What's Educational about Open Educational Resources? Different Theoretical Lenses for Conceptualizing Learning with OER[1]

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Abstract: In the last decade, the concept of Open Educational Resources (OER) has gained an undeniable momentum. However, it is an easy trap to confuse download and registration rates with actual learning and interest in the adoption and re-use of open educational resources. If we focus solely on access, we cannot differentiate between processes of mere information foraging and deep sense making activities. The paper provides an overview of the OER movement, stressing emerging concerns surrounding the educational efficacy of OER and highlighting learning theories which aid our understanding of this growing domain. We discuss building-blocks for a theoretical framework that allows us to conceptualize the learner's part in open educational practices, also characterizing challenges of open learning and traits of successful open learners.

1. Introduction

The term open educational resources (OER) was coined in 2002 during a forum held by the UNESCO as *the open provision of educational resources, enabled by information and communication technologies, for consultation, use and adaptation by a community of users for non-commercial purposes*. Leveraging information technologies (ICT) to equalize access to education has ever since been a core motivation for the OER movement – "*eliminate the access gap to high-quality education in the developing world"* (Pereira, 2007, 42). In the last decade, the concept has gained undeniable momentum. In their report on OER achievements and challenges, Atkins, Brown & Hammond (2007) estimate a total of 68 million OER grants between 2002 and 2006. In 2010, the Horizon Report, which identifies emerging technologies likely to have a large impact on teaching and learning, described "Open Content" as a key trend, expected to reach mainstream within the next twelve months. In the fall of 2010, UNESCO initiated an international online discussion on OER-related topics. The "European Consultative Group on Open Educational Practices" has recently developed management instruments for individuals and institutions to position their OER-strategy (OPAL, 2010). The "Open Resources: Influence on Learners and Educators" (ORIOLE) project is currently looking at ways of gathering and sharing information about the effect of open educational resource (re)use.

As these examples show, the idea of educational material, freely and openly accessible on the Web, attracts substantial attention. The idea is as simple as it is convincing: Free access to educational material facilitates learning. As Elia Tomadaki from the British OpenLearn project pointed out: *With open learning, people have greater access to higher education material than ever before, at their pace and time and from anywhere in the world* (Scott & Tomadaki, 2007). Many scholars, journalists and educational practitioners predict OER to be a disruptive technology: *Open courseware is a classic example of disruptive technology […] an innovation that comes along one day to change a product or service* (New York Times, 8. April 2010). As Beck (2007) puts it: *Opening educational resources is an action that will take education to a new place* (3).

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Despite its popularity, a general consensus on the scope and classification of the term OER is yet to be found. Goertz and Johanning (2007) conclude that the design of OER-portals is extremely heterogeneous, and numerous projects are in accordance with the goals of the OER movement, without explicitly adopting the label. Whereas some authors emphasize the free use of materials in educational institutions, Downes' (2007) characterization of OERs includes a variety of media and types, as opposed to e.g. Stacey (2007), who gives a narrow definition, which almost exclusively addresses material provided by universities. The literature is also divided on the notion of openness of OERs. Does open mean available for free, free to (re-)distribute or free to change? Is openness simply the ability to read online without payment?

Not only is it difficult to give a clear-cut definition of OER, the landscape of OER is populated by a wide variety of projects with slightly different scopes and purposes (Johnstone, 2005; OEDb, 2007; Stella, 2010; Butcher, 2010). For the purpose of this article, I use the definition of Atkins & Hammond (p.3):

"OER are teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use or re-purposing by others. Open educational resources include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge."

Browne et al. (2010) see OER as a chance to rebalance the debate about responsibilities for the learning experience, moving students from consumers to co-producers. OER provide the building-blocks to construct personal learning environments (PLE) – "*a metaphor to describe the activities and milieu of a modern online learner"* (Martindale & Dowdy, 2010). PLEs comprise tools, communities, and services learners use to direct their own learning and pursue educational goals (Educause, 2009, Couros, 2010) and "*migrate the management of learning from the institution to the learner"* (Downes, 2007). The concept of OER is promising not only for the individual learner, but also for the educational organization: As universities make strategic decisions to increase their levels of investment in design and development of better educational programs, the cost effective way to do this is to embrace open licensing environments (Butcher, 2010). Strategic alliances allow universities to develop high-quality open content in key subject and disciplinary areas (see Table 1).

Bissel & Boyle (2007) describe the potential of OER by devising the hypothetical situation of a person having to predict the impact of the Internet: "*Imagine that it is twenty years ago. A stranger asks to you prognosticate about the future. You are to postulate, he tells you, that there will be a worldwide computer network, open in design, that allows relatively cheap access to anyone"* (p. 6). The authors provide three choices of potential socio-technical impact of this 'worldwide computer network' and pose the rhetorical question which trend is most likely to happen: (1) a comprehensive, multilingual online encyclopedia, which allows anyone with a net connection to read, contribute, or edit; (2) computer software developed by an international programmer community, which can be modified and redistributed without permission or fee; (3) open educational resources, routinely shared, used and customized by teachers and learners from kindergarten through graduate programs and further training. The authors argue that given the collaborative culture of education and the production of knowledge artifacts in the heart of the learning process, the respondent would deem choice number three as most likely: "*open learning will come first—open encyclopedias and open software later, if at all*" (p. 6). However, whereas Wikipedia and open source software are

established visibly and ubiquitously, the OER movement has reached neither their prominence nor sophistication.

Despite the potential benefits of OER, "*the level of adoption of OERs into common teaching practices remains quite low*" (De Liddo, 2010). Many university students are unaware of open learning opportunities or struggle to negotiate and integrate open educational resources with the formal, institutionalized parts of their education. Current research usually focuses on benefits of OER at the institutional and organizational level as well as models for the sustainable production and provision. Dinevski (2008) stresses the fact that open educational resources change the roles of all stakeholders in the learning process, although managerial and technological provision models often dominate the debate: "*The discussion of OER has often been dominated by technical and management considerations rather than the perspective of the educational practitioner*" (119).

Today's learners ride the open frontier between formal and informal learning. As educational content is increasingly available for free over the Internet, making effective use of informal and incidental online learning opportunities has become a challenge for students, teachers, researchers and self-organized learners. Whereas traditional textbooks perform the role of information gatekeeper, the Internet floods the learner with a veritable cornucopia of educational resources. From this seemingly limitless amount of material, the learner must unearth personally and contextually relevant information and assess the quality, up-to-date-ness, accuracy, and comprehensiveness of the source. With growing repositories of online educational material and social software, learners may interact with different digital representations, and apply new forms of self-assessment. To fully understand the concept's role in informal as well as institutional learning, we need to shift our attention towards the learner's use and adoption of OER. Learning theories can help to conceptualize these practices. The purpose of this article is to provide an extensive, though by no means comprehensive, overview of approaches that can help us to make sense of open educational practices. The paper presents different theoretical and methodological perspectives on OER and evaluates the assets of each of these perspectives for different OER settings.

2. Theoretical and Methodological Perspectives on Researching Learning with OER

Consider the following statements:

> *Make the world your study group (openStudy), learn almost anything for free (Khan Academy), join the world's first tuition-free online university (University of the People), learn anything with your peers (P2PU), learn anything, anytime, anywhere (iTunesU), your opportunity is here – take it (University of the People), free online education, open to anyone, anywhere in the world (OpenLearn), free and openly licensed, accessible to anyone, anytime via the internet (OpenCourseware Consortium), a community devoted to collaborative learning (Wikiversity), turning the digital divide into digital dividends using free content and open networks (WikiEducator), towards free learning for all students worldwide (OER university), ask, answer, understand (OpenStudy).*

What goes through your mind reading these slogans? Maybe you think '*These are some serious claims*' or '*What's not to love about OER?'* While both thoughts – the skepticism about the movement's prowess to change the world as well as the awe and admiration towards

its cause – are valid concerns on an educational policy and advocacy level, they are not at the center of educational research: The basics of knowledge, learning and instruction. The OER-movement, together with familial concepts of open, networked and personal learning, lately also called "*do it yourself learning*," make inherent claims about the nature of knowledge and the nature of learning. Whereas there is a common ground for understanding the nature of knowledge as public good[2] that unifies various approaches towards open educational practices, there is no one-size-fits-all theory that allows us to understand all aspects of the learner's use of open educational resources. Instead, different theories can account for specific phenomena and are particularly viable to analyzing communities, individual behavior or social practices.

As a prominent field in teaching and learning research, the domain of information and communication technologies (ICT) is encompassed by a broad variety of methodological approaches – from controlled experiments of single applications to ethnographic studies of complex online environments to case studies of individual learners (Zumbach, 2011). In the course of this article, I will examine several, alternative perspectives on learning and instruction and couple each of them with examples of open educational practices. I will illustrate how the practice may be analyzed and understood in the light of the respective approach.[3] Sections 3 and 4 of this article explore two main theoretical paradigms in learning sciences, namely the sociocultural perspective and the information processing perspective. Section 5 introduces emotional and affective aspects of learning, i.e., the concepts of interest and flow. The conclusion comments on the possibilities to combine and synthesize different approaches.

3. Sociocultural Theories

Based on pragmatic theory and critical psychology (i.e., the works of Vygotsky, Mead, and Dewey), the sociocultural approach sees cognitive, social and cultural aspects as interdependent phenomena that should not be studied as independent variables, but as intertwined and embedded practices. Though theories differ in their focus, they share a common interest in investigating the role of artifacts in thinking, learning and acting. The unit of analysis typically spans the individual mind and instead takes into account social interaction processes. Ethnography, qualitative case studies and narrative interviews are typical methods of gathering data within the sociocultural paradigm. In the following, we will see how cognition can expand the individual mind, how human consciousness is situated in activities and how learning is constructed through social interactions in communities of practice.

3.1. Distributed Cognition and Connectivism

Edwin Hutchins developed the theory of *distributed cognition* in the mid-1980s, based on his ethnographic research about team decision making processes, activities and instruments involved in navigating a navy ship. Distributed cognition challenges the idea of the individual mind as the sole domicile of cognition and introduces a perspective on cognitive processes that views learning, thinking and decision-making as shared, situational and embodied practices. Hutchin's influential work "Cognition in the Wild" was soon adapted to the context of Human Computer Interaction (HCI) and Computer Supported Collaborative Work (CSCW) and aligned with related concepts such as Gibson's idea of 'situational affordances' that guide our perception of the environment (Gibson, 1996). Margaret Wilson (2002) gives an excellent

[2] The notion of 'knowledge as public good' is the central 'leitmotif' to the OER movement, which sees sharing at the heart of the educational process.

[3] The descriptions of the OER-environments draw from a current, ongoing webnographic study on open educational practices.

overview of the different claims that various authors make under the umbrella of 'embodied cognition.' Relevant for the "DCog" perspective of complex problem solving is the claim that the environment is part of the cognitive system:

> *"The forces that drive cognitive activity do not reside solely inside the head of the individual, but instead are distributed across the individual and the situation as they interact. Therefore, to understand cognition we must study the situation and the situated cognizer together as a single, unified system"* (Wilson, 2002, 630).

To understand the nature of this claim requires some clarification about systems, boundaries and functional explanations: "*how one defines the boundaries of a system is partly a matter of judgment and depends on the particular purposes of one's analysis. Thus, the sun may not be part of the system when one considers the earth in biological terms, but it is most definitely part of the system when one considers the earth in terms of planetary movement*" (Wilson, 2002, 630). This perspective renders the question of 'what is the nature of cognition' into, 'what is our current research interest and what is the best vocabulary to analyze it?'

What are we interested in when we analyze open educational practices from a "DCog"-perspective? Implications for educational practice are thorough and affect the organization of the learning process as well as the assessment of the learning outcomes (Karasavvidis, 2002, 15):

> *Much of current educational practice is founded on the assumption that cognition resides in the individual head […] [e.g.] during exams students have to solve problems or perform certain designated tasks but are not allowed to cooperate with fellow classmates, much less resort to artifacts such as calculators, computers, or even textbooks.*

If we see other learners and external artifacts as a part of, instead of apart from, the cognitive apparatus, the learning is no longer 'property of the individual' (Karasavvidis, 2002, 16), but becomes shared and distributed over various sources and artifacts. Research questions from a distributed cognition perspective include various aspects such as 'wisdom of the crowds' or 'social navigation' – in short: How can diverse groups solve complex problems? Distributed cognition allows us to make sense of learning networks and emergent processes in Web 2.0, i.e., crowdsourcing phenomena like the collaborative writing of Wikipedia (Mansour, 2009) or collaborative knowledge management through social tagging (Steels, 2009). In this view, information and communication technologies (ICT) are not just resources for learning, they are part of the cognitive infrastructure we have at hand (Saljö, 2011).

This idea is prominent in the learning theory of *connectivism*, as it is postulated by George Siemens and other, mainly Canadian, educational technology researchers (Siemens, 2005; Verhagen, 2006; Kopp & Hill, 2008). Connectivism conceptualizes knowledge as distributed across an information network and stored in a variety of (digital) formats. As a learning theory, it caters towards the characteristics of learning in digital environments and the network-structure of online interactions. In the digital age, learners need the ability to seek out current information, and the ability to filter secondary and extraneous information: "*In connectivism, the starting point for learning occurs when knowledge is actuated through the process of a learner connecting to and feeding information into a learning community*" (Kopp & Hill, 2008). Learning means to recognize patterns in your technology enhanced personal

network.

When we look at open educational practices, the pedagogical concept of *Massive Open Online Courses (MOOC)* is particularly tailored towards leveraging distributed cognition and connectivism. Since Stephen Downes and George Siemens organized the first MOOC in September 2008, numerous other open courses have been implemented by several educators and educational institutions worldwide – mostly in the subject domain of educational technology and technology enhanced learning.

McAuley, Stewart, Siemens & Cormier (2010, 4) offer the following definition:

> *[…] a MOOC integrates the connectivity of social networking, the facilitation of an acknowledged expert in a field of study, and a collection of freely accessible online resources. Perhaps most importantly, however, a MOOC builds on the active engagement of several hundred to several thousand "students" who self-organize their participation according to learning goals, prior knowledge and skills, and common interests. Although it may share in some of the conventions of an ordinary course, such as a predefined timeline and weekly topics for consideration, a MOOC generally carries no fees, no prerequisites other than Internet access and interest, no predefined expectations for participation, and no formal accreditation.*

The course setting relies essentially on autonomous and networked learning activities. Characteristic components of MOOCs are 'aggregation' (the collection, processing and integration of multiple sources), 'remix,' 'repurpose' and 'feed forward' – an automatic transfer of information and content via RSS. The pedagogical approach is based on the idea that learning takes place when learners collaboratively generate new connections through producing knowledge artifacts, such as blog posts, podcasts or diagrams.

A recent example is the Massive Open Online Course "Personal Learning Environments, Networks and Knowledge" (PLENK 2010). During 10 weeks, the course covered different aspects of personal learning environments. The course activities were supported through a wiki environment, a daily newsletter, discussion forums in Moodle and Web conferencing sessions with Eluminate. Over 1,300 learners worldwide participated in the course. PLENK2010 deliberately provided an oversupply of learning sources. The individual learner had to filter relevant information as part of the learning process. The teacher as "facilitator" moderated this process: *"[it] is an unusual course. It does not consist of a body of content you are supposed to remember. Rather, the learning in the course results from the activities you undertake, and will be different for each person. In addition, this course is not conducted in a single place or environment. It is distributed across the web* "(Open Online Course PLENK2010).

From the learners' point of view, the construction of artifacts and the collaborative processing and filtering of information make an MOOC a unique learning experience. "*I think creating of artifact is a way to focus your thinking. Providing flexibility in the format or the tool used is a good way to provide individuality"(*Nancy Rubin, PLENK2010, discussion posting, September 2010). The knowledge artifact produced by Nancy serves as a connecting node that has the potential to resonate with other learners and thus continuing the discourse in a

distributed network. A potential research question from the point of view of distributed cognition and connectivist theory are adequate methods for identifying learning outcomes in a connectivist learning setting: *"Learning is* recognized*, not measured – although we have taken to using tests and such as proxies for recognition, ultimately, we are not confident in saying that a person has learned unless someone who is already qualified in the field has observed and attested that the learning has been achieved"* (Stephen Downes, Oct. 2010, MOOC PLENK2010 Forum).

How can learning be recognized in an open, fragmented learning environment? The 'Mozilla Open Badges framework' is designed to allow any learner to collect badges from multiple sites, tied to a single identity, and then share them, e.g., through the personal blog or through social networking profiles. The infrastructure allows learners to take learning outcomes across the web and other contexts. This OER solution reflects the idea of learning and knowledge acquisition as the product of group activities, rather than individual cognitive achievement.

3.2. Activity Theory, Design in Use and Cognitive Flexibility

Since the mid-80's Activity Theory has gained relevance within the domains of Human Computer Interaction (Bertelsen & Bødker, 2003) and CSCW (Halverson, 2002). The basic assumption of Activity Theory is the interconnectedness of complex mental and cognitive processes and external artifacts, based on cultural practices and division of labor. "*Consciousness is located in everyday practice: you are what you do*", (Nardi 1996, 7). Activity Theory sees people as socio-culturally embedded actors who embark in a common activity that requires division of labor. The activity consists of single actions that allow achieving specific subgoals, where each actor is directed by individual motives and goals. Thereby, the framework emphasizes the impact of emotional attributes, individual gains and power structures that can enlighten the analysis of learning communities.

Which gap does activity theory fill for analyzing the construction of educational practices? Open learning is a mediated activity that involves a bundle of techniques and tools. A researcher with a background in activity theory is interested in the genres the agents will use, adapt or invent for their learning purposes, i.e. the dynamic process of open learning from an individual's activity system perspective. An educational practice is never all finished and done: "*[…] activities are always offbalance, always changing, always coming into contact with other activities*" (Spinuzzi, 2003, 117).

Throughout their use of open educational resources, learners re-purpose the material. The learners pursue very specific, individual goals, for example presenting oneself in a prestigious platform, belonging to a community, retrieving a piece of information or copy and paste a particular paragraph to further work on it and create a new context. This is usually not what the instructional designer had in mind of what the resource was "supposed to be used like". A central assumption of activity theory in HCI is that online information environments do not have a pre-set purpose, defined by the designer. Rather, the purpose is determined by the larger context of human activity (Kaptelinin & Nardi, 2006). Lamb und Kling (2003) propose to change the perception of "software users" to "social agents" (Lamb & Kling, 2003). The instrumental genesis approach puts forward similar claims (Béguin & Rabardel, 2000). Learning how to use a software or Web site is not an ad hoc, one-time event, but rather a design process in itself. This process is a coin with two sides, characterized by both the developers' goals as 'design for use' and the user's practice as '*design in use'* (Folcher, 2003); Béguin (2003) called this '*activity exchange'*.

How does this help us to understand open educational practices? Users browse and access

open educational resources based on their personal experiences, habits and preferences. The learning takes place voluntarily, spontaneous and without commitment. Each user constructs her own view, and, over time, individual paths of adoption and selective perception shape the personal learning environment. Thereby, users co-design open educational resources; the educational artifact is meandering between '*design for use'* and '*design in use'*. Although not all artifacts are perfectly designed for their target audience, they serve the individual motive and situational need. Learners will find creative solutions to adapt and instrumentize OER.

Consider the example of iTunes U: In 2004, Duke University gave out 1600 iPods to incoming freshmen to experiment with the educational value of podcasting.[4] Students and teachers soon were facing a mobile content distribution problem. This gave birth to the idea of applying the distribution logic of the Apple iTunes music store to educational material: The same infrastructure that was already used to provide download opportunities for albums and tracks could easily cover lectures and sessions. This was the start of "Project Indigo," a collaboration of Apple with Duke, Brown, Stanford, Michigan, and Wisconsin. As a result, in 2007, Apple officially launched iTunes U, a distribution system for educational content with the compelling slogan "Learn anything, anytime, anywhere." 800 institutions from 26 countries provide content on the educational repository, which so far comprises 350,000 assets and has surpassed the 300 million download mark (Panke, 2010).[5] Universities that decide to create their own iTunes U presence can choose between an open access model and a password protected option – or provide both. iTunes U offers slightly different strategic advantages to each institution involved. Some institutions use it primarily for marketing purposes, others to facilitate alumni contacts or to address the general public. Recurring issues from an institutional point of view are getting the faculty and the central units engaged in the process and ensuring a constant flow of compelling content.

From an educational research perspective, however, it is of interest to look beyond impressive download rates and ask who uses the podcasts, for what educational activities and how the podcasts mediate learning.

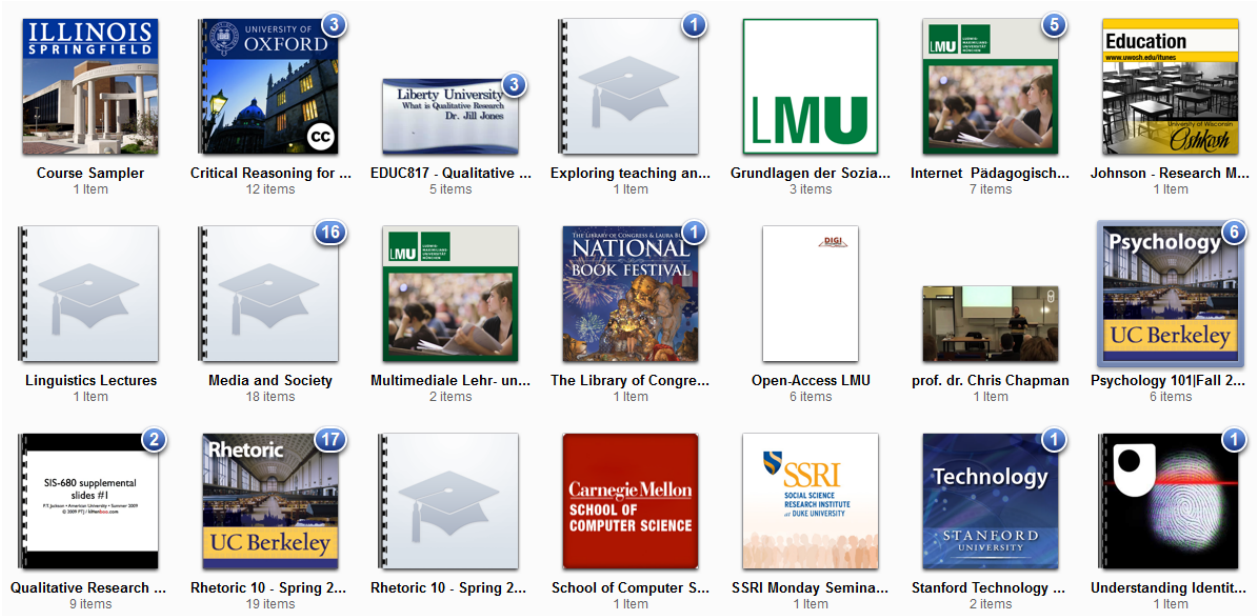

Figure 1: Design in Use: The personalized iTunes U Library

[4] http://cit.duke.edu/pdf/reports/ipod_initiative_04_05.pdf
[5] http://etcjournal.com/2010/11/07/apple-meets-open-educational-resources-itunes-u-conference-in-munich-oct-2010/

So, let us take a look at Susan's personal library with podcasts from ITunes U. We see a variety of resources, form different providers, encoded in multiple representations (text, audio, video). In comparison to attending a "real" class, she lacks central elements such as co-students, peer-to-peer interaction, tutoring, and feedback from the instructor. She will most likely not follow a class from its first to last session. Listening to an audio recording, there might be some crucial information lacking, because she cannot see the presenter's slides or chalkboard notes. However, she takes notes, uses Wikipedia to look up the names of individual researchers and technical concepts mentioned in the podcast and – bit by bit – forms a cohesive picture of the subject matter. Through these activities, Susan becomes a co-author of her learning environment. None of the resources she uses has, from her perspective, an educational goal in itself. Rather, the open educational resources are artifacts that mediate her learning activity.

Is this "design in use" a waste of cognitive resources that could be better spent on actual information processing? One answer is: It is better than nothing. For learners who lack the financial means to access other forms of education, OER offer a cheap or free option. Another way to look at this question is the Cognitive Flexibility Theory (CFT). CFT is defined as "*a set of principled recommendations for the development of instructional hypertext systems to promote successful learning of difficult subject matter*" (Spiro, Feltovich, Jacobson & Coulson, 1992, 57), that emphasize the real-world complexity and ill-structuredness of many knowledge domains.

> *"Cognitive and instructional neglect of problems related to content complexity and irregularity in patterns of knowledge use leads to learning failures that take common, predictable forms. These forms are characterized by conceptual oversimplification and the inability to apply knowledge to new cases (failures of transfer)." (Spiro, Feltovich, Jacobson & Coulson, 1992, 57)*

Learners who are confronted with multiple explanations, analogies, and methods of analysis and viewpoints will produce a mental model that is on a more abstract level and thus supports 'cognitive flexibility' – an ability that supports real-world problem solving. Susan's 'design-in-use' of her personal, open learning environment can contribute to this ability.

3.3.Social Constructivism and Communities of Practice

Social constructivists see learning as a situated activity and emphasize the social contexts that learners bring into the learning situation. The theory stresses the learner's role in knowledge acquisition by organizing information into individually meaningful constructs. "*According to the constructivist metaphor, learning is a process of knowledge construction. Teachers are cognitive guides for academic tasks, and learners are sense makers"* (Mayer, 1996, 157). Learning is supported when learners can probe their own construction of meaning against others' understandings; essentially, meaning and knowledge is socially negotiated. Therefore, learning is best supported through collaborative, authentic activities. At this, the concept '*zone of proximal development'* (Vygotsky, 1978) plays a crucial role. Practitioners in the field or other, more advanced learners provide scaffolds so that the individual learner can improve and expand her abilities.

Though constructivist approaches can serve as a theoretical projection screen for various group learning methods, open learning situations that are based on peer-to-peer interaction are an obvious candidate for analysis in the communities of practice (CoP) paradigm. In a

community of practice "*learning means to become, that is, to belong differently than we do at the moment*" (Lee & Roth, 2003). This process of 'finding one's place' or 'belonging somewhere' is not conceptually different in online or face-to-face interactions. Instead, communities usually develop characteristic activity patterns or *'orientations*':

> *"Communities learn together in different ways: some meet regularly, some converse online, some work together, some share documents, some develop deep bonds, and some are driven by the mission they serve. We say that these communities have different orientations towards the process of learning together. An orientation is a typical pattern of activities and connections through which members experience being a community."* (Wenger, White and Smith, 2009, 69)

A researcher who looks at open learning from a CoP-perspective will try to identify the community's characteristic activity pattern. She might also be interesting in the different roles the community offers and how it supports a certain level of reciprocity while maintaining the idea of '*legitimate peripheral participation'*. Reciprocity can take place in a mode of '*generalized exchange',* so that *"a benefit given to a person is reciprocated not [necessarily] by the recipient but by someone else in the group*" (Kollock 1999, 222).

Another potential research focus is the process of identity formation. Identity for the community as a whole involves discussing boundaries between one community and another; it implies positioning a given community within a constellation of other communities. "*Building identity consists of negotiating the meanings of our experience of membership in social communities*" (Wenger 1998, 145). Learning together in a community of practice does not require or produce a homogenous group of people, all focused on the same goals. Instead, the activity level, learning aspirations, and needs vary individually. There is a natural tension between the individual and the community, so that technology becomes both a challenge and an enabler for discourse.

> *"Technology contributes to the tension between individual and community. While a tool may be designed for groups, it is largely used individually, often when one is alone. Technology also increases the complexity of the group/individual polarity. By providing varied opportunities for togetherness, it also opens the possibilities for extreme multimembership" (Wenger, et al., 2009, 59).*

Let's look at the Web site P2PU ('Peer-to-Peer-University')[6] from the CoP-perspective. Since its founding in 2007, the community has grown to approximately 2000 members. The credo, "*everyone has something to contribute and everyone has something to learn*," guides the design of this informal university. Users can create their own courses or choose to subscribe to an existing course – either as active participant or as a follower. Courses run for several weeks at a time and are open for enrollment during this period. Course organizers can set up a list of tasks, link to online material or work through a book.

Jessica is a very active member of the P2PU community and is currently involved at several

[6] http://www.p2pu.org/

classes at the School of Webcraft. Jessica has 10 years of web development experience, and, apart from her P2Pu activities, she contributes to open source projects like Ubuntu and OpenHatch. Among other things, P2PU helps her to hone her virtual team work, evaluation, and coding skills and allows her to help others. Her learning activities in the community are constructivist in nature: "*I have a github account with code. That's how I communicate what I've learned*"[7]. Jessica has attended courses on testing automation, blog writing, usability, Ruby on Rails and Django. She also created a study group to help others contribute to the code that P2PU runs on.

Her engagement with P2PU has developed over time from peripheral activities to legitimate participation. Jessica's experience as a teacher shows how communities create a feeling of reciprocity, even though the level of participation and expertise varies: "*I always learn by looking at others' codes. Also, sometimes it takes a long time and a lot of question answering to get someone to the point that he or she is able to commit code. It's completely worth it when it happens because it's one of the best feelings in the world :)*"

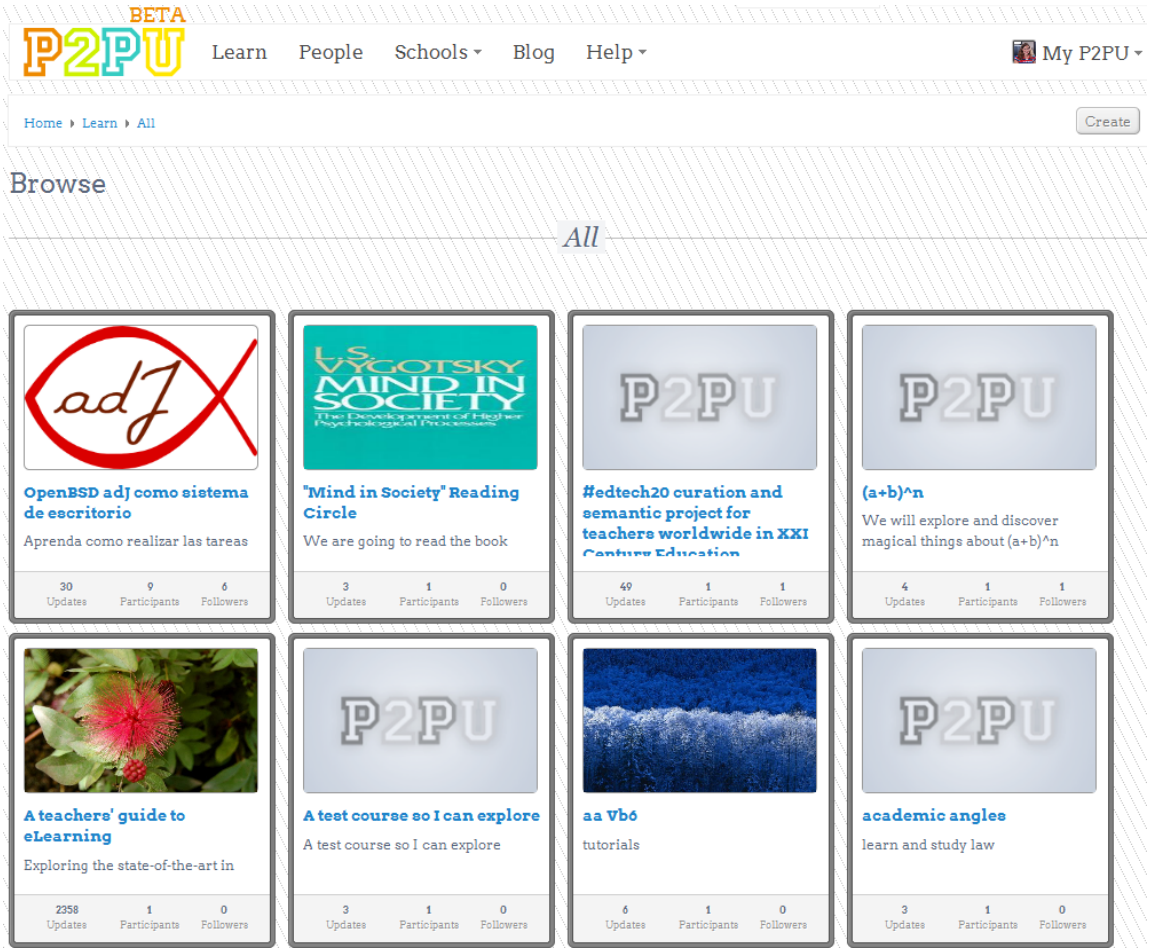

Figure 2: Opportunities for Multi-Membership and Sharing – P2PU

Though not all open, informal learning happens in the context of communities of practice, Web sites like P2PU are certainly examples of successful open learning. However, the today's open learner is not only member in the virtual community, but in various other social communities (cf. Wenger's notion of 'multi-membership'). This multi-membership can hinder deep engagement and learning. As an example, the study group "Blogging and Writing for

[7] Github is a free, Web based repository: https://github.com/

Web" had 32 participants, 70 followers and 9 organizers in the period of July-August 2011. However, the number of active participants was approximately 8. Unsurprisingly, there is a difference between signing up for a class and being up to regularly completing tasks and providing peer feedback. In line with the Community of Practice approach, different degrees of participation are usually not a sign of 'lurking' or 'free riding'. Instead, a low level activity reflects constraints from being a participant in various social contexts – online as well as offline. This is illustrated by the following statement from a study group member who seemingly left the group after his first post:

"It's not that I've dropped out. It's just I really haven't managed to even look at the site in the last while. It's really a shame that I haven't been able to. My duties at work have become more strenuous and with planning my wedding and trying to sort other bits and bobs it leaves no time to do much else but sleep. I really hope I can begin to become a more productive member on the site soon. It's not just my efforts here that have been put on the back burner, I have only given my short story website about an hour of attention in about 6 weeks."

3.4. Summary

The previous section discussed open educational practices from a socio-historical perspective introducing three different angles:

- Distributed Cognition and Connectivism emphasize the ontological nature of knowledge as 'in-between' people, artifacts and different environments.
- Activity Theory offers a 'design in use' perspective on open learning, with a focus on the learners' goals that direct their actions.
- Social Constructivism and Communities of Practice highlight the structures and processes that scaffold learning in informal environments.

In the following section, the level of analysis shifts from situational affordances to the cognitive processes in the individual's mind.

4. Cognitive Information Processing

The cognitive information processing theory was first developed in the 1970's and 1980's as a reaction to the shortcomings of behaviorism. Information processing theory sees learning as the structuring and restructuring of memory (Svinicki, 1999). For learning to occur, sensual input has to surpass a certain level of attention to enter the working memory where it has to be processed to get integrated into the learner's prior knowledge and existing schemata, to be stored in the long term memory. In short, learning means to acquire mental representations. The cognitive perspective focuses on different aspects of instruction that can either facilitate or hinder information processing: "*According to the information-processing metaphor, learning is a process of knowledge acquisition in which information is transmitted from the teacher to the learner. It follows that teachers are dispensers of information and learners are information processors*" (Mayer, 1996, 153).

In the following, we will see how the information processing perspective aims to inform instructional design practices and how the meta-level of cognition can affect learning outcomes and learner performance.

4.1. Cognitive Load Theory / Cognitive Theory of Multimedia Learning

As Brünken (2011) points out, the impact of cognitive information processing on instructional design has been to a large degree centered on the Cognitive Theory of Multimedia Learning (CTML) proposed by Richard Mayer (e.g. Mayer, 2009) and John Sweller's Cognitive Load

Theory (CLT) (e.g. Sweller, 2010). Both are second level theories, inspired by, or borrowing from, basic psychological research of cognitive processes published in the 1970's and 1980's (cf. Brünken, 2011): the dual-coding theory of Allan Paivio, schema theory, the three component model of memory from Atkinson and Shiffrin, and Baddeley's working memory model.

Though CTML and CLT both offer explanations for differences in learning success based on the design of the learning material, their focus is slightly different: Whereas Mayer's design principles address aspects of knowledge processing and representation, the idea of cognitive load focuses on the efficient allocation of limited cognitive resources in the working memory.

An example that illustrates the meaning of these theories for the instructional design research of open educational resources is the Open Learning Initiative (OLI): "*We use knowledge from learning science and the affordances of the web to transform instruction, significantly improve learning outcomes and achieve significant increases in productivity in post secondary education*" (OLI, n.d.[8]). Launched in 2002, the Open Learning Initiative offers currently 13 courses. Selected material offers an in-vivo research environment for the Pittsburgh Science of Learning Center (PSLC), where researchers embed experimental manipulations in OLI courses to test specific learning theories. "*The researchers then analyze the data collected by the OLI logging service using the PSLC datashop tools. […]Our Learning environments both build on what we know about learning and serve as a platform in which new knowledge about human learning can be developed and further refined"* (OLI, n.d.[9]).

The implicit belief that the learning process can be directed through an optimized design of learning material and clear instruction is illustrated through the OER-site *Khan Academy.* Since 2004, Salman Khan has produced over 2600 learning videos, chiefly in the fields of mathematics and science. The Khan Academy learning material consists of approximately ten to twenty minute videos that briefly introduce a concept, integrating panels, diagrams, notes and audio-comments.

[8] http://oli.web.cmu.edu/openlearning/initiative
[9] http://oli.web.cmu.edu/openlearning/initiative

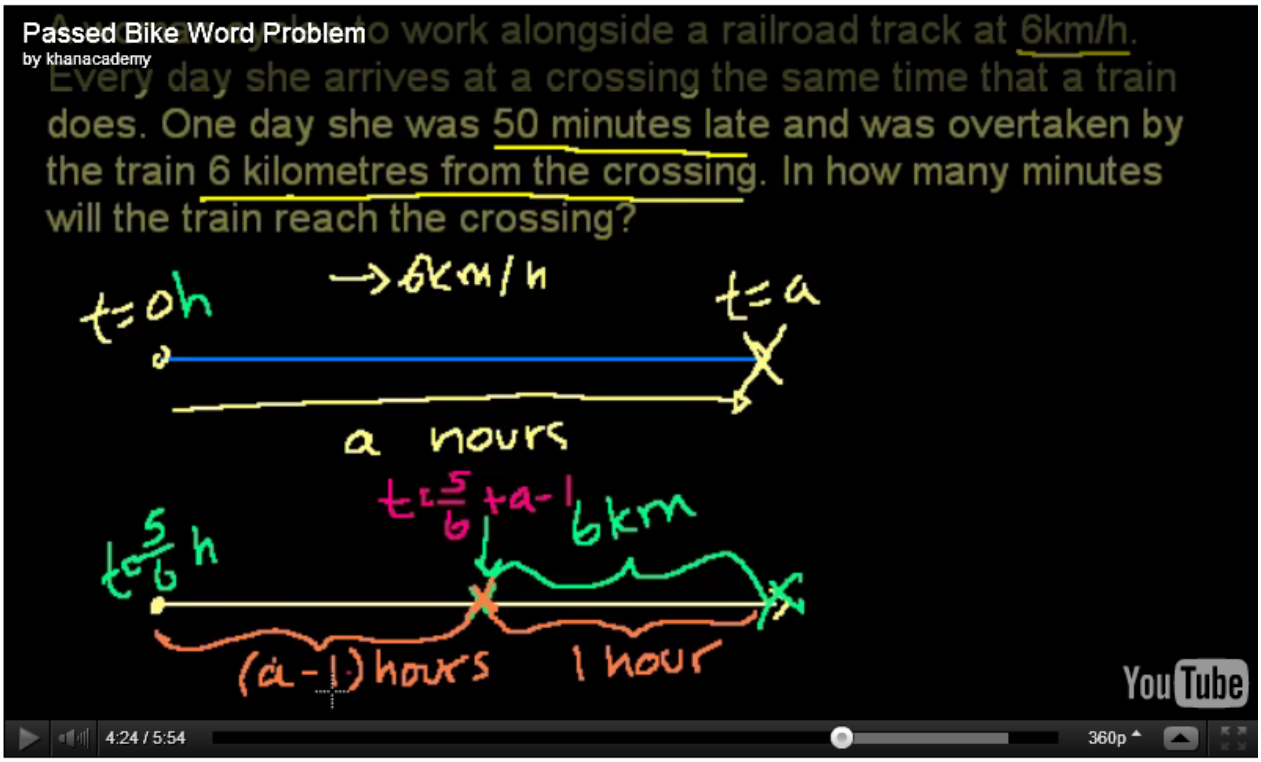

Figure 3: Multimedia Principles at Work - Khan Academy

Salman Khan claims that his instructional techniques are particularly motivating and offer students easy-to-follow instructions. The combination of visual and auditory channels corresponds to the '*principle of modality'*, as advocated by Richard Mayer (2009): Students learn better from animation and narration, than from animation and on-screen text. Another example for a design principle derived from Mayer's Cognitive Theory of Multimedia Learning is the '*principle of personalization'*. It claims that a conversational tone and identification with a pedagogical agent can increase learning. As Khan puts it: "*The conversational style of the videos is the tonal antithesis of what people traditionally associate with math and science instruction. […] I teach the way that I wish I was taught. The lectures are coming from me, an actual human being who is fascinated by the world around him. The concepts are conveyed as they are understood by me, not as they are written in a textbook developed by an educational bureaucracy.*" (Khanacademy.org, FAQ, n.d.).[10]

4.2. Self- Regulation

As Svinicki (1999) stated, early cognitive theories that focused on the limitations of the working memory were "*extremely useful in making recommendations about the way to structure learning materials and situations to maximize understanding, but […] not totally satisfactory*" (10). Albeit cognitive information processing theory took into account prior knowledge and individual differences in processing capacity, the learner remained a mere recipient of instruction. In contrast, metacognitive theories emphasize learner activities and steering of knowledge construction.

> *"Although the learning processes of storage and retrieval are still the same, in metacognition the learner is involved in directing that process. Current theory proposes that we are learning for a purpose, to achieve a goal we have set, and we are aware of that goal, using it throughout the learning process*

[10] http://www.khanacademy.org/about/faq

> *to assess progress. To achieve the goal, we have analyzed the requirements of the task, our skills, and alternative strategies (if we have any) for moving toward the goal. We have selected one alternative for any number of reasons (some good, some not so good) and implemented it. Now we begin to monitor our comprehension and progress. If we start to go astray, we back up and reassess our strategies for learning. Is a different strategy called for at this point, or is it just a matter of more effort? Through this continuous cycle, we progress toward the goal and eventually achieve it." (Svinicki, 1999,11)*

The concept of self-regulation comprises a set of cognitive, motivational and personal components that can help or hinder effective information processing, for example pre-knowledge, working memory capacity, learning strategies, self-efficacy. Cognitive psychologists have developed a number of models that describe the self-regulatory qualities of successful learners and/or models of self-regulation. These models emphasize in varying degrees metacognition, interest, pre-knowledge, volition, motivation and learning strategies. Examples include Pressley's model of the 'Good Information Processor' (Pressley, 1994), Wine's 'Self-regulated Learning Model' and Pintrich's 'Phases of Self-regulation' model. A recent summary can be found in Sitzman & Eli (2011). In general, concepts of self-regulation try to explain why some students succeed in an educational environment where others fail, by attributing inherent qualities to the successful learners that facilitate their learning process.

> *At one time or another, we have all observed self-regulated learners. They approach educational tasks with confidence, diligence and resourcefulness. Perhaps most importantly, self-regulated learners are aware when they know a fact or possess a skill and when they do not. Unlike their passive classmates, self-regulated students proactively seek out information when needed and take the necessary steps to master it. When they encounter obstacles such as poor study conditions, confusing teachers, or obtrusive text books, they find a way to succeed. (Zimmerman, 1990, 4)*

Azevedo concludes that most models of self-regulated learning are composed of four phases:

> *"The first phase includes planning and goal setting, activation of perceptions and knowledge of the task and context, and the self in relationship to the task. The second phase includes various monitoring processes that represent metacognitive awareness of different aspects of the self, task and context. Phase three involves efforts to control and regulate different aspects of the self, task, and context. Lastly, phase four represents various kinds of reactions and reflections on the self and the task and/or context."(Azevedo, 2001, 7)*

Being able to regulate one's own learning processes is seen to be the key to successful learning in online learning settings, hence instructional design research has developed prompts and trainings for self-regulation and learning strategies.

Consider the example of an OER-content-repository such as OpenLearn. The site offers over

500 study units spread across 12 subject areas. Each unit can be completed online or downloaded to the learner's desktop environment. Research on the OpenLearn OER-repository shows that the majority of users are so-called 'volunteer learners' (Godwin & McAndrew, 2008) who are chiefly interested in the OpenLearn content as well as eager to use self-assessment components. Only a small portion of users can be characterized as 'social learners', who value the networking and communication features of the open learning environment. Hence, these features are scarcely used.

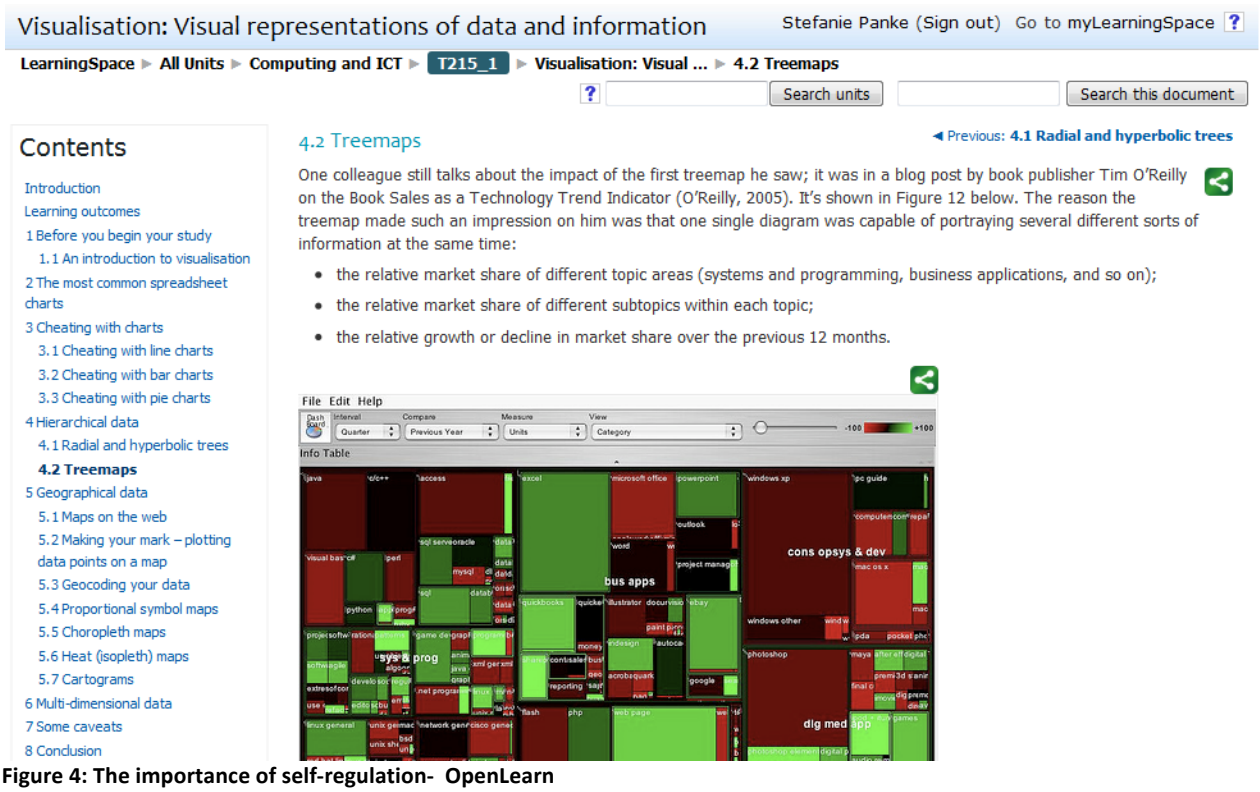

Figure 4: The importance of self-regulation- OpenLearn

Let us look at the OpenLearn community from a self-regulation perspective: Susan has just registered at the OpenLearn community, and sees very little social interaction. It is difficult to find out who else is currently actively involved in her course T215 on "Visual representations of data and information." Communicative features such as forums and learning logs contain very little (current) content. Hence she decides that the best way to work through the OpenLearn course is to download the material and make sense of it at her own pace. She uses the different tasks as prompts for deeper engagement.

From the perspective of self-regulation, we can describe Susan as a 'good information processor'. By directly observing her learning process, we could try to map her use of OpenLearn to the different phases of self-regulation. Another potential research goal is the question whether or not Susan has additional skills that are pertinent to informal, open learning and distinguish her from the self-regulated classroom learner.

Learners who actually acquire skills through studying open courseware material without tutoring and peer feedback need a high level of self-regulation, since there are no external prompts to focus their attention on the study material. This explains why after being initially intrigued, learners are oftentimes frustrated by navigating open courses, as illustrated by the statement of an undergraduate engineering student: "*I visited the MIT homepage. I found an interesting topic called 'Introduction to algorithms' ... I study Information Systems*

Technology and we deal with algorithms right now. I read some pages in the pdf-file and didn't understand anything. … All in all I can say that I learned nothing in this hour I spent in e-learning."

5. Emotions, Interest and Flow

Emotion and affection have been regarded as peripherals in learning and instruction within behaviorist and early cognitivist theories. After the 1990's, however, emotional aspects of learning have received growing attention in the educational community. Researchers developed models to link the positive emotional climate of the classroom and respective instructional strategies to learning outcomes (e.g., Astleitner's FEASP-model, c.f. Astleitner, 2001).

Understanding why students are motivated to engage in specific topics for self-directed learning projects is an important prerequisite to facilitate open learning. How people develop and maintain interest and what constitutes *flow* experiences are particularly relevant questions to researching *voluntary*, *informal* learning. The paradigmatic concept for research into learning and interest is Hidi and Renninger's (2006) Four-Phase Model of Interest Development that comprises (1) a triggered situational interest, (2) a maintained situational interest, (3) an emerging individual interest, and (4) a well-developed individual interest: "*Phases in the development of interest range from an initial triggered situational interest that may only last for a few moments, to a well-developed individual interest that is relatively long lasting*" (Reinninger, 2011).

In its earliest phases, interest is primarily triggered or maintained by the environment (others, tasks, etc.). Especially in early phases of its development, interest does not necessarily involve deliberate decision-making. In later phases, interest is more likely to be self-regulated. Hobbies are paradigmatic of long-term, interest-based engagement. Each and every person can be expected to have interest (although the specific content of this interest may vary from science to video-games). However, it is never entirely either extrinsically or intrinsically motivated. "*Rather, in each phase of interest development, interest reflects what the participant brings to the task, what the environment (others, objects, etc.) affords, and the way in which the participant is able to work with the environment"* (Renninger, 2011). This means that interest is not merely a trait existing within the person, but evolves in the interaction of the person with the environment, which means it can be influenced by the instructional design: In an open learning environment, learners develop interest when they have their ideas are respected, feel genuinely appreciated for their efforts, and know that they (potentially) understand the content (self-efficacy).

Developing stable interests in an open, informal learning process requires a 'flow experience', where the person is completely absorbed by and highly concentrated on the specific activity (Csikszentmihalyi, 1985). Flow is supported when an activity challenge meets the learner's abilities and creates an ideal level of arousal, meaning it creates neither anxiety nor boredom. The concept of flow has been related to what a player experiences when totally immersed in a computer game. To support flow, some OER-sites incorporate game-like structures and social networking features.

The community OpenStudy is an example for the design of OER that takes into account the affective side of open learning. OpenStudy was founded in 2007. It offers simple question and answer activities in different categories such as writing, math, history and computing. New users start as "neophytes" (new plants) and can reach other 'levels' through activities and reward points. "*Currently, the ranks are mostly for bragging rights*", explains user

'*shadowfind'*, who holds the level 'champion'. OpenStudy fosters a positive emotional climate, flow experience and situational interest through a combination of social interaction and gaming features. Open Study is an ideal environment to nurture situational interest because it offers a low-risk, fun and social setting to explore digital identities, as for example the user *Gandalfwiz*: "*My Mom is terrified that I'm going to meet a creeper on the web who lures me into a strange park and strangles me during the night... in fact, this is the closest thing to a chat room I'm allowed on. She'd absolutely flip if someone knew my real name or address or something. I also think the anonymity is cool. no one knows if I'm an eight year old boy or a high school girl or a 60 year old man or a soccer mom with three kids... it's kind of fun. I modeled my username after my all time favorite books. I also think it's funny to picture Gandalf hunched over a computer doing math."*

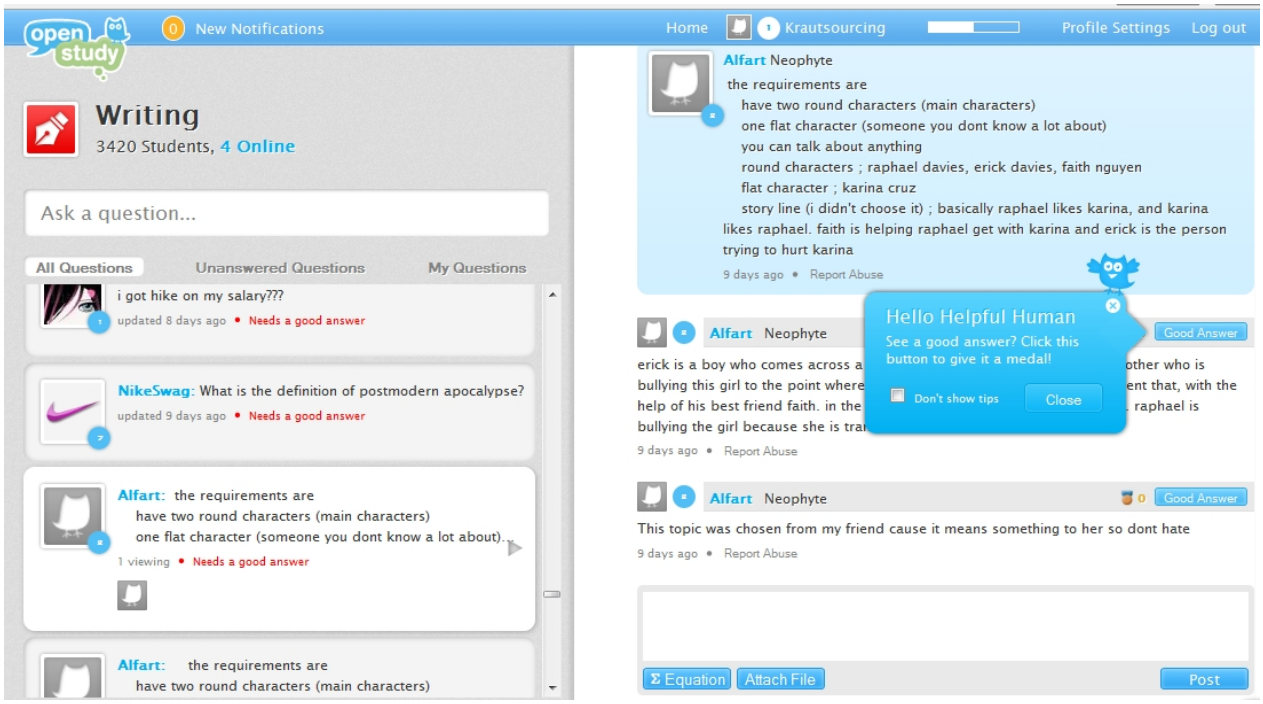

Figure 5: Flow and Interest-Development: OpenStudy

6. Conclusion

Smith & Wang (2007) describe several research challenges related to the learners' use of OER such as monitoring use and creating indicators of progress, understanding user demand and impediments and examine learning success stories (accomplishments and their components). "*One of the first priorities is to understand better how various incentives work in different settings and for different types of users. Another is to examine the effects of open educational interventions on learning outcomes, especially those that pertain to twenty-first century skills, such as creativity, innovation, and ability to collaborate effectively. […]At a practical level, systematic research of user behaviors and use patterns would help the field develop better tools." (14)*

Instructional design models generally assume a well-defined target group with presumed learning needs, and intrinsic as well as extrinsic incentives. OER address a multitude of potential learners with unknown learning needs and – in the case of informal learners – no extrinsic reward mechanism. As Lane (2010) argued, open educational material has different affordances than traditional, 'closed' educational courses. To explore the instructional design challenges in developing OER, educational research can draw from various theoretical approaches to learning and instruction.

It is impossible to give a comprehensive picture of all learning theories relevant to open educational practices in the course of one article (for example, we have not considered self-determination-theory). Not only is the field diverse, it is also constantly evolving. From our point of view, a unified vision of "*what needs to be done to make [open] learning happen*" (Svinicki, 1999, 24) is neither easily attainable, nor *per se* scholarly desirable. Pluralism of learning theories can foster and fuel discourse and creativity. In order to achieve this, we need to be sensitive about our theoretical choices. The afore given '*tour d'horizon'* is an attempt to clarify how various theoretical and methodological approaches can serve the investigation of open educational practices. Depending on the research interest, one theoretical lens will provide more adequate vocabulary and better methodological tools than another. Academic acculturation and personal preferences will also influence the theoretical choices.

Some of these theoretical lenses are based upon fundamentally different ontological and epistemological assumptions. These differences make the research approaches used to study them potentially incommensurable and thus theoretical awareness when triangulating results is required. An ethological biologist who specializes in the study of cat behavior, will have extremely different results from a neuroscientist who also happens to work on cats. Though both researchers look at the same object, each asks different questions, gather data with different methods, and explain findings within the scholarly discourse of her respective scientific community. In the same way, open educational practices look different depending on the theoretical lens we use to observe them. It is therefore important that we clearly state our theoretical assumptions and related research methodologies. To foster the investigation of the educational impact of open learning, learning theories should be viewed as conceptual tools that offer analytical angles to explore learning with OER.

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