyed into the myriad of opportunities afforded to them by ICT, they as natural users, utilize them. Sometimes they utilize them in ways that are unexpected but, in most cases, it is effective (Chemi & Zhou, 2016).

An essential aspect of creative spaces for participation outside the classroom is that the teacher makes the space available for the student (Rienties & Toetenel, 2016). Many such environments add complexity to the student's day, i.e. they are not sitting listening to a lecture, and therefore there is competition for attention. This is where the importance of leadership, motivation, and management enter the discussion. The role of the teacher is to create a space and then communicate how the space is to be utilized. This is often successfully done by creating a plan for the

activity. Research shows that the actual space is less important than lesson design for improving learning outcomes (Rienties & Toetenel, 2016). This implies that where a teacher saves time by not delivering so much content, in order to make the new environment work, learning outcomes are improved by spending time ensuring the space will generate the kind of activity the teacher requires for the student's learning outcomes.

Examples of environments that can be used in the class are discussion threads and collaborative spaces, such as shared documents and message boards.

R.E.A.L.- Active

Transitioning to an active learning environment has to start with the realization that teaching often involves passive learning. In another booklet
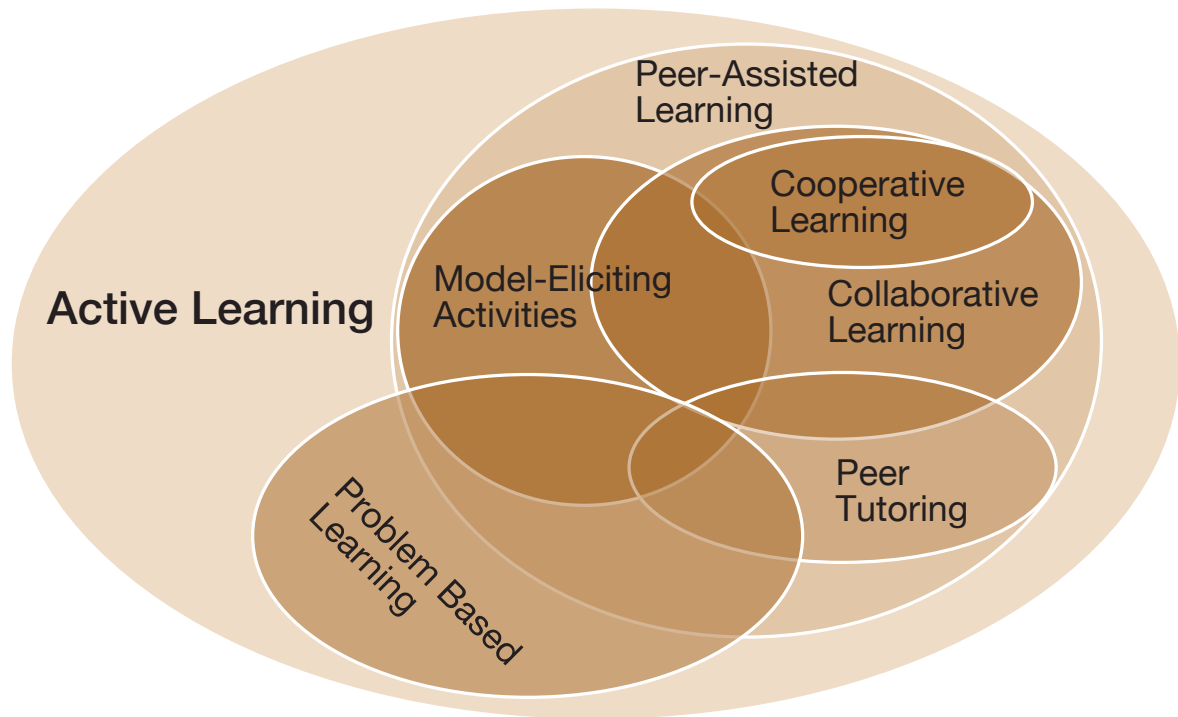

Figure 4: Ven diagram of learning theories, (Bishop & Verleger, 2013)

in this series, Gnaur and Hüttel explore active and passive modes within and outside of the classroom (2016) and recognize the advantage of moving passive learning activity outside the class. To summarize, one of the key ideas behind flipping the classroom is to mitigate negative aspects of passive learning, "such as procrastination or surface approaches to learning" (Abeysekera & Dawson, 2015, p.4), happen outside the classroom and active learning within it. In this booklet, we extend this idea and explore how active *and* passive learning can happen outside the classroom. One of the principles here is that active learning should be well structured, and that lesson design is of key strategic importance (Rienties & Toetenel, 2016).

Many strategies, such as peer-2-peer, cooperative or collaborative learning, reflective based learning, and problem-based learning, are all examples of active learning strategies that the teacher can employ to improve outcomes.

In figure 4 from Bishop and Verleger (2013), it is shown that active learning takes place amongst all the modern approaches, so it is a common theme that the lesson design should include that students are active. Certainly, active students are consistent with the modern curriculum requirement for skills and competency. In fact, it is the primary way teachers can provide for the obligation to give students competency.

Students can be active by doing practical activities as is obvious however, active learning also includes dialogue, discussion, explaining, arguing, defending, and reflecting or responding to others. Activity refers to mental processes rather than physical activity in most cases. It is true that physical activity is also recommended for students, especially in primary schools however, this seems generally less of a priority in HEI (Bishop & Verleger 2013). However, activities in labs, makerspaces, classes, and other affiliated campus learning environments are in many cases also involving some kinds of physical activity even though it is not included at a high pulse.

R.E.A.L.- Learning

REAL is a learning model for instructional practice (Grabinger & Dunlap, 1995). The idea is to engage learners and give them an opportunity to take control over their own learning process while working with authentic problems or in authentic contexts. In the realm of REAL, learning is as flexible as the teacher's whim to define it. By this we imply that learning can be enhanced by a REAL, but the structure is flexible, the key is that the environment is rich and active, and the outcome will be a result of careful lesson design. Thus, the REAL learning is also dependent on the student's engagement, involvement, and motivation. Nevertheless, REAL learning is a pedagogical structuring of processes aiming at extending and developing student knowledge and professional judgement. The basis for working with REAL takes its departure in the constructivist learning approach

but is also inspired by elements from social constructivism, cognitive and self-regulated learning theories, as well as practice theory. This learning approach is founded in the idea that people learn by continuous knowledge construction taking place in the activities, the collaborative work and the cognitive processes that people are involved in. Especially, the idea that students can engage in meaning making processes and social negotiation with peers and others. In REAL however, the idea is that the teacher has a responsibility to guide and structure these processes in an appropriate way. A structure and guidance should be founded in the relevant pedagogical considerations including the goals, the student's prerequisites, the right mix of didactical elements, the social environment, and the available environments. The REAL-learning approach is thus putting a responsibility to the teacher combined with some explicit expectations for the students to reflect and evaluate their learning processes (Grabinger & Dunlap, 1995, 2002).

Principles of REAL's

In order for REALs to be effective, there must be space for students to participate. In class, the space is automatically provided however, when students are outside the classroom, care must be taken in the lesson design to provide space for active learning, which is the focus of this section. There are several principles that helps one understand how to design REALs.

A practical Example
A lecture slide providing a list of the key technical information about the quality standard ISO 14000 was replaced with a quiz. The quiz requires information sourced from ISO website; the students obtain the information themselves to answer the questions.
This will require active research for the students and the teacher has provided a virtual space that can be operated in any of the e/B/F teaching environments or the students in class. In such a case, the quiz evolves from a method of evaluating existing knowledge to a tool requiring active

Principle 1: In such environments, teachers become facilitators of thinking processes, not presenters of knowledge. It is a revelation and a relief to realize that you are not responsible for providing a priori all information. A revelation, because giving a lecture is the primary way we communicate the 'need to know information' to students at a HEI. A relief because there is no way to give them all the information, it is filtered through what the teacher thinks they need and have the time to give. In a REAL, the students should work with lesson plans and objectives, trying to solve a problem and discover knowl-

self-instruction and research, collaboration and can provide instant feedback.

The first principle of REALs (that the teacher act as facilitator and not knowledge giver) is fulfilled. The teacher has not provided the information, but rather facilitated the students to acquire their own knowledge. The quiz format enables the teacher to focus the activity on specific facts that the teacher wanted the student to acquire and more generalized questions can be added to give context.

The second principle, (that there is interaction) has been addressed, because the students are required to interact with the ISO website, and the quiz itself. This quiz could also be done in groups where they can discuss a more nuanced answer, or a long form answer. The students are actively participating in the lesson and this activity can lead to better learning outcomes.

The third principle (there must be space for critical and reflective thinking) has evidently been fulfilled because the students are required to assess quiz answers with respect to their research and the space has been provided for them to act, in class or virtually.

edge rather than be given that knowledge directly by the teacher. REALs based on this principle can improve learning (Dunlap & Grabinger, 1996; Fetherston, 2006).

Principle 2: Learning must occur by interaction. It is common in educational literature to read about the benefits of peer-to-peer interactions. An example of a REAL principle is that students should work cooperatively in teams. Team activities make students analyze their own and others' knowledge and reflect upon others' interpretations. According to Vygotsky (1978) and Wenger (1998) most important learning occurs through social interaction. Moreover, interaction with peers in the class are as important as interactions with teacher and interaction with educational content (Moore, 1989). It could be argued that REALs feature the role of teacher as one to encourage interaction, so higher order thinking such as analysis, synthesis and evaluation become involved (Bloom, Krathwohl, & Masia, 1964).

Principle 3: There must be space for critical and reflective thinking, which is dialogic in nature

(Dunlap & Grabinger, 1996; Mulcare & Shwedel, 2017). An example of this principle in action would be for teachers to ask such questions as: "What methods did you use? What worked? What did not? Are there any other methods you would use next time?" According to Walberg (1984), instructional interventions as "reinforcement, cooperative learning, tutoring, feedback, and adaptive instruction have the highest effect on learning" (p.24).

The traditional instructional lecture does not sit well within this active learning paradigm. To teach in a e/B/F does not mean REALs must be created, this is just one strategy that may suit the content. However, in any Community of Inquiry, consideration of the selection of the content must be supplemented by the setting of the climate and a supporting discourse connecting the social, the teaching, and the cognitive presence (Garrison & Arbaugh, 2007). How this can be achieved by REAL is explored later in this booklet. The issue that faces the majority of teachers is how to take slide presentations of thirty or so slides and prepare this information for use in the e/B/F courses. The translocation of slides from one context to another is not sufficient and neither is it appropriate, as such translocations will reduce the possibilities and the affordances related to the different environments. Some teachers take the approach of recording their slide shows. This may seem like a convenient way forward however, what results is still passive learning. What is required is that teachers can evolve their slideshow content that better suits the REAL, and a consistent and usable methodology is provided herein.

One of the key aspects to this structure concerns the leadership, which is essential (Freeman et al., 2014). Most teachers know that merely asking for the students to complete some exercise may result in a poor response. Economic theory tells us that where a required action is not taken, there is a lack of incentive (Rothschild, 1994). So, the incorporation of a REAL into the e/B/F environment requires a strategy that considers how to incentivize students. As the teacher is not co-located where or when learning is taking place, the teacher is not able to actively manage the learning process directly. So, what are some of the management tools available to the teacher in the e/B/F environment? The most potent tool available is the learning management system (LMS) where the teacher is offered management tools such as the power to grade work and give points or feedback. A teacher might look to business management for effective strategies suited to the age, ability, and task. The teacher has the facility to monitor activities via the LMS, especially as lessons migrate from a lecture style into the REAL. This is because the teacher is not lecturing but uses the freed-up time that lectures would have taken up otherwise, to provide feedback and follow up on work that has not been submitted. The grading of work done in the REAL provides three main positive benefits, one; the students maybe incentivized to compete for

points or credit, and the teacher has a good overview of participation, (via the metadata) two; the marking provides an opportunity for the teacher to provide instant and formative feedback, and three; the familiar grading system is a trigger to the students' extrinsic motivation (Docan, 2006). However, the triggering of the students' intrinsic motivation is dependent of a broader and more formative feedback, e.g. feedback offered by peers and teachers that involve student's active engagement, co-construction, and dialogue (Boud & Molloy, 2013).

Overview of planning Rich Environments for Active Learning
Anatomy of a slide show and how to make use of it to create a REAL

It is common that institutions are now requiring teaches to move their practice from face to face environments to e/B/F. This macro scale problem is daunting for teachers in many cases. The techniques offered herein have been around almost as long as the technologies that can afford them have been made available. However, the whole teaching process is set on its head. The presentation slide, as seen in so many classes, is often a collection of the teacher's opinion as to what is important to say in class. It is typically a whole lecture worth and is often well crafted. Teachers can consider each full presentation as the micro scale, the nanoscale in this case applies to each slide in a presentation. If we approach the issue from a slide-to-slide perspective it becomes much clearer for the teacher to combine different methods, tools, and environments to achieve specific goals. Because the goals become much simpler on a nanoscale (slide-to-slide basis), this removes a barrier to progress.

If the teacher treats the existing presentation slides as a storyboard and script for recording video it is easier to take existing content and putting it in a format that is suitable for the blended environment. This process helps teachers also to understand that the presentation style lecture is teacher-centered or teacher-oriented (Kravchenko & Cass, 2017), a document that a teacher creates to use as a prompt on what to say in class. Such presentations are often highly crafted and can be successful at achieving goals when included in a lesson design with assignments and other active content.

To create a REAL, presentations need to evolve more active ways for the students to acquire the information in the presentation. A key part of this process is the social constructivist approach where the teacher no longer needs to play the role of knowledge giver, and instead, the role is focused on establishing goals and nurturing activity. Focusing on the nanoscale, the teacher can take each slide and decide what future it had in different contexts (Cass & Kravchenko, 2017). At each slide it was asked if it was essential if the information came from the teacher, or if it could involve an activity where the students would

be responsible for finding the information or achieving the goal.

This approach has been condensed into a modified lesson planning toolkit that is presented in the final section. The process has been divided into four decision points a teacher can leverage to make this process structured and therefore repeatable.

Modified Lesson Planning

The following section takes a contextual look at the four core elements of the lesson plan; Goal, Methods, Tools, and Environment as they are applied in this process. This all leads to the Wave teaching planner (see figure 6), a simplified tool for assisting teachers create REAL's from existing content which is presented in the next section.

Learning goal - Column 1

In the example given (figure 5), the teacher is showing that a learning goal is either a new concept, some new vocabulary, a background/history, or a model. On the nano scale of this slide, the teacher asks; Is that the whole story? Well no, it suits only that lecture this particular slide is embedded in. As a reader of this, you may well feel that this list needs some additional goals. In your case that is probably correct, and how appropriate it would be in class to hear your opinion and have it discussed by your peers if your other goal should appear in the list. If in class, this is as easy as putting your hand up, however
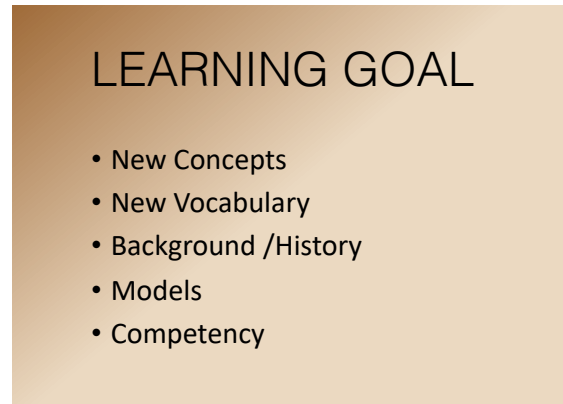

Figure 5: A typical presentation slide

in the e/B/F environment the teacher must create this opportunity virtually. This is the main subject of the following chapter. This slide (figure 5) actually presents the first column of the wave teaching planner (figure 6) and is a complete list of goals in this case. This information can only come from the teacher; therefore, it might be appropriate to convert the slide into a little video or even post it as a pdf. Research shows there is almost no difference in how content is delivered to a student, it is the lesson design that is of critical importance (Rienties & Toetenel, 2016). So now, taking this example to the e/B/F environment, the teacher starts with the same presentation slide, and alone has insight to the learning goal of that slide. Depending on the teachers goals, the teacher might ask you for your list of commonly used learning goals and publish that to a collaborative space for others in the class to

comment on or present a .pdf file showing the list and talking about something completely different . The insight here is to look at each slide or small group of slides in a nano-scale slice and decide what the learning goal is.

Learning Approach – Column 2

The next step is to choose which learning approach is best suited to the learning goals. Across all subjects, across all institutions there are as many methods and blends of methods as teachers, so this list may get unwieldy. However, some lessons happen in a s pecific laboratory doing an experiment which is excluded here, as there is no simple improvement afforded by removing students from that environment. This list is not meant to be exhaustive, rather than a list of methods widely used in general and is compiled for its explanatory ability. A lecture should be at the top of the list of general methods however, the purpose of this booklet is to discuss moving to the e/B/F and replacing the lecture, and it is the lecture's content that we are assessing.

Here are the learning approaches that were useful to the authors:

- **Guided research**
  When the information in the slide contained information available online in a book, paper, website, or other space, then it is a simple task to let the students go to a site and retrieve it themselves. In this way the students have to write the answer, which has a similar ef-

fect of taking notes. Importantly, the teacher should set it up so that it is not a difficult task to retrieve the correct information unless that process adds to the value of it. Furthermore, the teacher should follow up to check if the students have retrieved the information and this can be done in a variety of ways like answering some quiz questions, for example.

- **Independent inquiry**
  If the information is more conceptual and there may be many pathways to it, the teacher can allow students to conduct their independent inquiry in a context they have chosen to apply the concept to.

- **Collaborative Inquiry**
  The collaborative inquiry allows students to go deeper individually and engage in critical sparring with other students. This is often used to explore case studies and is often part of a wider learning goal or reflect at the micro scale of the whole lecture.

- **Peer-2-Peer**
  Here, the learning approach implies that the teacher has set up the lesson design such that the students can critically reflect on each other's work. Examples of this activity might be a group report — a common element in most HEI's but discussion boards work well too. If a student participates in a discussion it is advantageous for the teacher to act as moderator, moving threads in beneficial directions and helping students discover new knowledge.

Teaching Materials – Column 3

The tools the teacher deploys in the pursuit of achieving learning goals are individual due to the legacy of previous decision tree pathways (Unruh, 2000). Readers should replace these generalized materials with their own array. The list here, is prepared for its explanatory power and is not indicative of any proper way of doing things. The key take-away is that the lesson design has more importance than the method and tools, or rather that it is the combination of lesson design and tools that gives the REAL's their effectiveness.

No discussion on teaching in e/B/F can be removed from recognition of the important role the Learning Management System (LMS) plays. A teacher is afforded different interface opportunities depending on the platform. The case study utilized a sophisticated LMS with many useful management and online collaboration possibilities. The LMS should support integrated quiz and assignment portals where the students can get resources, instructions, and supporting material, and have a secure upload process. The assignments should be integrated with the calendar functions and notifications alarms, and messaging should be easily integrated with time management platforms. In addition, it is assumed that the LMS has some integration with institution administrative side so that enrollments, class allocations, and scheduling are all automated. These features and abilities are common among the main LMS systems.

In regard to the REAL it is the flexibility in the LMS that can afford the teacher the opportunity to exploit different environments. However, adding this complexity to things has the potential to be hard to coordinate, unless it is integrated in the LMS. The teachers who are approaching this method to evolve their practices are also going to have to pay attention that they take notice of apps and tools, such as those listed below, and how they are integrated (Rubin, Fernandes, & Avgerinou, 2013).

- **Documents**
  It is common for teachers to base a lecture on published material like academic papers or a book. There is no reason that students can't go directly to the source to retrieve the information and the teacher's role transforms into facilitator — helping students to find the right book and page; and leader — ensuring the students have received the information and get credit for the work involved in reading it. In the online or virtual environment, documents are equally valid as a source as video or some other material.
- **Video**
  Video is a flexible way for teachers to communicate with students when face to face time is limited or absent. Also, it is a very simple process to voice over presentation slides and in that case the presentation given in class is made more suitable for e/B/F environments. Before a teacher records a video,

it is often worth checking that no suitable video already exists and can be used instead, providing permission is granted. There exist plenty of recorded explanations of basic principles and background concepts in a variety of fields of study.

- **Quiz**

  The quiz differs from an assignment because the teacher puts the correct answers into the quiz and it is automatically graded by the LMS. In this case quizzes were used as a guide for research and tool for activating students in a learning environment and providing formative assessment. In this context, questions should be generated such that the student needs to do the intended research before answering. This takes some careful planning unless the teacher breaks things into smaller chunks. Making a quiz can be time consuming, and from our case study it became clear that teachers who made a lot of small quizzes for the purpose of guiding students to specific information and actively relaying this to the teacher, found this approach much easier than a quiz designed for assessment.

- **Discussion**

  Many teachers include discussions in class, often by asking for 'any questions'. While a moderated discussion often takes unexpected turns, well-moderated, often opens more 'teachable moments' and deals with differences in the class's comprehension. This tool is immediately available in e/B/F environ-

ments in discussion forums however such forums need to be carefully scaffolded in order to be useful (Whipp, 2003). Many of the LMS's have not only moderated discussions, but an ability to grade discussions or incentivize participation which is very important.

- **Assignment**

  Assignments are typically active learning and in the case of this book, need little or no change to be implemented in a e/B/F environment. Assignments have the added complication that the teacher must assess the work after the students submit it. In some cases, this additional workload can seem daunting because in-class interactions are one-to-many, and this can evolve to one-to-one teaching which is time consuming in larger classes. The teacher should always be aware of the impacts of shifting work into a new environment and institutional leaders should be, (but often aren't) cautious about the assumption that e/B/F occupies less teacher time than in classes.

There are many other materials that may comprise an individualized list. The above were identified materials in the case example. Next, we unpack the teaching environment and which environments the specific case utilized.

Environment – Column 4

The paradigm that most HEI teachers currently find themselves in is dominated by the tradi-

tional classroom environment. Creating a REAL requires careful consideration of which environment is activated and how it is included in the lesson design, as there's a myriad to choose from. Also, some teachers and courses will have highly specialized environments such as laboratories or hospital wards which already are consistent with the principles of REALs and are not further considered here. However, if one approaches a class with a presentation, it is worth the time to consider on a slide to slide basis, how this information can be obtained outside the class, and if so, which environment affords the students the best access, to actively retrieve or generate it.

In many HEI's, the LMS is the students' first point of contact with the lesson for the day, and it will be opened in preparation for the class, (even when in-class activity is scheduled), so students often arrive knowing what is up next. In that case, it is often expedient to shift all introductions, learning goals, and agendas from the presentation into the LMS environment, so that it is one click nearer to them and they are therefore, more likely to digest this before class.

Students can also utilize the affordances provided by ICT to coalesce into groups to share knowledge, techniques, and experience, and in the REALs, these require shared platforms. A platform is any host of software allowing two-way communication among participants. The more developed platforms also allow for asynchronous participation. This is the ability to review (track changes for example) other participant's activity and work safely knowing your input will be preserved and shared. Research reveals the importance of students' contributions and responsibilities through assigned student online roles e.g. as motivators, directors of the conversation, idea makers, theory users, respondents, and synthesizers and summarizers of fulfilment (Wise, Saghafian, & Padmanabhan, 2012). Especially valuable is the student's responsibility for the start and direction of a discussion.

An excellent way to stimulate a robust discussion is to enable the students to comment on each other's work. This forum can take the form of discussion threads and they have the advantage that such forums are quite a familiar space for students to operate in however, some are often unsure about the safety of personal information (Wang, Woo, Quek, Yang & Liu, 2012). Some forums can be quite challenging (i.e. YouTube comments) however, the teacher can create a well moderated safe space for students to develop nuance and to defend their positions.

Some teachers may find utility in utilizing social media channels, but it is of critical importance that such endeavors are well planned. Social media spaces are designed to distract the participant and divert their attention, following clicks and developing advertising revenue, which is some of the challenges faced in Blended Learning environment (Dau, 2015). There is a strong misalignment of incentives, and while it may seem attractive to try to include Snapchat

and Facebook as platforms in lesson design, there is a significant proportion of attention that will be diverted away from structured activity (Wang et al., 2012). YouTube is a social media platform that many teachers use to engage students on some topics, and it is worth checking if a video exists on a topic before recording your own. You can minimize students following clickbait by adding a short URL into the LMS and watch the video embedded within the LMS, thereby enabling you to check if the students have watched the video and exclude the 'suggested' temptations.

Let's consider the wider affordances of the WWW. There is no doubt that almost any information a student seeks could be found on the WWW in some form. The problem is one of incentive misalignment and scale. We rely on search engines to navigate this environment and the results of their activity are not easily corelated with lesson goals or design. In fact, this difference is a 'black box' to everyone except a few experts, and one of the most important things a teacher must do to make effective use of WWW services is to help students navigate to reliable sources, evaluate content, and check origins. The second issue being scale, there is so much information that it is easy for students arrive at exactly the opposite of what the teacher envisaged was the goal. Whether it's climate change or advice on vitamins, there is quite contrarian content that is presented as scientific and it's sometimes impossible to discern unless you are already an ex-

pert. This environment is best navigated towards noncontroversial topics and in a more structured approach by feeding starting points or prewarning students of the controversial aspects unless the controversy is part of the lesson plan.

Of course, there are as many environments as a teacher's creativity allows and each will tend to afford students depending on the lesson design, at the risk of being repetitive, it is the lesson design that is the critical aspect here. In the next chapter, we will explore lesson design in the context of an existing power point presentation.

Introducing the Wave Teaching Planner

At this point we would like to introduce the wave teaching planner shown in figure 6. It is designed to help a teacher think about a slide's content and explore ways, other than a slide, to achieve the learning goals. Most teachers will have a substantial number of slides prepared for lectures, but as discussed, simply recording them is not taking full advantage of the affordances of the ICT and LMS available.

The wave teaching planner is constructed so that from left to right the columns represent the learning goal, learning approach, teaching material or tools, and the environment. The aim here is to separate these aspects of the lesson design so that the teacher can assess which of each is appropriate for the learning goal of the exercise. The key to this approach is the na-

The Wave Teaching Planner

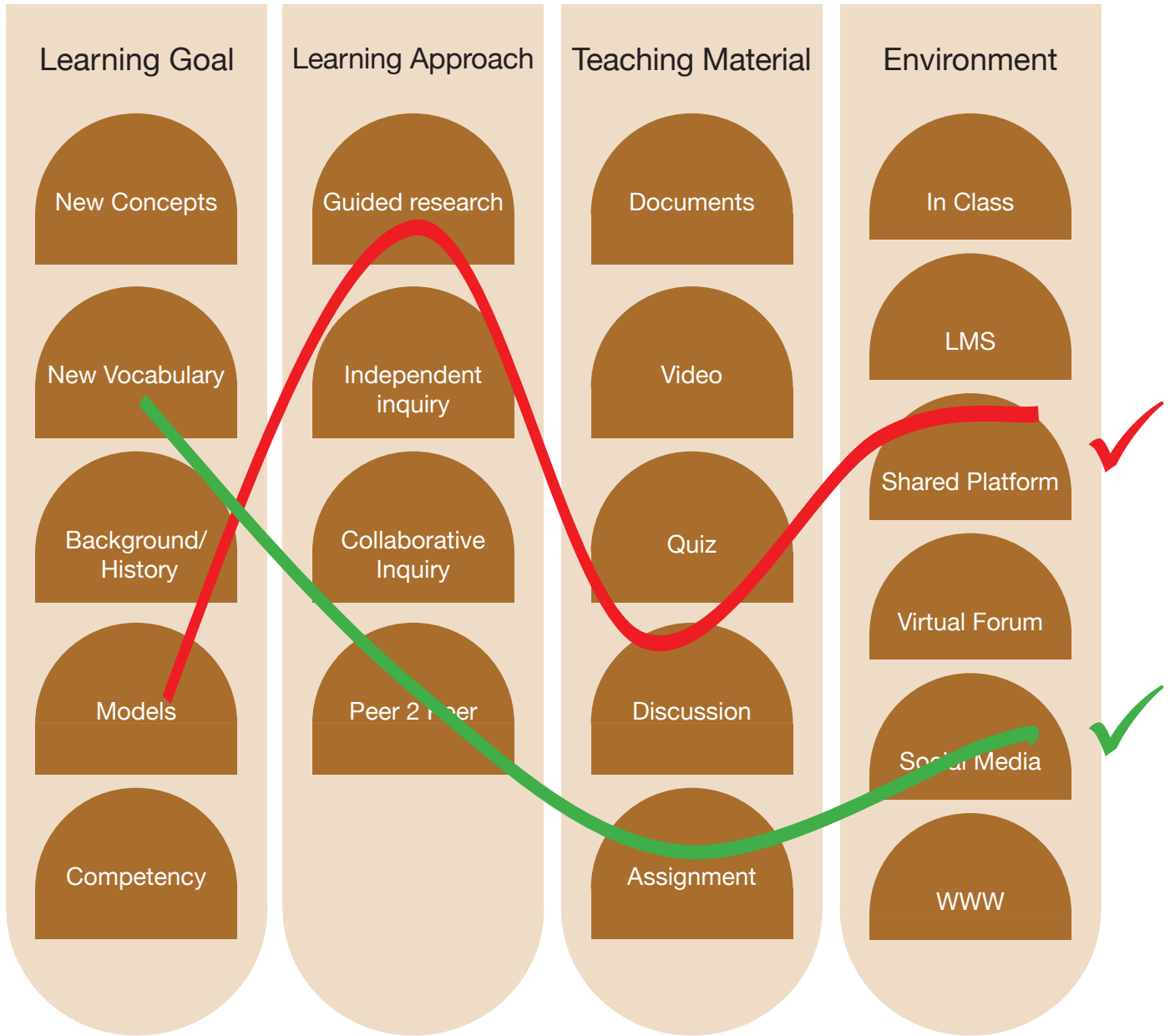| Learning Goal	Learning Approach	Teaching Material	Environment
New Concepts	Guided research	Documents	In Class
New Vocabulary	Independent inquiry	Video	LMS
Background/ History	Collaborative Inquiry	Quiz	Shared Platform
Models	Peer 2 Peer	Discussion	Virtual Forum
Competency		Assignment	Social Media
			WWW

Figure 6: Wave teaching planner for lesson design promoting constructivist approach to e/F/B lesson design.

noscale of deciding on a goal for each slide (or say, trio of slides) rather than a lecture of say, 30 slides. The issue that the teacher faces is principally one of scale. In the case study, once teachers were introduced to this process, they immediately could see the advantage of considering the smaller scale and found it much easier to think of innovative ways to move into an active environment. It was reported by the teachers that it was interesting that in group exercises there was a rapidly forming group consensus on which combination would be coherent for the students and also in the larger perspective of the lecture or module goals.

The wave teaching planner is designed to break individual slides (or small sets of several) into subsets, starting with the intended outcome i.e. the learning goals, and consider the methods, tools, and how this outcome can be achieved — where.

What is being shown are two different examples, hereinafter referred to by their respective color. These two waves indicate the learning goals of introducing a new model of a technical aspect (red) or new vocabulary (green). How the teacher chooses to design the lesson (at the nanoscale) here is indicated by following the wave to the right. It is important to remember that the lists presented here are not definitive and only represent a selection of methods, materials, and environments. A teacher approaching this can use simple post-it notes to include any methods, materials, or environments that are available to

the teacher, both technically and experientially. One aspect of this approach is that most whole lectures cannot be simply moved to a different environment. However, when looking at an individual slide it is easier to think beyond the CR environment only and consider how that little piece can be evolved to a virtual environment.

Example 1: The red wave

Starting with the red example in figure 7, the original slide showed a theoretical model and, in this case, is a similar example without the technical issues. The three dimensions of learning model (Illeris, 2002) and a proposed typical slide is shown in figure 7. For the purpose of this example, let's assume that the goal is to introduce this learning model to a class of teachers.

Step 1 - The process is that the teacher can ask 'is this slide in this lecture the only way the students can get this model?' Certainly not in this case; it is widely available, so the teacher decides that the students should go to a particular place to get the model with the relevant text and offers a link to the page. The teacher chooses guided research.

Step 2 - In the lecture the teacher would talk about the points of the triangle and what they represent. The teacher would further discuss the gradual continuums represented by the two bi-directional arrows. However, because the teacher has guided the student to a page that has these main points included, the role of the teacher is modified from the knowledge giver,
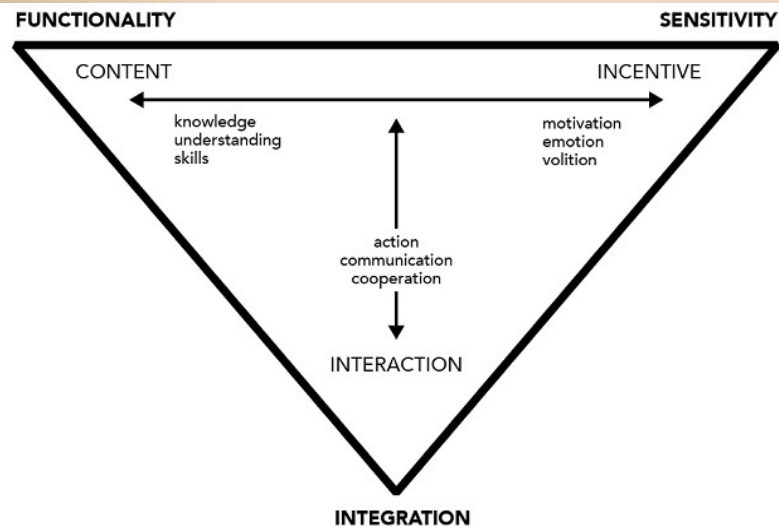
3 Dimensions of Learning

Figure 7: example of a model for the wave teaching planner red example. Using image from Illeris (2006 p.26)

to the guide and mentor. The teaching material chosen for this is a discussion platform, because in class the teacher would give relevant examples and put the labels into context and the students might discover this context by discussing what is happening with each other. Utilizing a discussion platform, the teacher can seed a discussion by asking for the students to comment on the information they have found and give their opinion. An example might be asking the question, "In this model, how do you think you can move learning to the left along the top continuum (acquisition)?"

Step 3 -Because the discussion is a multi-modal communication, the platform stimulates peer-to-peer activity. The teacher chooses a shared platform that everyone in the class can use and interact on. The students are asked to 'like' other's comments that they support and add critical commentary on those they don't. Furthermore, the teacher joins the discussion at a later time and posits different angles or questions on the

comments, stimulating deeper thinking and critical reasoning skills.

You will see on the wave teaching planner (figure 6) that at the end of the wave is a tick. This tick represents the requirement to go back and look at the student's activity. The activity can be summatively assessed, but it is not critical to summatively assess student's participation herein any more than it is for their participation in class, rather the teacher needs to act like a leader and mentor. This is an opportunity for formative assessment, looking to see participation is an opportunity to ask students with no participation if they have questions or problems, (in the same way as one might in class) delve into their assumptions and preconceptions or give context and nuance to their understanding.

In this example, the teacher moves the time in class giving this slide, say 5 minutes, to go into the discussion, sprinkle 'likes' for motivational purposes, and add comments where necessary. An example of how this might be structured is given in figure 8. It shows the discussion module embedded in the LMS, it is one click for the

Figure 8: An example of a discussion for the red wave.

students and the teacher to follow. In this case study the students in a HEI responded well to the incentives and the due date. The LMS used here makes the discussion an integral part of the lesson.

When this process is approached, the reader will find their own ways to incorporate the leadership aspects such as the likes and due date, these are not necessary elements, just what worked out for the case class and in this environment. In this example the teacher has used the principles for REALs as follows;

First principle — teachers become facilitators of the thinking process, not presenters of knowledge. In this example this principle has been fulfilled, the teacher has only provided a link to the article and the student goes off and looks it up for themselves in their own time. The slides related to presenting the model and explaining the model's parts, can be replaced. The teacher is facilitating the discussion by providing the platform and incentivizing participation. The teacher's further obligation is to follow up and moderate the discussion, correct or intervene where necessary and issue the points as necessary.

The second principle — learning has to occur by interaction. This requires very little explanation for this given example, as it is a discussion and therefore the interaction is implicit.

The third principle — there must be space for critical and reflective thinking, which is dialogic in nature. In this example, the teacher has asked the students to reflect on how they relate to the model and if they can infer how their acquisition of knowledge has been affected. This requires the students to reflect on the model and critically assess how they have moved along the continuum the model presents. The students have also been required to post their reflections and assess the reflections of others.

In this case, the principles have been fulfilled as set out herein, so one can say that this lesson has migrated from the passive lecture environment to a REAL and the teacher's workload has not necessarily increased.

Teacher Feedback

When teaching takes place face-2-face then there is an immediate feedback loop available. A teacher picks up visual or verbal cues from
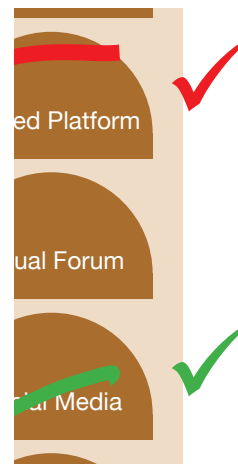

Figure 9: Feedback

the students and is able to modify the lesson as it progresses to facilitate a better learning environment. When teaching moves to the virtual space, or e/B/F environments, then this feedback is denied to the teacher unless the teacher creates the space for it. In the lesson-by-lesson case, and more specifically, at the slide-to-slide nano-scale, this is not considered

summative assessment, rather, it reserves the opportunity for the teacher to interact, follow-up, and give feedback. The reminder in the wave teaching planner for creating space for this feedback is represented by the ticks (figure 10). An LMS that can track these interactions is very useful and the opportunity to issue points is intended not for grading purposes but to gauge the involvement of the student and indicate which students need more attention and follow-up. If you are using one of the major LMS platforms, you will find that much of this can be 'switched on' however, the teacher should proactively make this happen. In this modern data privacy environment, teachers are sometimes denied the opportunity to look at the raw metadata even if they have the skillset to do so. However, if the teacher issues points for participation, then the LMS will present a neat graphical overview. An example is provided in figure 9.

Evolving Practice

The obligation is on the teacher to figure out how to make a system that works for them because if the teacher is not in the classroom, or is trying to shift knowledge acquisition out of the class, then there is a risk that they will assume that having asked students to complete a task, that the students will have done it. It is important for a teacher to actively manage a e/B/F environment. An advantage of moving to e/B/F virtual spaces is that a robust systematized overview can help modify practice.

In the case overleaf, (figure10, coloured boxes) it can be seen that the wave energy assignment was poorly designed. The students did not engage with it and wrote it off. It is clear from this feedback to the teacher the students who normally would do assignments did not participate. The teacher then has the opportunity to review the tasks and redesign them if time allows or modify their own practice next time around. In the assignments where no grade is entered, the teacher can also see that there is still formative feedback to be given to most of the class. It is through utilizing these tools that enable teachers to modify their own practice and keep track of everyone's progress; the students, and their own.

Example 2: The green wave

In the second example, the teacher has the learning goal of introducing the students to understanding and using new technical vocabulary. For this example, we shall return to the actual case study conducted in the subject of energy technology. The original slides were a sequence of three explaining the electricity market trading system in Europe — Nordpool. Originally the slide presentations showed several pages cut from Nordpool website and the learning goals were to help the students understand the differences between the inter-day and the intra-day markets, the spot price mechanisms, primary, secondary, and tertiary reserves etc. Now to anyone outside this course, this will sound like a

Energy Intro (9764)	Debate (9811)	Discussion_HW video (10134)	Group contract submission (10137)	Project plan submission (10139)	Problem formulation (10140)	Roll Call Attendance (10145)	Classwork_Sustainable energy world (10227)	District heating research Quizz (10260)	Class work_Gas infrastructure (10287)	Gas discussion (10293)	Heat pump in Europe (10338)	LCC calculation (10355)	Heat pump application (10357)	Wave energy (10416)	Assignment_Solar collector system (10455)	Classwork_solar research (10638)	HW_solar technologies implications (10639)	Assignments Current Points	Assignments Final Points	Assignments Current Score	Assignments Unposted Current Score	Assignments Final Score	Assignments Unposted Final Score	Current Points	Final Points	Current Score	Unposted Current Score	Final Score	Unposted Final Score
10	10	10	5	5	5	100	15	20	10	10	10	15	15	5	10	15	15												
8	0	0	5	5	5	46	15	14	0	10	0	0	13	0			15	146	146	56.2	56.2	51.2	51.2	146	146	56.2	56.2	51.2	51.2
0	0	10	5	5	5	24	0	0	10	10	10	13	0	0			13	105	105	40.4	40.4	36.8	36.8	105	105	40.4	40.4	36.8	36.8
10	10	10	5	5	5	65	15	16	10	10	10	14	0	0			15	200	200	76.9	76.9	70.2	70.2	200	200	76.9	76.9	70.2	70.2
10	10	0	5	5	5	62	15	0	0	0	0	14	0	0			15	126	126	51.4	51.4	44.2	44.2	126	126	51.4	51.4	44.2	44.2
10	10	0	5	4	5	79	15	8	0	10	10	13	15	3			15	202	202	77.7	77.7	70.9	70.9	202	202	77.7	77.7	70.9	70.9
10	0	0	5	5	5	72	15	16	0	10	8	0	15	0			15	176	176	67.7	67.7	61.8	61.8	176	176	67.7	67.7	61.8	61.8
10	10	10	5	4	5	100	15	20	10	10	10	13	15	5	10	15	15	282	282	99	99	99	99	282	282	99	99	99	99
0	0	0	5	5	5	19	0	0	0	0	0	13	0	0		15	15	77	77	28	28	27	27	77	77	28	28	27	27

Callout annotations: "This student needs more incentive" · "Assignment was poorly designed" · "Teacher has work to do in follow up"

Figure 10: An example of the grading system in an LMS used for active student management in a flipped class environment.

foreign language however, it is very important for the students to grasp what these terms mean because they can make the difference between enabling new technologies and hindering renewable development.

In this case, the teacher assessed the learning goals and felt that by asking the students to use the language it would both demonstrate their understanding of the new vocabulary and put it into context of when they might need it in real life. In order to stimulate the student's use of the new vocabulary, a collaborative exercise was chosen in the form of an assignment. However, in this case the teacher felt that the burden of writing another assignment or project was going to take too much time to digest as the collaborative nature leads to longer reports as each person in the group dives deeper into the technical aspects.

The task framework was set about a case for integrating energy systems and the case data was selected from a local power station that supplies

both electricity and heat for district heating. The business chosen for this exercise published its power production online and files of data were available to download as is the case with price and volume of the trading of energy from Nordpool. The task was to compare data for a given period and record a short video explaining how the power station responded to market pricing.

It is always a temptation to confuse or combine learning goals in this process and set the students a long and confusing task that achieves very little. However, the learning goal in this case was using vocabulary, and not to develop a new marketing strategy. The data was highly correlated because the power station in question was already responding to supply that market. An assignment was created with links to the relevant websites, but one click short of the actual tables so the students were introduced to the relevant websites and how to navigate them. Once the correlations were graphed the students recorded themselves explaining why the power station reacted to market pricing thereby using the vocabulary, understanding where the data comes from, and for the teacher, watching a few short videos to check the learning outcomes were achieved.

The advantage of asking the students to respond in video format, is ease of reviewing data and allowing creative flexibility in work. One group voiced over some presentation slides, another used their smartphone to film their printed material, and another chose a news report format. This flexibility seems to appeal and allowed the less technical in the group to contribute and use the vocabulary in the filming.

As in the previous example, the principles of the REAL have been achieved. The teacher facilitated the process by setting up the assignment and guiding the students to exactly the information that was presented in the original presentation lecture format. Further the assignment was tightly constrained by time and task limiting the student's ability to get side-tracked by details that were outside the learning goals of the lesson. There was interaction as it was a group exercise and involved critical and reflective thinking and activity by asking the students to assimilate what they had found and use the new language in verbal form in their videos. The whole task took about 10 minutes to set up, this was aided by the teacher being very familiar with the websites in question and how to look for highly correlated data from two different datasets. In addition, the students were given only 20 minutes to work on their data and record a video. Now this seems very constricted, but the teacher set this due to the learning goal being using and learning the vocabulary, and not developing an energy management strategy. The class was busy with activity, because 20 minutes is not long to do the work, so the students had to go straight at the task. This class was conducted in the classroom but was copied directly into a Blended Learning environment with the only modification being shifting this to an individual exercise and putting a due

date on it at the typical Sunday midnight deadline for those students who work full time and do their school work during the weekends only.

Conclusions

REAL's are a constructivist approach to achieving learning goals both in and outside the classroom (Dunlap & Grabinger, 1996; Grabinger & Dunlap, 1995; Kim, 2001). Many teachers face the barrier that it is hard to decide how to move a whole lecture into a REAL and the approach utilized here is to break the lecture down into the nanoscale of 1-3 slides in a presentation. In those slides which the teacher cannot think of a more effective way to present the content; a short video can be produced using voiceover technology. However, where information presented is available elsewhere, the teacher can create a REAL by focusing on one single learning goal and choosing from materials, tools, and environment to effectively get the students to obtain the information themselves.

The principles of a REAL are;

1. the teachers become facilitators of thinking process, not presenters of knowledge;
2. learning has to occur by interaction;
3. there must be space for critical and reflective thinking, which is dialogic in nature.

These principles are a simple checklist for lesson planning. The key to understanding the possibilities is the wave teaching planner which graphically represents some of the steps and may open the mind to the expanded possibilities that are made available to teachers, especially if the school has implemented a modern LMS system. This process often involves activities that the students participate in either in class or online, and it is the participation or the 'active' learning that lifts the burden from the teacher as the presenter and arbiter of the knowledge that the students acquire. In this modified environment, the teacher's role evolves to that of facilitator and mentor, leading the students to their acquisition of the goals. To effectively play this modified role, the teacher should take advantage of all the management tools afforded to them by the LMS and migrate as many of the active learning activities into the virtual spaces and collect the metadata. This collection of metadata is essential for the teacher to maintain the role of leader and facilitator because it is essential for the teacher to check that the information has been gained by the students if the teacher has not in fact provided it (Wise et al., 2012).

Many school administrations are seeking ways to reduce cost and increase teacher productivity and it is common to find courses migrating into the online environment in the hope that this will reduce costs. However, only a small percentage of teachers have the necessary skills to make this migration without help and there seems to be a lack of preparatory training for this change (Aldunate & Nussbaum, 2013). We hope that this

booklet and the wave teaching planner can assist teachers to make simple changes to their approach and utilize the affordances provided by the modern LMS to facilitate this change. What school administrations should realize is that migrating things to the virtual space does not remove the teaching burden, in fact, the role for the teacher is changed, not eliminated and the one-2-class teaching effort becomes one-2-one. In this new framework it is important for the teacher to consider how this new burden will affect their ability to mentor, facilitate and guide a class to the learning goals. Strategies to alleviate this new burden are to utilize group work and assignments, encourage pee-to-peer activity, and utilize tools that are embedded in the LMS. The modern teaching environment will become more flexible, and those who evolve their practice will suffer least the burgeoning pressure for increased efficiency and productivity. Teachers also found that the tasks involved in mentoring and facilitating also gave good feedback on how their modified environments worked for the students. With the constant overview afforded in the LMS, teachers could examine why activity led to poor outcomes and repair or modify exercises for the next time around.

Most notably, in our case study, teachers involved found that with so much deeply embedded in the LMS, it became much easier to repeat courses year on year with little or no preparation and investing much more time in facilitation, feedback, and guidance.
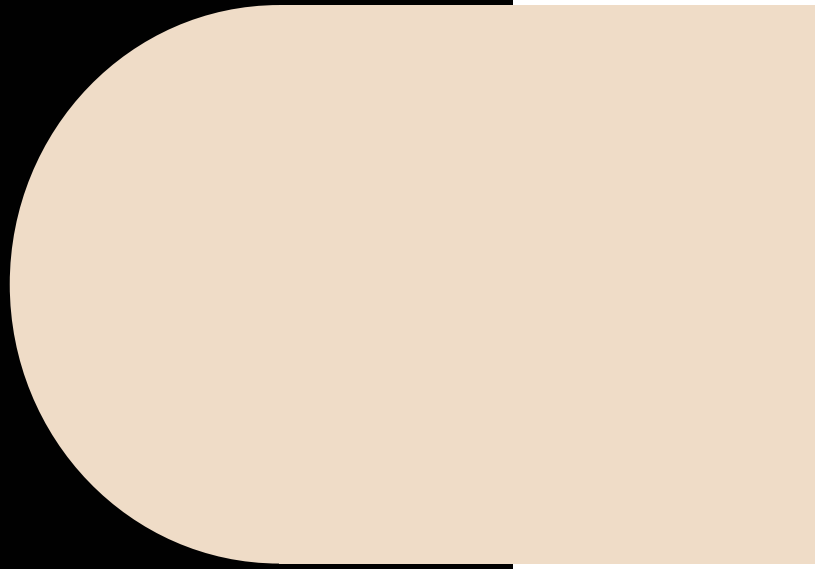
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