David Kergel · Birte Heidkamp
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Samuel Nowakowski *Editors*

RESEARCH

The Digital Turn in Higher Education

International Perspectives on Learning and Teaching in a Changing World

Springer VS

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Table of Content

1 Introduction to the Book: The Digital Turn in Higher Education Multi-Disciplinary and International Perspectives

David Kergel, Birte Heidkamp, Patrik Kjærsdam Telléus, Tadeusz Rachwal & Samuel Nowakowski

Digitalization is affecting our world and thus our individual lives to an increasing extent. We may envisage a digital turn leading from the book-based Gutenberg Galaxy to the `internet-based´ Digital Age. This ongoing change affects the academic field as well as all other parts of society. Not only research and knowledge communication but also teaching and learning in higher education are increasingly `going online´.

The digitalization process alters the media upon which learning processes are founded. In higher education, digitalization permits decentralized, action- and product-orientated teaching and learning. To implement this kind of modern, digitally based learning, it is essential to develop scientifically grounded approaches to teaching and learning in a digitalized world. This challenge requires suitable theoretical, epistemological and ethical foundations as well as practice-oriented methods.

Alongside such possibilities, digitalization also presents a challenge for higher education. One objective of modern higher education is to ensure that students acquire the media skills they need for professional life in the Digital Age. Apart from the harmonization of Europe´s higher education, the employability of students is a major concern of the Bologna Process. The harmonization process itself requires an international and interdisciplinary discourse on changes in higher education at the dawn of the Digital Age.

This discourse necessitates critical thinking – an essential feature of any scientific perspective on the world. Drawing on Derrida´s concept of an unconditional university, the university can be understood as a space in which to reflect on digitalization and its effects on society. From this perspective, universities could provide the discursive space for analyzing the societal impacts of digitalization and discussing the ethical dimension of changing media. Consequently, the university may be expected not only to react to digitalization but also to become an actor in its own right.

As a forum for scientific, critical thinking, universities also represent a space for innovation. Higher education can itself play a key role as a driver of innovation. Learning scenarios implemented and evaluated in higher education can become best practice examples to be adapted for the professional world.

It is clear that digitalization challenges higher education on multiple levels. One aim of this book is to address the challenge by providing a multi-disciplinary, international perspective on higher education during the digital turn. It therefore presents epistemological, ethical and theoretical approaches, and best practice examples, from universities in different countries (Poland, Denmark, France, Germany and the USA) using different learning strategies (including problem-based learning, mobile learning, heutagogy, and inquiry-based learning). The book can be understood as an international and interdisciplinary collection providing heuristic strategies for handling the digitalization of higher education in theory and in practice.

Individual contributions are introduced below.

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I The Digital Turn in Theory – Theoretical Reflections on Higher Education in the Digital Age

This chapter presents contributions which reflect on different disciplinary approaches to changing media in higher education.

The `digital turn´ can be defined in two ways: as an analytical tool to discuss the digitalization process affecting society, and as a description of the digitalization process itself. Media change in the academic sector imposes new demands on higher education. According to the objectives of the Bologna Accord, higher education must ensure students' employability in the professional world. But, at the same time, the university is a space for critical reflection on the impact of digitalization. Birte Heidkamp and David Kergel discuss in their article *"The Digital Turn in Higher Education – Towards a Remix Culture and Collaborative Authorship"* the ambivalent position which higher education occupies as a result, and advocate an approach which fosters critical thinking and modern project management simultaneously by harnessing the collaborative potential of digital media.

In his article "*The Return of the One. Some Perspectives on the Analog and the Digital and their Uses and Abuses in Education*" Tadeusz Rachwal addresses theoretical and epistemological issues related to what has been termed `digital turn´ with an eye on the shift from the analog to the digital communication and the postulated division into two realities (actual and virtual). This division is approached in the text from the perspective of its broad consequences for education not only as regards the use of digital media in teaching and learning, but also as a new possibility of revising the relationship between man and technology and as a potentially effective means of rethinking the binary/dual cognitive ordering of various categorizations of the real, which ordering, especially as regards higher levels of education, need not be taken for granted. Bringing in the post-philosophical ideas of, among others, Francois Laruelle, the paper considers the coming of the dual to visibility through digitization as a possibility of critical bringing alternative ways of thinking to the educational agenda as a possible effect of the digitalization of the social/cultural milieu by way of what may be called a return of the One which encompasses all kinds of pluralities, and not only the ones decisionally enabled by binary oppositions. The digital turn, as Rachwal claims in the paper, may also be thought of in terms of an educational turn in which technology is not only used as tool, but which may also be constitutive of students' less externally oriented self-consciousness.

Birte Heidkamp & David Kergel reconstruct the development of E-Learning in German higher education. In their article "*From E-Learning to eBologna in an Augmented Reality – The Past and the Future of E-Learning in German Higher Education*" the authors trace E-Learning from the end of the 1990s up to the current perspective of an eBologna, which is defined by a European-wide international mobile learning. In this context digital media are not part of an `E-Learning´ as distinguished from an `analog learning.´ Rather, mobile learning uses the ubiquity of the internet as an additional media dimension through which we can perceive the world and which opens up new learning worlds. The polydirectional and collaborative features of digital media could be used, to establish an European-wide international co-teaching and co-learning in higher education.

David Kergel discusses in "*The Postmodern Dialogue and the Ethics of Digital Based Learning*" the ethical implications of digital based learning. Starting point is a postmodern understanding of communication and the dialogue as idealimage of postmodern

communication. The dialogue can be considered as postmodern ethics in communicative practice. Such a communicative practice is defined by a decentral and polydirectional dimension of communication. Web 2.0 tools provide the media-landscape to realize a digital based postmodern dialogue. Formulated the other way round: the media-landscape of Web 2.0 tools bears ethical implications: The polydirectional and decentral structure of Web 2.0 media enable a postmodern dialogue – one might speak of the ethical implications of Web 2.0 tools. Consequently, E-Learning 2.0 which bases on Web 2.0 tools bears ethical implications. For the E-Learning practice, one challenge is, to transfer such theoretical reflections into learning-scenarios, which meet the requirements of a postmodern dialogue. As a proposal for such an transfer from theory-to-practice, a best practice example for a Web 2.0 based learning-scenario is provided.

II How to do the Digital Turn? Methodical and methodological Approaches for Higher Education in the Digital Age

This chapter collects contributions which outline strategies for implementing innovative, digitally based methods in higher education.

Claudia De Witt and Christina Gloerfeld introduce in their article *"Mobile Learning and Higher Education"* the concept of mobile learning to higher education. Drawing on Schrock's analysis of apps, which in turn refers to Bloom's taxonomy of learning, the authors provide analytical strategies for unlocking the didactic potential of apps in mobile learning scenarios. Subsequently, de Witt and Gloerfeld analyze the actual implementation of mobile learning in higher education. The mobile learning offerings of nine top universities are compared for this purpose. One main finding is that "universities lack behind developing scalable didactical concepts for mobile learning". But universities increasingly "transfer e-learning solutions or prolong face-to-face learning scenarios to mobile devices." A full-scale shift has yet to take place, but seems inevitable in view of the ongoing evolution of media and the increasing ubiquity of the mobile internet.

Dirk Jahn and Allesandra Kenner introduce in their article *"Critical Thinking in Higher Education: How to foster it using Digital Media"* the concept of critical thinking which is, not least, an explicit priority of the Bologna Accord. Critical thinking can be viewed as a basic skill for researchers, especially in times of an increasing media change. The authors provide a systematically grounded approach to implement critical thinking in higher education. For this purpose, they discuss the need for critical thinking in the context of digital literacy and provide strategies to foster critical thinking and a modern, participative use of digital media in higher education. These strategies open up possibilities for the digitally supported implementation of appropriate participative teaching and learning strategies in higher education.

In their article *"Inquiry-Based Learning 2.0 – A Didactic Framework for Inquiry-Based Learning with Digital Media*" introduce the concetp of a inquiry-based learning 2.0. Inquiry-based learning 2.0 combines elements of contemporary E-Learning (i.e. E-Learning 2.0) with elements of inquiry-based learning. To facilitate a systematic implementation of inquiry-based learning 2.0 strategies in higher education, a so-called didactic framework for inquiry-based learning with digital media has been developed. This article introduces the framework, first providing a working definition for inquiry-based learning. It will then go on to introduce the didactic framework with reference to the working definition. As a further step, it will discuss

the concept of e-science/e-research. The didactic framework for inquiry-based learning with digital media emerges from these considerations.

Ronald Arnett provides in his article *"The Lecture as Testimony: In a Technological Age"* a semiotically oriented re-reading of the meaning of the lecture in the Digital Age. According to Arnett, the Digital Age facilitates a decontextualization of the lecture. The lecture can be consumed independently, outside a specific time and space. But despite these media-led changes, the lecture in the Digital Age is also a form of `testimony´ – it is "a public test of opinions, moving ideas from the private space of reading, writing, and self-talk to collective engagement." In this sense the lecture could be the starting point of a dialogue: it is not a vehicle for content demanding passive listeners. Rather, the lecture as testimony "announces the interplay of content and commitment from the speaker that necessitates critical listening and discernment from attentive listeners". In the Digital Age, the lecture can "invoke the local while influencing well beyond the moment of saying".

In her article "Self-determined Learning (Heutagogy) and Digital Media. Creating integrated Educational Environments for developing Lifelong Learning Skills", Lisa Blaschke introduces the learner-centered, theoretically based concept of heutagogy. Heutagogy is a form of self-determined learning which is defined by "the key principles of learner agency, self-efficacy, capability, and meta-cognition (knowing how to learn) and reflection." Blaschke outlines strategies for implementing this approach in higher education. In a further step, she identifies digital technologies – particularly in social media – which can be used to support heutagogical learning in teaching or learning scenarios. This type of digitally supported learning can "equip learners with the necessary skills for a lifetime of learning" in the Digital Age.

III The Digital Turn in Practice – Best Practice Examples for the Digital Turn in Higher Education

This chapter presents examples of higher education incorporating digital media, from different countries.

In "*Establishing a sense of community, interaction and knowledge exchange among students*" Thomas Ryberg and Jacob Davidsen work with the idea of establishing a form of third platform between the dominating social platform of Facebook and the formal academic platform of Moodle. To test the idea they introduce Google+ Communities as a digital tool for students who are, in groups, working on their semester projects. The course is part of a problem-based learning program, which allows the projects to be student driven, forcing them to establish their problem of interest in the project, and to manage a successful communication within their groups and form productive links between lectures, supervision and their project work. Ryberg and Davidsen argue well for the need of this third platform, and conclude that their experiment showed that it is possible to create such interfaces. However, their study also detect different problems in doing so, amongst them the importance of support, and not least usage from the side of the lecturers.

Mia Thyrre Sørensen looks closer at students' choice of ICT tools in her chapter "*The students' choice of technology – A pragmatic and outcome-focused Approach.*" Sørensen claims early in her chapter that although students are familiar with social media, some to the extent of being 'digital natives', they have trouble transferring those digital competences to learning capabilities. Based on this assumption, Sørensen discusses a study on students' motif and rationale for their choice of ICT tools. The study has been carried out on 5th semester

students, by observation, survey and qualitative interviews. The results from the study are very interesting, showing e.g. that students prefer ICT tools that they are used to, such as Facebook and Google docs, and have more difficulties in adapting more academically adequate tools such as Refworks or Zotero. But the study also shows that the students reasoning behind their choice have little to do with the ICT tools ability to expand their learning process, and more about the tools not being too complicated, or time consuming, and they tend to disregard tools that they do not have prior knowledge of. Sørensen clusters the students reasoning into a pragmatic paradigm with e.g. cost-benefit analysis, and concludes that although the students chose quite conventional and general tools, the tools are working for them.

In "Addressing EAP Students' Needs in the Tertiary Context – on the Use of Digital Course Books in English for Language Teaching Academic Purposes," the authors Agnieszka Gadomska and Jarosław Krajka discuss the needs of EAP students and teachers in terms of the development, adaptation and usage of IT based teaching resources. The chapter focuses not only on practical aspects underlying teaching EAP with the use of technology, academic writing in particular, such as: the use and adaptation of digital course books, implementation of IT based materials in the classroom with the use of interactive whiteboard technology, but also on the methodological issues of teaching EAP in the Digital Age, such as: learner autonomy, teacher training and material design.

The role of ICT for overcoming disabilities is the theme of Ulla Konnerup's "*Inclusive Digital Technologies for People with Communication Disabilities.*" She claims that there is a lack of research on the subject of how digital technology can mediate learning for learners with special needs and disabilities. From the theory of social learning and situated learning Konnerup deduce that communication is a vital part of any learning process. She focuses on two cases of learners suffering from aphasia (impairment of language skills), and through ethnographical interviews and phenomenologically inspired studies Konnerup looks closer into how digital tools can increase the subjects communication skills and thereby their learning potential. As one part of this, a special web based learning environment called BaseCube was designed. In all, Kunnerup can conclude that making ICT a part of the rehabilitation of the patients with aphasia, as a result of brain injuries, has positive results. The ICT tools are flexible and motivate the participants, who show progress on all communicative parameters, and are able to create themselves a form of alternative voice.

Appendix: A technical-didactical Perspective on the Digital Turn in Higher Education – an Informatic Approach

This section provides approaches from the field of Computer Sciences.

In their article "*Trace-Based Multi-Criteria Preselection – Approach for Decision Making in Interactive Applications like Video Games*" Hoang Nam Ho, Mourad Rabah, Samuel Nowakowski and Pascal Estraillier thematize the process of decision-making in the context of interactive applications for game-based learning: Decision-making in games is essential to make them more automated and smart. A decision algorithm performs its calculations on the set of all the possible solutions. This increases the computation time and may become a combinatorial explosion problem if there is a huge solution space. To overcome this problem, the authors present their work on relevant solutions preselection before making a decision. The authors propose a two-steps strategy: 1.) the first step analyses the system's traces (users

past executions) to identify all the potential solutions; 2.) the second step aims to estimate the relevance, called *utility*, of each of these potential solutions. The result is a set of alternative solutions that can be used as an input to any decision algorithm. The authors illustrate their approach on the Tamagotchi game.

One of the rapidly developing tools for online learning is learning through mobile environment. Therefore, developing and improving of mobile learning environment is an active topic. One of the ways to make learning environment more accurate to user's needs is to use his context. Context of user consists of current context in online learning environments and physical context. In their paper "*Analysis of Means for building Context-Aware – Recommendation System for Mobile Learning*" Larysa Shcherbachenko and Samuel Nowakowski concentrate on such physical contexts and develop solutions to improve the user's experience in learning environments by using actively the context. For this, an ontology-based system is presented and a learning context ontology was extended for user context ontology. A set of use-case scenarios is provided to show situations which will be covered by such an approach.

I The Digital Turn in Theory

Theoretical Reflections on Higher Education in the Digital Age

2 The Digital Turn in Higher Education Towards a Remix Culture and Collaborative Authorship

David Kergel & Birte Heidkamp

2.1 Introduction

Abstract
An ongoing process of media change is affecting and, increasingly, challenging all fields of society (Krotz, 2008). This change has been discussed as an epochal shift leading to a digital age (Hanson, 2014; Nordmann, Radder & Schiemann, 2014). The process in which the structure of media in society is redefined can be termed a `digital turn´. This digital turn is increasingly affecting academia: the university can be viewed as a space of digitalization. Universities propagate inventions which push the digitalization process. But science itself is changing in the course of digitalization. Thus the concept of `e-Science´ describes the increase in digital scientific research and the establishment of digitally based scholarly communications (Büffel, Pleil & Schmalz, 2007; Lang & Zobl, 2013; Heidkamp, 2014). Media change in the academic sector makes new demands on higher education. Higher education has to ensure that students acquire the academic media skills needed in a digital age. According to the goals of the Bologna Process, higher education must ensure students' employability in the professional world of the digital age. But at the same time, the university is a space for critical reflection on the impact of digitalization. Following Derrida, one can envisage the university as a space of critical reflection and resistance (Derrida, 2002). From this perspective, the university is bound to discuss the shift in which digitalization re-defines the media landscape.

This heuristic consideration raises a crucial question: What does the term `digital turn' mean in the context of higher education?

Keywords: Digital turn, Higher education, Remix culture, Digital age, Collaborative authorship

2.2 The Double Perspective of the Digital Turn in Higher Education

The `digital turn´ can be defined in two ways: as an analytical strategy to discuss the digitalization process affecting society, and as a description of the digitalization process itself. This process leads from the `book culture´ of the so-called Gutenberg Galaxy to a digital age. The following two subsections discuss this `double perspective´ of the digital turn.

2.2.1 The `Turn´ as an analytical Perspective

In the field of culture studies (Bachmann-Medick, 2006) the concept of the `turn´ is used to describe and to analyze societal discursive practices. Several turns have been identified. Each has a specific analytical focus: the postcolonial turn, the linguistic turn and the spatial turn enable us to analyze societal dynamics from a paradigmatic perspective in the sense of Kuhn (1970). These different analytical approaches provide a strategy for focusing on complex social realities from different perspectives. In adopting a specific focus, the use of a `turn´ offers a particular analytical perspective on social reality: thus the methodological focus of the linguistic turn opens up the linguistic dimension of social reality – or the `linguistic

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construction of reality´ – for analysis. It is a premise of the linguistic turn that the analysis of language facilitates an appropriate understanding of social reality. Our understanding of reality, or the way in which we construct reality, is represented in our language and the concepts we adopt. Language analysis can thus be used to understand how we give things a meaning, how we order our reality through words, or even how we produce things through words – for instance, using the term `alternative facts´. For just one example of how language represents and shapes our world-view, we might consider the term `disabled´. Handicapped persons are termed `disabled´. The word `disability´ defines handicapped people as `not-able-to-do-something´ instead of describing them as `other-abled´. The term `disabled´ carries the implication that a disabled person lacks something. S/he differs from the norm and is limited in his or her functionality.

According to the linguistic turn, the analysis of language provides a better understanding of how we give meaning to the world through words. In contrast to the linguistic turn, the spatial turn facilitates the analysis of social reality in its spatial structure – for instance, when we map the distribution of wealth in the districts in a city. This enables us to reconstruct the socio-economic structure of a city in a spatial dimension (Döring & Thielmann, 2008). In conclusion, the concept of a `turn´ signifies an analytical strategy. The specific form of the turn (linguistic, spatial, or otherwise) provides a specific analytical angle on social reality.

This definition of `turn´ casts the digital turn as an analytical strategy which enables us to focus on the role of digitalization within social reality. As an analytical perspective, the digital turn makes it possible to analyze and discuss the societal meaning of digitalization. The term `digital turn´ thus signifies an analytical approach which centers on the role of digitalization within a society. If the linguistic turn is defined by the epistemological assumption that reality is constructed through language, the digital turn is based on the assumption that social reality is increasingly defined by digitalization. Social media symbolize the digitalization of social relations. Individuals increasingly engage in identity management on social networking sites (SNS) such as Facebook, Twitter, Snapchat, and Instagram. SNS are polydirectional, meaning that users can connect to each other and share information. Social media such as SNS "became informal but all-embracing identity management tools, defining access to user-created content via social relationships" (Mitrou et al., 2014, p. 2; see also Boyd & Ellison, 2008). The concept of a digital turn opens avenues for further research concerning how digital communication changes social relations.

With these considerations in mind, the digital turn in higher education should be understood as an analytical angle focusing on how higher education, learning, and teaching are changing in the course of digitalization.

2.2.2 The Digital Turn as Term for an ongoing Media Change

The semantic dimension of the term `turn´ denotes a motion or change. As a term for analytical strategies in the field of cultural science, the motion expressed in the `turn´ is the shift towards a new analytical focus. From the perspective of media theory, the term `digital turn´ means more than a change of analytical perspective or paradigm shift: According to Kuhn (1970) the paradigm shift represents the emergence of a new analytical perspective on the world. With this new perspective, new methodological assumptions and research strategies emerge. Kuhn's concept of the paradigm shift does not take into account that the media landscape of an entire field may change. The change inherent in the digitalization process challenges the established media of the academic field. A basic example is that citation

systems such as APA-Style, Harvard-Style, and Chicago-Style were developed for book and journal citations. They were not developed to refer to internet sources. The development of appropriate strategies for quoting from a chat record or podcast is still far from accomplished.

From the perspective of media theory, a turn signifies an ongoing change in media, recasting their place in society. In this sense, the digital turn can be defined as the process which leads from the so-called Gutenberg Galaxy to a Digital Age. In his analysis of the Gutenberg Galaxy, McLuhan (1962/2011) pointed out how book-print changed the media landscape and, with it, the practices of Western society. According to McLuhan, the book and print technology led to a redefinition of the media used by civil society. The new media landscape had specific effects on social interaction: "Print had a levelling function on all verbal and social forms" (McLuhan, 2011, p. 239). According to one theory, the digital turn is now causing a redefinition of society's media, as the Gutenberg Galaxy did in its time. In other words, the digital turn signifies the shift in the structure of media within society. From this perspective, the digital turn in higher education represents the shift as it affects and challenges universities and higher education as a whole. The double perspective inherent in the term digital turn thus becomes clear:

- As an analytical focus, the digital turn calls attention to the digital dimension of social processes.
- In the context of media theory, the digital turn refers to the restructuring of a society's media.

2.3 The Double Perspective of the Digital Turn and the Double Challenge to the University

The digital turn challenges the university in both respects. This double challenge corresponds to the double function of the university. The university is

- a place of critical reflection and resistance on the one hand; and at the same time
- an educational space and institution.

In encountering the digital turn, the university has to

- analyze the societal dimension of this change; and also
- react to the shift in the academic field's media and its implications for higher education.

The theme of a double challenge to the university through the double perspective of the digital turn will be developed in this subsection.

Digitalization is inevitable but, at the same, a social product. This means that digitalization, and media change generally, does not occur like a force of nature. It is a cultural manifestation and has to be discussed as such. Digital media are part of our everyday lives and cultural practices – we need to reflect on this pervasiveness and discuss how digital media change our practices. In our discourses we give digital media a meaning in everyday live – and from the perspective of critical discourse analysis we should question this meaning. Following Derrida (2002), we can think of the `unconditional university´ as a space where the societal meaning of digital media can be questioned.

> Here then is what I will call the unconditional university or the university without condition: the principal right to say everything, whether it be under the heading of fiction and the experimentation of knowledge, and the right to say it publicly, to publish it. (Derrida, 2002, p. 26)

The university "should remain an ultimate place of critical resistance – and more than critical – to all the powers of dogmatic and unjust appropriation" (Derrida, 2002, p. 25f.). Derrida's concept of the unconditional university makes critical reflection, here analyzing the digital turn in the sense of a fundamental media shift, a task of the university. At the same time, the university is an educational institution: as such it is tasked with educating skilled workers. In the interest of students' employability, higher education has to meet the challenge of ensuring that they acquire the media skills required for professional life in the Digital Age.

2.3.1 University and Higher Education as Drivers of Innovation in the Digital Age

The double perspective carried by the digital turn entails a double challenge to the university. One task is the critical analysis of, and reflection on, the digitalization process. On the other hand, the university has to equip future professionals to handle the challenges of the media shift leading to a Digital Age.

These two tasks also challenge teaching and learning in higher education. According to Derrida's concept of the unconditional university, teaching and learning have the goal of mediating critical thinking strategies. In higher education, the unconditional university manifests itself in learning which enables students to develop a critical attitude towards `the powers of dogmatic and unjust appropriation' by scholarly means (Derrida, 2002, p. 25f.).

Another goal of higher education during the digital turn is to mediate the necessary media skills for employment in a Digital Age. This means that students must learn how to harness the flexibility, and polydirectional and collaborative potential, of digital media in their field of study. Strategies such as mobile and inquiry-based learning with digital media, are likely to prove important for such purposes. These strategies enable participative, action- and product-orientated learning with digital media.

In a dawning Digital Age, higher education is in a position to experiment with innovative forms of teaching and learning, to foster critical thinking, and prepare students for employment. In line with the innovative role of the university as a place where knowledge is discussed and produced, the university can also provide best practice examples for the implementation of digital media. These could then be transferred into the professional world. In this respect, the university and higher education in general have the potential to act as a driver of innovation in the Digital Age.

It is not yet possible to predict how higher education teaching and learning will change in the Digital Age. What we can safely say is that teaching and learning in higher education are already changing. The following section considers, through the lens of the digital turn as analytical approach, how the digitalization process can change teaching and learning in higher education. The starting point is a changed conception of the author. With a new understanding of the author – or rather, with the substitution of digitally based collaborative authorship for the old single author – learning and teaching will change in their turn.

2.4 From Author to Authorship

The author provides one example of the impact of digitalization, and the way in which it alters cultural practices and concepts. It seems likely that the concept of the individual author will be replaced by that of collective authorship. This process can be interpreted as a pars pro toto for the ongoing structural change in media – or digital turn – leading from the Gutenberg Galaxy to the Digital Age.

The rise of collective authorship affects the way in which people read and write and, consequently, teaching and learning in higher education. This point will be developed in the following section.

2.4.1 The Concept of the Author in the Gutenberg Galaxy

With the Gutenberg Galaxy, "the dynamic logic of printing as a centralizing and homogenizing force" (McLuhan, 2011, p. 230) emerged. This led to the concept of the individual author, who creates literature and distributes knowledge by the publication of their books. Barthes points out the historical conditions which gave rise to this concept:

> The author is a modern figure, a product of our society insofar as, emerging from the Middle Ages with English empiricism, French rationalism and the personal faith of the Reformation, it discovered the prestige of the individual, of, as it is more nobly put, the `human person´. It is thus logical that in literature it should be this positivism, the epitome and culmination of capitalist ideology, which has attached the greatest importance to the `person´ of the author. (Barthes, 2008, p. 313)

In the academic field, the scholarly author represents the emancipated, active citizen who constructs rationally based knowledge with their writings.

The scholarly author produces knowledge and disseminates it through books. The `author concept´ establishes a scholarly hierarchy, which is defined by the poles of `writing´ and `reading´. The author represents the one pole: they write the book. The unidirectional orientation of the printed book performatively reproduces the poles of reading and writing. The structure of the printed book requires a sharp distinction between author and reader. The author provides knowledge through their written text and printed book, and needs a reader. In academia, the author communicates their knowledge by way of books and journals. The "order of the book" (Weel, 2011, p. 91) and the concept of the scholarly author also influences learning. In the Gutenberg Galaxy, learning is based on the distinction between the author and the reader, who can be considered the `learner´: "The printed book was a new visual aid available to all students and it rendered the older education obsolete. The book was literally a teaching machine" (McLuhan, 2011, p. 164). The student reading a book became an iconic representation of study.

The idea of the `author´ not only influenced learning but also other fields such as law: just as the merchant owns his goods, the author owns his works. With the advent of printing technology, the idea of the single, creative author gained currency and was eventually enshrined in copyright laws: copyright was established in the USA in 1790, in France in 1793, and in Prussia in 1837. Copyright legislation constituted the author as a legal person (Dommann, 2008, p. 44).

Setting the concept of the author against ongoing media change, one may ask whether digitally based and polydirectional forms of writing are likely to develop a similar impact. Such a development could see the rise of a collective, digitally based conception of authorship to replace the individual author who writes books for print publication.

2.4.2 The Emergence of collective Authorship in the Digital Turn

Media change challenges the concept of the single author: in 1962, McLuhan wrote that ongoing media change leads from a book-based Gutenberg Galaxy to an `Electronic Age´. In view of the emergence of the internet and the digitalization process, we may term today's Electronic Age the Digital Age. According to McLuhan, one essential feature of the change that leaves the book behind and leads to an Electronic Age, "is the new drive for decentralism and

pluralism in big business itself" (McLuhan, 2011, p. 230). The polydirectional and polyphone potential of the internet – mainly the Web 2.0 – provides the communicative basis for decentralism and pluralism. The participative structure of social software challenges established concepts like the author, and consequently higher education teaching and learning. Simplifying for emphasis, one might say that in the Gutenberg Galaxy, the scholarly author provided the knowledge and the student could acquire it by reading printed books. In the Digital Age, by contrast, the concept of the author changes or is indeed replaced by digitally based collective authorship. For a theoretical approach to help formulate a new concept of authorship, one might refer to Barthes' idea of the `death of the author´: In 1967, five years after the Gutenberg Galaxy was published, Roland Barthes formulated the thesis of the death of the author: "The removal of the author […] is not merely an historical fact or an act of writing, it utterly transforms the modern text" (Barthes, 2008, p. 314). Barthes argues that to "give a text an author is to impose a limit on that text, to furnish it with a final signified, to close the writing" (Barthes, 2008, p. 315). Instead of focusing on the author, Barthes stresses the role of the reader as the real actor who gives the text its meaning – "[A] text´s unity lies not in its origin but in its destination" (Barthes, 2008, p. 316). According to Barthes, the reader is "someone who holds together in a single field all the traces by which the written text is constituted" (Barthes, 2008, p. 316). Barthes concludes that "the birth of the reader must be at the cost of the death of the author" (Barthes, 2008, p. 316). One might propose that media change provides the technical infrastructure for texts in which the sharp distinction between author and reader dissolves. A new way of reading and writing could establish itself thanks to the polydirectional and polyphone potential of digital media. Wikipedia represents an example. A Wikipedia article is at least potentially the product of diverse individuals, who are readers and writers simultaneously. They may use the participative features of Wikipedia to discuss the subject and can re-write the article. The single author dissolves into a plurality of perspectives which constitutes a collective authorship, represented in a collaboratively written article. Collaborative writing tools such as Authorea or GoogleDrive make collaborative writing practical in the academic field. A consequence of collective authorship could be texts which remain in constant flux. Lessig (2001) anticipated this digitally based remix culture 16 years ago:

> Technology could enable a whole generation to create – remixed films, new forms of music, digital art, a new kind of storytelling, writing, a new technology for poetry, criticism, political activism – and then, through infrastructure of the Internet, share creativity with others (Lessig, 2001, p. 9).

The text is no longer an entity, immutable once written, which waits for its readers. "Moreover, the `democratisation´ of textual production, distribution and consumption creates an entirely new relationship between author and reader" (Weel, 2011, p. 4). Instead of reading a text only by oneself, it is possible to annotate collaboratively and thus change a text with social bookmarking tools like Diigolet. When Barthes empowers the reader as the person who gives a text a meaning, the digital media transfers the text into a constant collaborative process of knowledge construction. The text can be `used´, changed, remixed – readers inscribe themselves in the text. The result is a new text with a new perspective, or a mash-up of the earlier text. Such `textual instability´ (Weel, 2011) marks a break with the concept of the `lasting structure of a printed text´. According to Weel, this idea of lasting textual stability is an effect of the book which was established in the course of the Gutenberg Galaxy – "The printing press has in the course of time created a (largely unconscious)

expectation of stability and permanence of form and content" (Weel, 2011, p. 149). The digital text is literally in motion: "Different people can comment on the same digital text, giving rise to, for example, various – virtual – combinations of texts and commentaries" (Weel, 2011, p. 159).

The new possibility of producing and remixing a text digitally, calls into question the relationship between reader and author. The redefinition of this relationship affects other fields just as the concept of the `author´ once did. A challenge to the established copyright principle thus arises: the copyright which emerged out of the Gutenberg Galaxy and constituted the author as legal person is being subjected to modifications. The so-called Creative Commons license (CC) approach provides an example. It not only ensures non-commercial use of the text, but also allows derivatives. The CC license model provides a legal structure to underpin the `remix culture´ (Lessig, 2008) which has emerged from of the polydirectional and polyphone media of the Digital Age. The `read and write culture´ of the Digital Age stands in contrast to the `read only culture´ (Lessig, 2008) that derives from the established, book-based distinction between author and reader.

There is an argument that the concept of the `author´, which emerged in the course of the Gutenberg Galaxy, is vanishing (or `dying´) in the Digital Age. The author, writing alone in their study, is being replaced by collective authorship. This change is bringing about a remix culture and also challenging (copyright issues aside) the entire book-based conception of learning. Weel (2011) identifies "many challenges" in the context of digitalization. Chief among them is to learn "how to deal with turning the solid, unchangeable monuments of print into the continual, ever-changing events of the digital realm" (Weel, 2011, p. 218). Taking Weel's cue, we may conclude that the higher education system will have to adapt to ongoing media change and develop strategies to deal with the university's ambivalent position in the digital age. From the perspective of an unconditional university, critical thinking must be practiced. As an educational institution, the university has to ensure the employability of its students. In other words, students need to acquire the critical thinking and other skills with which to exploit the collaborative potential of digital media, so as to participate in the remix culture of the digital world. This can be achieved with participative higher education strategies such as inquiry-based learning, heutagogy, mobile learning, and problem-based learning. These strategies must harness the collaborative potential of digital media to establish a critical remix culture in learning and teaching, reading and writing. Using such approaches, the university can develop best practice examples which can then be adopted by the professional world as it seeks appropriate strategies to adapt to digitalization.

This analysis and conclusion remain tentative and limited in scope, but provide a heuristic frame in which to think about teaching and learning in higher education in a changing world.

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3 The Return of the One
Some Perspectives on the Analog and the Digital and their Uses and Abuses in Education

Tadeusz Rachwał

Abstract
The paper addresses theoretical and epistemological issues related to what has been termed `digital turn´ with an eye on the shift from the analog to the digital communication and the postulated division into two realities (actual and virtual). This division is approached in the text from the perspective of its broad consequences for education not only as regards the use of digital media in teaching and learning, but also as a new possibility of revising the relationship between man and technology and as a potentially effective means of rethinking the binary/dual cognitive ordering of various categorizations of the real, which ordering, especially as regards higher levels of education, need not be taken for granted. Bringing in the post-philosophical ideas of, among others, Francois Laruelle, the paper considers the coming of the dual to visibility through digitization as a possibility of critical bringing alternative ways of thinking to the educational agenda as a possible effect of the digitalization of the social/cultural milieu by way of what may be called a return of the One which encompasses all kinds of pluralities, and not only the ones decisionally enabled by binary oppositions. The digital turn, as I claim in the paper, may also be thought of in terms of an educational turn in which technology is not only used as tool, but which may also be constitutive of students' less externally oriented self-consciousness.

Keywords: Digital turn, Virtuality, Prosthesis, Spectrality, Dualis

Numerous turns have been recognized in the contemporary disputes within the social sciences and humanities, especially in the last half of the 20th century. Mark Carrigan (2014) distinguishes 47 names of the species. The linguistic turn, for instance, the one which opens Carrigan's list, initiated the critique of foundationalism in philosophy and seems to be responsible for opening up ways of approaching reality as determined by language, for opening up vistas of textual worlds, thus linking the linguistic turn with what Clifford Geertz called the literary turn which also carries the name of textual turn and may well be connected with the discursive turn or conflated with the communicative turn. Most of the turns listed by Carrigan are strongly interrelated and Carrigan rightly finds their proliferation "a bit silly" (Carrigan, 2017, para. 3). However, what this proliferation clearly points to is a demand for new perspectives, for ways out of the furrows along which our thinking and inquiring has been for quite a long time guided. Most of those turns, moreover, are relevant for various aspects of education because, as related to changes of perspectives and positions of perception, they also, and inevitably so, involve the ways and methods of broadly understood learning and teaching.

The English word "turn" has a wide range of senses – from rotation, through revolution, to beginning of a period of time – the latter two senses being applicable to the idea of turns in culture. The linguistic turn, for instance, was revolutionary as regards the epistemological aspects of what could be considered as reality, simultaneously initiating a substantial number

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of new, or at least newer, times of poststructuralism, postmodernism, postcolonialism and quite a few other "posts" which, in turn, changed a lot of teaching curricula and programs on all levels of education. In higher education, particularly as regards the humanities, these "posts" have been taught as discourses problematizing simple and given binary oppositions as responsible for the apotheoses of presence carried by what Jacques Derrida called the metaphysics of presence.

Within the turns preceding the digital turn, to whose conceptualization I will have to return shortly, technology in the common understanding of the word as machinery, tool or equipment did not play a significant role. Though the invention of the printing press was a revolutionary event in its time, the few hundred years of the existence of print in European culture interiorized writing as a natural means of communication which was almost glued to speech and which it in some sense quite unfaithfully copied. The visible linearity of writing has also, at least according to Marshall McLuhan, linearized our cognition and simultaneously increased the distance between man and man, the distance which he also perceived as the temporal delay of language communication in general. His only too well known recognition of medium as a message prompted him to think of a replacement of the linearity of print with fragmentation and flashbacks used in film and television and thus, as Philip B. Meggs (2011) phrases it, "explode[d] the tradition of continuity so precious to writers and editors" (Meggs, 2011, p. ix). McLuhan's *The Mechanical Bride*, originally published in 1951, was a praise of discontinuity. This kind of discontinuity was conceived of as a complex kind harmony which evades ideological and discursive imposition of faith carried in continuity which was treated an epitome of rationality. The metaphor for this new kind of harmony was "orchestration" which, as he wrote,

> permits discontinuity and endless variety without the universal imposition of anyone social or economic system. It is a conception inherent not only in symbolist art but in quantum and relativity physics. Unlike Newtonian physics, it can entertain a harmony that is not unilateral, monistic, or tyrannical. It is neither progressive nor reactionary but embraces all previous actualizations of human excellence while welcoming the new in a simultaneous present (McLuhan, 2011, p. 34).

What is thus brought as an alternative to the linearity of the visual manipulation is a blend of the auditory with certain aspects of modernist art which, quite interestingly in the context of the coming of the approaching digital era, is rooted in new physics, the science associated with, among others, the name of Alan Turing with whom McLuhan corresponded and which he clearly invoked "as support for his critique of visual space" (Cavell, 2015, p. 153). Though what is called the new media, or digital media, along with their potential to produce images, were as yet unknown to McLuhan, his readings of the orchestrating potential of both new physics and the symbolic art seems to be a gesture towards an alternative perception of the real, hidden beneath the visuality controlled by the rules of linear language. Perhaps like Turing, he realized that not everything is computable, that, as Cavell puts it, "reality is flow, or traffic. It is not countable, not separable: reality is analogue" (Cavell, 2015, p. 155). The Turing machine was not a mimetic project which simply duplicated reality. So too, for McLuhan, media did not transmit or transfer reality, but transformed it. What both McLuhan and Turing clearly saw was that our control of the images of reality we produce can only be partial and that "to attempt to provide rules of conduct to cover every eventuality […] appears to be impossible" (Turing, 1950, p 457, quoted in Cavell 2015, p. 158). Though we may speak nowadays of something which may be called a "digital turn," we should remember that the opportunities offered by this turn should be looked at, and used, with some modesty, that the

vistas opened by it do not prove that we have become able to regulate the world along with its irregularities. Such an ambition, as it seems, underlies Benoit Mandelbrot's (1977) dream of fractal mimicking "reality by purely geometric means" (Mandelbrot 1977, p. 84) with which he, literally, "attacks irregularity" (Mandelbrot, 1977, p. 12).

The subtitle of Wim Westra's 2012 book devoted to the digital turn (*The Digital Turn. How the Internet Transforms Our Existence*), and, as he writes at its very beginning, to "the progressive virtualisation of the world" (Westra 2012, p. 6), carries an in fact ontological claim of some progressive transformation of our existence. Such a progressive change carries with it the possibility of ending the process of transformation, of giving it a finish, perhaps in Jean-Luc Nancy's (2000) understanding of the teleology of the promise of the end and completion:

> The finish consists in executing (ex-sequor means to follow through to the end), in carrying out something to the limit of its own logic and its own good, that is, to the extremity of its own Being. In our thinking, Being in general, or rather Being proper or plainly Being, in each of its singular effectuations or existences, has it substance, end, and truth in the finish of its Being. (Nancy, 2000, p. 118, emphasis in original)

In the case of virtualization, an implicit promise of the final transformation, of virtual reality fully replacing our imperfect rootedness in the world of our bodies and minds, goes hand in hand with the faith in boundless possibilities of technological advancements. Westra refers to such a possibility in terms of immigration from the real world:

> We disconnect the mind from the body and thereby transfer ourselves from the real world to the simulation. We are real-world immigrants in a simulated realm, where we can interact with other immigrants or with artificial characters without noticing any differences. This would be the ultimate virtual reality because the body is frozen while the brain, which would still be processing sensory data and controlling motor actions, is still active. We might want to keep our brain in a vessel and renounce our brainless body. (Westra, 2012, p. 125)

This idea of immigration from the real world rhetorically marks this world as in some sense inhospitable, one which we leave in order to find an asylum in a better one. What is thus left behind, or at least one aspect of what is left, is the analogue world as opposed to the digital world brought in by the new media. The old analogue world is, again rhetorically, seen as less perfect, as an ambiguous and noisy world which the digital world as it were cleans up of all the unnecessary disturbances. What the digital turn necessarily involves is "digitization," the technical process which converts streams "of analog information into digital bits of 1s and 0s with discrete and discontinuous values" (Kreiss & Brennen, 2014). Daniel Kreiss and Scott Brennen briefly outline the effects of digitization referring to a number of texts devoted to the problem:

> As communication scholar Tony Feldman (1997: 2) argues, unlike analogue data with "continuously varying values, digital information is based on just two distinct states. In the digital world, things are there or not there, 'on' or 'off'. There are no in-betweens." That digital bits have only two possible values leaves many to argue that, in the words of Robert Pepperell (2003, 126), "digital information is discrete and 'clean', whilst analogue information is continuous and 'noisy'." Robinson (2008, 21) defines analog as: "smoothly varying, of a piece with the apparent seamless and inviolable veracity of space and time; like space and time admitting infinite subdivision, and by association with them connoting something authentic and natural, against the artificial, arbitrarily truncated precision of the digital (e.g., vinyl records vs. CDs). (Kreiss & Brennen, 2014, para. 4)

The value judgements of the digital can surely be called positive. The digital world, even in the short quotation above, guarantees the certainty of the presence of things as they are, with no undecidable in-betweens. The presence is clean, its transmission undisturbed, its divisions are

finite and precise. Kreis and Brennen rightly notice that digitization carries a symbolic claim to immateriality, to the forgetfulness of the material systems on which, as they put it, the information is "housed" (Kreiss & Brennen, 2014, para. 7). This, in fact metaphysical, dimension of digitization overshadows the materiality of "housing," something which Jean Baudrillard quite long ago expressed in terms of fear. "The compact disc," he wrote.

> It doesn't wear out, even if you use it. Terrifying, this. It's as though you'd never used it. It's as though you didn't exist. So it's as though you didn't exist. If things don't get old any more, then that's because it's you who are dead. (Baudrillard, 1994, p. 101)

The nostalgia for the analog, expressed in the rebirth of vinyl records for example, seems to be lying in the feeling of in inauthenticity of the digital world also mentioned by Kreis and Brennen in the above quotation. There seems to be no question that what is brought by the new media is, at least symbolically posthuman, a construction of a seemingly absolute space uprooted from the homeliness of "housing," even the rootedness in the brain. The subtitle of Robert Pepperell's (2003) book on posthuman condition (The Posthuman Condition. Consciousness beyond the brain) quite clearly points to the possibility of placing consciousness outside the body. Such a possibility, however illusory, is carried by the potentialities of the digital turn as what it also enables is a presence without a body. As "virtual representations are combined with digital communications," writes Pepperel,

> we start to see 'meetings' of thousands of people who are physically remote, and the building up of on-line communities distributed across the world. It seems that in this electronic world one's physical attributes will be less significant that one's 'virtual presence' or 'telepresence' (Pepperel, 2003, p. 5).

This withdrawal of the human away from the human is paradoxical, as though we can easily find virtually present persons or objects, we do not really know where they are. It is difficult for us, as Pepperel puts it, "to determine where a person 'is'" (Pepperel, 2003, p. 5). The inverted commas around the 'is' are quite telling here, as what is really at stake is the possibility of nonexistence which terrifies, as we have seen, Jean Baudrillard. This nonexistence is, paradoxically, communicated by the digital existence, pure, clear and unambiguous which in some sense is a fulfillment of the philosophical dream of presence, of a being-in-itself, a being devoid of any contextual dependencies and rootedness.

Martin Heidegger did see technology as indispensable, and strongly associated the technology of building with dwelling and thinking, the activities which he, etymologically linked with being and with autochthonic belonging to the soil. He quite explicitly wrote that ''the arrangements, devices, and machinery of technology are to a greater or lesser extent *indispensable* […] We depend on technical devices; they even challenge us to ever greater advances'' (Heidegger, 1959, p. 55, quoted after Glendinning, 2017, p. 2). Long before the digital turn, he warned against the dangers of uprooting, against the loss of "rootedness, the accelerating deracination of our lives from any 'patch of home ground', an uprooting from any definite 'here' by new forms of social technology" (Glendinning, 2017, p. 2). Heidegger's autochthonic rootedness and native belonging to the home ground seems to be irrevocably gone, and what Simon Glendinning (2017) finds to be a crucial educational issue for "digital natives" is a "new rootedness" which will replace the old rootedness represented in "exclusively 'blood and soil' terms" (Glendinning, 2017, p. 3). What he, against Heidegger, affirms is "another nativisation – the being-at-home of a more cosmopolitan plant – that belongs, as Nietzsche stressed, to a human being who has achieved ''independence of any definite milieu" (Glendinning, 2017, p. 3, quotation from Nietzsche, 1973, p. 153).

The idea of independence from definite milieu slightly complicates the understanding of the notions of digital immigration and digital nativity to which I have already briefly alluded. For Marc Prensky (2001), who wrote his well-known essay "Digital Natives and Digital Immigrants" (where the two now popular phrases were used for the first time) in 2001, the metaphor of immigration was used with reference to those of us who "were not born into the digital world but have, at some later point in our lives, become fascinated by and adopted many or most aspects of the new technology" (Prensky, 2001, p. 1), with Prensky positing himself as one belonging to that group. Importantly for the subject of this volume, he used the term with reference to teachers for whom the generation of students born after the arrival and rapid dissemination of digital technology in the last decades of the 20th century constituted a generation of "digital natives" (Prensky, 2001, p. 1). The phrase "digital natives" designates here those students who have spent their lives surrounded by various "toys and tools of the digital age," among "[c]omputer games, email, the Internet, cell phones and instant messaging" Prensky, 2001, p. 1) which became "integral parts of their lives" (ibid.). The use of these toys and tools, Prensky claimed, may have changed their brains (Prensky, 2001, p. 3), perhaps in the way the use of print has changed the brains of the previous generation of the Guttenberg Galaxy through the linearization of the processes of the cognition.

What is at stake seems to be something more than a generation gap which is, putting it bluntly, only a temporal and passing phenomenon. Prensky's use of the anthropological metaphor of tribe along with the in fact colonial metaphor of immigration brings in the questions of space and its conquest, though in a slightly paradoxical way. Seen as a tribe, as an autochthonic society, the digital generation is simultaneously posited as living in another space, occupying it, though as it were nomadically, in opposition to the sedentary tradition of life to which the old generation is accustomed. Moreover, the digital tribe produces this living space, crates it by various means and `toys´ seemingly independently of the space already occupied by the analogically mediated world of the old generation. Institutionally, however, it is the older generation which organizes the world, education being one of the powers which remains under their control. From that perspective, the `autochthonous´ education of the digital tribe is frequently seen as destructive of the old world and is comparable to a coming of barbarians into the walls of the city for whose culture and traditions they do not have any respect. So what should happen in this predicament, asks Prensky:

> Should the Digital Native students learn the old ways, or should their Digital Immigrant educators learn the new? Unfortunately, no matter how much the Immigrants may wish it, it is highly unlikely the Digital Natives will go backwards. In the first place, it may be impossible – their brains may already be different. It also flies in the face of everything we know about cultural migration. Kids born into any new culture learn the new language easily, and forcefully resist using the old. Smart adult immigrants accept that they don"t know about their new world and take advantage of their kids to help them learn and integrate. Not-so-smart (or not-so-flexible) immigrants spend most of their time grousing about how good things were in the "old country. (Prensky, 2001, p. 3)

However, the immigrants are also natives, though natives to what Prensky calls "the old country" within whose territory the digital natives function building their new virtual spaces. What frequently goes unnoticed is that the digital world is not exactly new, that it is a fulfillment of various philosophical dreams of the old world whose analogue means never managed to fulfil. One of those dreams was a perfect language, one which is devoid of contradictions, ambiguities, perhaps also of the haziness of meaning which Michael Taussig called, in the context of colonialism, "epistemic murk" (Taussig, 1987, p. 132). The murkiness

of natural language, its systematic refusal to be systematically clarified has turned out impossible to be overcome by philosophers. Thus philosophy, as Pepperell notices, had to idealize it through making it somehow quantifiable and thus available to mathematical logic:

> Linguists, and philosophers of language, tend to idealise language in order to make it quantifiable. But real language can be likened to a turbulent fluid, the catastrophic ruptures between continuous flows of words, the flips and reversals of meaning, are instantaneous and unpredictable; while there is much stability the fluid is never the same twice, it has recognisable form but is not fixed. Seen in this way, no element of language can be autonomous, isolated or reliable, just as a turbulent fluid contains no autonomous, fixed components. (Pepperell, 2003, p. 88)

The 0-1 language of the digital world clears up the murkiness of the uncertain along with the ambiguities and obscurities of natural language, and though it should be attractive for the digital immigrants, they, for some reason, want to keep the "old country" of the analog alive and refuse to see digitization as an offer of an absolutely new world. For what is involved in digitization is also digitalization, the social effects of "digitization" and the "macro-level changes in social structure and practice" brought in by digital media (Kreiss & Brennen, 2014, para. 16). It seems that the very presence of the digital media within various social spaces and institutions digitalizes them in the manner. The "digitization/digitalization" distinction seems to be important in thinking about the digital turn in education, as what it brings to the fore is the fact that the worlds of the digital tribe and of the digital immigrants are strongly intermingled, and that their simple separation is highly reductive. One important aspect of our time seems to be the hybrydization of the digitized and the analog worlds in which digitalization may well be seen as constructive of ourselves. Donna Haraway (1991) rightly sees in her "Cyborg Manifesto" all of us as cyborgs. "By the late twentieth century," she writes,

> our time, a mythic time, we are all chimeras, theorized and fabricated hybrids of machine and organism; in short, we are cyborgs. The cyborg is our ontology; it gives us our politics. The cyborg is a condensed image of both imagination and material reality (Haraway, 1991, p. 150).

The ascription of having become digitalized only to the digital tribe is thus a clearly reductive gesture in which resistance to technology is seen as a virtue of remaining closer to the more authentic and autonomous world of nature. This latter world, however, has been constructed in the Western culture as an image of technology's resource bound to be transformed into the technologically controlled space. The dualisms of nature and culture, of body and mind, of maker and made have been challenged by high-tech culture in "intriguing ways," and it is now not clear, according to Haraway,

> who makes and who is made in the relation between human and machine. It is not clear what is mind and what body in machines that resolve into coding practices. […] There is no fundamental, ontological separation in our formal knowledge of machine and organism, of technical and organic (Haraway, 1991, p. 177f.).

Though we still, at least discursively, use the dualisms and separations, their chimeric nature consists in the fact that technology seems to be perceived as a means to their eventual overcoming, of translating and transforming the natural into technological, of perfecting the world's analogous nature into digital virtuality. This, as we have seen, lies at heart of the fractal dream of geometrization of the disorderly non-geometrical, but also in the rhetoric of the possibility of immigration to another world which goes hand in hand with the idea of autochthonic belonging to it, projected upon the already briefly discussed digital tribe. The existence of the tribe is a myth which in various writings on education depicts children as fully

immersed in the digital world, as fully conquered and "cyborgized" beings who did not simply lose their contact with another reality, but in fact never had it. Lydia Plowman and Joanna McPake demythologize Prensky's category of "digital tribe" (Plowman & Pike, 2013, p. 28) along with other mythologized visions of wrong uses of media by children, such as the alleged obstruction of social interaction with the real world or their almost absolute immersion in computer playing games or surfing the web.

The rhetorical image of being immersed strongly connotes being lost, the metaphor already present in the idea of getting lost in the postmodern world of the funhouse explored by John Barth (already in 1968) through the figure of Ambrose. Ambrose, immersed in the funhouse world without exit, died telling stories to himself. His skeleton was found much later in one of its labyrinthine corridors, and was mistaken "to be a part of the entertainment" (Barth, 1968, p. 99). If the rhetoric of tribalism involves only the participants in virtuality as a kind of a different community, the rhetoric of immersion translates the whole milieu into a virtual copy of the real within which it disappears from the analog world and becomes, as it were, another. Moreover, the figure of digital tribe is most frequently used with reference to children in whom the propensity to play, aided with computer games, threatens with an irreversible departure from the real. However, the figure of immersion is also used in more `serious´ contexts of academic research and education where virtuality is seen as equivalent to the real, though one more easily made available to observation. This is the case of, for example, the idea of Immersive Virtual Environment technology used in experimental research in psychology where the virtual is described as "the ultimate representational system" which allows the observer "to interact 'naturally' with objects and other individuals within a simulated environment or 'world,' an experience indistinguishable from 'normal reality'" (Loomis et al., 1999, p. 557). What is thus seen as a potential of the digital graphic technologies is the blurring of "the distinction between reality and its representation" (ibid.), a creation of a representation which is in fact the same as the represented, a representation without a difference. This is, of course, yet another rendition of the already mentioned dream of an ideal philosophical language, the odea itself rooted in what Jacques Derrida called the metaphysics of presence, the metaphysics for which the idea of truth was itself the domain of virtuality, though not of a digital kind. Though the representation then available was only analog rather than digital, the idea of the perfection of the represented authentic was a figure of a virtual reality for which writing and, more generally, language were secondary and supplementary proofs of something `existing in the mind´, the last phrase being in fact a dictionary definition of the word `virtual´. Philosophy is rooted in this denial of the real as always split, always divided, always dual – the mode of existence exactly duplicated by the 0-1 divisions of the digital reality. François Laruelle (2010) in his critique of the dual claims that "[p]hilosophy cannot begin except by that originary denial of the Real by representation, it closes its eyes and constructs its thought in an ideal blinding light" (Laruelle, 2010, p. 80). Philosophy is blind to non-duality, reduces non-dualities to an absence achieved at the costs of enforcing binary oppositions as the only conceivable structuring of reality. Laruelle's proposition of `non-philosophy´ which, unlike traditional philosophy, is not blind to the decisional dual split, seems to be relevant in thinking about the promises of the digital turn which are, in fact, not quite new. What seems to be the crucial problem of traditional philosophies is an inevitably two-sided unilaterality, and what Laruelle proposes is what he calls "unilateral duality," (Laruelle, 2010, p. 14) a kind of duality which stands beyond simple relation and dependence on two parts. In *The Future Christ,* for instance, Laruelle rethinks the idea of Christ's second coming in

terms of its "*being split in two*" (Laruelle, 2010, p. 122) , the division which obstructs looking at the reality of the event in terms of the indivisible identity carried by philosophical doubles. Laruelle's unilateral doubles are not quite double because their unilaterality is not decided by exclusion. The philosophical unilaterality is, as Laruelle phrases it, "bad, misplaced towards inadequate spot" (Laruelle, 2010, p. 134), while the proposed unilateral duality is non-exclusive mix which avoids opposition. The split existence of Christ's second coming which he reads hand in hand with the idea of heretical serves as an exemplary re-reading of the dual and its philosophical uses and abuses. Though the concept of `the digital´ is not the main concern of Laruelle's works, Alexander Galloway's (2014) book on Laruelle and the digital offers, though somehow negatively, invaluable insights into the role of the concept in the ways of the contemporary world.

Galloway admits that Laruelle hardly ever writes about the digital, yet he sees "evidence of the topic on almost every page" (Galloway, 2014, p. xii). This invisible presence, the invisible traces of the digital, are the tropes leading him not to "forge a new digital Laruelle, but on the contrary to show how, even in this day and age, Laruelle remains a profoundly non-digital thinker, perhaps the only nondigital thinker we have" (Galloway, 2014, p. xii). I have decided to bring in both thinkers to this text on digital turn not in order to condemn the digital and re-embrace the old, analog world along with the old vinyl albums sitting on my shelf, but rather in order to question the illusion of the absolute newness of the digital. Rephrasing Galloway, one may well say that reading various texts written in praise of the digital, one always sees evidence of the topic of the analog whose traces as it were speak through the digitally purified realities. What is more, the digital also speaks through the analog, splits it at the cost of the loss of its continuity and oneness, divides into various kinds of signifiers and signifieds whose functioning is based on difference, or, as de Saussure had it, on differences without positive terms. Both Laruelle and Galloway see this as cataclysmic for `the one´, for the immanent in which the distinction between the one and the multiple is indistinguishable – a world in which there is "only the one and its various identities" (Galloway, 2014, p. 47), writes Galloway, and then quotes Laruelle from "L'ordinateurtranscendantal: Une utopie non-philosophique":

> In immanence, one no longer distinguishes between the One and the Multiple, there is no longer anything but n = 1, and the Multiple-without-All. No manifold watched over by a horizon, in flight or in progress: everywhere a true chaos of floating or inconsistent determinations . . . between Identity and Multiplicity, no synthesis by a third term. (Laruelle, 2005, p. 13 quoted in Galloway, 2014, p. 47)

Without engaging into the possible connections of this new search for oneness with Jean-Luc Nancy's idea of spacing or Quentin Meillasoux's anti-correlationism, Galloway seems to be pursuing an idea of the One prompted by digitization seen as the perfect doubling of the analog, as a production of a world apart which in fact reveals, or unveils, an almost absolute domination of the dual in which the one cannot be spaced either analogically or digitally. Hence what he calls "the cataclysm of the one" about which he writes invoking a teratology of sorts and reads it as both glorious and monstrous:

> Deleuze was on to something when he remarked that "thought 'makes' difference, but difference is monstrous.' … Still, he didn't go quite far enough. Digitization is monstrous, but it does not hold a candle to the glorious, monstrous cataclysm of the one." (Galloway, 2014, p. 22, quotation from Deleuze, 1994, p. 37)

Laruealle's/Galloway's `one´ is a sphere which does not evade an involvement in language, though it transcends the dualities governing both the analog and the digital constructions of the real. The idea of immersion in one or the other is related to the absolute division into

inside and the outside, and thus we can speak `of´ the inside only from the perspective of its relational opposition. The use of the preposition `of´ is significant here, and Laruelle is highly sensitive as regards their use. Laruelle, Galloway notices,

> generally avoids any linkages that indicate belonging, which is to say a relation that determines the object. So he steers clear of prepositions like of, within, from, against, for, and with. Nevertheless some prepositions, contrary to their grammatical role, tend to obscure the object's determination in favor of a linkage of nonrelation. […] Prepositions useful to embody such structures include in, as, by, according to, alongside, and without (Galloway, 2014, p. 27).

What links these seemingly highly abstract conjectures with the digital turn and its possible bearing on education is that it is exactly the coming of the digital which enables us to encompass the digital **by** the analogue not as a separate outsidedness, but as a possibility of repositioning our visions of the world through a change in its prepositional structuring. One of the effects of treating the digital as a better or clearer version **of** the analog, and of thus making it a function of the linguistic genitive case is the frequent prosthetic rhetoric which it brings about. Wim Westra devotes a whole chapter of his Digital Turn to media as cognitive prostheses which he compares to various prostheses of the body. Though it is quite true that artificial teeth, for instance, "replace our affected originals and allow us to bite into any firm, leathery, hot, or cold substance without problems" (Westra, 2012, p. 64), in case of using the prosthetic argument with reference to our cognition implicitly debilitates this human ability and renders it as either missing or, at least, too weak and insufficient. The prosthetic reconstruction of corporeal integrity projected upon the cognitive processes is misleading because what it also carries with it is the possibility of reducing cognition to a pure potential of sorts "a sustained individual capability that reflects a potential rather than the actual performance" (Westra, 2012, p. 65). However, the cognitive performance, very much unlike the bodily performance, is inevitably technological and demands exteriorization and in fact is exteriorization. As the process of exteriorization, Stiegler claims, "technics is the pursuit of life by means other than life" (Stiegler, 1998, p. 17). One crucial technology of this exteriorization is writing which can hardly be thought about in prosthetic terms otherwise than as prosthesis of mind and memory, though one which liberates itself from the instinctive or genetic kind of writing which enables it. Stiegler writes about this paradoxical liberation in terms of `rupture´, the notion which, in the context of prostheticity, brings to mind not only a division into two and a breach in harmonious relationship, but also an image of severing or amputation:

> It is by freeing itself from genetic inscription that memory at once pursues the process of liberation and inscribes thereupon the mark of a rupture – on stones, walls, books, machines, madeleines, and all forms of supports, from the tattooed body itself to instrumentalized genetic memories, dis-organized, made inert as it were, then reorganized, manipulated, stored, rationalized, and exploited by the life industries named "biotechnologies", including the holographic memories that the information-processing industry is planning. An inscription of memory through rupture, the inscription of the rupture in memory. (Stiegler, 1998, p. 169f.)

What is also inscribed in this kind of exteriorization are doubling and repetition which Stiegler reads in his book as immediately connoting the question of tekhne, but which also conceals a repetition of a certain fault of forgetfulness in the duplicity of epimêtheia and promêtheia (*cf.* Stiegler, 1998, p. 217). His bringing in of the mythical figure of Prometheus to make up for the forgetfulness of his brother Epimetheus in various discourses on prostheticity and memory (Heidegger, Husserl, Leroi-Gourhan, Derrida) may be quite revealing in the light of thinking about the loss of `the one´ in dualization and digitalization and its prosthetic replacement which, in the case of the idea of memory for example, may be perceived as a phantom limb

whose felt presence is reduced to absence. Stiegler's idea of technics as the pursuit of life by means other than life strongly links prostheticity with memory and history by which we are defined as living:

> The evolution of the "prosthesis," not itself living, by which the human is nonetheless defined as a living being, constitutes the reality of the human's evolution, as if, with it, the history of life were to continue by means other than life: this is the paradox of a living being characterized in its forms of life by the nonliving – or by the traces that its life leaves in the nonliving. (Stiegler, 1998, p. 50)

What is peculiar in this observation is the idea of traces of life carried within the nonliving, left within the prosthesis which thus may function away and independently from what it seems to have replaced or enhanced. Though Stiegler does not refer to the phenomenon of phantom limb, the frequently painful sensation of a missing bodily part, the trace or the reminder of the living within the prosthesis signals that the already mentioned freeing of memory from its genetic inscription is never complete. This incompletion also disables the possibility of a complete technological copying, and the mark of rupture is simultaneously a mark of a trace of the one, a mix of the analog and the digital which takes place between them. The one is thus brought back to the seemingly dual world not as a metaphysical concept of finality, but as a spectral, or phantomic, kind of factuality whose spectrality is irreducible. It is, as it seems, the envisioning of a purely digital world without specters which has made the technological prosthesis into a metaphysical perfection and ideality, an ideality which will eventually replace not only our limbs, but also the phantom limbs of which we are, however painfully, reminded.

Such a possibility has been quite recently opened up by a proposition to `exercise´ one's missing limb in a virtual reality scenario by way of engaging `amputees´ in computer games with an on-screen arm. The amputees involved in the game "reported relief from phantom pain" (Chang, 2016, para. 1), which relief has been described as "a novel solution to this persistent problem" (ibid.). This example from *Digital Trends* is an interesting case of the rhetoric of prosthecity in which it is in fact a digital prosthesis which replaces an analogically constructed one thus literally freeing the genetic memory through as it were double exteriorization. The promised full immersion in the digital as a solution to bodily impediments may well be extended to cognitive processes crucial in education and, I think, even more relevant in higher education which, ideally, should be as it were conscious of itself in which the student is the agent of the learning processes. And yet the capacity of digital memory is frequently as a kind of `cognitive offloading´ which offers a promise of removing memory to the outside and giving the activity of remembering to the hands of `agents outside the head´. "Our increasing reliance in the Internet," we read in a text on this kind of offloading,

> and the ease of access to the vast resource available online is affecting our thought processes for problem solving, recall and learning. In a new article published in the journal Memory, researchers at the University of California, Santa Cruz and University of Illinois, Urbana Champaign have found that 'cognitive offloading', or the tendency to rely on things like the Internet as an aide-mémoire, increases after each use. We might think that memory is something that happens in the head but increasingly it is becoming something that happens with the help of agents outside the head (ScienceDaily 2016, para. 1).

We do more and more often reach to the screen rather than to paper, and yet this does not mean that we have to, increasingly, offload one world for the sake of the speedy, reliable and perhaps non-precarious space from whose prosthetic perspective we gradually, after each use, forget our own agency. What has been called the digital turn may also become a crucial educational turn, one through which we can even more clearly see ourselves as agents of both the analog and the digital by way of realizing the aporetic character of the turn, of realizing

the aporia which has always already been there, without falling into its trap of the division into before and after. For the movement of the digital turn illustrates the paradox which was not easily discernible within the analog world, the foundational myth of the development of knowledge in which, as Stiegler phrases it,

> there is never anything, at the origin, but the fall outside it. This aporetic moment is one in which the aporia always ends up hardening into a mythology opposing two moments: those of purity and corruption, of before and after—the point separating them always already diluted. This is an excellent archetype of the discourse of philosophy on technics, relating through a fiction, if not by a myth, how the man of pure nature is replaced by the man of the fall, of technics and of society (Stiegler, 1998, p. 101).

The prosthetic rhetoric of the digital turn complicates this pattern by way of positing the pure as purer and better than the originary, thus in fact reversing the archetype and reading technology as a return of a bettered or improved lost object, be it a lost limb, a memory, or, for that matter, paper whose prosthesis is screen. What seems to be remaining of paper, however, is its spectral return to variously remediated reality, also as regards the language used in relation to the technologically present things. A webpage, for example, are still page, and Jacques Derrida saw it as "primarily a figure of paper (of the book or codex)," (Derrida, 2005, p. 46) noticing in *Paper Machine* that

> the page nowadays continues, in many ways, and not only metonymically, to govern a large number of surfaces of inscription, even where the body of paper is no longer there in person, so to speak, thus continuing to haunt the computer screen and all internet navigations in voyages of all kinds (Derrida, 2005, p. 46).

This haunting presence of paper on the computer screen may, of course, be ignored, and we may believe with Wim Westra that "media turn us into a different type of creatures" (Westra, 2012, p. 64) and to thus endow media with the agency of making us anew. Or, and this seems to be crucial for the educational agenda, we may notice this spectrality and see in it a reminder of Laruelle's immanence of the One of the non-philosophical subject for whom the technological performance is only an instance of our radical performativity in which, and through which, we perform the Real rather than represent it (*cf*. Srnicek, 2011, p. 169). Though the venture of non-philosophical performativity is not, in itself, an educational project, in the context of the performative possibilities offered by the digital turn it might be well thought of in terms of the formulation, or rather re-formulation, of the task(s) of knowledge, of the `what´ of what we know. The digital (qua virtual) problematization of the real as the immutable foundation of everything, as the foundation misleadingly posited in its conceptualizations as teleological task by the "philosophies which aim at the Real" (Srnicek, 2011, p. 164), might be also an invitation to the non-philosophical which, as Nick Srnicek phrases it, "provides the most intriguing conceptual tools to begin thinking 'in accordance with' the Real (ibid). This accord, or accordance, may be called a return of the One, a return of an insecure non-foundation in which, with which, and not on which, we are all, however virtually, becoming.

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4 From E-Learning to eBologna in an Augmented Reality The Past and the Future of E-Learning in German Higher Education

Birte Heidkamp & David Kergel

Abstract
The article reconstructs the development of E-Learning in German higher education. It traces E-Learning from the end of the 1990s up to the current perspective of an eBologna, which is defined by an European-wide international mobile learning. In this context digital media are not part of an `E-Learning´ as distinguished from an `analog learning.´ Rather, mobile learning uses the ubiquity of the internet as an additional media dimension through which we can perceive the world and which opens up new learning worlds. The polydirectional and collaborative features of digital media could be used, to establish an European-wide international co-teaching and co-learning in higher education.

Keywords: Web 2.0, Learning management system, E-Learning 2.0, Bologna process, eBologna, Mobile learning, Personal learning environment, Augmented reality**,** Digitalization strategy, Digitalization of teaching and learning

4.1 Introduction

It is discussed that digitalization possesses an epochal importance (Schwalbe, 2011; Hug, 2012; Heidkamp & Kergel, 2016). Digitalization unfolds its increasing significance within the educational field from the early child education, to the primary school education and to higher education. As academic educational space, universities have to face the challenge of dealing with the requirements and with the potential of digitalization for research, teaching and learning. The challenge of digitalization receives an increasing discoursive relevance:

- Funding programmes[1],
- conferences, at which the significance of digitalization within universities is thematized,
- the discussion of best practice examples (how other universities deal with digitalization)[2] and
- change management processes, which should lead to an appropriate implementation of digitalization within higher education.

These are the part of the everyday reality of people working in the field of higher education E-Learning. With reference to the challenges of an appropriate E-Learning within German higher education in a digital age, it might be helpful to have a meta-perspective on the development of E-Learning in higher education. Such an meta-perspective might help to develop a reflexive position towards the requirements one have to face when using E-Learning strategies. With reference to this aspect, this contribution provides a reconstruction of the last 16 years of E-Learning in German higher education. In the course of this reconstruction

[1] See https://www.bmbf.de/foerderungen/bekanntmachung-1152.html. Last accessed: 11 April 2017.
[2] See example. https://hochschulforumdigitalisierung.de/de/news/tagung-digitalisierung-der-hochschullehre. Last accessed: 11 April 2017.

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three phases were identified and are described in the following.

4.2 First Phase: First Steps into E-Learning

Although the discussion of the possibilities and limitations of digitally supported learning has a long history (e.g. computer based training), there has been an increase of innovation of higher education learning and teaching with digital media since the end of the 1990s. It is possible to identify two main reasons for this increase of innovation which mainly took place between the end of the 1990s until the mid-2000s:

- The implementation of Learning Managment Systems like Moodle, Stud.IP, Ilias or Blackboard and
- Large-scale funding of pilot projects (E-Teaching Funding Projects) which should develop best practice examples and improve the digital infrastructure of universities.

4.2.1 Learning Management Systems – the `Backbone´ of E-Learning in Higher Education

A first step, to establish a large-scale digital infrastructure for teaching and learning in higher education has been the implementation of so-called Learning Management Systems. Since the mid-90s Learning Management Systems were increasingly implemented at universities. Learning Management Systems are the digital platform/the backbone which enable digital based teaching and learning in higher education. Mostly, Learning Managment Systems such as ILIAS or Stud.IP had their origins at universities and are – at least partly – available as Open Source Systems. That means that it is possible/it is intended that people from `outside´ of the university contribute to a continuing development of the software. For example, 1999 Moodle was developed at the Curtin University of Technology (Australia). Since 2002 Moodle is free and available as Open Source system. Other Learning Management Systems such as Blackboard are developed and sold by private companies like Blackboard Inc.

With the beginning of the 2000s Learning Management Systems are implemented, so one can raise the thesis that a digital infrastructure for teaching and learning in higher education has been established since that time.

Among other things, Learning Management Systems enable course management. The teacher can provide teaching/learning material and it is possible to implement chatrooms (Baumgartner, Häfele & Maier-Häfele, 2002). Due to the technical progress and emerging innovations of the Digital Age, Learning Management Systems are constantly updated. As an reaction to the so-called mobile internet which led to the fact that the internet is everywhere smartphones are (Kergel, 2014), apps were developed. These apps access Learning Management Systems from mobile devices such as smartphones or tablets.

Despite the diverse functions which are provided by Learning Management Systems and the adjustment of Learning Management Systems to the ongoing media change, there is a critical perspective on them. Since the mid-2000s Learning Management Systems are increasingly labelled as part of an so-called E-Learning 1.0. This E-Learning 1.0 is contrasted with a so-called E-Learning 2.0 (E-Learning 2.0 can be used as term which signifies the second phase of E-Learning in German higher education): According to the criticism, Learning Management Systems reproduce traditional learning worlds and therewith receptive learning within a digital dimension (Ehlers, 2011, p. 65). Learning Management Systems reflect a linear

course structure of sessions – e.g. when they are only used to provide texts which should be discussed at the course-sessions (Ehlers, 2011). The main criticism centers on the fact that the traditional teaching in higher education does not implement the collaborative and polydirectional potential of digital media. According to this criticism, Learning Management Systems do not provide the structure for a participative E-Learning. Thus they are used mostly solely as so-called Content Management Systems (Content Management Systems distribute learning material and enable the administration of courses).

4.2.2 Pilot Projects and External Funding – E-Teaching Funding Projects

While Learning Management Systems constituted a first `backbone´ for E-Learning in higher education, the so-called E-Teaching Förderprojekte (E-Teaching Funding Projects) provided best practice examples and pilot projects for digital based learning and teaching in higher education. These projects were initiated at the end of the 1990s/at the beginning of the 2000s and were funded by the state. One can interpret the funding of the pilot projects as an political echo on the increasing meaning of digitalization in German higher education (Arnold et al., 2011, p. 25). The German Federal Ministry for Education and Research (BMBF) provided approx. 300 million Euro for projects which should enhance digital based learning and teaching in higher education (Haug & Wedekind, 2009; Baumgartner, 2003). Diverse pilot projects in different scientific fields were realized. Experts like Arnold et al. (2011) or Haug and Wedekind (2009) problematized the lack of lasting effects of these projects – despite the intense financial funding. In most of the cases, the results of the pilot projects – the developed best practice examples and E-Learning solutions – were not adopted. Haug and Wedekind (2009, p. 34) stressed that the pilot projects mostly suffered from a lack of embedding into the infrastructure of the universities. Mostly the pilot projects were not – or not sufficiently enough – connected to important actors like the IT-services of a university.[3]

4.2.3 Summary of the First Phase

The first phase established E-Learning in German higher education at the end of the 1990s/at the beginning of the 2000s. Within this process Learning Management Systems and the E-Teaching Funding Projects played a key role. Until today, Learning Management Systems such like Moodle provide the basis for E-Learning at universities.

The critical discussion of Learning Management Systems led to the second phase, in which a participative, more learner-centered E-Learning approach has been developed. This approach uses so-called Web 2.0 tools and their collaborative and polydirectional potential. With reference to this learner-centered shift the second phase is called ”E-Learning 2.0 – the digital Shift from Teaching to Learning“ (see 4.3).

The E-Teaching Funding Projects provided best practice examples and the insight that pilot projects need to be embedded into the infrastructure of an university. This insight gained an

[3] These mistakes shoud not be repeated: The current third phase of E-Learning development in German higher education is defined by the insight that universities in the Digital Age need a guided processes of digitalization in which all relevant actors are interconnected. Consequently some universities formulate a so-called digitalization strategy to deal with the challenges of digitalization as well as use digitalization to improve the key areas of universities (namely research, teaching and learning, administration).

increasing relevance within the third phase digitalization of "Third Phase: From E-Learning to the Digitalization of Teaching and Learning in Higher Education" (see 4.4).

4.3 Second Phase: E-Learning 2.0 – the Digital Shift from Teaching to Learning

With their programmatic articles "Connectivism" (2005) and "E-learning 2.0" (2004) Siemens and Downes provided the basis for a new paradigm in E-Learning. This new paradigm, called E-Learning 2.0, is defined by the use of the collaborative and polydirectional possibilities of the Web 2.0 for E-Learning. Web 2.0 tools such as blogs allow users to easily produce content within the world wide web with some clicks and without any programming knowledge. The user turns from a consumer into a producer or fulfills as a prosumer both functions (*cf.* Gaiser, 2008).

The polydirectional and collaborative advantages of the Web 2.0 technology opens spaces for a product- and actionorientated E-Learning – in other words: for an E-Learning 2.0 (Lehr, 2012, p. 47). The new technological possibilities extend the learning spaces of the individual. In contrast to the interaction possibilities of Web 2.0 tools such as wikis and blogs, the `traditional´ Learning Management Systems limit the possibilities and the interaction spaces of the learning individual. With reference to Siemens, Ehlers (2011) speaks about Learning Management Systems as a `walled garden´. The collaborative possibilities of the Web 2.0 are located beyond the walls of the Learning Management System. E-Learning 2.0 approaches emphasize that E-Learning has to be a situational, self-regulated learning which takes place within the authentic world of the internet and not within separate spaces which are constructed through Learning Management Systems. Instead of Learning Management Systems as central learning platforms, Web 2.0 tools can be used as individual learning platforms. Using such individual learning platforms (e.g. WordPress) the learners can connect with each other and thus initiate socio-collaborative learning processes.[4]

> The e-learning application, therefore, begins to look very much like a blogging tool. It represents one node in a web of content, connected to other nodes and content creation services used by other students. It becomes, not an institutional or corporate application, but a personal learning center, where content is reused and remixed according to the student's own needs and interests. It becomes, indeed, not a single application, but a collection of interoperating applications – an environment rather than a system (Downes, 2005, para. 33).

Learning Management Systems – which represent an E-Learning 1.0 – should be substituted by individual learning platforms which enable an individual-reflexive learning within the collaborative contexts of the Web 2.0. Downes concept of individual learning platforms has been modified by Atwell´s (2007) model of Personal Learning Environments. According to Attwell, a Personal Learning Environment embraces "all the different tools we use in our everyday life for learning" (Attwell, 2007, S. 4). In contrast to Learning Management Systems, Personal Learning Environments are like an open system which is detached from educational institutions such as universities and can be used for lifelong learning processes.

Personal Learning Environments can be interpreted as individual learning platforms which are not bound to specific educational institutions. Within an E-Learning 1.0 approach the

[4] These kind of `Connecting´ as process of knowledge construction within the virtual space of the Web 2.0 is a basis premise of Siemens (2005) concept of `Connectivism´ which he considers as a `learning theory of the digital age´.

learner receives via Learning Management Systems like Moodle learning material. In contrast, E-Learning 2.0 empowers the learner to use digital media for a self-regulated learning within the collaborative context of the Web 2.0.

4.3.1 Current Perspectives: From E-Learning 2.0 to Mobile Learning in an Augmented Reality

4.3.1.1 The Ubiquity of the Internet and Mobile Learning

The E-Learning 2.0 approach is extended through the emergence of the so-called mobile internet – the mobile internet accompanies us everywhere via our smartphone. The ubiquity of the internet enables new forms of a situational or `mobile learning´. "With mobile learning, the learning phase is not bound to a location with specific characteristics" (Pieri & Diamantini, 2005, p. 184). With reference to the ubiquity of the internet, mobile learning can be defined as a learning which merges E-Learning strategies and presence learning.

4.3.1.2 Mobile Learning in an Augemented Reality

The internet provides a new media dimension, a new way we perceive the world. The Google-Glasses or other augmented reality apps can be used as examples how the internet construct a new media dimension through which we can perceive the world.

Figure 4.1: Augmented-Reality-App `*Wikitude´* on a Smartphone (https://de.wikipedia.org/wiki/Erweiterte_Realität, last accessed: 20 May 2017).

From this point of view it does not seem valid to distinguish a virtual world of E-Learning from a physical world of presence/analog learning. Instead of such a distinction one can speak about a mobile learning in an augmented reality:

> [T]he rising interest in new learning spaces such as information commons, where wireless, mobile connectivity admits the full informatic range of the Internet into any niche or conversation. Older spaces take on new pedagogical meaning; for example, wireless cafes allow the full range of classwork to be deployed between a coffee and a bagel. (Bryan, 2004, p. 62)

Contemporary E-Learning dissolves in a mobile learning which is embedded in an augmented reality (see figure 4.1). Established concepts of situational/authentic learning like problem based learning turn into a problem based learning with digital media. From this perspective, E-Learning is not an `add on´, but a new media dimension within learning processes.

4.3.2 Summary of the Second Phase

The second phase is defined by a learner-centered approach which uses the polydirectional and collaborative possibilities of the Web 2.0 for an action- and product-orientated E-Learning. This shift from teaching to learning is accompanied by a critical discussion of Learning Management Systems and the development of the concept of Personal Learning Environments. The learner-centered shift from teaching to learning, the plead for an action- and product-orientated E-Learning is an essential feature of this phase. With reference to the ongoing technical process the mobile internet leads to an mobile learning within an augmented reality. E-Learning as a distinct sphere of learning dissolves in teaching and learning strategies which combine established participative methods of teaching and learning in higher education with participative forms of mobile learning in an augmented reality.

4.4 Third Phase: From E-Learning to the Digitalization of Teaching and Learning in Higher Education

The process of digitalization affects not only teaching and learning in higher education. Also the administrative processes are affected: E-Services, the digitalization of administrative services, are a challenge for universities. Libaries need to react on the media changes in their field (Reinhardt, Schmitz & Siebert, 2009) and researchers have to face the digitalization of research-processes which lead to an E-Science (Heidkamp, 2014).

The digitalization of universities can be understood as an ongoing process which affects the university as a whole. The increasing discourse about the need for a digitalization of universities as a whole organizational complex requires to identify a third phase: at conferences, in an increasing number of lectures and within discussions in the press the digitalization of universities receives an increasing discoursive relevance. Within the structural digitalization of universities, the focus changes from E-Learning to a Digitalization of Teaching and Learning: In the course of the digitalization process of teaching and learning in higher education it is relevant to distinguish between E-Learning and the `Digitalization of Teaching and Learning´. The term `Digitalization of Teaching and Learning´ refers to the structural dimension/to the infrastructure which support digital teaching and learning. In contrast to Digitalization of Teaching and Learning, E-Learning signifies the concrete implementation of digital media. Digitalization of Teaching and Learning requires to invent a technical infrastructure as well as didactical counselling for teachers and learners, so that digital-based learning can be realized. E-Learning scenarios in turn can be introduced via best practice examples, workshops and further trainings, in which interested teachers can gain knowledge about concrete implementation strategies. One challenge of the Digitalization of Teaching and Learning is the merging of E-Learning 1.0 approaches with E-Learing 2.0 strategies. Most of the innovative E-Learning 2.0 concepts are realized via external fundings and possess thus only the temporary character of a project. For a lasting effect and implementation of the advantages of E-Learning 2.0 into the infrastructures of universities, it is important to ensure the merge between E-Learning 1.0 and E-Learning 2.0 within the process of Digitalization of Teaching and Learning. Another challenge of the process of Digitalization of Teaching and Learning is to invent or to extend digital study programmes. From this perspective, Digitalization of Teaching and Learning locates E-Learning/mobile Learning in an augmented reality within the infrastructure of an university. The process of Digitalization of Teaching and Learning is part of the digitalization processes which the university is subjected to.

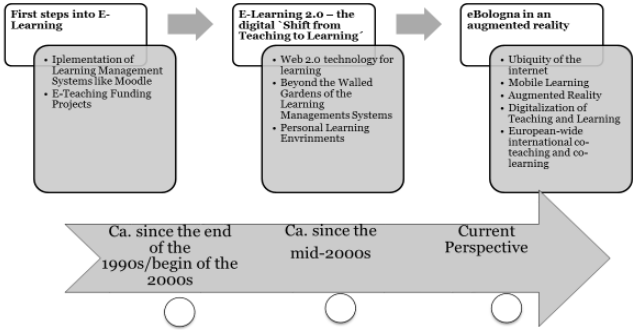

Figure 4.2: Development of E-Learning in German Higher Education (own Figure).

4.5 Outlook – eBologna in an Augmented Reality

With reference to the reconstruction of the development of E-Learning in German higher education, one can observe that there exist parallel tendencies between the unfolding of E-Learning and the unfolding of the so-called Bologna process.

In 1998 the so-called Sorbonne-Declaration had been signed by the education ministers of France, Germany, Great Britain and Italy. The Sorbonne-Declaration formulated the goal to harmonize the architecture of the European higher education system. In 1999, 29 other countries joined the declaration. The initiation phase of the Bologna process had started and took place in a time when the Learning Management Systems were increasingly implemented at universities. Since then the Bologna process and E-Learning had inscribed themselves in German universities. In the course of this lasting change of German universities, an interlinking between E-Learning and the Bologna process emerged: In 2001 the European Association of Distance Teaching Universities (EADTU) discussed possible synergy effects between E-Learning at universities and the Bologna process. The programmatic text “Communication of Madrid about virtual higher education and the Bologna process“ states that E-Learning “will contribute to the Bologna aims of mobility, broad access to higher education and competence development in a context of lifelong learning“ (EADTU, 2001, para 7).

The interlinking between E-Learning and the Bologna process is symbolic represented in the term `eBologna´. This term was discussed and coined at the Bologna follow-up conference in 2005 – in times when a Web 2.0-based E-Learning increasingly unfolded. A basic assumption of eBologna can be summarized as follow:

- One central aim and feature of the Bologna process is to harmonize the architecture of the European higher education system.
- Digitally supported learning and teaching enable decentralized learning and teaching processes which are detached from spatial and temporal constraints.
- The merge of both approaches enables a constructive perspective on a virtual European educational space (*cf.* Handke, 2005, p. 36).

The `harmonizing perspective´ of the Bologna process is extended through the media

dimension of an augmented reality: teaching and learning can take place across the boarders of national states. International courses can be realized via co-teaching and co-learning. For this purpose, project based learning or inquiry based learning with digital media could be used. Thus the competence of international project work with digital media can be trained. Such an approach would prepare the students for the requirements and challenges of the labour market in the digital age: participative learning and digital based collaborative work can help to acquire the media competences which are needed in a Digital Age (Reinmann, 2008). From this point of view eBologna – a.o. defined as an international co-teaching and co-learning within the European academic space – would foster the `employability´ of the students.

Employability in turn is one of the crucial requirements of the Bologna process and means that the university should ensure that the students obtain the needed qualifications, skills and competences they need to meet the requirements of the modern labour market.

The concept of eBologna corresponds with the requirement that European universities should foster the `employability´ of the students. With reference to such an understanding of eBologna, it is possible to locate E-Learning or mobile learning in an augmented reality within the broader context in European higher education.

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5 The Postmodern Dialogue and the Ethics of Digital Based Learning

David Kergel

Abstract
The article discusses the ethics of digital learning. Starting point is a postmodern understanding of communication and the dialogue as idealimage of postmodern communication. The dialogue can be considered as postmodern ethics in communicative practice. Such a communicative practice is defined by a `decentral´ and `polydirectional´ dimension of communication. Web 2.0 tools provide the media-structure to realize a digital based postmodern dialogue. Formulated the other way round: the media structure of Web 2.0 tools bears ethical implications: The polydirectional and decentral structure of Web 2.0 media enables a postmodern dialogue – one might speak of the ethical implications of Web 2.0 tools. Consequently, E-Learning 2.0 which bases on Web 2.0 tools bear ethical implications. For the E-Learning practice, one challenge is, to transfer such theoretical reflections into learning-scenarios, which meet the requirements of a postmodern dialogue. As a proposal for such an transfer from theory-to-practice, a best practice example for a Web 2.0 based learning-scenario will be provided.

Keywords: E-Learning 2.0, Web 2.0, Dialogue, Postmodern thinking, Communication, Polydirectional, Constructive feedback

5.1 How to Act? Ethics and Normative Communication

As a field of philosophy, ethics focusses on questions according to which rules, norms, values people should arrange their actions as well as their relations to others. In contrast to logic, epistemology and metaphysics, ethics discusses concrete actions and their moral implications (Copp, 2006). As branch of practical philosophy, one essential feature of (normative) ethics is that it defines communication strategies. From this point of view, ethics can provide orientationpattern for every day life, giving profound answers to the question `how to act?´ According to this applied dimension of ethics, Copp formulates typical normative ethical questions – 'What kind of actions are right or wrong? What kind of person should one be?' (Copp, 2006, p. 18). These guiding questions point to the social dimension of ethics. As mentioned before, one crucial task of ethical reflection is the discussion of communication: Communication can be considered as a basal factor of social life as it signifies social interaction processes. In the course of interaction processes 'communion' (community) is performatively constructed – communication constitutes a community. Ethics discuss how communication processes should be organized and thus how actors of a communication based community should interact which each other (for a more detailed overview see Nykanen, Ole, & Zeller, 2013 and Newton, 2013).

Ethical considerations have an normative perspective on communication processes and define values/norms for these processes. From this point of view it is possible to distinguish ethics by the way they define communication – e.g. the categorical imperative requires other forms of communication as Levinas concept of the Other (Kergel, 2015a). The following

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subsection sets a focus on a postmodern understanding of communication and the dialogue as the idealimage of postmodern communication.

5.2 The Dialogue as Postmodern Ethics in Communicative Practice

5.2.1 Metanarrations as Features of Modern Thought

The notion `postmodern´ emerged within the 1930s-1940s. Until today it possesses various definitional approaches (see Al-Rodhan & Stoudmann, 2006). Basically, the notion signifies the state of a society after its modern phase. This modern phase bases among other on so-called `modern´ thought. Modern thought `believes´ in rationality and a rationality based societal progress. Postmodern thinking challenges this kind of modern thought: One main criticism of postmodern thinking centers the totalitarian implications of modern thinking. According to this criticism, a modern worldview tends to subject phenomena/social processes etc. to one coherent explanation model – so called `metanarrations´. A metanarration can be defined as a `totalizing´ explanation model which enables to order and schematize diverse phenomena which appear. It has the function of an explanation model or scheme which gives meaning to everything, makes out of a past a history (gives past events a meaning) and predicts the future. From this point of view, metanarrations constitute a totalizing meaning and claim to possess the truth. The truth claims of a metanarration provides the legitimation of a society or group and their value-system. One problem is that there is more than only one metanarration and that they contradictory exist besides each other – for example Western Democracy/Civil Society versus Marxist-Leninist conceptions of society. The truth claims of the metanarrations are in conflict with each other. Actors, who represent metanarrations do not enter into a dialogue with an actor who is representing another metanarration. Instead of refering to each other in a tolerant, respectful manner, the truth claims of a metanarration are defended. From this point of view, modern thinking leads to a confrontative communication, wherein the interlocutors are trying to establish the truth claim of their metanarration.

5.2.2 Pluralism and Diversity as Features of Postmodern Thought

Postmodern thinking can be understood as a point of view which problematize the dysfunctional aspects of `modern´ communication which are caused by the confrontative communication between metanarrations. Thus, one essential feature of `postmodern´ thinking is that it suspends the truth claims of metanarrations: “Simplifying to the extreme, I define postmodern as incredulity toward metanarratives [...] The narrative function is losing its functors, its great hero, its great dangers, its great voyages, its great goal. It is being dispersed in clouds of narrative language elements” (Lyotard, 1979, p. xxiv).

To sum it up, it can be said that postmodern criticism addresses the truth claims of metanarrations and is defined by a skepticism towards the idea of a totalizing unity and concept of incontestable truth claims. Postmodern thinking is still modern, because it bases on rationality. But it is `post´ because it detaches from the truth claims of modern metanarrations. One might say, that to live in a postmodern world means that one lives in a world without an universal truth (for the complex background of the notion postmodern see Harvey, 2000). One consequence of the loss of incontestable truth claims is that diverse

interpretations of the world have to be considered as equal. Postmodern thinking is defined by a rational based meaningful and at the same time tolerant apprehension/perception of the world. One can stick to narrations to interpret the world, to understand the diverse phenomena which appear and social processes which take place in a society. But the interpretation of reality, in which one gives things a meaning and thus constructs narrations, has to be accompanied by the awareness that there exist other world views. These other worldviews have to be acknowledged as equal. The legitimacy of other narrations of reality, the equivalent appreciation of other interpretations are basic requirements of postmodern thinking (and also goals of a postmodern orientated education, Aronowitz & Giroux, 1991, p. 110; Kergel, 2015b). From this point of view pluralism and diversity are features of postmodernism. "Educationally, the art of creating and choosing is more important than ordering and following." (Koo Hok-chun, 2002, p. 58)

5.2.3 The Dialogue as Idealimage of Postmodern Communication

According to postmodern thinking, communication should be based on tolerant appreciation: The tolerant appreciation and the acceptance of diversity are the preconditions of a postmodern dialogue with other narrations and their cultural manifestations (other myths, rites etc.). Another ethical premise of communication in the sense of postmodern thinking is that every interlocutor considers the dialog partner, his understanding and experience of reality as equivalent to his own: On the ground of such a mutuality, a dialogue can take place. In such a dialogue a critical reflection of narrations should be realized. The postmodern epistemological skepticism towards truth claims manifests besides the appreciation of other narrations in an infinite rational based challenging of `believes´ about how the world is organized. The meaning of the world is questioned within dialogical interaction: Therefore postmodern thinking is defined by a critical challenging of all prefigured and seemingly indisputable positions. Lyotard illustrates this `attitude´ with reference to the modern development of art:

> What then, is the postmodern? What place does it or does it not occupy in the vertiginous work of the questions hurled at the rules of image and narration? It is undoubtedly a part of the modern. All that has been received, if only yesterday […] must be suspected. What space does Cézanne challenge? The Impressionists`. What object do Picasso and Braque attack? Cézanne´s. What presupposition does Duchamp break with in 1912? […] In an amazing acceleration, the generations precipitate themselves. A work can become modern only if it is first postmodern. (Lyotard, 1979, p. 79).

With reference to these considerations one could raise the thesis that the communication structure of the postmodern challenging possesses the structure of a dialogue.

5.2.4 The Communicative Structure of a Dialogue

As a communication process, the dialogue is defined by the way, in which interlocutors interact with each other. In a dialogue interlocutors confer with each other in a tolerant, rational, and open-minded manner. With reference to Habermas one can identify three criteria which define a dialogue. Such criteria or `validity claims´ are `truth´, `rightness´, and `truthfulness´. These validity claims are made by the protagonist when s/he engages in dialogue:

- an utterance is used to refer to something in the world (truth),

- s/he establishs a legitimate intersubjective relation (rightness),
- and expresses intentions (truthfulness).

In his concept of communicative action Habermas stresses the rationally based and tolerant structure of communication (Habermas, 1984): "This approach is coined by the intention to provide a strategy [...] how actors in a society could reach a common understanding. And [...] how this actors could be enabled to coordinate rational and consensus based cooperate actions" (Habermas, 1984, p. 86). Fundamental to this strategy is dialogical interaction, which ensures an open-minded and equal exchange of opinions, ideas, and worldviews. Premise of such a communication process is that every interlocutor has equal rights:

> Only if there is a symmetrical distribution of the opportunities for all possible participants to choose and perform speech acts does the structure of communication itself produce no constraints. Not only are dialogue roles then universally interchangeable, but there is in effect also an equality of opportunities to take these roles, that is to perform speech acts' (Habermas, 2001, p. 98).

These requirements of equality within interactions can be considered as an ethical premise of a postmodern dialogue. The dialogical interaction is defined by the reciprocal assumption that the interlocutor is open minded as oneself. From this perspective a dialogue requires trust to etablish an open-minded relation. Such a dialogue can be considered as challenging: "Challenging because engaging in dialogue entails trusting others with personal experiences and reflections" (Kelly, 2014, p. 58).

In dialogical interactions different worldviews meet. The postmodern dimension of a dialogue entails the discussions/critical analysis of truth claims. The mutual open-minded recognition provides the precondition for dialogical interaction, in which the truth claims can be tested/evaluated through discourses. The parties deliberately discuss the truth of a matter on equal terms. In a such a dialogical interaction the own worldview is at stake: "Dialogue, by its nature, is a type of conversation that challenges people to enhance their understanding of themselves and others by sharing and reflecting on deeply held beliefs and values" (Kelly, 2014, p. 55). The infinite challenging of the own worldview prevents the worldview to become a totalizing meaning with incontestable truth claims. The skepticism of postmodern thinking is thus re-produced. Already Socrates point to the challenges which arise from a dialogue partner. He expressed the challenging impact of dialogical practice in a socio-political dimension when he stated:

> For if you kill me you will not easily find another like me, who, if I may use such a ludicrous figure of speech, am a sort of a gadfly, given to the State by the God; and the State is like a great and noble steed who is tardy in his motions owing to his very size, and requires to be stirred into life. I am that gadfly which God has given the State, and all day long and in all places am always fastening upon you, arousing and persuading and reproaching you […] I dare say that you may feel irritated at being suddenly awakened when you are caught napping; and you may think that if you were to strike me dead […] then you would sleep on the remainder of your lives, unless God in his care of you gives you another gadfly. (Plato, 1899, p. 25)

A dialogue enables a critical challenge of all prefigured and seemingly indisputable meanings – an effect of this dialogical critical challenge is that new perspectives on the world, new meaning-patterns can be discursively constructed. Challenging the own worldview means also to wider the perspective and discover new meaning-patterns. These meaning-patterns can be in turn dialogically challenged.

To sum it up, it can be said that via a dialogue, conventionalized thinking patterns are put into question, traditional principles and established worldviews can be evaluated. A dialogue

requires open-minded acceptance of diversity. Only such an acceptance makes it possible to enter into a tolerant exchange with other worldviews/narrations. From this point of view the dialogue can be considered as the ethical practice of postmodern thinking: A rationally based, tolerant, and open-minded dialogue helps us to gain new perspectives on the world. Via the dialogue we can discover new worldviews – and thus construct new knowledge. The dialogical discussion of worldviews lead to the construction of new perspectives – a process which can also be theorized as learning (*cf*. Kergel & Heidkamp, 2015). The dialogue is at the same time an ethical concept as well as a concept of postmodern learning: "Post-modern education mediates/ teaches post-modern skepticism and implements the epistemological skepticism within intercultural encounters" (Kergel, 2015b, p. 1192). The ongoing media change enables a dialogical learning in the postmodern sense of the term. The polydirectional possibilities of so-called Web 2.0 media open up the space for a digital based dialogical learning. To elaborate on this thesis, the next subsection discusses, whether the Web 2.0 provides the structure for a digital based postmodern dialogue. In this context, we refer to the concepts of E-Learning 2.0 and Connectivism. Both approaches are strategies to implement the postmodern dialogue into E-Learning contexts.

5.3 Web 2.0 and E-Learning 2.0

5.3.1 Web 2.0 – the Redefinition of Mass Media in the Digital Age

The emergence of so-called `User Generated Content Technology´ (Lehr, 2012) provides the possibility that users can become interactively involved in the internet. User Generated Content Technology permits the users to produce easily content. They can `inscribe´ themselves on the internet. Via Web 2.0 tools users are able to produce an interpretation of the world through blogs, wikis, and podcasts. Social networks sites like Facebook and Google+ provide a platform for internet based interactions and via some clicks the users can write articles on Wikipedia. New forms of digital based communication arise – a.o. the users can communicate with each other instantly. The possibilities of Web 2.0 technology mean that the users are able – at least potentially – to enter into a dialogue with other users. O´Reilly (2006) termed this polydirectional internet the Web 2.0. With the Web 2.0 a user-centered internet, based on polydirectional communication is evolving.

The media change of the Web 2.0 leads to a redefinition of the notion mass media. Former mass media such like the television were defined as mass media, because they could reach a mass of individuals. The individuals functioned as receivers and could not answer the sent message. This definition of mass media is limited to an unidirectional understanding of communication. Due to the lack of dialogical structure, such an understanding of mass media corresponds with a non-dialogical structure of metanarrations which spread their message (*cf*. Baudrillard, 1972). In the context of the digital age, a mass media is defined by the fact that a `mass´ of people can communicate via media in a polydirectional way with each other. In contrast to an unidirectional orientation of mass media, Web 2.0 tools need the users as producers of content. Consequently, the receiver who answers the message turns into a sender. Without the interactive dialogical dynamic, Web 2.0 tools such like wikis can not unfold their polydirectional potential – the Wikipedia concept of a collaborative validation of articles requires a partner in dialogue. The individual can thus become part of a collective

process of knowledge construction. From this perspective the media change is more than simply a technical issue. With the new technologies new structures of communication emerge. The dawning digital age effects new forms of communication and therewith new forms of teaching and learning. This has led media educational researcher Stephen Downes (2005) to understand the new digital posibilities as a social revolution: "For all this technology, what is important to recognize is, that the emergence of the Web 2.0 is not a technological revolution, it is a social revolution" (Downes, 2005, para. 26).

5.3.2 E-Learning 2.0 and Conncetivism – The Postmodern Dialogue in Educational Contexts

E-learning can employ the dialogical, online based orientation of the Web 2.0. With his programmatic article "E-Learning 2.0", Downes (2005) formulated an approach which transfers the polydirectional communication possibilities of the Web 2.0 into E-Learning contexts – "And now, e-learning is evolving with the World Wide Web as a whole and it's changing to a degree significant enough to warrant a new name: E-learning 2.0" (Downes, 2007, para.2).

This approach uses the polydirectional dimension of the Web 2.0 for online based learning processes. The E-Learning 2.0 approach empowers the learner to become more dialogically productive in E-Learning scenarios (*cf*. Martin & Noakes, 2012). The E-Learner 2.0 is not only a recipient of media content but produces media content via dialogical interactions. From this point of view, the process of producing media content in the course of dialogical interactions is a crucial part of the learning process – for example, when hypotheses are formulated and discussed via blog posts. The implementation of dialogue based E-Learning needs to employ Web 2.0 technologies.

In his concept of `Connectivism´, Siemens (2004) point to the dialogical aspects of modern E-Learning. Siemens thereby seeks to provide a theoretical learning model for the digital age:

> Behaviorism, cognitivism, and constructivism are the three broad learning theories most often utilized in the creation of instructional environments. These theories, however, were developed in a time when learning was not impacted through technology. Over the last twenty years, technology has reorganized how we live, how we communicate, and how we learn. Learning needs and theories that describe learning principles and processes, should be reflective of underlying social environments. (Siemens, 2004, p. 1, for a critical approach towards Siemens interpretation of learning theories see Jones, 2015)

In encounters and interaction processes the learner can produce dialogical knowledge. These encounters/interactions processes are conceptualised as `nodes´. For Siemens, learning "is a process of connecting specialized node or information sources" (Siemens 2004, 5). And Şahin (2012) stresses that "[i]n Connectivism, learning occurs when a learner connects to a learning community and feeds information into it" (Şahin, 2012, p. 442). According to the concept of Connectivism, one principle is that "Learning and knowledge rests in diversity of opinions." (Siemens, 2004, para. 27). It is not about to produce a totalizing worldview but to exchange knowledge und to produce knowledge in the course of dialogical interaction processes. One purposive idea of such an learning process is decision-making in the pragmatic sense of the term:

> Decision-making is itself a learning process. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. While there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision. (Siemens, 2004, p. 5)

With reference to postmodern thinking, such an understanding of decision-making can be

interpreted as the substitution of truth claims through the acknowledgement that we are living in a `shifting reality´. To cope with the `shifting reality´, dialogical based interactions might help, to produce a multi-perspective interpretation towards this shifting reality – instead of sticking to one metanarration and its truth claims.

From this perspective the media structure of the Web 2.0 and the dialogical implications of an E-Learning 2.0 correspond with the ethical aspects of postmodern thinking/postmodern communication. The dialogue as prototype of postmodern communication requires to acknowledge other worldviews and to evaluate in rational based interactions truth claims. In the course of such an interaction, knowledge is produced. The media structure of the Web 2.0 enables to establish an E-Learning 2.0 which bases on the premise of an dialogical connecting. The learners can produce in a dialogue orientation-patterns within a `shifting reality´ – and thus put truth claims into question. One can raise the thesis that the polydirectional potential of the Web 2.0 and the unfolding of this potential within learning contexts through the concept of E-Learning 2.0 is the realization of the idealimage of the postmodern dialogue in higher education.

One challenge is, to transfer such theoretical reflections in appropriate E-Learning 2.0 scenarios, which meet the requirements of a postmodern dialogue. In the follwing subchapter, a best practice example for such an E-Learning 2.0 scenario will be introduced.

5.3.3 The Postmodern Dialogue in Educational Practice: The Web 2.0 based constructive Feedback

The following best practice example has been developed within the field of higher education. The best practice example uses Web 2.0 tools to implement an online based dialogical structure. This dialogical structure is realized via feedback-processes. It has been applied in context of inquiry based learning 2.0. Inquiry based learning 2.0 is an approach which combines elements of inquiry based learning with elements of E-Learning 2.0 (Kergel, 2014).

The presented best practice example combines inquiry based learning with a formative feedback by other students and is often used in inquiry based learning 2.0 scenarios (Kergel & Heidkamp, 2015). The students are organized in research groups. Each research group is asked to develope a research question and a study outline. They should collect and interpret data and finally present their research results. Every research group has the task to present their outcomes on a so-called Seminarblog – a Wordpress based, Web 2.0 learning platform. At the same time, every research group has to provide a feedback on the outcomes of an other research group.

Via the constructive feedback every phase of the research process accompanied by a dialogical discussion of the research. This approach ensures the dialogical structure of scientific inquiry.

As an example of how the constructive feedback can be used in an online based learning scenario, the course `Das Ich und das Netz – subjektorientiertes e-Learning in Theorie und Praxis´ (`The I and the Net – subject-orientated E-Learning in Theory and Practice´) will be introduced (the course took place summer term 2014 at the pedagogical Institute of the Carl von Ossietzky University Oldenburg). This course was organized as an online based learning scenario. Each research group presented their results and provided their constructive

feedback online via the Seminarblog. The students had been divided into three research teams. Each research team was tasked with producing an essay. Each research team should,

- develop an own research question for the essay,
- develop a structure for the essay,
- write the essay.

All these tasks were accompanied by a constructive peer feedback from another research team. The outcomes of each phase (developing a research question, developing a structure for the essay, and writing the essay) was uploaded to the Seminarblog. The constructive feedback in each phase was provided via the commenting function of the blog. After a research team has received the constructive feedback to their work, the research team was asked to list the three main points of the received constructive feedback. Via this strategy a dialogical, online based interaction between the research teams could be secured. The constructive feedback turned the essay into a collaborative text. The reviewers inscribed themselves via their feedback in the text and a postmodern multiperspective exchange could be established.

This online based interaction ensured the quality of the essay during the different phases. A further advantage of this online based, dialogically structured inquiry based learning 2.0 is that each student experience both perspectives: the perspective as a reviewer and as recipient of a constructive feedback. As simultaneous recipients and reviewers, they hone the dialogical process from different points of view.

The course decribed above was a pilot course. Due to the character as pilot course a formative evaluation was carried out for the whole length of the course. At different phases, the students were in surveyed in a questionnaire based survey whereby semi-standardized open questions were used (questions which can be answered without prefigured, implied, or explicitly presented choices). The students were asked how they experienced the collaborative work process in its different phases (the evaluation design was orientated at Dalsgaard [2005] concept of `theoretically grounded evaluation', Kergel, 2015c). This evaluation process was accompanied by exploratory interviews with two students. The results of the exploratory interviews allowed to adjust the semi-standardized questions of the evaluation to the needs/perspectives of the students. The evaluation questions thematized mainly the self-awareness of the learner within a collaborative, dialogical oriented E-Learning 2.0 process which implemented the constructive feedback. Via this evaluation concept the dynamics of a dialogical based E-Learning 2.0 process could be reconstruced. In the following main results of the evaluation are listed in a synoptic overview (for a more detailed and systematic presentation of the evaluation results see Kergel & Heidkamp 2015): All students appreciated the requirement to provide feedback because... '*One is forced to think about the work of the other students*'.

In response to the question of whether they would prefer to give constructive feedback within a group or alone, all students preferred to provide constructive feedback in a group: '*The reason is that the collaborative feedback provided a more profound understanding of the work to be reviewed*'.

Receiving feedback put the students in a position to 'understand one's own work more deeply and sharpen and structure it´. To 'receive feedback helps to better locate one's own work'.

Formulating constructive feedback appropriately, particularly critical points, was experienced as a challenge: '*To put critical points in a friendly way is quite hard*'. The significant degree of self-regulation and independent organization was mostly experienced as a *`relief´*– '*one is usually forced into very pre-structured courses in Bachelor's as well as Master's studies. The organization process can be complicated but encourages more active participation in the course'*.

The intrinsic motivation as an effect of required independent organization of the own research overlapped with the intrinsic motivation resulting from the content orientated requirement to develope an own essay topic: the process of learning/knowledge creation was experienced as more *`deep and profound* due to the freely chosen topic of the essay: *'I can apply myself more actively because I can write about things which I am interested in'*.

The students felt appreciated and respected as dialogue partners. The feedback testified to the relevance of their position as being worthy of statement: '*somebody was really interested in my/our work´*.

The Web 2.0 based constructive feedback turned the students into dialogue-partners. With process of producing and reviewing an essay, a postmodern process of knowledge creation emerged and realized the postmodern commuication via the polydirectional media structure of the Web 2.0.

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II How to do the Digital Turn?

Methodical and methodological Approaches for Higher Education in the Digital Age

6 Mobile Learning and Higher Education

Claudia de Witt & Christina Gloerfeld

Abstract
Digital media changed teaching and learning and are continuing to do so. The spread of mobile devices and mobile internet opened up further potential and pushed mobile learning into the universities. New technologies like cloud computing, learning analytics and augmented reality promise new mobile learning solutions. With the rise of apps, access to learning content and information is always and everywhere at students´ fingertips. This ubiquitous availability leads to a variety of learning scenarios – seamless, contextualized or personal learning. They can be grouped into four categories according to their dependence of place and time; learning independent of place and time, situated and authentic at concrete learning places, application at presence teaching, usage in distance learning respectively virtual presence.
In this article, the current situation of mobile learning in higher education is discussed and mobile learning offers of nine top universities are compared exemplary. There are two main findings: first, universities lack behind developing scalable didactical concepts for mobile learning, but second, they use to transfer e-learning solutions or prolong face-to-face learning scenarios to mobile devices. Hence an entire alteration did not occur so far. However mobile learning will continue to intrude everyday life at universities and keep transforming the way we teach and learn.

Keywords: Mobile learning, Higher education, Mobile technologies, Scenario framework

6.1 Introduction

Digitalisation of university teaching changes the traditional image of universities and creates a need to reflect about future scientific education. The process of transformation affects the development of universities as much as university teaching. Digital media encourages personalisation of learning and digital forms of cooperation and communication (see Hochschulforum Digitalisierung, 2016).

The question has long ceased whether mobile learning for studying makes sense; technology based learning forms enable didactic-methodical designs, regarding heterogeneous learning needs, different learning biographies and diverse interests of media use (see Herber et al., 2011). Learning with mobile devices and mobile applications offers significantly different and varying teaching and learning formats than before. Teaching and learning applications for smartphones and tablets offer various possibilities of multimedia interaction and communication. Cloud solutions and concepts of BYOD (bring your own device) enable new forms of generating knowledge and using media.

6.2 Range of technological Solutions

Preconditions of mobile learning are mobile internet and mobile devices, which enable the user to display, store and distribute information as well as to interact with others. It was only in 1999 when mobile internet reached Germany at CeBIT, where a transmitting technology with 9,6kb/sec – WAP (Wireless Application Protocol) – was introduced (Diehl-López, n.d.). Since then transmission speeded up rapidly. Today LTE reaches up to 300 mbit/sec.

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Looking at the hardware, the first mobile phone that could be referenced to as a smartphone, was IBM's Simon Personal Communicator in 1994. Simon had a touchscreen, email capability and could also send faxes. However, it did not have a web browser.[5] With a battery life of one hour, a high price and some technical shortcomings in handling, Simon was cut off after half a year. Instead, Nokia, BlackBerry and Palm led the development of smartphones at the end of the 20th early 21st century.[6] When Apple entered the market with the iPhone in 2007 and with the iPad in 2010, a new era of mobile devices evolved and catalyzed distribution as well as usage of mobile data. The number of smartphone users in Germany rapidly increased from 6.31 million in 2009 to 49 million in 2016 (comScore, n.d.). Peaking in 2010, growth occurred at 66% from 8.43 to 14.03 million users. At the same time the amount of data transmitted via mobile more than doubled from 11.47 million gigabyte to 65.41 million gigabyte. In 2015 data traffic reached 591 million gigabyte in Germany (Bundesnetzagentur, n.d.).

There is no doubt that mobile devices and internet are part of our daily lives. Communication and information are at our fingertips wherever and whenever we want. They started to change the way we interact, teach and learn (Czerwionka, Klebl & Schrader, 2010; O'Connor, 2012).

The trend to learn independently of time and space by using mobile technologies slowly reaches universities. In the beginning universities started to offer their learning content online as a form of E-Learning. As the distribution of mobile devices and the improvement of communication infrastructure progressed, universities developed mobile applications to administrate and organise study programs by so called 'Campus Apps' (Davie & Heß, 2012). To initiate virtual interaction between students and teachers, wikis, message boards and newsgroups were created (Kleinmann, Özkilic & Göcks, 2008; Kerres & Voß, 2003). The delivery of mobile learning content was catalyzed by 'iTunes U'. It gave teachers a platform to record their lectures and offer them for free. Furthermore, single departments or faculties developed apps to distribute learning content of their lectures. They offered the possibility to generate content, to stimulate interaction or to provide a full master degree program. Even though full study programs, mobile courses and stand-alone mobile learning solutions are still an exception, they show the broad scope of mobile learning (Wegener, Bitzer, Oeste & Leimeister, 2011).

There are different possibilities to use upcoming technologies like the mobile internet for learning. Mainly there are four different kinds of tasks mobile learning can accomplish: Mobile learning as a stand-alone learning offer; replacing previous learning solutions; expanding the regular offer with additional content and/or features; containing exactly the same offer as the regular scenario or even less.

In 2015 Maren Lübcke identified middle- and short term technological trends in higher education in the course of a meta-analysis of trend studies, scientific publications and weets (Lübcke, 2016). Mobile devices and mobile learning are seen as a short-term trend. The prognosis is that mobile learning will lead to combined informal and formal learning, creating a sense of mobile seamless learning. Furthermore, Lübcke predicts a stronger focus on collaborative mobile learning (Lübcke, 2016). She identified six important technologies for

[5] See: http://time.com/3137005/first-smartphone-ibm-simon/. Last accessed: 27 March 2017

[6] See: http://www.chip.de/bildergalerie/Die-Geschichte-der-Smartphones-Galerie_58060219.html: Last accessed: 23 May 2017.

mobile learning: Cloud computing, adaptive systems, virtual reality, learning analytics, mobile paperless assessments and gamification (ibidem.).

Cloud computing offers the possibility to use applications or services that are centrally stored in a so called cloud – on a cloud platform – in the internet. It is defined as "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" (Mell & Grance, 2011, p. 2). Thus cloud services offer flexible and easy access to programs and services without the need to buy and install software, which might only be needed for a short period of time or on a rare basis. To put it in a nutshell, it saves storage capacity and money. The idea with cloud computing is that it is scalable in two ways. It can be scaled up or scaled out in size, meaning bigger or more computing power can be used. Also, it is possible to use resources independent of their location (Bräuninger, Haucap, Stepping & Stühmeier, 2012).

Looking at mobile learning the advantages of easy and ubiquitous access to resources is obvious.[7] Bräuninger et al. (2012) named five main components of cloud computing: Resource pooling, rapid elasticity, on demand self-service, broad network access and measured service (Bräuninger et al., 2012). Especially in Germany, given the strict laws on privacy, data security and data protection, the question in which geographical region the data of a cloud is stored might suppose a problem, because a different jurisdiction may apply.

With the growing use of the internet, communication means and digital learning content, the amount of tracking data that documents these activities increases. To make use of this data, technologies are needed to record, display and analyse it. Furthermore, concepts and skills are needed to correctly apply and interpret it. *Learning Analytics* is defined as "the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs" (1st International Conference on Learning Analytics & Knowledge 2011. LAK'11., 2010, p. 4). For mobile learning Davis and Aljohani (2012) break it down to two activities, which are to be tracked. These are the "interaction between learner and available learning materials; this is called Explicit Learner-to-Learning-Materials-Interaction" and "the interaction among learners, this is called here Explicit Learner-to-Learner-Interaction" (Aljohani & Davis, 2012, para. 14).

With tracked data and learning analytics tools a vast variety of possibilities to support the learner evolved. Whether it is for the teacher to be able to offer adequate support when it is needed or for the learner to self-assess his level of learning and/or give automated feedback together with suggestions what to learn next.

Adaptive learning systems use these data to find the best fitting offer for the learner. Paramythis and Loidl-Reisinger (2004) define an adaptive learning environment as adaptive, "if it is capable of: Monitoring the activities of its users; interpreting these on the basis of domain-specific models; inferring user requirements and preferences out of the interpreted activities, appropriately representing these in associated models; and, finally, acting upon the available knowledge about its users and the subject matter at hand, to dynamically facilitate

[7] More details about cloud computing in mobile learning can be found in Jansen, Bollen & Hoppe, 2017.

the learning process" (Paramythis & Loidl-Reisinger, 2004, p. 182). According to mobile learning the term activity should be complemented with different context information like geographical location, transmitted data from nearby objects (e.g. artifacts in a museum, smart home devices, mobile payment, etc.), subjects (other learners or teachers) and the learner himself (e.g. data from activity tracker). Adaptive systems may lead to individual, personalized but directed learning (by an automated system) in contrast to self-determined learning (Goertz, 2014). However, adaptive systems may be a scaffold to guide learners to become self-determined. The crucial point is whether or not the power what, when and how to learn remains in the hands of the learner. Thus, suggestions and recommendations by the system should be optional and the reasons why they are proposed should be made transparent to the learner.

Virtual reality is an old technology dated back to the beginning of the 20th century when a patent for a head-based periscope display was granted (Sherman & Craig, 2003). It is an artificial, technologically constructed world, in which the user is completely immersed (Azuma, 1997). Furthermore Sherman and Craig add that the user gets sensory feedback and, that the environment is interactive (Sherman & Craig, 2003).

> **virtual reality** a medium composed of interactive computer simulations that sense the participant's position and actions and replace or augment the feed- back to one or more senses, giving the feeling of being mentally immersed or present in the simulation (a virtual world). (Sherman & Craig, 2003, p. 13, emphasis in original)

Common tools to experience virtual reality are virtual reality glasses or combined with other so called wearables like gloves or suits. With the help of virtual reality, learning scenarios, knowledge and skills can be trained in secure environments. For example, learners can practice to repair expansive machines in virtual reality before working on real machines and likewise medicine students can operate on virtual patients first (a good overview can be found in Metzger, Jannaber, Berkemeier & Thomas, 2017).

A*ugmented reality* is a special variation of virtual reality and very closely related to it (Azuma, 1997).

> **augmented reality** a type of virtual reality in which synthetic stimuli are registered with and superimposed on real-world objects; often used to make information otherwise imperceptible to human senses perceptible. (Sherman & Craig, 2003, p. 18, emphasis in original)

Hence, while in a virtual reality environment the world the user acts in is an artificial one, in augmented reality the physical world is visible and just enhanced with virtual objects as an additional layer, not as a substitution. Augmented reality also bears high potential to support teaching and learning, because it can be perfectly integrated into real life or working processes (Azuma, 1997). Necessary information or guidance can be provided without interrupting activities or additional effort. In addition, using AR or VR is fun and motivating because it is very playful and also used for gaming.

Deterding, Dixon, Khaled and Nacke (2011) define *gamification* "as *the use of game design elements in non-game contexts"* (Deterding, Dixon, Khaled, & Nacke, 2011, p. 9, emphasis in original) for example in learning environments. The aim is to increase motivation, engagement and activate learners (Butgereit, 2016; Deterding et al., 2011). In contrast to that, a game, designed to not just entertain the user, is called serious game (Deterding et al., 2011). Examples for game elements in mobile learning are badges, scores, high-scores, levels, challenges or competitions (Butgereit, 2016). Butgereit identifies different game mechanics,

with which she achieved improvement in a course with PhD-students; challenges, quests, points, leaderboards, badges, levelling, onboarding and engagement loops (Butgereit, 2016). A very easy implementation in mobile learning can be achieved with direct response systems, because nearly every student has a smartphone with internet connection and the applications are web-based, easy to use and free of charge. Here participants can be grouped in teams and a competition about the correct answers can start (e.g. 'Poll Everywhere').[8] Badges like Mozilla Open Badges are a kind of award or reward a learner receives to honor his or her achievements. At the same time it can visualize skills or knowledge "surfacing the less-obvious learning that is often hidden due to the focus on grades and transcripts" (Glover & Latif, 2013, p. 1398).

This leads to another important technology to assess the outcome of students – e-assessment or *mobile paperless assessments*. "E-assessment involves the use of digital devices to assist in the construction, delivery, storage or reporting of student assessment tasks, responses, grades or feedback." (Crisp et al., 2011, p. 5) Crisp et al. differentiate between three forms of assessment based on the moment when it takes place. Diagnostic assessments are used before the actual learning process to get to know the starting position of a student. During learning formative assessments document students' performances and reveal lacks of knowledge or students lagging behind. At the end of the learning process summative assessments grade learning outcome or success (Crisp, 2007). A fourth type added later on is called integrative assessment. These are "designed to promote and measure student self-regulation" (Crisp et al., 2011, p. 6). E-Assessments bear two main advantages; they are very efficient and take workload off the teachers (Handke & Schäfer, 2012). They are good tools to support self-guided learning, because they give immediate feedback about the current performance of the student. The most common e-assessments in higher education are closed formats, which are limited to measure declarative knowledge instead of cognitive skills (Cano, 2017). But different skills are needed to become employable in a century, which is mainly driven by digital technology. Crisp et al. (2011) cites seven 21st century skills identified by Mioduser, Nachmias, and Forkosh-Baruch in 2008; multimodal information processing, navigating the infospace, interpersonal communication, visual literacy, hyperacy, personal information management literacy and coping with complexity.

"E-assessment can offer new opportunities to assess these 21st century skills through the design of tasks that require Web 2.0 creative activities; interactive tasks that include branching and decision points such as role plays and scenario based activities; and through the use of global communication tools." (Crisp et al., 2011, p. 12)

Obviously mobile devices and mobile technology can very well support these tasks.

6.3 Range of didactic solutions: Classification of Apps/mobile applications by reference to Bloom's Taxonomy

In the context of teaching, learning and researching at universities there is a multitude of systematics and taxonomies to grade teaching and learning applications. Kathy Schrock (2017), for example, undertakes a classification of apps corresponding to the 6-stepped taxonomy of learning targets of Benjamin Bloom (Figure 6.1).

[8] See: URL: https://www.polleverywhere.com/features/ segmentation. Last accessed: 04 February 2017.

Mobile applications for studying or for preparation of classes or courses can be distinguished between independent of content or dependent of content. Apps **independent of content** are little instruments of work respectively service programs. They include a wide range of functions like searching for information or management of appointments or notices (i.e. with Evernote); communication across Microblogging, Social Media (i.e. Whatsapp or iMessage); showing, editing and managing documents (i.e. with GoodReader, FileApp or AnnotaBitePDF).

There are also apps for storing data or media in cloud systems (i.e. iCloud or Dropbox), scanning documents with photo-cameras (i.e. CamScanner) or for video documentations with cameras or augmented reality (i.e. Layer) or voice recordings to test ones own wordings.

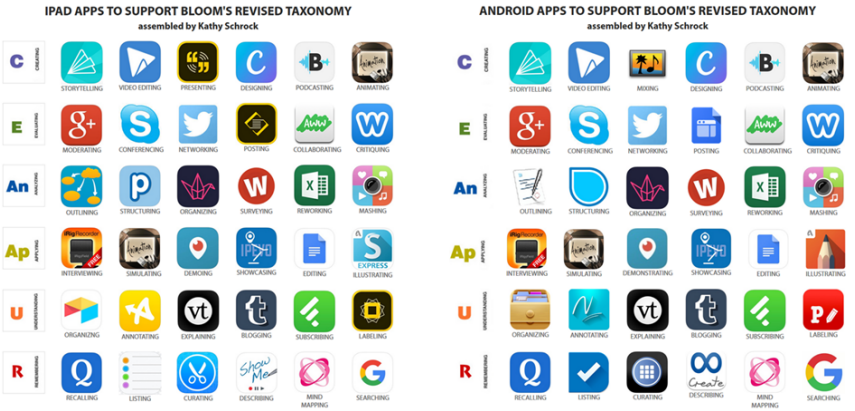

Figure 6.1: Table of classification for Apps with Bloom's arrangement of knowledge, understanding, application, analysis, synthesis and evaluation (Schrock, 2017).

Apps **dependent of content** offer compact, text-based and/or audio-visual learning contents. These can be information units (news, for example), closed learning texts, contents from learning platforms (i.e. Moodle or communication panels), flashcards or vocabulary trainers. Databases of knowledge, lexica, glossary, dictionaries and tests of knowledge also matter. Didactically edited apps for certain subject areas, which offer tasks, solutions and interfaces of communication, are named learning apps. They are designed for learning in little units, short steps and short time periods. This so-called "micro learning" can be understood as a process of short learning activities which are especially conducive if questions are asked, answers framed, opposite positions exchanged or betterments undertaken. Controlling a learning effort can take place via immediate feedback and direct evaluation.

Besides independent and dependent of content, applications can be further classified as learning and organizing.

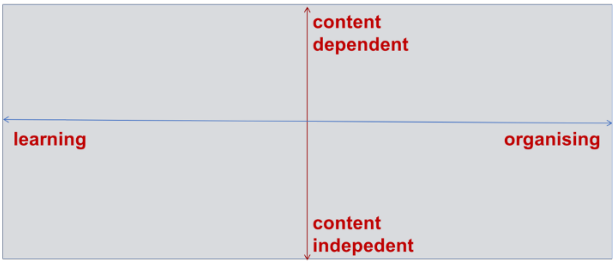

Figure 6.2: Classification of Apps for studies in independent and dependent of content (own Figure).

Thus we distinguish between apps that

1. are able to ease or simplify studies (little or nothing to do with learning) – Organization of learning;
2. organise ideas for oneself, to share with others (i.e. via Dropbox or Evernote), or to use for joint work over texts to collaborate and/or reflect – material elaboration;
3. are suitable for an immediate use during a course like mobile flashcards or direct response apps (i.e. immediate interaction between teacher and learner) – Supporting the process of learning;
4. offer concrete and fixed learning content, a base of knowledge like Wikipedia, a quick test or a context-sensitive tasks – acquisition of information and dealing with information.

Such apps support the use of knowledge and learning contents. They involve the students and activate them to produce contents themselves or to organise learning contents. Mobile learning is designed for three essential activities:

- Research and use of content;
- Production of self-contents and sharing with others;
- Founding of networks and active participation in online-communities.

Accordingly, the essential functions of digital media are the presentation of contents, the visualization of complex facts, the usage as a tool, the preparation and storage of teaching/learning material, communication and collaboration between students and teachers as well as between students themselves.

6.5 Scenarios of Mobile Learning in the Context of Universities

Looking at the development of innovative mobile learning applications, didactic needs rather than technological opportunities are the main driver.

The frame for the design of didactic scenarios for mobile learning depicts factors like targets, target groups, learning contents and learning materials, learning context, teaching and learning organisation, communication and cooperation as well as learning support. These factors are already relevant at the conception of e-learning activities. Specific factors for mobile learning arise by elaborating the aforementioned factors considering other aspects like: the ubiquitous availability of information and communication; learning at any time and

place; support of contextualized and seamless learning; ease of personalised learning; easy conjunction of formal and informal learning, which makes direct feedback and evaluation possible.

According to Arnold, Thillosen and Zimmer (2015), learning scenarios generally describe the pedagogic circumstances respectively the organisation of virtual teaching and learning . The term scenario has a certain character of example or blueprint for a situation of teaching-learning that has to be conducted. With the term scenario the design of teaching-learning processes in or through a teaching-learning surrounding is signified. E-learning scenarios are the result of a technology supported design of teaching-learning situations. To classify the essential scenarios of mobile learning systematics, the two context-factors time and place shall be introduced. Because a didactic scenario after Baumgartner (2006) is defined as "a script for staging a certain arrangement of learning and composes the necessary needs – actions at the (learning-) time respectively equipment at the (virtual) room for the implementation" (Baumgartner, 2006, p. 239).

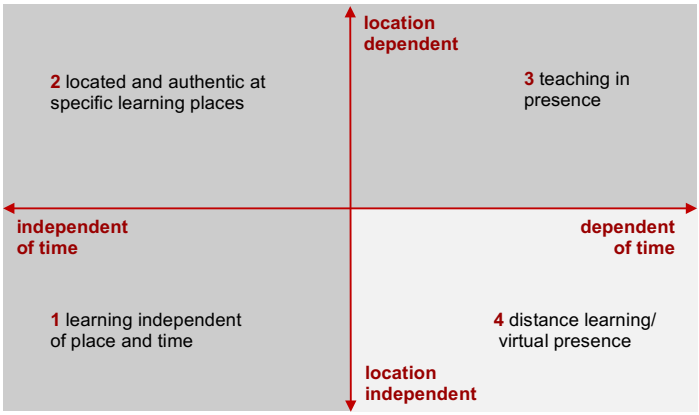

Figure 6.3: Scenarios for mobile learning in dependence to place and time (own Figure).

With the possible different combinations, the following four scenarios derive:

1. Learning independent of place and independent of time;
2. Learning independent of time, but dependent of place: located and authentic at specific learning places;
3. Learning dependent of place and independent of time: teaching in presence;
4. Learning dependent of time, but independent of place: distance learning respectively virtual presence.

6.5.1 Learning independent of Place and Time

Mobile learning is conducted without changing the current location and situation somebody is in. Smartphones and tablets are used in idle or waiting times. In every situation information, knowledge or tools are available. Everybody can access learning materials in audio-, video- or text-formats and micro-content. The learning management systems, which were originally only usable at desktop computers, are meanwhile usable via smartphones or tablets due to

the responsive designs of learning management systems like the Moodle learning environment at the FernUniversität in Hagen. These learning environments are increasingly integrated in mobile personal learning environments (PLEs). Moreover, commercial or learning apps produced by teachers are available. Here, students are able to deepen and extend their knowledge self-determined during phases of self-learning – not only for exams.

6.5.2 Located and authentic at specific Learning Places

In this scenario place is relevant but time is not. Located learning on site means, that knowledge can be acquired in a direct context and classified in the learning coherence, for example at historic sites or excursions. Located and authentic learning supports the ability to explore one's own context and experiment. It also supports the separation of learning processes within a classroom-setting and the initiation of learning in new significant settings outside. Within this learning in a physic context is also meant: Access to knowledge is given contextually to its area of application or when being of meaning.

Mobile technologies offer many opportunities of context-dependent grasp to information, like augmented reality or locations-based services. While learning at a bus stop happens in an irrelevant context, augmented-reality-applications provide relevant learning contents or information at the places the learner is located. Applications of augmented reality has big potential to enable contextual learning experiences as well as *accidentally* researching and exploring pieces of information, which correspond with each other in the real world. Augmented Reality stands for blending, respectively enrichment of virtual data – information and even real action – with something we see in the real world, either via app or AR-glasses. Mechanics already use AR-glasses while working in the automotive industry; the glasses show every step of the work process, identifying the needed tools and delivering guidance as well. This kind of AR is of particular interest when training special tasks. The learning contents catch somebody´s eye directly.

Another example for this scenario, but with a different technology, can be found at the University of Linz. They employ a special platform of information, communication, collaboration and navigation (SICS Smart Information Campus System), which was developed on the basis of digital-graffiti-technology. Affiliates of the university – teachers, students, administration – can offer elements of information documents like text, picture, sound, video and so on geo-positioned or drawn directly at mobile equipment on site. Teachers display documents for their (virtual) classes in front of the lecture room. Before entering the room the documents will be offered to the students automatically. A so-called friendfinder component allows collaboration and social networking. SICS (Smart-Information Campus System)-users are able to connect to other SICS-users (friends, colleagues, professors and so on), so that they are able to exchange their current geographic positions and start virtual dialogues (chat).

At a different scenario, at the European Mymobile Joined Project (Belgium, Germany, Italy and Great Britain) mobile portfolios, which produce a connection between everyday life and the formal institution of education, are mentioned. Therewith one of the crucial advantages of mobile learning is used, namely the creation of *user generated contexts*. This is context that is produced from learners themselves, because mobile equipment makes it possible to

develop synergies of knowledge which arise in most different societal, social and temporal contexts (see Pachler et al. 2012, p. 12).

6.5.3 Application during Classroom Teaching

This scenario depends on time and place. The use of mobile technology occurs in a physical context. A typical example for this is the well-known classroom situation in a classic and – nowadays still mostly overcrowded – auditorium (different to the Fernuniversität). Teachers do not only give lectures, but also formulate questions or tasks offering response options. Students can choose their preferred answer via their digital device. The results are transferred to the computer in real-time and can even be displayed to all attendants.

The target is to actively involve the students in class and to give the teacher the possibility to for example gather opinions or feedback and directly react to lack of knowledge, if necessary. Meanwhile, election clickers are not needed any longer, good apps are existing instead (i.e. Polleverywhere, Socrative, Pingo, ARSNova and so on). Students can answer with words, sentences or predefined responses, but they can also compete against each other in learning teams. A didactic target insisted is, that students not only listen but actively participate in class via smartphone, tablet (or laptop). Some classic learning platforms like ILIAS increasingly start to offer live voting plugins.

6.5.4 Usage in Distance Learning respectively Virtual Presence

In this scenario of mobile learning not place is important, but time. For example, this is the case, if an online lecture in form of a live stream or Google hangouts takes place. The participants gather at a certain date, but their location is totally irrelevant. This scenario is an outstanding opportunity to reach students worldwide. This way exams can be held independent of location. Teachers and students arrange an appointment in digital meeting rooms. Students can also participate in online surgeries or online lectures via mobile applications like Adobe Connect Mobile. A complex commute for a lecture of one hour becomes obsolete. Also students can use these possibilities to connect globally und take part in online lectures of educational opportunities worldwide (like MOOCs, for example).

6.6 Mobile Learning in Practice – A Reality Check

The potentials of mobile learning technology are evident and could improve scenarios in higher education as well. Thus in the following section the realization of mobile learning in higher education is analysed. Based on a general overview of where mobile learning is headed we take a deeper look into how mobile learning is currently implemented at German universities.

6.6.1 Mobile Learning Settings in Higher Education

According to Zhang (2015b) mobile learning is still behind its potential, because of technological shortcomings like an unstable internet connection, costs and safety. Thus she recommends to use mobile learning additionally to classical teaching and learning – as blended learning (Zhang, 2015b). For Zhang mobile learning is not ready to replace classical teaching and learning yet. Besides the technological limitations, a complete understanding of the requirements of a good mobile learning design is missing (Zhang, 2015a). But this is particularly necessary, because the situations mobile devices are used in are totally different

from former learning situations. Mobile devices only have small screens to display content or interact and students access mobile content anywhere and with just limited time (Zhang, 2015a). Furthermore, she describes students today as different "and ready for different learning methods and technologies" (Zhang, 2015a, p. 13), because they grow up with digital media and mobility, traveling and getting into exchange with different cultures (2015a). Petrakieva (2015) agrees that students are more used to digital media, but still need to be taught, how to use technology to enhance learning. She points out, that to offer digital content or to use automated feedback technologies does not make real mobile learning or even blended learning. It is not just about the access to digital content that counts, but a "proper m-learning and m-teaching strategy, with support for both educators and learners to fully benefit from m-learning" (Petrakieva, 2015, p. 976).

Petrakieva develops a mobile learning requirements hierarchy based on the idea of Maslow's hierarchy of needs, but she puts together two stakeholder perspectives – the students' and the educators' (2015):

- Students: access to device, internet access, ICT skills, attitude;
- Educators: access to technology, pedagogy, ICT skills, flexibility.

Similar to Zhang, for Petrakieva mobile learning still is a question of access, followed by the affordance of ICT skills to both stakeholders. The main challenge for the educators is to really produce mobile learning and not just make e-learning accessible through mobile devices (Petrakieva, 2015).

Pimmer, Mateescu and Gröhbiel (2016) analysed 36 studies on mobile learning in higher education to figure out what kinds of mobile learning exist and what the results are in education. As most researched subjects they identified language learning, health science and computer science. Their research especially focuses on the question, which kind of mobile learning settings is realized in higher education. They found out, that most of them are based on instructional design patterns, followed by constructionist learning and situated action. There were hybrid settings, which consisted of a combination of these. These four categories can be divided into sub-categories to structure the findings and to display the state of research in mobile learning (Pimmer, Mateescu & Gröhbiel, 2016).

Interactionist approaches

- Ad hoc and post hoc transmission of lectures;
- Supplementary text and multimodal materials;
- Activation and formative assessment.

Constructionist approaches

- Designing linguistic representations (written and recorded speech);
- Designing visual representations (photographs and videos).

Situated approaches

- Situated action and contextual scaffolding.

Hybrid approaches

- Hybrids of situated, constructionist and collaborative design, link of formal and informal learning settings, collaboration and exchange.

There is no question that mobile learning reached universities. Mainly due to the spread of

smartphones and tablets in society and everyday usage also by students. This strategy of BYOD saves the universities money in case of the hardware but requires much more staff support to ensure connectivity of all different devices (Petrakieva, 2015). Universities themselves start to align their offer to the demands of their target group and want to profit from the advantages and potential of mobile learning (Sousa Pereira et al., 2016). The market growth of smart portable devices and the flood of emerging apps facilitate integration and open up new possibilities of teaching and learning. Pereira et al. (2016) analysed helpful apps for higher education focussing on apps that support organising and administration tasks and on apps promoting well-being or mental health for students. Next to super ordinated apps, which provide general information about higher education most universities in Portugal offer their own apps to students to administrate their studies.

To sum it up, mobile learning is still struggling with access to technology and interoperability. Moreover, there is still a lag of mobile learning scenarios based on didactical concepts and which benefit from contextual integration. Instead interactionist and constructionist approaches are the dominant form in higher education.

6.6.2 Comparison of Mobile Learning in Higher Education in Germany

After this look into the variety of technological and pedagogical/didactical possibilities of mobile learning in higher education, in this paragraph mobile learning at top universities in Germany is analysed. The universities were selected based on the official CHE ranking 2016/2017. Using the CHE ranking, users can find the best university in each study programme rated by different criteria. First of all, ten study programs with the highest numbers of students were selected from official statistic (Statista, 2015/2016). These were business studies, mechanical engineering, economics, medicine, German language and literature studies, psychology, educational science and electrical engineering (Statista, 2015/2016). Secondly, the ranking was used to find the best state universities. As selection criteria, online offer – E-Learning – or, if this criteria was not available, the general study support, was chosen. E-Learning means the evaluation of quality and distribution of online offers (CHE Hochschulranking, 2016/17). General study support includes different items concerning support to network, mentoring, organisation, access to and quality of study materials. It came down to seven study programs, which had top flight results. Medicine was eliminated, because both criteria were not tested, as well as educational science, where there was no top flight at all. These two criteria were chosen to figure out, which universities are on top of learning with digital technologies or at least offer a high variety of student support. Comparing the rankings nine universities came up more than once in the top flight. Seven had two nominations; these are RWTH Aachen, University of Bayreuth, University of Bamberg, University of the Armed Forces Hamburg, Karlsruhe Institute of Technology (KIT), University of Hannover and Technical University of Munich (TUM). Two universities had top listings in three study programs, the University of Mannheim and the University of Ulm.

Following, the mobile learning offer of these nine universities were compared in two steps. In the first step we searched the websites of the universities with the terms mobile learning and mobiles Lernen. As second source of information we checked whether the universities provide learning apps in apple's App Store and Google's Play Store. Because these are the

dominant operating systems on smartphones with a market share of 90% in 2015 (Schmidt, n.d.), no other operating systems were taken into account.

Looking at the homepages of the universities mobile learning is not a prominent topic. Even e-learning needs to be tracked down. A search of the terms mobile learning and mobiles Lernen showed no relevant results at University of Bamberg and RWTH Aachen. Up to 40 results can be found at the KIT, 12 with the English term (Et) and 28 with the German term (Gt) mainly about a special training for school teachers, and at the University of Mannheim there are 30 results (Et) mainly publications and two results (Gt) linking to old news. Between 71 and 102 search results are listed at University of Hannover, 71 (Et), these are mainly links to events. On the website of the University of the Armed Forces Hamburg there are 61 results for the English term linking to projects and publications and 14 results (Gt) with a strong focus on publications. At TUM 71 results (Et) were found directing to publications and events and nine results (Gt) to events and projects. The longest list were the results at University of Bayreuth with 60 (Gt) and 42 (Et). The main subject, the results linked to, was the research unit on mobile learning at the university.

According to the provision of apps, mobile learning is not of high priority. The University of Bamberg and the University of the Armed Forces Hamburg do not provide any apps. The University of Hannover did not develop an app but participates and uses the app Stud.IP (which they use as learning management system) and the Technical University of Munich only got an unofficial android app developed as a faculty project.

All apps can be ranked according to their functional scope. The one with least functions is KIT-Navigator (Karlsruhe Institute of Technology), which just helps to navigate the campus. Some more features are offered by University of Bayreuth, University of Mannheim and University of Ulm, they included all kinds of information which might be useful for students, like the menu of the cafeteria, events, news or links to further information. Two apps are able to deliver individual information and integrate personal study schedules, Stud.IP (University of Hannover) and TUM Campus App (Technical University of Munich). In the former one students can also download material or use forums. The app with the most functionalities that really provide learning features is the app of RWTH Aachen. Next to search, navigation, and all other functions mentioned so far, there are more administrative functions like get informed and register for events or check grades and schedule. Furthermore, the virtual learning environment L2P is integrated in the app as well as additional tools like quizzes and direct response systems.

Besides these main apps with core functionalities to organise students' lives, some universities supply additional apps to take on special tasks. Although there are quite a lot of apps developed by departments, faculties or as student project in any subject, this analysis focuses on apps to support learning in higher education.

RWTH Aachen and Karlsruhe Institute of Technology provide two more apps, one learning app and one organizing app. Both learning apps, Phyphox (physical experiments; RWTH) and Dein Klima (regional locations and climate change; KIT) are running on both operating systems. KIT Career Service is an android app, which delivers information and news about future career. Climbr is an app to book further education and training by RWTH and the only one targeting the university staff.

The University of Mannheim offers a library app: students can research literature and also look up free study desks. There are at least two more universities offering learning apps, TUM and University of Ulm. TUM fml is an android app developed by a single institute supporting two classes. eMed (University of Ulm) is an interactive learning application with quizzes and content management system.

To sum it up, looking at universities highly ranked due to their learning offer with digital technologies or student support, mobile learning is not a high priority issue. Two universities do not even have an app or any content on mobile learning on their websites. Astonishing is the fact, that on the one side the university of the Armed Forces do not have an app, but lists the most information (in a quantitative way) about mobile learning. While on the other side RWTH Aachen provides the most integrated app, but there is not even a single relevant search result with the term mobile learning on the website. The functionalities of the apps are mainly to organize student life or keep users up to date. Only two apps (RWTH Aachen and University of Hannover) contain learning materials. Further features to support mobile learning are only provided by rwthapp, namely a quiz and a direct response system. But further apps specialized on single subjects or content evolve enriching students possibilities to learn anywhere and anytime.

Broadening the scope besides apps, all universities use a virtual learning environment, mainly open source solutions; the University of Bamberg, Bayreuth, TUM and Ulm chose Moodle, the University of the Armed Forces, KIT and Mannheim use ILIAS and the University of Hannover Stud.IP. Only RWTH Aachen developed its own learning management system. All systems can be accessed with mobile devices either with the web browser or with an app.

Although the analysis just compared nine universities in Germany, a tendency of the development in mobile learning in higher education can be concluded. Together with the findings in the literature it becomes clear, that mobile learning primary is an object in research projects or pilot studies. There is just little evidence that it plays an important role in current university strategies. In the development of mobile applications universities put emphasis on organization and information. Moreover, learning features mainly stick to instructional approaches as Pimmer et al. (2016) pointed out as well.

But single solutions by departments or faculties pop up. The only problem is that they are strongly related to specific subjects or tasks and cannot easily be transferred. This lack of scalability hinders fast and broad distribution of mobile learning apps. Examples to prove the opposite are the apps, belonging to learning management systems like Stud.IP, Moodle or ILIAS. But as said before a bare transfer of E-learning content to mobile devices cannot automatically be called mobile learning. Furthermore, apps are needed which provide mobile learning functionalities but can be adjusted and filled with individual content and tasks.

6.6.3 Summary and Future Questions

The development and maintenance of apps especially with interactive content, automated responses and multimedia learning materials is expensive and challenging. Thus the solution of the University of Hannover to use an open source learning management system like Stud.IP, which also runs an app, seems to be smart but limited in its mobile learning potential.

The apps so far mainly prolong the regular learning offer to mobile devices and in some cases they add special content like quizzes or functions (direct response systems). Some succeed in providing a seamless user experience, if app and virtual learning environment or browser based solutions are connected and distribute the same content and features.

Of course there are research project or single solutions, which are based on virtual reality (Albrecht, Folta-Schoofs, Behrends, & Jan, 2013; "Social Augmented Learning", n. d.), integrate context (Filipski & Forster, 2012), mobile collaboration (Wang, 2014) or mobile game based learning (Lee et al., 2016), but this is not part of everyday life at universities yet and scalable solutions are needed.

However mobile learning technology does not have an inherent value or improve education just because of its existence. Didactical designs with concrete tasks and involved teachers are necessary to integrate mobile learning into existing scenarios or to initiate new ones (Pimmer et al., 2016). Pimmer et al. conclude that "the simple availability of creative and apparently empowering media does not per se lead to changed and enriched learning and teaching practices in higher education" (Pimmer et al., 2016, p. 498). It is necessary to involve, engage and prepare students as well as teachers to properly use digital media for mobile learning. Petrakieva sums up that "there is nothing natural in using technology for learning […] Simply providing access to it to educators and learners will have a very minimal and limited effect" (Petrakieva, 2015, p. 978). Moreover, it should be taken into account that in higher education the adoption of technology to enhance learning is slow (Pimmer et al., 2016). Especially in Germany administrative structures and privacy concerns limit and slow down technological developments.

Obviously mobile learning is arriving at universities in particular because there is no other chance. Students will continue to use smart mobile devices and this certainly will increase even more. Therefore they will demand more content and functionalities to support their student lives. But there is no entire turn in teaching yet.

6.7 Digital Turn with mobile learning at Universities – Consequences for the Understanding of Learning and Education at Universities

Altogether apps and scenarios visualize the evolution towards a consistent learning support (Ubiquituous Learning) respectively to a seamless learning. Meant is a transition from informal and formal settings of learning, the transition of personalised and social settings of learning, the transition of a physical area and digital information or the transition between different devices respectively different learning activities (see Specht et. al., 2013, p. 2; de Witt et al., 2016).

The end of the digital turn has not yet come. In future all applications will happen on one surface and the jumping between apps will disappear. Bots respectively digital assistants will execute our learning orders via voice input or text input. Apps will become so-called `invisible service-contractor of a messenger or bot´, which will also finish the download of apps. More and more human language will become the new user-interface and digital assistants will run apps on smartphones or tablets in the background (Schmiechen, 2016).

If our learning becomes smarter, it does not mean, that universities are allowed to be satisfied with a *learning to go*. Learning, which is aimed on educational formation and training, is still connected with strain and work. With a stronger digitalisation of university teaching there is to be followed: Students are offered huge resources of knowledge outside universities like online lectures or online articles in the internet and nowadays they are naturally roaming

the social networks, leading their own blogs, taking part in MOOCS and so on. They start to turn to informal learning processes outside regular courses more frequently and take part in designing informal learning rooms themselves, for example on facebook. Looking at MOOCs and Open Content the question remains who to consider an expert. The question is whether the internet is a *pool of knowledge* or rather sciolism.

In the future the role of universities should not entail to be an institution of exams, where students get the OER from outside, and only to be certificated at. Universities should be interested in further innovative development of university teaching and contemplate, that most university teachers themselves – still – hardly use new technology, neither for learning, teaching nor research. And yet they are still the experts and able to evaluate the quality of resources. Therefore, their task will be the support of students and enable them to recognize reliable sources and to examine content of high-quality.

The *net generation* including a great part of its students use their mobile equipment not only to ask for educational knowledge but also to be co-constructor of virtual learning rooms. They bring in new perspectives in terms of openness towards new forms of digital learning. Their social behavior shows the ability of participation and actively taking part in the internet. On the other hand, more and more (self-)responsibility is being demanded. They grow increasingly responsible for their own studying and qualification. University teachers need to assess the value of education, which digital media and mediated communication have according to provide orientation in the ever-changing relation of self and world. The key question is how changes of the world influenced by internet and digitalisation change relationships between human beings and the world. Mediated (learning) spaces became places of social meeting and these social meeting rooms in the internet gained essential importance and serve as orientation. Today education is mostly interfered by media and the result of learning processes in context of digital media.

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7 Critical Thinking in Higher Education: How to foster it using Digital Media

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Abstract
Critical thinking (CT) is an integral part of education, notably in higher education. In times of misinformation, oversimplified answers to complex problems and populist agitators, critical thinking remains a vital skill, necessary to differentiate accurate information from manipulation. Although students should learn how to use digital media critically to not fall prey to false information, hasty actions or to the dominance of the smart devices, digital technologies can also be very supportive to foster critical thinking. Therefore, they must be imbedded discreetly in teaching and learning environments in a way that they become supportive for the different activities of the critical thinking process.

In this paper, we would like to unroll some ideas indicating how this could be done in higher education contexts. Fostering critical thinking demands quite a lot from teachers and students. Students, for example, must conceptualize and exercise different thinking modes, jettison dear beliefs and create new and substantial ways of thinking and acting. Teachers however need to get a very clear idea of what critical thinking means in their field. They must be able to model critical thinking, its criteria or strategies. Furthermore, they need to know and apply different instructional strategies that are helpful to bring students into the different activities of critical thinking.

To broaden the perspective on concepts, we will discuss different definitions and traditions of critical thinking and offer a synthesis. In the next step, we will examine process-models of critical thinking and introduce educational strategies and design-principles. A further chapter is dedicated to digital media and critical thinking. We will have a focus on why students should critically think about media. From there, we will go back to general strategies and design principles for fostering CT and show how digital media could be practically used in accordance with these principles.

Keywords: Fostering critical thinking in higher education, Concepts of critical thinking, Using digital media for critical thinking

7.1 The Fear of a Decline in Critical Thinking

Immersing into the endless streams and posts on Facebook and other social media channels, it sometimes seems that average citizens are no longer capable or willing to seperate facts from fiction, right from wrong, racism from criticism, demagogues from original thinkers or experts from maniacs. The internet, once praised as a medium of knowledge and empowerment, has come under suspicion with its bots, filters, tweets, feeds, fake news and shit storms. Its promptness, its easy access and selectiveness is part of the problem: a decline in critical thinking, various experts from different fields like neuro-, social- or computer science claim. It seems like some people just hear and see what they want to hear and see and some of them respond and judge immediately, instead of examining statements critically or proving validity and origin of information. Forums, blogs and social media contain loads of unchecked, unbalanced or even hostile posts – and some of them get shared virally throughout the web.

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Some current and extreme examples: Reptiloid political leaders, Dangerous Chemtrails in the sky, the Federal Republic of Germany and its constitution nothing more than a con, a whole country controlled and led by foreign and even alien powers. The internet has become a source for conspiracy theories.

Besides the controversial public debate about an alleged lack of media-literacy and critical reflection in society, there are other and more silent, surprising cases, where experts proclaim the absence of critical thinking in places where it should normally dwell and thrive: in schools and especially in higher education. Wolf talks about an "educational catastrophe" referring to the poor study skills of students entering university; students that are socialized between Nintendo, iPhones and the internet (Wolf, 2013, p. 55). He has evidence on his side and quotes some of his own and other studies, which all show that many students in Germany are not only lacking basic knowledge in relevant subjects, but they also fall short in reading, writing and thinking. For example, beginner-students often uncritically copy and paste information from the net in their first papers, write in platitudes or fail in recognizing ideological perspectives in texts (Wolf, 2013, p. 56).

But the critique does not only refer to decreasing and inadequate study skills. Other authors complain about the uncritical spirit of students. Florin is asking why students are so conformed, apathetic and incurious these days. In her controversial book, she discerns a vanishing willingness of (her) students to engage in critical thinking and dialogue, e. g. developing one's own and rich arguments, dealing with ambiguity or taking on different perspectives (Florin, 2014, p. 23). Her students only appear to be critical when their grades and learning-outcomes are concerned. For a better grade, they wake up from lethargy and painstakingly start scrutinizing and challenging their achieved scores. Instead of putting the blame merely on the students, Florin reflects the conditions and contexts students have to cope with. She finds a system almost detrimental for critical reflection. A curriculum with little time to reflect, tests that detain deep learning and thinking, a teacher-centered learning culture where students only take over the given information and don't engage in thinking on their own, "schoolification" like strict timetables and so on. Apologists of humanist education like Liessmann (2006, 2014); Pongratz (2012) or Hauser (2012) go even further in their profound critique. They consider higher education as a realm of growing non-education, where the paradigms and restraints of the market and the ideology of neo-liberalism rule out critical thinking, aesthetical contemplation or lessons in *áskesis or ataraxia*. In their perspective, the conforming demands of employability and mobility have taken over teaching and thereby corrupted the idea of what education once meant.

Some studies seem to confirm certain aspects of the critique on the bachelor- and master system. In a representative long-term survey, Bargel, Heine, Multrus and Willige (2014) continually asked German students about their contentment with their studies. The report concludes that students indeed acknowledge critical thinking as an important skill, but according to their views, its facilitation has come off badly and in addition waned in recent years. Of course, the Bologna process has brought conditions for studying, which seem impeding for critical reflection and deep learning. To criticize and to work on these flaws and problems is very important. On the other hand, with the Bologna Process university teaching and learning has become its own field of expertise and consideration that includes projects with financial state subsidies. Thanks to the "Quality Pact Teaching" for example, funded by the German ministry of education and science, many universities got the opportunity to set

up several projects on a large scale to improve learning and teaching, including projects to foster critical thinking skills via inquiry based learning, deeper learning or service learning.

Furthermore, certain aspects of critical thinking are officially a fundamental goal of university teaching, although the term `critical thinking´ is not used explicitly in the relevant documents. Just to give on important European example: The European Framework for Lifelong Learning, which is fully compatible with the qualifications framework for higher education developed under the Bologna Process, states that students on master level should gain "critical awareness of knowledge issues in a field and at the interface between different fields" (n. D., p. 3) or evolve "specialized problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures and to integrate knowledge from different fields" (ibid., p. 3) or "take responsibility for contributing to professional knowledge and practice" (ibid, p. 3). These learning-outcomes could be referred to certain qualities of critical thinking.

What are the qualities of critical thinking and how can we promote them? In our opinion, this question is more important than the debate about if critical thinking is really "missing in action". Is critical thinking really on the decline in higher education? Was it really so much better in the past? We can't say that easily. Critical thinking cannot be observed like clouds in the sky or tested like a math-equation. It is difficult to assess and highly dependent on the concepts of the assessor. And even bad assessment results don't predicate bad thinking skills. A person, who achieved good critical thinking results in a test, can be very uncritical in a non-test-situation and vice versa. A person, highly critical in one domain, shows up to be very uncritical in another and so on.

In contrast to other countries like the USA, the concept of `critical thinking´ in Germany is often not elaborated, reflected or operationalized by teachers, lecturers or politicians. In clarifying its meaning and actions, its criteria, its demanded mind-set and attitude, we get the chance to bring life to a rather abstract term. Then, critical thinking gets visible, touchable and, thus, better addressable. What do we mean, when we say `critical thinking´ and how can we foster it appropriately with respect to our resources and partners? What role can digital media play? Here we enter.

7.2 Critical Thinking: An Approximation to a familiar but vague Concept

The origins of a thinking-style like critical thinking are rooted way back in ancient times. For example, Plato's ever questioning, contradiction-arousing and truth-seeking character Socrates is considered as the ideal critical thinker nowadays. His style of open dialogue and questioning even became a model for certain classroom-discussions and questioning-methods (see for example Boghossian, 2004; Weil, 2004). Germany's middle class intellectuals refer `critical thinking´ often to more modern (and often German speaking) philosophers and scientists. For example, Emanuel Kant, Martin Heidegger, Hannah Arendt, Ludwig Wittgenstein, Karl Popper, Paul Feyerabend or Theodor Adorno thought in their very own, distinctive and brilliant way critically about various issues, subjects or phenomena like perception, enlightenment, the connection of speech and reality, thinking itself, the darker side of enlightenment. Thereby, as a side effect, they shaped and clarified, what critical

thinking could mean, what it should cover and intent, where it comes to an end, how it is done well and where it should lead to. Their work and concepts have become a reference for many disciplines and of course for the few German-speaking authors who deal with critical thinking in a pedagogical context (for example Kergel & Heidkamp, 2015; Petri, 2003; Dubs, 1992). In everyday life, critical thinking is often perceived as negative, pejorative, annoying and destructive. However, being critical has nothing to do with being negative or insulting. Originally, `critique´ is derived from the Greek verb *krinein*, meaning to differentiate, to separate, elect, select or decide. Critique refers to the art of reasoning, to differentiate assumptions from facts or to question interpretations (Wohlrapp, 2008, p. 213). Instead of being negative, critique encourages one to think independently and to arrive at one's own conclusions and insights.

In the US, where critical thinking is deeply imbedded in education on a national level, many authors from different fields have addressed it as a pedagogical concept ever since pragmatist philosopher and educator John Dewey published his book "How we think" in 1910, defining how pragmatist learning theory matters for epistemology and for pedagogy. He is often considered a founding father of critical thinking and its pedagogy as we know it today (see for example Garrison & Anderson 2003). Dewey was one of the first to come up with a process model of critical thought and a didactical concept to foster it, which modern pedagogy nowadays embraces. "Reflective thinking", his preferred term, is defined as "active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends" (Dewey, 1991, p. 6). It is about curious minds having their own, rich experiences, and deriving judgments by debating, observing, collecting and examining evidence. Systematically analyzing a problem, inductive and deductive reasoning, coming up with conclusions, testing them empirically, interpreting the results and other "rational" and epistemic activities are part of the thinking process. Reflective thinking aims both to authenticate existing knowledge and to generate new knowledge and thereby deepen the meaning of experiences (Garrison & Anderson, 2003, p. 56). Although Dewey has inspired many English-speaking authors in defining and setting up a pedagogy for critical thinking, there are still plenty of other influences and perspectives with their own accents available. Most of the approaches share a lot, like thinking-activities, thinking directions, methods, standards or criteria. But still some of them are idiosyncratic and vary in emphasis and focus areas, depending on the person who invented the definition and concept or the time and context, in which he or she lived (for a history of the critical thinking movement in the USA see Paul, 2003 or Resch, 2008). Let us have a look at older as well as more recent definitions on critical thinking:

- "As a root notion of critical thinking it is taken to be the correct assessing of statements" (Ennis, 1962, p. 83 cited in Resch, 2008, p. 32).
- "Critical Thinking is open rational dialogue among friends" (Schwarze & Lape, 2012, p. 3f.).
- "Critical Thinking is the use of those cognitive skills or strategies that increase the probability of a desirable outcome. It is used to describe thinking that is purposeful, reasoned and goal directed – the kind of thinking involved in solving problems, formulating inferences, calculating likelihoods, and making decisions" (Halpern, 2007, p. 6)
- "[Critical Reflection] is the process of unveiling the social, economic, and political dynamics of oppression, that are embedded in everyday situations and practices

> (…) Hence, in the radical tradition of adult education `critical reflection´ is fundamentally emancipatory since it involves social critique, addresses oppressive social structures, and results in a transformation of a comprehensive worldview and eventually in social change" (Schugurensky, 2002, p. 61).

Ennis, coming from a philosophical background, for example, stresses logical and reasonable thinking in his concept. Analyzing propositions, deducing, inductive reasoning, judging inferences – these are the activities to evaluate arguments and judge, whether they are true or flawed. This logic-oriented thinking (formal and informal logic, probabilistic logic etc.) has practical value, because it "is focused on what to believe or do" (Ennis, 2011, p. 1). Thinking about the formal correctness of arguments and judging them is also part of Schwarze and Lape's notion, but the professors of philosophy place critical thinking in a certain communicational context: `rational dialogue among friends´. In that dialogue, in a Socratic tradition, friends express their different viewpoints and perspectives on an issue and together they elaborate, clarify and enrich the most evident and convincing opinions and arguments. During that dialogue, some assertions might get refuted and abandoned, because they won't hold up to rational standards (see Ennis). Beside the element of rationality, the authors stress taking on different viewpoints in an open face-to-face communication situation, where the speakers feel confident. For Schwarze and Lape this kind of critical thinking is supportive for the life of the individual: Critical thinking helps people to live happier, more productive and even healthier lives (ibid., p. 3f.), because "critical thinkers tend to be more successful at meeting their goals" (ibid., p. 3). Halpern, professor of psychology, also interprets critical thinking as a resource for achieving different individual ends like solving problems, but she describes it as a specified bundle of cognitive and meta-cognitive-operations and strategies. Here, in a psychologist tradition, critical thinking is interpreted as a `process´ that can be divided into different `cognitive´ activities like analysis, evaluation, synthesis or self-regulation. By contrast, Schugurensky, professor for adult education, stresses not the process, but the purpose of critical thinking, which is dedicated to empowerment of the individual and transformation of society. In this Marxist tradition of Critical Theory, authors assume that not all individuals are free in so called `free´ societies (even if they may think they are), but many of them must face (hidden) oppression even in everyday situations. Critical thinking here questions the unquestioned and taken for granted practices, ideas, traditions and results of (capitalist consumer) society. To denote social injustice and try to break the shackles of (hidden) oppression is the focus of critical thinking. Hence, critical thinking in this tradition is certainly not a tool for a more prosperous, successful, happier and healthier life in general. More the opposite seems to hold true. Digging in the dirt for too long will take its toll, Nietzsche once recognized: "He who fights with monsters should look to it that he himself does not become a monster. And if you gaze long into an abyss, the abyss also gazes into you**"** (Nietzsche, 1999, p. 892). But maybe critical thinking in this version helps the individual to live a freer life, not being governed like that (Foucault, 1997, p. 44). Having said that the conceptualizations of critical thinking in general have very much in common, these five definitions from Dewey to Schugurensky show how diverse accentuations can be. The same holds true for terminology. Other terms (just to name a view) that describe aspects of critical thinking or can be used as synonyms are critical reflection (Mezirow, 1997), scientific thinking (Crowley, 2003), critical awareness (Johnson & Freedman, 2005), high-order thinking

(Williams, 2003), thinking socratically (Schwarz & Lape, 2000), reflective decision making (Truglio-Londrigan & Lewenson, n. d.) or complex critical thinking (Kincheloe, 2004).

These given definitions can be more or less categorized as belonging to certain `traditions´ of fostering critical thinking. With the described definitions, we have exemplified some of them. Jahn (2012) categorized them as *tradition of logics and epistemology* (see Dewey, Ennis, Schwarze and Lape), *cognitive psychology* (Halpern) and *critical pedagogy/critical theory* (Schugurensky). Again, these approaches share very much the same ground (logic, rationality), but differ in aspects like the purpose of critical thinking, assumptions about its capability (for example its epistemic limits), its effects on the individual, the used terminology, thinking-strategies and concepts and of course methods and guidelines in fostering critical thinking. In a synthesis, Jahn (2012) tried to bring the different styles of thinking, their approaches, concepts and criteria together on fertile plains for pedagogical purposes. It shows, that as a root notion, critical thinking engages in the identification, evaluation and appraisal of assumptions that underlie the ideas, beliefs, actions or values of different viewpoints, using different criteria and concepts (logic and epistemology; multiple perspectives; power relations; constructiveness). Other authors like Brookfield (1987) arrived at a similar categorization much earlier, inspiring Jahn in his work.

Assumptions are at the core of arguments. They can be considered as premises or propositions. However, to assume something means much more than drawing conclusions. Assumptions establish the singular and individual view on the world of a person. Weil defines them as "the beliefs we have – the ideas we have taken for granted – about ourselves, people, and the world around us" (Weil, 2004, p. 63). They are like windows, through which we look at reality. Assumptions shape our perception, our interpretation of reality, the actions we take (or omit), the feelings we have or the beliefs we stand for. Brookfield even goes further: "In many ways people are their assumptions. So much of what one thinks, says and does is based on assumptions of how the world should work, and what counts as appropriate, moral action within it" (Brookfield, 2003, p. 144). Other authors like Petri (2003) or Hamilton (2016) consider assumptions in relation to concepts from neuropsychology and neuroscience: So-called mental schemas (organized chunks of information linked with theory), derived from one's own experience or taken over from other sources, explain how certain aspects of reality are functioning or should function. These schemas also allow the thinker to predict. If the predictions work, the usefulness of the schema is reinforced and thus its validity for the person. Therefore, these dynamic schemas are the tools of constructing worldviews and grounds for actions of a person. In these tacit schemas, assumptions play a vital part as constitutions of worldviews, like axioms in theories.

There are different types of assumptions. Some of them are obvious to identify (explicit), others sometimes very hard to find (implicit; see mental schemas). Just to name some important examples (Browne & Keeley, 1986, p. 65ff.): *Descriptive assumptions* are beliefs or truths about (aspects of) the world, it's conditions and contexts, how things work etc. *Prescriptive or normative assumption* express, how aspects of the world or the world in general should be. *Definatory assumptions* depend on the individual's usage of language. They effect for example how certain issues are recognized and explained.

After this short excursus on assumptions, let's get back to synthesis of critical thinking. Jahn (2012) gives a short overview to four levels of critical thinking styles derived from the three discussed `traditions´ and exemplifies some specific thinking activities in these domains. Concerning and scrutinizing assumptions are essential in this concept. Please note that these

activities are related and depend on each other. For a more detailed description see Jahn (2012; 2015).

Table 7.1: Four levels of critical thinking (own Figure).

Four Levels of Critical Thinking			
Analysis and evaluation (logic & empirical evidence)	*Perspectives and ambiguity*	*Power relations and negative effects*	*Constructiveness*
Identifying explicit and implicit assumption in ways of thinking. Analyzing these assumptions on a logical and empirical level. Judging the accuracy and validity of given arguments and given pieces of evidence. Evaluating (own) derived conclusions and the hereby used criteria and standards of critical thinking with respect to the boundaries of knowing (e. g. the epistemic limits of logics and/or empirical evidence).	Extension of perspectives: trying to find alternating viewpoints on the issue, permeating them even if they may sound exotic or unsettling: walk in someone else's shoes. Looking out for inconsistencies or contradictions in and between these perspectives and elaborate them. Explicating your own view, your assumptions and standards in thinking.	Scrutinizing the found assumption with respect to power and negative consequences. Recognizing open or concealed power relations and elaborating them. Find out for example, if persons or other living beings are marginalized, objectified, manipulated, oppressed or in other ways bereaved from their liberty or expelled from their scope. Who or what is the oppressor and why? What kind of circumstances, thoughts or practices don't allow a free development?	Looking out for ways to check unchecked assumptions. Establishing ideas and specific plans to tackle the recognized problems Implementing the ideas and plans into everyday conduct (= walk the talk).
Interconnection of activities			

Critical thinking always draws on an issue that seems relevant, astonishing or even threatening for the thinker, an observation, a given argument, something somebody said, sang, preached or taught, a feeling of bewilderment, a slogan in the media, something seen in a movie or experienced in the streets and in everyday job routines. Critical thinking can refer to all kind of things. The neighbor's chit chat, the doctor's diagnosis, the outcomes of a study, the slogan of a commercial, the conclusions of the latest news report, a posting on Facebook, an instruction from the boss, the university teacher or the new girlfriend. In every case, critical thinking raises doubting and skeptical questions on the validity and the intentions related to the given source. Therefore, the thinker needs detachment from his experience in the form of contemplation. Reflection in solitude helps to cool down, suspend premature judgment, sort feelings out, clear presuppositions or think thoroughly about claims. Analyzing and evaluating

the logic of arguments and (empirical) evidence are the main activities of critical thinking. Are the statements correct? Do these conclusions really derive from the premises? Is there empirical evidence for this assumption and how was it gained? What kind of evidence is it? Does it really support the assumption? Raising these kind of questions leads to taking on different perspectives, exploring different and ambiguous paths to explain an issue, even if they might seem odd or exotic. Critical thinking questions statements of absolute truth: `A person/the brain/a tree/learning/x is nothing more than…´ Truth can be related to different forms, approaches and criteria. In science for example, a subject matter can be explained with diverse and even conflicting theories, notions, terminology or methodology. Yet within a tradition, let's say educational science, this subject matter (for example: what is human learning?) is considered diversely, using different theories and epistemic assumptions. Even facts spring from a context of justification and can be interpreted differently, depending on the person's viewpoint. The glass is half-full or half-empty. See the difference. The same holds true for the subject matter in this text, "critical thinking" itself. Therefore, thinking critically rests upon itself, scrutinizing its own criteria, theory, epistemic assumptions, truth claims or conclusions.

But critical thinking is more than a vehicle of veracity. It is not neutral. It is committed to reduce suffering, deprivation, alienation, exploitation and suppression, strengthening liberty and integrity. Critical thinking is committed to the protection of life and dignified living. For this difficult task, it must question power relations, envision negative consequences of actions and look out for constructive ways in dealing with social wrongs, threats or contexts of delusion. This also means thinking about negative side effects of consumption, capitalism or technology; for the individual, for society or nature. Critical thinking is concerned with respecting and upholding the dignity of living beings. This lifelong task requires the balancing of one's own interests with those of other beings: A famous quotation from Albert Schweitzer expresses both the insight and the dualism of that endeavor: "I am life that wants to live, in the midst of life that wants to live" (Schweitzer, 1963, p. 30). Hence, critical thinking is very much about considering the (possible) consequences of actions, words and thoughts in complex and interdependent contexts.[9] It demands for social interaction, not only to get in touch with the world and enrich one's own knowledge and experience, but also to look out for solutions and strategies to reduce distress, suppression and hardships.

To sum it up, critical thinking according to Jahn (2012) is an analytical, emancipatory, transformative, ecological and constructive thinking style, in which multiple viewpoints and their underlying assumptions on an issue are identified and evaluated in order to judge, decide and take actions more deliberately and independently. This investigative process of gaining insights, expanding perspective and changing conduct unfolds in turns of social interaction (experiencing and encountering reality to examine its diverse qualities) and reflection in solitude – to gain distance and digest experience. In the latter, critical thinking, its underlying assumptions, concepts and its outcomes are questioned. For example: Are the stated assumptions on the concept of assumptions and schemata accurate? Is this constructivist theory of making meaning adequate to describe human thought and behavior? Does my criticism of ideology spring from an ideological viewpoint itself? Do these logical conclusions

[9] For example: What kind of exploitative and oppressive systems do I support and how much suffering do I accept, when I buy mass-"manufactured" meat, fish, milk, clothes, technology or soya at the discounter? What kind of external effects and threats do I oppose on my environment, when I ride my big, gasoline-thirsty car, let's say my S.U.V?

really correspond with the evidence of the real world? These kinds of questions could be labelled `critical meta-cognition´. Critical thinking, conceived in this view, is not recommended to those who search for enlightenment or the best arguments and strategies to succeed. It produces many more questions than it can answer. It does not guarantee `better´ (more successful) decision-making or problem solving. It discovers more problems than it can solve. To think critically requires a lot of energy, rigidity, keenness, defiance and resilience with sometimes little reward in terms of utility and success. It can have negative effects on the thinker, his or her relationships, career or emotional security (Brookfield, 2003). Yet it is vital for a more self-determined, ethical and contemplative life.

7.3 How to Foster Critical Thinking. Theoretical and practical Implications

7.3.1 What works best: the controversial Discussion on Critical Thinking Instruction

Critical thinking is a western style of thinking, founded on the concept of rationality. It has a long tradition of different educational approaches. In some environments like higher education for example, logical and analytical thinking activities are highly embraced, requested and fostered. “If there is one thing that all college and university teachers want their students to learn, it is to think critically“, Buskist and Irons notice (2008, p. 49). Nevertheless, the answers to the question of how to foster critical thinking and which approaches work best is as diverse as the different concepts of critical thinking. Depending on the aspects of critical thinking, its definition, the intended learning-outcomes, the audience and context, different instructional strategies are discussed. The debate on the best instructional strategies is still in progress, although many studies and even some meta-analysis have been conducted (for example see Abrami, Bernard, Borokhovski, Wade, Surkes, Tamim & Zhang, 2008). Furthermore, integrating digital media in instructional designs that aim at fostering CT, have become a new, promising and wide field of research.

To compare endeavors of fostering critical thinking in educational contexts, some authors introduced categories to label these. Ennis (1989) was one of the first, who came up with a concept of differentiation. He introduced a grid for instructional approaches, often referred to by other authors (see e.g. McKown, 1997). The *infusion approach* describes all efforts of inserting critical thinking directly within subject-matter instruction. The concepts of critical thinking thereby are made explicit in relation to subject matter content and become tools for better understanding and deep learning. While using them, students achieve certain subject-matter-related-learning outcomes. The *immersion approach* is quite like infusion, but in this instructional mode the concepts or strategies of critical thinking are not made explicit, so the lecturer won’t talk about deduction, inferences or criticism of ideology and so on. But the instructional designs are arranged in a way, that it will provoke certain intended cognitive activities in critical thinking. Students, for example, think deeply about advertisement after analyzing a manipulative TV-spot. Then, in a roleplay they discuss different perspectives on advertisement, its purpose, strategies and effects. The CT-terminology is not used, but students are nudged to think critically by the chosen media, the instructional tasks, and prompts. In the *general approach*, fostering critical thinking is not combined with subject matter instruction. It is separately taught as a subject in an autonomous course or module. All

the theory and concepts of critical thinking are made explicit, using different kind of examples, which don't have to refer to subject content. Often critical thinking is demonstrated and exercised with non-subject-related-content. In the *mixed approach*, the general and either the infusion or the immersion approach is combined in different formats (for example an extra module in critical thinking (general approach) linked with normal class instruction in seminars etc.).

In these different and controversial approaches, several assumptions are made concerning the nature of critical thinking. Proponents of the general approach for example believe, that critical thinking is a generic skill. Context does not matter much. Once the thinking skills are acquired in one domain, the thinker can transfer and apply them in a different domain. In contradiction to that assumption, advocates of the infusion approach belief the opposite: Critical thinking skills are highly dependent on context and content and cannot be transferred lightly. Moreover, apologists of the immersion approach assume that knowing terminology and concepts of critical thinking is not very important for conducting critical thinking. You do not have to know the laws of gravities and force when you learn bicycling. In contrast, promoters of the infusion approach emphasize the conceptualization of critical thinking as a very important requirement for learning deep critical thinking. Understanding concepts and terminology in this view just enables and sharpens critical thinking.

The four approaches are either backed or disputed by popular authors in the field (for an elaboration see McKown, 1997). The debate is led with strong arguments for each approach, but often without broader empirical evidence. Some studies and meta-analysis have pointed out that the general approach leads only to modest results (Van Gelder, 2000; Abrami et al., 2008). This could be an indicator that critical thinking is rather a specific domain related skill and not generic, applicable to all kinds of contexts. On one hand, there is some convincing empirical evidence available, that the infusion approach is an effective instrument to foster critical thinking skills (Swartz, 2003). On the other hand, there are studies that suggest that a strong focus on thinking concepts and strategies could be detrimental for the agility of thinking, resulting in poor thinking achievements (Prawat, 1990). Then, critical thinking becomes a rigid routine. The concepts and strategies could hinder free thought, like an emphasis on grammar can impair free speech in a foreign language, some authors argue. Abrami et al. revealed that the immersion approach also showed only modest positive effects. It turned out to be least effective. But other authors like Warren, Memory and Boldinger (2004) concluded differently in their research: "The immersion approach is a more effective vehicle for developing students' higher-level critical thinking abilities than approaches that stress specific skills or operations without attention to knowledge and attitudes" (Warren, Memory & Boldinger, 2004, p. 209).

For a practitioner, these kinds of comparisons and rankings are unrewarding and bland, because they are too abstract and unspecific. What seems to matter is not so much the chosen approach, but how an instruction is carried out in detail in a certain context. The problem is: What works for one singular group in one unique context and in one irreversible point in time can fail with another, even similar group in a similar context. The underlying definition of critical thinking, the intended learning outcomes, the audience and the teacher as persons, the occurred interactions, the different methods of instruction and assessment used – these and many more terms make every educational enterprise unparalleled, complex and open. So rather than asking what works best, we should ask what works where, when, how, with whom

and why? This perspective is more about the specific design principles in relation with the different constraints and conditions of a context (see Jahn, 2012; 2014).

7.3.2 The Process of Critical Thinking: Food for Thought when developing Instructional Strategies

Jahn (2012) suggests that for every specific context an individual solution should be developed and refined through educational experience. It is very important to have a clear, tangible and context-aware concept of CT in mind, from which concrete intended learning outcomes, instructional approaches or assessment-strategies, can be derived. For this, it is helpful to elaborate the aimed thinking activities as processes of actions. From there, the teacher can develop appropriate instructional strategies. As an inspiration for educational purposes, established models of critical thinking process can be very helpful (e. g. see models of Brookfield, 1987; Wolcott, Lynch & Huber, 1998; Ennis, 1989; Halonen, 2008; Jahn, 2012). A prominent and useful model by Garrison and Anderson (2003) refers to Dewey's concept of reflective thinking. In this model, the focus is on experience and what springs from it: perception, deliberation, conception and action, carried out in two "worlds"; the private world of reflection and the shared world of discourse.

In the practical inquiry model, the process of critical thinking starts with a cognitive or emotional dissonance/disequilibrium of the thinker, a **triggering event** in the `shared world´. Something (an experience) seems odd, ambiguous, inconsistent, perplexing, puzzling, overwhelming or unsettling and demands for further thought. Why is that so? Is that correct? How can this be explained? Why me? Questions like these may come to mind. Thinking becomes more skeptical. Although many models imply negative experience as inducement for critical thinking, Brookfield (1987) states that positive, affirming triggers like fascination or being amazed also can commence the thought process. The philosopher Karl Jaspers points out three origins as occasions for critical thinking: Wonder, doubt and experiencing boundary situations (Jaspers, 1992, p. 16ff.): Wonder leaves the individual amazed and astonished. Something seems so peculiar, fascinating and incredible at first sight that it demands for further attention. Through wondering, the individual becomes aware of his or her lack of knowledge to explain – a lack, he or she wants to overcome. Hence, wonder can be a positive trigger, speaking in psychological terms. When claims are challenged and the opposite is claimed, doubt, despite wonder, prompts the individual to question his dearly held assumptions and beliefs. Once trusted knowledge seems to disintegrate and decay. Certainties suddenly turn out to be uncertain. Only raising skeptical questions may bring back new grounds of trustful knowledge. The most powerful impact on the individual and his or her thinking, however, arises from situations, that challenge existence. Jasper calls them "boundary situations". The loss of a love, a letter of dismissal, a tragic accident, the diagnosis of a serious disease. In situations like these we can't control, suddenly we witness our own weakness, vulnerability, fallibility, finiteness or dependency on others. The unsettling experience is breaking up our thinking. Essential questions about the world and life, often avoided in daily routines, are now addressed seriously and with a new quality.

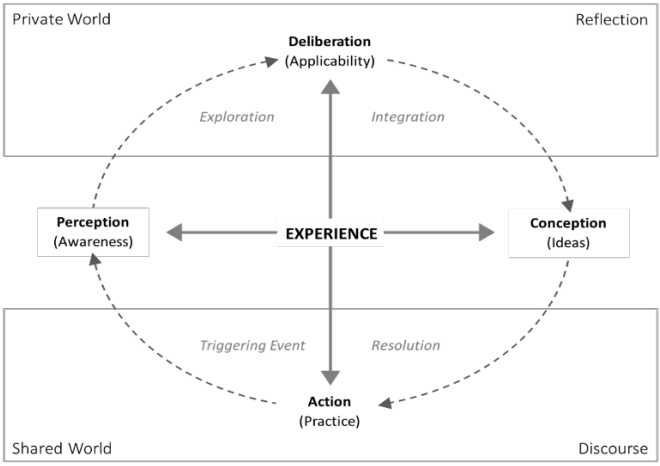

Figure 7.1: Practical inquiry model (Garrison & Anderson, 2003, p. 59).

In the **exploration phase**, an evaluation of the situation follows the trigger. Understanding the nature of the problem, searching for relevant information and meaning, looking for different viewpoints or finding possible explanations are characteristic for this phase (Brookfield, 1987; Garrison & Anderson, 2003; Jahn, 2012). This phase is marked by a several shifts from reflection to social interaction and vice versa. Brainstorming, talking to and negotiating with certain people, reading certain books or articles, watching certain videos, writing down different arguments, making notes, checking and testing sources. Activities like these define exploration.

The **integration phase** is characterized by delivering judgments, developing solutions or makings decisions. Brookfield describes it as follows: "Having decided on the worth, accuracy, and validity of new ways of thinking or living, we begin to find ways to integrate these into the fabric of our lives" (Brookfield, 1987, p. 27). This phase is all about constructing an own and sound perspective and derive plans to deal with the gained insights. This could also include developing reasonable solutions to address recognized problems.

The **fourth phase** describes "*the **resolution** of the dilemma or problem"* (Garrison & Anderson, 2003, p. 60). Now the new and discussed ways of thinking or acting and the plans for solving a problem are carried out and tested. Actions speaks louder than worlds. Reality is responding. Assumptions now can be confirmed, new ways of thinking or acting can turn out to be successful or at least acceptable. Often, however, new ways of thinking and acting are challenged by the environment (because the individual shows divergent behavior). Then, new triggers for critical thinking might take place. During the process, the individual moves from awareness of experience to the development of ideas, from reflection to action, from the inner realms of deliberation to the shared world of discourse. New experiences start off a new cycle of critical thinking.

Models like these are often criticized (in detail see Jahn, 2012): too simple, too abstract and artificial, too idealistic, too linear or static, not sufficiently grounded in context and experience, too much dedicated to problem-solving. Many of the underlying assumptions that

guided the development of the models can be criticized. But aside from these objections, process models can give pragmatic insights for educational purposes. A model with different phases and delineated actions can be helpful to find the specific educational strategies that "fit". Models prompt specific questions on the nature of critical thinking, how to foster conditions and activities that are important in every step or phase. For a pedagogical professional, it is important to use an own model for their field and context, from which concrete instructional strategies can be legitimated, explained and developed. Many authors from different educational domains have contributed with their own models and concrete educational guidelines. These models and guidelines are fruitful to develop own approaches on fostering CT, because they address a certain professional practice. They give hints, how it could be done, for whom, when, where and why. After all, critical thinking remains an abstract concept every educator must bring to life in his or her context for himself or herself.

7.3.3 Critical Thinking Instruction: Preliminaries, Requirements and Guidelines

In the following we will discuss important guidelines for CT-instruction in accordance with the presented model. A comprehensive synthesis can be found in Jahn (2012). In books, articles or videos many experts talk about appropriate triggers or the most effective methods. Though before even a single method is applied, critical thinking first needs the right climate and setting to unfold (Garrison & Archer, 2003; Brookfield, 1987). In the practical inquiry model, the critical thinker operates under ideal conditions (e. g. the skills and the attitude of the thinker, certain circumstances in the shared and private world). In daily routines of everyday life however, the given conditions often are detrimental for critical thought. For example, as mentioned before, somebody being critical often is perceived as a wet blanket and avoided by others.

Remember one of the discussed CT-definitions: Schwarze and Lape wrote that "*Critical Thinking is open rational dialogue among friends*" (Schwarze & Lape, 2012, p. 3f.). In this definition, essential characteristics and preliminaries for fostering critical thinking can be found. First, it has to be `open´ rational dialogue, which means that not only students should be open to new experiences or worldviews, but also the teacher. He or she is not a sage without fail, even if recognized as a brilliant expert in a specific domain. The teacher needs a modest attitude like that one of caring older brother or sister: Of course, some years of experience and learning in advance, but still fallible, still searching for accurate answers to questions, still in awe of the great unknown and mysteries of life. Students can learn a lot from teachers, but in `open´ dialogues teachers also become students of their students, for example when they present innovative and challenging perspectives or conclusions on an issue. `Open´ means that the outcome of the dialogue is not defined by the teacher, but by arguments. To be `open´ also requires the consideration of exotic, strange, outdated or even stirring viewpoints. It also means to struggle for the right words, explanations and actions, to misdo in this struggle or to explore deviant positions, which might bring the speaker in trouble (e.g. by challenging the arguments of other students or the teacher). `Open rational dialogue´ needs challenging viewpoints, making errors and learning from them. `Among friends´[10], to

[10] Friends can be a driving force for critical thinking. However, sometimes they share a similar worldview and style of thinking or they do not want to burden friendship with bald and contradicting facts. Then, open

say what somebody truly believes is not a problem, even if a position may sound quirky, irritating, offensive or is badly expressed. It does not matter: Friends are most of the time tolerant and appreciative. In front of friends to make a fool of oneself can even be funny. Friends deal with that. Fellow students and teachers might not. In the worst case, they impose sanctions on `the fool´. Students fear these possible bad outcomes. Carrier-wise, it is better to be focused on good marks, graduation and `useful´ social networks. That means: Be a good boy or a good girl. Do not make or say something wrong or stupid.

It is up to the teachers, to create an atmosphere where students do not have to fear the consequences of bad marks and spoiled reputations when they say something odd or false. Critical thinking needs a climate where arguments are not taken (that) personally and everybody is invited to make mistakes. How can this be achieved?[11] First of all, teachers do not have to become `friends´ with students, but they should explain to them, what kind of mode is needed for `open rational dialogue´. Teachers can tell them to refrain from strategical behavior and ease their worries. They can assure, that students don't have to fear negative consequences. Invite them to make mistakes or take on challenging perspectives. Develop and establish a policy for open rational dialogue together with the students. Show them that you are fallible too. Encounter your students at eye level, as a caring older brother or sister. Try to give them self-esteem through compliments, humor and appreciation. These are not only principles to build a setting atone to critical thinking in class but also online, when students meet virtually, for example in learning management platforms. Questions should be taken seriously and answered within two working days. Netiquettes and an instructed moderator help to manage discussions in message boards or chats.

Having installed the right climate for `open rational dialogue´, now the afford lies on enabling the requested experience to `trigger´ critical thinking (phase 1). But the thought provoking experiences in the intertwined worlds of reflection and discourse are sometimes not given at hand, especially in educational contexts. Fully elaborated but dull PowerPoint-Presentations recited by soliloquizing experts in grey rooms often spoil the students thinking activities. *Why thinking an issue thoroughly through myself, why thinking about my thinking when an expert tells me all the answers and facts he or she is going to test later in the exam?* This kind of experience may not lead to own cycles of critical thinking. Creating situations that enable wonder, doubt or experiencing boundaries is a difficult task. It all depends on the students' worldviews, their knowledge, attitude and their experiences so far. First, the new experience they are going to face must be in some way relevant for them. Students should recognize their part in the matter and the significance of that experience or issue for them. Furthermore, it must be brought to them in a style which they can build upon. Second, it has to be challenging for them, an invitation to withdraw from the comfort zone of knowing and thinking. This can be achieved for example by an ambiguous and complex problem or dilemma that the students must address. It can be material that leads thinking or feeling (or both) into contradictions, wonder or doubt. It can be a `mediated´ experience (as if), where students are confronted or challenged with perplexing sources, statements or observations, but without

rational dialogue is stuck. Sometimes it needs an outsider, a fool or even an adversary to challenge professional blinkers.

[11] With different strategies and activities, teachers can work on a climate for "open dialogue among friends", but they cannot guarantee it. The same hold true for the process of critical thinking. Teachers can invite to think critically, they can show how it's done, they can provide plenty of opportunities for exercise, but in the end, it is the individual who decides how to think.

having real experience beyond the classroom. Mediated fragments and even fictional fragments of the outer world are brought into the classroom for consideration. Outer realities are simulated which involve taking on different roles and perspectives. Nevertheless, challenging realities beyond the classroom can also be directly brought into educational settings, for example by using authentic sources, witnesses, cases, places, experiments and so on. Although there are so many ways to `trigger´ critical thinking, it is very difficult to find the right, balanced triggers, because students differ rigorously in interpreting an experience. The Jamaican proverb `What is joke to you, is death to me´ articulates the individual perception of experience.

Having found adequate situations and questions that lead to experiences triggering critical thinking, the students then need plenty as well as rich opportunities to explore the experience and its underlying issues from different viewpoints (phase 2, exploration) and develop solutions, judgments, explanations etc. (phase 3, integration). This demands rich and open learning environments and forums that provide the students with different viewpoints and information, leaving space and time for reflection and further dialogue. Different formats of interaction and discussions for example can help to identify different viewpoints, collect and broaden ideas, refute assumptions and so on (Brookfield & Preskill, 2005). Socratic questioning, problematical and dialectical discussions, buzz groups, role plays, debate clubs, devil's advocate strategy, questioning the author – there are so many opportunities to shape critical discussions, although it can be a rather difficult task to bring the critical spirit into discussions. Writing as the hard copy of thinking, on the contrary, can be very useful to sound out and reflect experience, identify and evaluate assumptions, develop an own and balanced view or look for plans of action. There are plenty of methods and strategies available to foster critical thought in written exercises (for detail see Meyers, 1986; Swartz, 2003). To process critical thought and refine points of view, phases of reflection and social interaction must be geared to each other. Various methods and instructional designs like think-pair-share (Petri, 2003) can be useful for this purpose. However, the teacher is not only stipulated as a mere designer of learning environments or media, formats and methods or setting-policies. His or her job as facilitator is also to make activities of critical thinking visible. This means to model critical thinking in multiple ways, for example to introduce helpful concepts and strategies, show good and rather poor arguments or demonstrate flaws in thinking. Furthermore, the teacher must continually evaluate the group process in the "shared world of dialogue" and individual thinking activities in the realm of reflection to come up with the adequate feedback on individual or group-level. Sometimes dialogues falter or turn out to be superficial, because the participants share the same views or lack important knowledge. Then, it is the teacher's role to bring in challenging perspectives and contra-inductions. Sometimes students have problems with understanding and/or applying new thinking concepts or strategies. Then, the teacher must give feedback, model and help to exercise thinking in that style. Other times students may struggle to overcome old views and jettison them, even if their positions were clearly refuted. Depending on the experience, sometimes individuals are rattled, because their worldview is turned upside down and they have not yet found the right approach to deal with the new perspective. Then, the teacher should provide for solid ground and help the student to find ways to cope with that hesitancy by showing empathy, affirmation and coaching. Like seismographs, teachers must record what is going on, prevent from too strong

eruption or instill convulsions if needed. In addition, teachers should cater for a good laugh. Critical thinking is demanding and sometimes burdensome, but a certain sense of lightness and humor can help to overcome severity.

The phases of exploration and integration end when a certain degree of saturation and elaboration of clear ideas, perspectives, approaches or solutions is achieved. When entering the phase of resolution, the students get the opportunity to test their insights and new ways of thinking. In traditional educational contexts, let's say in big classrooms and slots of 90 minutes, it can be difficult to directly test or apply solutions or to defend a concept or position. Formal educational contexts often cannot compare with those experiences `real life´ has to offer. This is one of the main reasons why the phase of resolution is often neglected and hardly accomplished in formal educational settings (Garrison & Anderson, 2003, p. 62). Nevertheless, even in restrictive environments teachers can find ways to create experiences that allow authentic `trial and error´ and feedback from the real world. If thinking and acting cannot be applied or tested under `real´ conditions, vicarious actions can be helpful: Roleplays, thinking experiments, simulations or games provide good opportunities for engaging assessment and response (Jahn, 2012). For example: Working with case studies, teachers can show how `real´ persons in `real´ settings thought and acted and how it turned out in comparison. But not all testing and applying is restricted to simulation and quasi-experiences. Response to new ways of thinking can also be gained from actions in the "real world", for example when students leave the classroom and conduct research in the field (Kergel & Heidkamp, 2015), work in projects (Kaliva, 2016) or render a service for society (Jahn, Mayrberger, Meyer & Stitz, 2012). Sophisticated forms like research-based-learning, problem-based learning or service learning demand for special educational settings and designs, which differ from `traditional´-lectures drastically. However, with these rather challenging formats, full and intense cycles of critical thinking can be initiated and traversed. In these settings, students can undergo meaningful and sustainable experiences that have the power to broaden their perspective, break up misconceptions and even change their worldview (Hamilton, 2016). These approaches itself don't guarantee sure-fire success in fostering critical thinking. A lot depends on how the experience is designed, structured, moderated and accompanied by the teacher. Action and experience from the shared world must be followed by reflection and discourse to make it meaningful and broaden it, for example. New cycles of critical thinking must be initiated and guided. The teacher as a designer of experience and facilitator of thinking always has to think critically about the process on an individual and group level. In which phase is the group/the individual now? How can I make their thinking visible? Is the experience conducive for critical thinking? What must be done to deepen reflection or dialogue? What are the assumptions of the students? How can I help them to think differently and challenge their assumptions? Questions like these must be addressed continually during all phases of the process and teachers must come up with adequate strategies and actions. Depending on the chosen format, the context, the intended learning outcomes, the group of students, the teachers as a person and the current process, answers can vary considerably. Whatever a good answer may be, it should be built on rich evidence gained from the hints and traces where students thinking becomes tangible: For example, discussions, written reflections, observations or products of the course can reveal where the students are at. The assessment of the critical thinking process is crucial for creating effective learning arrangements.

7.4 Critical Thinking and Digital Media in Higher Education

7.4.1 Thinking Critically about Media

Why should we think critically about media? Digitalization seems to make our lives so comfortable. We won't get lost anymore thanks to Google Maps, we are able to find nearly every unthinkable piece of information online in databases or communicate anywhere anytime with others thanks to WhatsApp, Skype and Facebook. Digital media expands our ability to perceive, think, make decisions or shape our world to an extent that would be impossible without media. "The medium is the massage" – so Marshall McLuhan (2005).[12] He was one of the first scientists who asked the question about the impact of mass media on society and criticized its lulling effect. Media comforts and touches us, it enlarges our world, our abilities and forms us. McLuhan defines media as an extension of the human body. In his theory search engines are for instance an extension of peoples' brains. The consequence is the amenity of having a library, a map or a virtual diary in our pockets. On the other hand, inertia, sluggishness and superficial knowledge might be an effect. (Digital) Media seems to numb or weaken certain human capacities and skills. In a way, we become dependent on the comforts and services digital technology is providing.

Besides McLuhan, pedagogues, teachers or parents have often been skeptical when it came to media usage. Since mass media was established in the 18-19th century, first books, then movies and later TV, video games or the internet have been criticized. Especially in the early 20th century, critics believed that people needed to be guarded and kept away from written adventures or fantastic worlds in texts or on screens (Süss, Lampert & Wijnen, 2013). Even today, parents and teachers are worried about the consequences of being faced with violence, pornography or radicalism in (digital) media. Authors like Ball describe young people as "slaves of uninterrupted availability" (Ball, 2014, p. 66) – he and Markowetz (2015), for instance, criticize the dependency on mobile devices and the need for checking messages or being available. Furthermore, Manfred Spitzer, a much-noticed German neuroscientist, published books with titles like "Digital dementia" (2012) or "Cybersickness" (2015), focusing on the noxious effects – for example bluntness or the lack of concentration – that digital media can cause.

We don't want to deny these effects. Nevertheless, we want to reconsider that a total refuse of digital media is not an option in our opinion. In Germany, the media affinity and media usage of university students is high (Zawacki-Richter, Hohlfeld & Müskens, 2014). Not only private communication and fun activities but also schools, universities, employers or authorities request (more or less) experienced computer skills. Students need to do research for their assignment by checking online databases, written tests become e-exams in a learning management system, more and more job offers ask for programming skills and applications or forms that have to be filled out online. Adolescents organize themselves with apps, communicate via social media with friends and family all over the world and thanks to mobile internet and smartphones they are continuously online. Teachers must deal with learners that want and have to use digital media. Moreover, the NMC Horizon Report estimates that

[12] The book title `The media is the massage´ was actually a mistake of the typesetter, who had confused `e´ and `a´ at a new edition of `The media is the message´. When he saw the pressure flags, he was thrilled. The new title pointed out exactly what McLuhan wanted to say (Leusch, 2011).

students do not possess high competences of digital literacy. In fact, they list digital literacy as a "significant challenge" in higher education which still has to be solved (Johnson, Adams, Cummins, Estrada, Freeman & Hall, 2016, p. 24f.). Therefore, the question is how we get students to think critically *about* media and how to *use* digital media to accompany the processes of critical thinking. Both aspects – to analyze and criticize media and its handling (for example knowing how to write a blog post) – are basically central aspects of media literacy (Baacke, 1997) and shall be discussed.

Digital literacy in general and critical thinking about media specifically are significant for almost every discipline in higher education – even if they're not embedded in many curriculums (Rott, 2014). As social media or web applications are part of the students' lifeworld, it is easy to get young people interested in the subject. However, not only the NMC Horizon Report 2016 but also our experience shows that students primarily use digital media and communication tools like Facebook, Instagram and Snapchat, web tools like Dropbox or Google, shop online or watch a movie via Netflix. However, "digital literacy is not a checklist of specific technical skills, but rather the development of critical thinking and reflection in carious social and cultural contexts" (Johnson et al., 2016, p. 24). What's Facebook doing with our data and with us, how come an iPhone is so expensive but workers in China are demonstrating for better working conditions and pay rises, what will happen, if – as the industry 4.0 propagates – all our domestic appliances get internet connections? Students, of course may have heard or thought about several of these questions before. Nevertheless, in our classes generally the minority of the participants reflected profoundly about questions like these. If improving digital literacy is a challenge higher education wants to accept, teachers must trigger issues on how the virtual world influenced our digital routine.

As already mentioned, connecting factors to critical thinking about digital media could be part of almost every study program: Cyber mobbing might be an interesting topic not just for law but also for pedagogy students. Soon-to-be psychologists or sociologists might like to discuss how online dating platforms like OkCupid and Tinder change the dating process and the expectations people have in future-partners today. Viral marketing and product placement via Instagram are interesting topics in economy or linguistics classes. Artificial intelligence and its ethical aspects – for example when robots are used in health care – should be discussed not only by computer science or medical students but also in philosophy classes. These examples demonstrate that critical thinking about digital media is often a cross-cutting issue.

7.4.3 How to Foster Critical Thinking using Digital Media

Digital media cannot only be the subject of a course, which intends to foster critical thinking. Digital media or learning management platforms itself can support the CT process – apart from the field of study. Since the 1990s the key technologies for digital learning environments have enhanced, from multimedia and computed based trainings to web based trainings and virtual classrooms. Since 2000 to 2005, web 2.0 tools and collaborative learning became central. Nowadays mobile learning on smartphones or tablets and MOOCs are common and discussed in university teaching (Röthler & Schön, 2017). How can digital media explicitly support the process of critical thinking and why should teachers consider implementing it in their classes? Authors and university teachers like Jahn (2012), Saadé, Morin and Thomas (2012), Brandon (2013) or Gharib, Zolfaghari, Mojtahedzadeh, Mohammadi and Gharib (2016) have implemented digital media successfully in different environments and disciplines like

economic education, computing courses or medical sciences. Saadé et al. (2012) resume, for example, that for "today's students, an interactive environment is very important for their learning. It seems that today's websites such as those of social media that are highly interconnected and interactive are the primary educational behavior agents to our university students" (ibid., 2012, p. 9). Gharib et al. accentuate that "critical thinking skills of virtual learners will depend upon their ability to work independently and deal with educational materials with minimal intervention of the instructor" (ibid., 2012, p. 277). Effective digital tools that support the CT process are according to Jahn (2012, pp. 178ff.)

- Logic software that helps learners to develop arguments based on logical criteria.
- Videos that evoke critical thinking.
- Web-based-trainings and simulations to expand critical thinking e.g. in an online story-setting.
- Discussion boards where students can debate asynchronously online.
- Virtual classroom where learners "meet" live online and communicate directly via (video) chat.
- Weblogs and e-portfolios where students write a (private) research/reflection diary, collect and share interesting links or websites.
- Web-quests where learners find independently online information to a "real" issue or topic.

Jahn (2012) summarizes recent research results on these web tools. They can be helpful to improve different aspects of critical thinking, for example to sharpen thoughts through writing and documenting ideas in a blog. Nevertheless, a teacher as an instructor and role model is required when critical thinking is directed (Jahn, 2012, p. 191). Tools follow the didactical design and so, when it comes up to conceive an educational concept, teachers have to analyze carefully based on their framework conditions which technologies can further be used to achieve their learning outcomes.

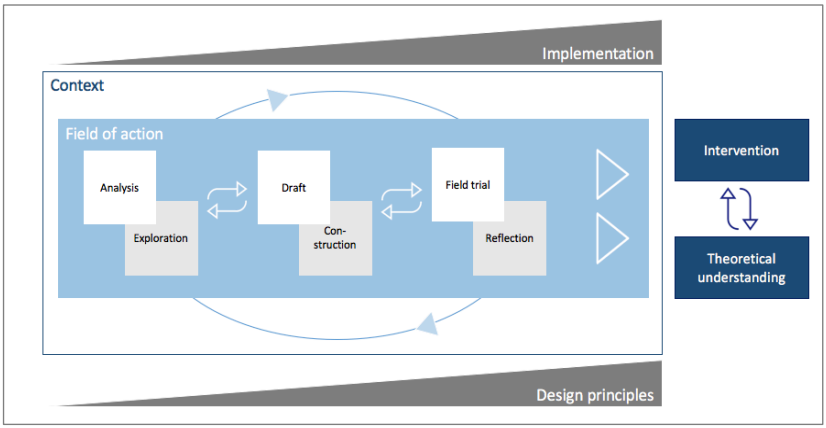

Figure 7.2: DBR cycle (own graphic referring to McKenney & Reeves, 2012; Reinmann, 2014).

Creating a new concept or a curriculum for university classes has much in common with research. Not research in the sense of foundational research, where outcomes should submit evidence-based, universal statements. We understand research in a pedagogical context as solving a didactical problem in a specific context. This may be, for instance, how to get students of computer science thinking more critically about the risks of digitalization (personal problems like hacking, social problems like the change of the labor market e.g.). Design-based research (DBR) "is a methodology designed by and for educators that seeks to increase the impact, transfer, and translation of education research into improved practice. In addition, it stresses the need for theory building and the development of design principles that guide, inform, and improve both practice and research in educational contexts" (Anderson & Shattuck, 2012, p. 16). Central aspects of DBR are doing research in real education contexts, the focus on the creating and designing process of an intervention and its testing in the field. After several iterations and reworks, the design principles (how to foster critical thinking) for a specific educational context become clearer, the quality of the intervention is optimized and the theoretical understanding has formed (for example: What's the meaning of critical thinking in my field work? How should it be fostered?). DBR interventions use in general, multiple methodologies and do not go strictly by quantitative or qualitative methods (Collins, Joseph & Bielaczyc, 2004; Reeves, 2006; Plomp, 2010; Anderson & Shattuck, 2012; Jahn, 2014). Figure 7.2 demonstrates a typical DBR cycle:

Creating a teaching concept/intervention (not only but especially for critical thinking) has much in common with research: How can I ensure my students reach the learning outcomes? Which methods and topics are useful for discussions? Will my concept also work in another context, for example with students of another faculty or in an interdisciplinary course? The DBR cycle may help in the implementing, testing and improving of a curriculum. In the following, we will quickly demonstrate the most important steps:

I. Analysis and exploration: Different contexts require a different understanding of critical thinking and it's the teacher's task to work these out. Teachers and students work and learn in a specific context, have individual preconditions and qualifications. Philosophy students may have taken a class about ethics and therefore be familiar with critical thinking. For architecture students, CT might be a new field. Talking to students and colleagues or reading good practice articles or research papers from teachers, can help in finding answers and getting a vague idea about how your CT understanding might be. After this overview analysis, it is time to get more specific and analyze the framework conditions: Who will attend my class (for example masters students in economy), what are my intended learning outcomes, topics, which media and methods can/will I use? How can I trigger the critical thinking process and how far will the class come into the thinking process? It is important to downsize the intended learning outcomes and to have in mind that students usually are novices in the field of critical thinking. If learning outcomes address explicitly critical thinking (for example the differentiation of sufficient and essential conditions in the section of logic), we recommend to communicate these to the students. Teachers need to have in mind that every single framework condition influences the field of action. Not everything can be changed or affected by the teacher (for example the classroom, media equipment).

II. Draft and construction: Garrison and Andersons' inquiry model (2003, p. 59) helps

to develop an educational design for the critical thinking class, having in mind the specific learning context. The course should start with a warm up to create an open learning atmosphere. After that, a trigger event initiates the critical learning process, the wondering and asking. The following exploration phase conduces the understanding and supports the finding of different explanations, viewpoints or research data. Students get in a circle of reflection, which is characterized by the enrichment of information, reflect by themselves and exchange arguments with the group. Solution approaches and opinion formations are the focus of the integration phase. Students build their own argumentation or find a solution for a certain problem. The resolution phase is for testing out new ideas and to implement the made-up strategies. In table 7.2 we will be more specific not only about helpful educational guidelines but also for the role, digital media may take in the process. To give the students individual feedback on their thinking skills, it is important to develop adequate assessment-tools and fitting exercises. Rubrics, for example, are either a good instrument to demonstrate the critical thinking criteria and performance levels and a good tool to evaluate the critical thinking performance of the individual student (or the group), let's say in online-discussions. If the teacher has a clear concept of critical thinking in mind, it is not difficult to derive descriptive criteria and operationalize concrete performance-levels for assessment tools.[13]

III. Field trial and reflection: After completing the draft, it is time for the teacher to test the intervention in the field and to ask him-/herself: How was the atmosphere in the group? Did the trigger event initiate critical thinking? Were the questions interesting and relevant for the students? Could the individuals build up a personal opinion? Was the material useful or too complex? Were discussions or group work constructive and what conclusion did the students come to at the end of the course: What have they learned about the method of critical thinking, the discussed topic? Did they advance in their thinking skills? The assessment of students' products of thinking (for example artefacts like written reflections, presented solutions etc.) give some first hints, if the instruction-design was appropriate. Furthermore, Garrison and Anderson (2003, p. 61) list some descriptors and indicators for teachers to observe, if and how the practical inquiry circle is at work respectively if students engage in critical thinking: For example, in the trigger phase students show puzzlement and try to recognize the problem. The exploration seems to function when students exchange relevant information, divert in viewpoints, suggest, brainstorm or show intuitive leaps. When integrating, the students converge, synthesize their viewpoints and come up with solutions. In resolution, they test, defend or apply the solutions, approaches and so on. These demonstrated actions (face to face or online interaction) can help to find out, if the course design works in general. To appraise the course design, it is helpful to implement a formative evaluation and reflect the presented questions in the middle of the semester, when conceptual changes can still be made. It might

[13] A rubric to assess critical thinking in written exercises (according to the authors definition) can be found in Wilbers (2014, p. 77f.).

be helpful to arrange a teaching analysis poll by students (Baldioli & Jahn, 2014) to get a structured and honest feedback from the course participants. The summative course evaluation at the end of the semester should focus on the didactical design's quality and the students' learning success. The teacher must reflect on the material, the trigger, the concept and the execution. Interviews or a feedback round at the end of the seminar will give the teacher furthermore an echo if the learning outcomes were achieved and if students could improve their critical thinking techniques. In addition, questionnaires are helpful to get an (anonymous) overall assessment of the class. Usually by this analysis and the teacher's reflection/conclusion, a new intervention can be designed. So, the DBR cycle starts over – and the concept gets revised in the next semester.

Finally, we want to give some ideas how to design and implement a critical thinking course with digital media (Table 7.2).

7.5 Conclusion

Critical thinking in higher education is not only a postulated task in the Bologna Accord (Kruse, 2010). It is an essential competence for adolescents and soon-to-be academics who live in a more and more complex world where it is not easy to make reasonable decisions easily. University teachers can encourage students to question established arguments, to literally view the world from another perspective and to have the ability to entitle an own option. Critical thinking is not just a subject in philosophy classes but in every study-program. In this essay, we tried to clarify its importance in general and to work out the possible role of digital media in this process: as a topic, students should critically think about and in the way that digital tools can support critical thinking.

Both, in the end, require teachers with not only high skills of digital literacy but also knowledge how to design, implement and evaluate a CT concept. These competences cannot be implied – especially as university teachers in Germany (who define themselves primarily as researchers) do not get a didactical instruction when they start their job. Nevertheless, centers for university didactics that nowadays are more or less established in most of the (German) universities help to bridge a gap and train teachers how to plan and design lectures. Workshops to enhance media competences, how to implement for example e-learning in higher education, are findable. Workshops how to implement critical learning in higher education, on the other hand, are scarce goods. But university teachers need a space, where they can think about, work on and share their approach on fostering critical thinking.

In 2017, the Center for Higher Education at the University of Erlangen-Nuremberg offered a seminar on this topic and the demand was very high – not only from people who teach in social sciences but also in technical, economic or medical sciences. We want to encourage other centers for higher education to implement critical thinking workshops in their program to bring the topic to teachers' attention. In this way, CT gains not only attention, but also research projects on a broad data basis can be realized and advanced.

Stage of Process	Description	Educational Guidelines	Possible usage of digital media	Example
Pre-stage: Atmosphere	Creating an open, relaxed and friendly atmosphere	Before the initiation of the CT process, it is important to start with an icebreaker session. It is important to set an open, discussion-friendly atmosphere in class. Teachers should also describe the needed interactions and the ends of the sessions (learning goals related with critical thinking).	A forum, message board e.g. that allows students to upload some personal facts or artefacts, maybe a photo or a motivational text about why they are interested in CT.	An introduction of participants in the learning management system (LMS) gives students an oversight of the group and the possibility of pre-knowing each other, for example in a forum. A netiquette and "communication guidelines" give advice how to argue or give feedback online and keep the communication flowing in a structured way (for example by quoting statements someone refers to).
Triggering event	Positive or negative trigger that initiates the critical thinking process.	The trigger event causes wonder, misunderstanding, doubts or a liminal experience and has to be chosen carefully from the teacher. It is important that students can build a bridge from the trigger to their own lifeworld. The trigger must be interesting, actual and relevant for the target group. It's challenging to discuss the topic and it is worth to think it critically through. There is no "easy" solution; in the end, there are lots of questions which have to be cleared.	Demonstration of a film, photo, picture, online-article, website, podcast e.g.	Demonstrating a provoking film about factory farming and, on the other hand, photos on Instagram with hashtag #beeflovers.
Exploration	Students find, collect and structure information, research data, statements from different stakeholders e.g. to the topic.	It is important that students find a great variety of different perspectives of interesting, catching sources. Teachers should give learners the space to find, reflect and discuss different theses in the group. Phases of single work are as important to think statements and information through as group work and discussions, where different opinions might be exchanged. Instructors can help the students to invent a position by making their own process of thinking transparent. Loud thinking and arguing, the visualization of thinking patterns and making explicit the steps of argumentation are good practice. The exploration phase usually takes some time. The teacher's task is to make the students thinking observable; how their thinking changes, how their CT process develops. This can be done by the learners, for example, by written reflection reports, loud thinking and in discussions. Teachers can evaluate on this basis the students' CT status.	Finding information: Online-research in scientific databases but also e-newspapers, social media channels, YouTube e.g. Collecting information: Mind maps, link lists and notes in LMS, learning portfolios, wikis e.g. Reflection and discussion: Blogs, discussion forum	Students can find (research) data and information about factory farming online, the current situation of farmers, animal welfare and consumers. On YouTube, they watch another documentation about the subject, also they find some Facebook pages pro/contra vegetarianism. The class collects interesting links in a list they made up in a LMS and every student create one own mind map. In a blog, they document their thoughts about factory farming weekly – and have the possibility to comment on each other's posts.
Integration	Students scrutinize and synthesize on basis of data,	Dealing with contraire arguments from different stakeholders is not easy to withstand for adolescents. Neither is taking position to an elusive issue. Teachers must help students to develop their own points of view and integrate them into thinking and acting in a rational way.	E-Portfolios, blogs e.g.	Writing makes thoughts visible and lines argumentation become clearer. Reflecting the "final" opinion about factory farming or vegetarianism is easier when students

Stage of Process	Description	Educational Guidelines	Possible usage of digital media	Example
	information and different perspectives an opinion about the subject.	Learners should have the opportunity to find and reflect ideas for improving practice. We also recommend to not let the humor in the critical thinking come too short: If the playful in the critical thinking process gets lost, it can lead to stress and bitterness.		can re-read their thoughts on an issue. Peer reviews of blog entries or e-portfolios or the feedback of the teacher help to refine argumentation lines.
Resolution	Students test out new ideas and implement made up strategies.	It is time to implement made up strategies in class beyond university: Which consequences will result from the students' résumé? Conducted situations help learners to apply and reflect their findings through concrete actions both in practice and in the class community teachers should tell students about possible risks that can lead to critical thinking and subsequent action. For example, they can report from own experiences and show how they deal with the issue. Examples from practice also help to show students how to act on the basis of insights.	Creating a podcast, writing a blog, starting a Facebook page, discuss in an online forum e.g.	Maybe after the course students view factory farming in a more critical way, buy meat with organic certification or get interested in vegetarianism. The internet is a great place to stay informed but also to get others informed about the issue. Students can start a podcast about factory faming, join an online forum to participate in more discussions or write a blog and share vegetarian recipes.

Table 7.2: Implementing a critical thinking course with digital media (own Figure).

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8 Inquiry-Based Learning 2.0 A Didactic Framework for Inquiry-Based Learning with Digital Media

David Kergel & Birte Heidkamp

Abstract
German discussions of inquiry-based learning in higher education have seen the development of an approach termed inquiry-based learning 2.0 (Kergel, 2014; Kergel & Heidkamp, 2016). Inquiry-based learning 2.0 combines elements of contemporary e-learning (i.e. e-learning 2.0) with elements of inquiry-based learning. To facilitate a systematic implementation of inquiry-based learning 2.0 strategies in higher education, a so-called didactic framework for inquiry-based learning with digital media has been developed. This article introduces the framework, first providing a working definition for inquiry-based learning. It will then go on to introduce the didactic framework for inquiry-based learning with reference to the working definition. As a further step, it will discuss the concept of e-research. The didactic framework for inquiry-based learning with digital media will emerge from these considerations.

Keywords: Inquiry-based learning, E-learning, Higher education, Digital media, Web 2.0, E-learning 2.0

8.1 Inquiry-Based Learning – a Working Definition

As an umbrella term, inquiry-based learning signifies processes in which learning and research are inextricably linked. Inquiry-based learning encourages learners to learn by carrying out research: a didactically guided research process entails learning and produces knowledge. Students think and act like researchers. A perfect model would have the students identify research questions, develop a research design, collect and interpret data, and communicate the results. Ideally, students will pass through the whole research process, which can be visualized as a circle:

Figure 8.1: Visualization of a research process (own Figure).

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Inquiry-based learning does not require the learner to pass through the whole research cycle. Nonetheless, elements of a research process must be taught, thematized, and didactically guided (Reinmann, 2016; Kergel & Heidkamp, 2015).

Inquiry-based learning can be understood as a process in which knowledge is constructed. The model envisages that the research and learning processes will coincide with each other. A research process, like a learning process, sees evidence as the result of grounding propositions in systematically collected data. From this perspective, research becomes a learning process in which knowledge construction meets scientific standards of objectivity, validity, and reliability. These points could define inquiry-based learning simply as a scientifically sound learning.

However, the pedagogical implications of inquiry-based learning also require consideration: inquiry-based learning focuses on the subjective dimension of the learning process. It is less about the concrete result (*i.e*. the research outcomes) than about developing a so-called `habitus of a researcher´ (*cf*. Kergel & Heidkamp, 2015). Students are expected to acquire thinking strategies of the kind that characterize the researcher: strategic skepticism towards knowledge, rational thinking, the use of logic instead of falling back on received beliefs, and so on.

This makes the experience of the learner as researcher a crucial focus of inquiry-based learning. It requires the provision of didactically framed possibilities, which enable the learner to act as a researcher or even – eventually – to become a researcher. As an action- and product-oriented approach, inquiry-based learning rests on socio-constructivist positions in learning theory. These provide its theoretical foundations and focus on the subjective experience of learning in a collaborative context (Kergel, 2014). Learner participation, the formulation of research questions, and the experience of research as a social, interactive process, all require the learner to take an active role. Fostering such an attitude in inquiry-based learning processes means promoting self-sufficiency. The learner as researcher experiences themselves as someone who is able to raise questions and develop scientific strategies to answer them.

By encouraging the learner to develop a researcher's disposition, inquiry-based learning acquires an ethical dimension. It requires a specific way of relating to the world: inquisitive, critical, skeptical towards beliefs and established knowledge: "Our amazement. – It is a deep and fundamental stroke of luck that science discovers things that stand up under examination and that furnish the basis, again and again, for further discoveries – after all, it could be otherwise!" (Nietzsche, 1882/2001, p. 59). Inquiry-based learning can help to develop this kind of research-oriented disposition. The self-regulated and active learning process requires support: on the learner's part with a willingness to engage in self-reflection; on the teacher's part by flexibly accompanying an open-ended learning process (for the changing relationships between teachers and learners under the paradigm of inquiry-based learning see Brew, 2003). One challenge is to open up spaces within which students can engage in inquiry-based learning processes that adjust to their skills. This means that students should be challenged to fulfil their potential as researchers and thus further develop these skills. Conversely, it is up to the teacher to ensure that students are not overwhelmed by the complexity of a research process. The didactic framework for inquiry-based learning with digital media has been developed to provide strategies for guiding the learning process and adjusting the research process to students' skills.

The didactic framework provides a template for implementing inquiry-based learning in different phases of the research process and at different levels of complexity.

8.2 The Didactic Framework for Inquiry-Based Learning

The didactic framework presented here is based on the model of Willison and O`Regan (2007), which they called a `framework for students becoming researchers´. O´Regan developed criteria for inquiry-based learning in the different phases of the research process. They also took into account that inquiry-based learning can take place at different levels of complexity. Wilison and O´Regan´s differentiation into complexity levels has been modified with reference to the German debate on the definition of inquiry-based learning. Multiple labels have become established in the German discourse on the subject: one speaks of inquiry-based learning while another uses the term inquiry-oriented learning. To clarify the conceptual dimension of inquiry-based learning, Huber (2014) provided a definition which distinguishes between 'forschungsbasiertem Lernen' (inquiry-based learning), 'forschungsorientiertem Lernen' (inquiry-oriented learning), and 'forschendes Lernen' (learning through inquiry). This conceptual differentiation has provided a basic guide in the development of the didactic framework. The degree of complexity increases from inquiry-based learning to inquiry-oriented learning, to learning through inquiry.

The horizontal axis of the didactic framework depicts the different phases of a research process (see table 8.1). The vertical axis represents the increasing degree of complexity in inquiry-based learning. From inquiry-based learning to inquiry-oriented learning, to learning through inquiry, the degree of complexity increases. Increasing complexity is accompanied by increasingly self-regulated learning. This increase in complexity in line with inquiry-based learning is predicated on Huber´s conceptual distinction between inquiry-based learning, inquiry-oriented learning, and learning through inquiry (or, according Banci & Bell, `open inquiry´, *cf*. Banci & Bell, 2008). To make the different phases and stages of the didactic framework accessible, a conceptual differentiation will be provided. This is based on Huber´s distinction between the three concepts inquiry-based learning, inquiry-oriented learning, and learning through inquiry.

Inquiry-based learning is defined as a form of directed learning in which students are introduced to the research field. They get to know the different paradigms of the discipline they are studying, and are introduced to the basic research focus, typical research questions, and methodological considerations.

Research-oriented learning stresses the dynamics of the research process itself, focusing on its practical requirements. Research-oriented learning introduces students to the ways in which methods and methodological considerations are applied and reflected in the concrete research process. Students have the opportunity to reflect on epistemological questions and the societal relevance of research with reference to its practice.

Learning through inquiry means an actual research process. Students carry out research according to `real/professional´ criteria. Here, the line of demarcation between learning through inquiry and research dissolves (Wolf, 2016). Learning through inquiry includes the `discovery´ of research questions, the development of a research design, the collection and analysis of data, and finally the presentation of results.

This conceptual differentiation is fundamental to the structure of the didactic framework for inquiry-based learning. The different levels of complexity depicted on the horizontal axis, rest on the conceptual differentiation between research-based learning, research-oriented learning, and inquiry through learning.

Table 8.1: Didactic Framework for Inquiry Based Learning with digital Media, Level 1-Level 3 (own Figure).

	Level 1 (Predetermined inquiry-based learning) Students are guided through a prestructured learning environment.	**Level 2 (Guided inquiry-based learning)** Students navigate a prestructured learning environment with a high degree of guidance.	**Level 3 (Prestructured inquiry-based learning)** A less prestructured learning environment facilitates a higher degree of self-determined and self-regulated learning.
A. Heuristic phase Students develop an interest in knowledge and formulate their own research questions.	With the guidance of a teacher and working within a predetermined structure, students answer questions and define concepts which are important to the field of research. Digital media: *e.g.* Wikis, Chat-Tools like WhatsApp.	Students answer questions generated in teacher-led dicussions, using a predetermined structure or developing their own. Digital media: *e.g.* Wikis, Chat-Tools like WhatsApp or Twitter.	Students generate questions relevant to a pre-defined research field. They develop their own structure to answer them. Digital media: *e.g.* Wikis, Chat-Tools like WhatsApp, Collaborative Tools like Google Drive, Authorea.
B. Research design Students discuss/develop a research design.	With the guidance of a teacher, students develop an understanding of a set research design. Digital media: *e.g.* Wikis, Chat-Tools like WhatsApp or Twitter.	Students discuss advantages and disadvantages of different set research designs. Digital media: *e.g.* Wikis, Collaborative Tools like Google Drive, Authorea.	Students choose one out of several set research designs and explain their decision. Digital media: *e.g.* Collaborative Tools like Google Drive, Authorea.
C. Data collection Students find required data or collect their own data.	With the guidance of a teacher, students research available data. Digital media: *e.g.* online databases, opendata.europa.eu.	Using a set method, students collect new data. Digital media: *e.g.* online databases, opendata.europa.eu., Wikis, Collaborative Tools like Google Drive, Authorea, Online Survey Tools like Limesurvey.	Students choose one out of several set methods to collect data, explain their decision, and apply the method. Digital media: *e.g*. online databases, opendata.europa.eu., Wikis, Collaborative Tools like Google Drive, Authorea, Online Survey Tools like Limesurvey.
D. Evaluation & reflection Students critically evaluate the process of data collection, or the selected data, according to scientific standards such as objectivity, reliability, and validity.	With the guidance of a teacher, students evaluate data/information according to set criteria. Digital media: *e.g.* Wikis, Collaborative Tools like Google Drive, Authorea.	Students evaluate data/information according to criteria developed in teacher-led discussions. Digital media: *e.g.* Wikis, Collaborative Tools like Google Drive, Authorea.	Students evaluate data/information that they themselves have collected. They evaluate the data according to criteria developed in teacher-led discussions. Digital media: *e.g.* Wikis, Collaborative Tools like Google Drive, Authorea.
E. Analysis & synthesis Students interpret data with reference to the research question, constructing data-based knowledge.	With the guidance of a teacher, students analyze and interpret data according to set data analysis techniques and strategies. Digital media: *e.g.* Wikis, Chat-Tools like WhatsApp or Twitter, Collaborative Tools like Google Drive, Authorea.	Students analyze and interpret data according to set data analysis techniques and strategies. Digital media: *e.g.* Wikis, Chat-Tools like WhatsApp or Twitter, Collaborative Tools like Google Drive, Authorea.	Students analyze and interpret data that they themselves have collected. They analyze the data according to techniques and strategies developed in teacher-led discussions. Digital media: *e.g.* Wikis, Collaborative Tools like Google Drive, Authorea, Online Survey Tools like Limesurvey.
F. Findings & presentation of results Students communicate their findings and the outcome of their inquiry-based learning process.	With the guidance of a teacher, students present their findings. They use terms/concepts which are important to the field of research. Digital media: *e.g.* Wikis, Chat-Tools like WhatsApp or Twitter, Collaborative Tools like Google Drive, Authorea or Presentation Tools like Prezis.	Students are familiar with the terminology of their research field. Digital media: *e.g.* Wikis, Chat-Tools like WhatsApp or Twitter, Collaborative Tools like Google Drive, Authorea or Presentation Tools like Prezis.	Students are familiar with the terminology of their research field and can relate concepts to each other. Digital media: *e.g.* Wikis, Chat-Tools like WhatsApp or Twitter, Collaborative Tools like Google Drive, Authorea or Presentation Tools like Prezis.

Stage 1 (‘predetermined inquiry-based learning’) and stage 2 (‘guided inquiry-based learning’) are based on the concept of inquiry-based learning: students are introduced to the research field and its paradigms.

Stage 3 (‘prestructured inquiry-based learning’) and stage 4 (‘autonomous inquiry-based learning’) are based on the conception of inquiry-oriented learning described above: theoretical and methodological challenges are reflected upon and discussed with reference to the students’ research. Research is guided by the teacher.

Stage 5 (‘learning through inquiry’) is based on the concept of learning through inquiry, which

involves self-regulated learning without elements of directed or teacher-guided activity.

At each of these stages, the degree of self-regulated learning increases. Each box of the didactic framework lists the criteria which define inquiry-based learning in the particular phase and on the corresponding level of complexity. These criteria may help to develop inquiry-based learning scenarios, or to analyze or classify them.

Table 8.2: Didactic Framework for Inquiry Based Learning with digital Media, Level 4-Level 5 (own Figure).

	Level 4 (Autonomous learning) Students initiate and structure the research process. The teacher provides flexible guidance.	**Level 5 (Learning through inquiry)** Students carry out their research in a self-determined and self-regulated manner.
A. Heuristic phase Students develop an interest in knowledge and formulate their own research questions.	Students generate research questions relevant to a pre-defined research field. They develop their own structure to answer them. Digital media: *e.g.* Wikis, Chat-Tools like WhatsApp, Collaborative Tools like Google Drive, Authorea.	Students generate research questions in a research field which they themselves have chosen. Digital media: *e.g.* Chat-Tools like WhatsApp, Collaborative Tools like Google Drive, Authorea.
B. Research design Students discuss/develop a research design.	Students develop their own research design with the guidance of a teacher. Digital media: *e.g.* Collaborative Tools like Google Drive, Authorea.	Students develop their own research design independently. Digital media: *e.g.* Collaborative Tools like Google Drive, Authorea.
C. Data collection Students find required data or collect their own data.	Using a method chosen by themselves, students collect data with the guidance of a teacher. Digital media: *e.g.* online databases, opendata.europa.eu., Wikis, Collaborative Tools like Google Drive, Authorea, Online Survey Tools like Limesurvey.	Using a method chosen by themselves, students collect data independently. Digital media: *e.g.* online databases, opendata.europa.eu., Collaborative Tools like Google Drive, Authorea, Online Survey Tools like Limesurvey.
D. Evaluation & reflection Students critically evaluate the process of data collection, or the selected data, according to scientific standards such as objectivity, reliability, and validity.	Students evaluate data/information that they themselves have collected. They evaluate the data according to criteria developed in teacher-led discussions, or use criteria which they have defined independently according to scientific standards. Digital media: *e.g.* Wikis, Collaborative Tools like Google Drive, Authorea.	Students evaluate data/information that they themselves have collected. They evaluate the data according to criteria which they have defined independently according to scientific standards. Digital media: *e.g.* Collaborative Tools like Google Drive, Authorea, Online Survey Tools like Limesurvey.
E. Analysis & synthesis Students interpret data with reference to the research question, constructing data-based knowledge.	Students analyze and interpret data which they themselves have collected. With the guidance of a teacher, they apply data analysis techniques and strategies which they have chosen independently. Digital media: *e.g.* Wikis, Collaborative Tools like Google Drive, Authorea, Online Survey Tools like Limesurvey.	Students analyze and interpret data which they themselves have collected. They apply data analysis techniques and strategies which they have chosen independently. Digital media: *e.g.* Collaborative Tools like Google Drive, Authorea, Online Survey Tools like Limesurvey.
F. Findings & presentation of results Students communicate their findings and the outcome of their inquiry-based learning process.	Students are familiar with the terminology of their research field and can relate concepts to each other. They can redefine concepts, and define new ones, on the basis of their research. Digital media: *e.g.* Wikis, Chat-Tools like WhatsApp or Twitter, Collaborative Tools like Google Drive, Authorea or Presentation Tools like Prezis.	Students can redefine concepts, and define new ones, on the basis of their research. Digital media: *e.g.* Wikis, Chat-Tools like WhatsApp or Twitter, Collaborative Tools like Google Drive, Authorea or Presentation Tools like Prezis.

8.3 Towards e-Science/e-Research – Research in the Digital Age

Ongoing media change pervades all parts of society, including academia. It is both a field for research and an agent of changing research practices. The development of participative online tools such as blogs, wikis, collaborative writing tools, and podcasts is increasingly shaping

academic practice. Not only accepted formats like open-access journals, but also more advanced projects such as public-peer-review journals or video journals, are indicators of the media-based transformation taking place in the academic field. Research, the presentation of research outcomes, and teaching in higher education are increasingly going online. This digitalization, and the extension of scientific practice into the digital world, can be conceptualized as `e-science´. The idea first emerged in the early 2000s: "'e-Science' is an exciting new buzz-word for computer science and information technology in the service of science" (Gardner & Manduchi, 2000, p. 1). Henry Gardner and Gabriele Manduchi identified shared computing power as a key feature of e-science: "It is particularly associated with the support of `big´ and/or `distributed´ science and engineering. It recognizes the revolution in global collaboration which is being wrought by broadband communications and the internet" (Gardner & Manduchi, 2000, p. 1). In view of the participative and collaborative possibilities of Web 2.0 tools, it would be helpful to revisit the definition of e-science. This re-definition has to consider how Web 2.0 tools such as Twitter and publication formats like open-access journals change the process of scholarly communication: "In addition to formal channels of scholarly communication, a wide array of semi-formal and informal channels such as email, mailing lists, blogs, microblogs and social networking sites (SNS) are widely used by scientists to discuss their research" (Puschmann, 2014, para. 1). With these considerations in mind, one may define e-science or in a borader sense e-research as follows: the extension of e-science/e-reserach into the digital world and the use of Web 2.0 media, which are re-defining scholarly communication and the ways in which researchers collect, analyze, and present data.

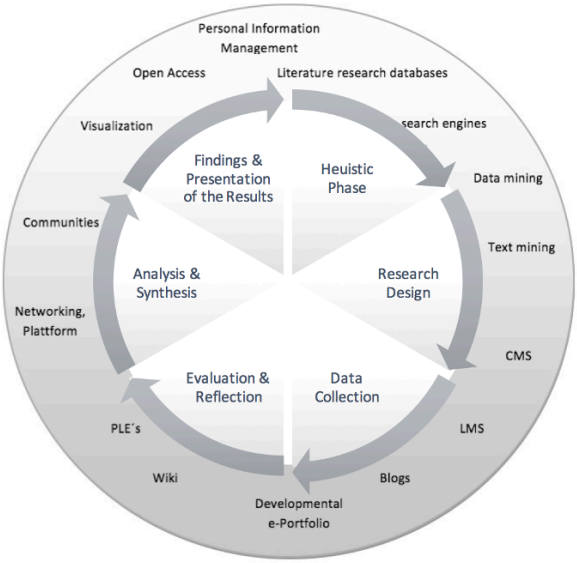

Figure 8.2: Visualization of a research process with an added digital dimension (own Figure).

From the perspective of higher education, a synergetic meeting of e-science/e-research and

learning is needed: students have to acquire the academic media skills required in the digital age. Inquiry-based learning with digital media represents a strategy for implementing contemporary forms of media use in the academic field. Implementation would extend action- and product-oriented learning processes into the digital sphere. Different phases of the research process can harness digital media, using Web 2.0 tools to foster students' inquiry-based learning processes. The focus of inquiry-based learning on action and end-product, enables students to acquire academic media skills and thus to enhance their employability in the digital age. A digital dimension can therefore be added to the research cycle depicting the structure of inquiry-based learning (see Figure 8.2).

The following subsection introduces the didactic framework for inquiry-based learning with an added digital dimension. This extended didactic framework systematizes the implementation of digital media in the process of inquiry-based learning.

8.4 The Didactic Framework for Inquiry-Based Learning with Digital Media

To facilitate the systematic implementation of Web 2.0 tools in the inquiry-based learning process, proposals for the use of digital media have been added to the didactic framework. An essential feature of the framework is that it provides a guide to adjusting the degree of complexity to the skills of the students. The extended didactic framework provides a systematized approach to implementing inquiry-based learning with digital media.

Corresponding to the increasing proportion of self-regulated learning from stages 1 to 5, proposals for implementation begin with pre-structured/receptive media use and end in an open, self-regulated level of media usage. At stage 1, Web 2.0 tools are recommended for specific purposes: for example, wikis can be used in the collaborative production of an encyclopedia defining the most important concepts and methodologies behind a scientific paradigm. The structure of a wiki corresponds to the didactic structure of the collaborative project, which is located at phase 1 (heuristic phase), stage 1 (predetermined inquiry-based learning) of the didactic framework: With the guidance of a teacher and working within a given structure, students answer questions and define concepts which are important to the field of research.

In this approach, which combines the interactive potential of Web 2.0 tools with didactic reflections, templates for the use of Web 2.0 media in inquiry-based learning have been developed. Web 2.0 tools such as wikis or chat apps, in which the structure of interaction is more predefined/directed, can be used for inquiry-based learning at complexity levels 1 (predetermined inquiry-based learning) and 2 (guided inquiry-based learning). More interactive and open Web 2.0 tools – e.g. collaborative writing tools such as Authorea or GoogleDrive – open up multiple possibilities. These tools can be used as collaborative platforms for organizing the research process, annotating memos, collecting sources, and writing the research report. The potential of such tools is best harnessed at levels 3-5 of the didactic framework.

These categories of course represent an exercise in schematization. The use of Web 2.0 media can be deconstructed. A WordPress blog can be used as wiki tool, and the polyvalence of Web 2.0 tools also requires consideration. Twitter, for instance, can become the vehicle for

an exchange of arguments within a broader discussion – e.g. on theoretical issues. The Twitter discussion may help students develop an understanding of key theoretical positions and controversies in a given field. Such a discussion should be located at phase 1 (heuristic phase), stage 2 (guided inquiry-based learning): Students answer questions developed in teacher-led discussions. To answer these questions, students use a predetermined structure or develop their own.

Twitter, however, can become a connecting tool across different phases and stages by establishing a research community through a common hashtag. Despite the schematizing tendencies of the didactic framework, it establishes a heuristic approach to the systematic implementation of inquiry-based learning with digital media – i.e. inquiry-based learning 2.0 – in higher education.

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9 The Lecture as Testimony: In a Technological Age

Ronald C. Arnett

Abstract
The question of this essay, shaped by a changing historical moment of a digital age, examines the old as garnering renewed importance. The text is old wine ever vital and now rediscovered in new wine skins of a digital age. This essay invites a creative opening for a historically important standpoint: the necessity of the understanding the rhetorical importance of the lecture as testimony in an era of technological change. The digital world in this case permits the old to find new energy and purpose in a changing rhetorical environment where the constant of text (that which matters) propels both a traditional and an ever-changing technological world. In a digital world of blurred issues of time, space, and speaker/audience, one must ask a basic question: Is there a rhetorical rationale for reliance on the lecture in a digital and information age? I contend that the connecting link between the lecture as a traditional form of rhetoric and digital modalities is the notion of text.

Marshall McLuhan (1993) considered the lecture a "hot medium," which suggests that it excludes and denies participation. He advocated forms of education that include and invite active engagement, "cool media." He wanted education to forego telling and invoke participatory discernment. "McLuhan advocated discovery learning, whereby students would find things out for themselves by working collaboratively on topics that interested them" (Kuskis, 2011, p. 319). The demand for a cool medium that invokes high participation made the lecture a prime enemy. The traditional assumption about the lecture is that it invites passive learning through mere knowledge transfer. In 1967, McLuhan contended that the lecture was finished. His criticism is not without numerous supporters. A simple search for the death of the lecture renders 31,000 titles since McLuhan's announcement. However, the death of the lecture in reality aligns with the famous quote from Mark Twain, "The reports of my death have been greatly exaggerated" (quoted from Messent, 2007, p. 22). The exaggeration for Twain was two-fold: he was not dead and he did not offer the quote attributed to him (Messent, 2007). Concurrently, I contend that the lecture is not dead and repetitive predictions about its demise exaggerate reality. In a media age, the lecture acts as a testimony accessible to a much larger world.

Keywords: Lecture as testimony; Digital age; Tesitmonies of ghosts, Glocalization

9.1 Introduction

Exaggerations are common fare, from statements about the usefulness of a given product to assertions tweeted by politicians on the world scene. With the advent of television, we witnessed predictions about the power of communication with a small number of channels dominating news. Predictions of the demise of radio were premature, as were the claims that television would become useless in an Internet age. The truth is that each form of media has a place and continues to contribute. Pejorative statements about the collapse of educational practices often generate initial confidence and then falter with their success. Predicted hegemony of influence is consistent with modernity's unifying inclination with destruction invited by undue confidence; modernity kills that which comes to define banality or extreme

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commonness. The critique of the lecture has reached this point, banality, making its resurgence possible and perhaps inevitable in a digital age.

In this essay, I offer a story about the lecture as testimony functioning as a cool medium in a media age. The first section, "Engaging the Text in a Digital Age," examines a place for unified ground of participation, which requires "text" as the pivotal point upon which information historically gathers its influence. The second section examines "Tradition that Matters" as a backdrop for understanding acknowledged diversity. The third section, "Testimony as Content and Sentiment," moves the lecture from a modern framework of control and imposition of information to attentiveness to ideas situated within a given perspective. The final section, `Testimonies of Ghosts´, explores the `not said´ as a continuing companion to `the said´ of the lecture in a digital age; it is the `inarticulate´ that adds texture to the `articulate´ (Taylor, 1992).

9.2 Engaging the Text in a Digital Era

In 2012, Peggy Jubien, wrote "A Phenomenology of the Podcast Lecture." The essay frames the nature of the lecture in a world of technological complexity. The podcast lecture displays differences between real time and recorded addresses. Jubien (2012) begins with a basic assumption: the two forms of lecture are different, and it is foolish to compare them. Technological media shift space, moving the conversation from the immediate to an enduring present that one can revisit. Shifting space defines the podcast lecture in an era marked by routine use of mobile devices. The "students' sense of place is not static" (Jubien, 2012, p. 77). Not only can the place in which one attends the lecture shift, but one's focus of attention can move between and among content, response, and surroundings. Listening with a mobile device also permits the current physical environment to fade, blurring into the background. When the lecture is done `well´ and captures the attention of the attendee, the presence of the person speaking captures the moment. If one's attention wanes for some reason, the technology permits one to rewind and provides a second chance at engagement with the speaker. The voice of the speaker invites awareness of content and organization; the sound either captivates or decreases interest in the lecture. Jubien cites Gardner Campbell's astute observation: "There is magic in the human voice" (Jubien, 2012, p. 80). The human voice accompanied by the flexibility of use of the mobile device announces the interplay of technology and person, permitting dexterous listening to a lecture repeatedly or in an order other than the expectations of the original speaker. Jubien (2012) reminds the reader of Harold Innis's (1991) understanding of new technologies as reconstituting space and time. Interestingly, the podcast invites forgetfulness of one's own corporality; the voice of another moves one into another dimension. It seems that the physical moment is "completely forgotten" (Jubien, 2012, p. 82). One-way communication, propelled by the magic of a human voice, manifests an invitation to increasing insight with maneuverability of mobile devices through the ability to repeat visits to podcasts, which acts as an educational opportunity to revisit the demanding, the complex, and the initially unclear.

The changing nature of the lecture in a technological age announces the texture of such a moment, articulated insightfully by Jude Fransman and Richard Andrews (2012) in "Rhetoric and the Politics of Representation and Communication in the Digital Age." The authors discuss the shifting role of learners in a multimodal society. The audience and the speaker meet together via a "digitally mediated world" (Fransman & Andrews, 2012, p. 125). Fundamental to rhetoric is the text, which is the content artifact under observation. The context or place of

rhetoric is also a historical given. Mobility of devices permits the shifting of context within which one receives the text of a lecture. Text is a constantly crucial element in rhetoric. The text remains, but must now join a global media reality of shifting context from which reception occurs, altering the interpretive nature of the event.

Semiotic engagement with a text requires reading that shifts signification as the context shifts the reading act. The digital world no longer presupposes unity between text and context. Rhetoric in a digital age transforms from an epistemological question to an ontological issue as the context of being in the world shifts and recasts one's reading of a given text. In the examination of five essays featured in a special issue of *Learning, Media, and Technology*, one discovers the power of text in quite different locations and contexts. The essays move from the text of YouTube videos to Facebook conversations to PowerPoint presentations to the academic lecture. In each case, rhetoric centers around and responds to a given text. Additionally, the texts are "multimodal" (Fransman & Andrews 2012, p. 128) with questions pivoting on the relationship between those involved in the event of learning and the rhetoric of information presentation within a number of modalities. The constant in the examination of the interplay of rhetoric and the digital world is a basic fact: the text remains the center of examination. The digital world expands our conception of the text, as the notion of text remains the heart of rhetorical examination and conversation. The text houses what matters in the digital exchange; the power of rhetoric lives within text that gathers attention and announces what matters.

9.3 Tradition that Matters

I now pause from addressing the interplay of rhetoric and the digital world in order to explicate an older, traditional conception of text centered on the lecture, defined as presentation of and about what matters. The lecture has historically structured material that matters with the rhetorical objective of assisting the learning of another. My contention is that this historical moment situates the lecture as a crucial communicative form, announcing what matters and, additionally, requiring others to listen and discern between and among ideas worthy of response and those best left forgotten. This historical moment of constant narrative and virtue contention (MacIntyre, 2007) and ongoing acts of misinformation (Helfand, 2016) moves rhetoric from engaging a text that matters to doing so in a manner similar to the communicative act of testimony. Amit Pinchevski (2012) defines testimony as a public accounting for "the search for a missing record" (Pinchevski, 2012, p. 149). In order to explicate this position on the lecture as testimony, I turn to essays offering two quite different perspectives on the lecture, coming from 2015 and 1956, respectively. These two contrasting orientations yield an understanding of lecture as testimony suitable for engaging a communicative world of routine narrative and virtue contention. The assertion that the lecture is a form of testimony announces the intimate connection between rhetoric and a text that matters and the fact that both sentiment of position and temporal reasoned insight situated within a given narrative or paradigm offer insight void of Universal Truth. The following essay from Empedocles: European Journal for the Philosophy of Communication links lecture and testimony in a manner consistent with a world no longer enamored with modern assumptions of Universal Truth, too often unmasked as imposed and hegemonic power. Ramsey Eric Ramsey's (2015) essay, "Letters on the Hermeneutic Education of

Dwelling," asserts that the lecture is public testimony. The lecture is a public test of opinions, moving ideas from the private space of reading, writing, and self-talk to collective engagement. In order to make his case about the power of testimony, Ramsey locates the lecture between two extremes: abstract pure logic and the sermon. He provides an intellectual landscape that unifies content and conviction. The lecture as rhetoric about a text that matters resembles public testimony that dwells within the interspace of evidence/facts and uniqueness of perspective and standpoint; such discourse seeks an audience and simultaneously expects response.

The lecture is one of the traditional conceptions of rhetoric in action, invoking a tradition about public discourse over questions that matter as they influence an audience that participates in response. The notion of testimony invokes the importance of tradition and standpoint; one testifies to something greater than one's own opinion. Granted, there is considerable questioning about the importance of tradition in a contemporary society – a digital age. Argument over tradition directed significant public conversations, such as the debate between Hans-Georg Gadamer and Jürgen Habermas, where they parted on the role of "tradition" (Teigas, 1995). Habermas critically rejected the vitality of tradition; he stressed the necessity of enacting discourse ethics with the objective of discerning temporal truth pointing to universal applicability. Gadamer, on the other hand, emphasized an existential fact – we are already part of an ongoing conversation, nominally termed "tradition." Multiple conversations reflect the reality of multiple traditions. We live in more than one conversation and tradition, and we engage others situated within traditions different from our own. Gadamer redirected our modern focus of attention back to tradition without assuming that only one hegemonic perspective triumphs. Gadamer's understanding of tradition is plural, tradition(s), in contrast to a single metanarrative or universal. Gadamer, like Hannah Arendt (1961), placed tradition(s) as the embodiment of a living connection between past and future. Tradition is the connecting link between past and future; tradition testifies to the reality of each. Traditions provide rhetorical power that testifies to what matters. Traditions provide the ground from which one pushes off, permitting movement to and fro between past and future. Such a perspective on tradition permitted Immanuel Kant (1798/2012) to differentiate between `imagination´ and `fantasy´, with the former housing the heart of genuine creativity. Imagination requires pushing off something real that calls forth a response; the real is tradition. Traditions make imagination possible. The lecture functions as public testimony of a given tradition that situates the significance of events. As a lecture engages a given tradition and frames a text that matters, we invite the unleashing of human imagination. From the perspective of lecture as testimony responsive to a tradition that matters, rhetoric understands a text as something capable of propelling the minds and hearts of an audience in a particular direction. Lecture as rhetorical testimony announces a given tradition via a distinctive standpoint. Lectures, understood as testimony, do not solidify or reify truth; they offer ideas and potential actions from a situated perspective that calls forth public hearing where ideas must bear the test of public scrutiny in the midst of empirical and phenomenologically congregated witnesses.

9.4 Testimony as Content and Sentiment

The lecture as testimony functions as a communicative voice for an inescapable interplay of evidence and standpoint of tradition. Presenting an informed account of a tradition requires

students to attend and listen to a particular rhetorical interpretation. The information is a testimony of responsiveness to learning garnered from the solitude of studying and learning. The lecture as testimony functions as a fulcrum of insight, enhancing public engagement and opinion with the objective of facilitating further conversation. The public testimony of the lecture joins the rhetorical functions of perspective/interpretation with responsive internal student learning.

The lecture is an open letter that testifies by inviting others into `why´, the importance of something, and the practical implications of the `how´ of doing something (Ramsey, 2015). The specific gathering of how and why is important in a world defined by Alasdair MacIntyre (1981/2007) as routinely contentious and without agreement on what should be the narrative and virtue structures guiding this historical moment. One loses the importance of ideas and events when the `why´ and the `how´ fragment into separate and discrete acts. The lecture as a form of rhetorical testimony addresses an era of fragmentation by attempting to unite the why and how of ideas through the announcement of standpoint, tradition, and position. Such public discourse requires student participation that is attentive and responsive. The field of communication has a long tradition of argument and debate, lending insight into pragmatic navigation of an era defined by disagreement. The lecture in this historical moment illuminates conversations propelled by content and sentiment in the pursuit of truth(s) that defies a final word. The lecture as testimony ever invites responses to the text.

The lecture in an age of narrative and virtue contention unites an Age of Reason with an Age of Sentiment (Arnett, 2014); there is an integration of organized evidence situated within commitments that announce `why´ something matters. Lectures of import point us to ideas of value; they introduce an audience to sentiments of profound significance. The French Enlightenment and the Scottish Enlightenment of reason and sentiment, respectively, function in tandem; the combination of reason and sentiment nurture the lecture as testimony. The lecture as the rhetoric of testimony brings together information, data, and evidence situated on and within sentiment of standpoint. A rhetor testifies with performative integration of reasoned ideas and human sentiment, inviting students to become active witnesses capable of addressing elements of the presentation. Linking of reason and sentiment acknowledges awareness of a 21st century given: we live in an era composed of multiple traditions and competing truths that constitute truth with a small `t´, and efforts to claim a universal Truth with a capital `T´ require unmasking.

The lecture in this historical moment humbly brings forth ideas with conviction, akin to the labor of a poet of communication, who offers a pragmatic assessment of a given subject coupled with a reminder that the world no longer operates with undisputed clarity of direction. In an era of routine uncertainty, public examination of multiple positions necessitates reflective and thoughtful examination of opinions. Education in such an era takes on the pragmatic charge of discerning between and among testimonies provided by a testimonial rhetoric. The lecture as testimony acts as a performative explication of the how and why, forging temporal insight in a world defined by perpetual quandary. The rhetorical importance of the lecture centers on testimony that unites reason and sentiment with a basic educational assertion central to this historical moment: listening with a questioning ear is a prerequisite for learning in a time of unprecedented dispute. Few modes of communication are better equipped to contribute to the public domain of learning than the lecture as

testimony. Understanding in an era of difference must take seriously perspectives of content and standpoints of sentiment; one must comprehend the influence of each.

In a media age, rhetoric remains tied to the text, and the lecture testifies to a text composed of reason and sentiment that demands active and critical listening. In such a moment of technological diversity in communication channels, one asks, `Why continue to use such a medium of communication; why enact the rhetoric of lecture?´ Contextualizing an answer to this seemingly perennial question prompts revisiting critiques about the lecture rendered more than a half century earlier. To make this point, I pivot to a provocative essay on the lecture by Ken-Etsu Dato (1956), the "Pressure to Lecture," published in 1956. Dato (1956) actively and loudly disagreed with the demand to lecture; he called the lecture an accommodation to a commercial need in order to address a rising number of students at minimal cost. Dato (1956) used the phrase "nose-count per dollar" (Dato, 1956, p. 364) in order to emphasize his critical perspective on a lecture-centered approach to education. He considered the lecture a commercially tainted rhetoric that corralled a thundering herd of students into a large space and then stuffed them into multiple sections in the same class and in a single large location. According to Dato, the lecture met a financial need mandated by administrators, who sought to manipulate a captive audience, which yielded joy for bean-counters and textbook publishers desiring large sales. Grand assemblies of students, according to Dato, suffered through blurred acts of dramatization and content; professors too often substituted conservative readings of evidence for entertaining presentations that were far too dependent upon emotive surface examinations. The lecture sought entertainment. Dato's portrayal of the lecture unmasked two major concerns: 1) monopoly over and hegemony of ideas and students, and 2) the assertion that the lecture was a communication channel used to carry out a compulsory commercial enterprise. Students became hostages herded into a single space.

Dato's criticism of 1956 was germane to his time and to any moment when commercial considerations triumph over learning. The communicative channel of the lecture offers an important counter in this historical era to one-sided proclamation propelled by universal assertions. The lecture as testimony announces the interplay of content and commitment from the speaker that necessitates critical listening and discernment from attentive listeners. The lecture does not presuppose that all in an audience will agree or even find the material of great significance. A lecture invokes audience interest that ranges from modest concern to intense attentiveness. The exposure, however fragmented, introduces an audience to the content and sentiment of a speaker that requires the audience to wade through information and passion that contribute insights and opinions to the public domain. Dato's warning is of ongoing importance; when the commercial eclipses learning, education suffers. Nevertheless, the culprit is not the lecture, through which students encounter the value of attending to content from a position of standpoint. Students must decide what to believe; encountering content and sentiment as testimony outweighs the limits and problems associated with Dato's caution.

My contention is that in this historical moment the lecture as testimony warrants reconsideration in an era defined by narrative and virtue contention in a time of information isolation. One needs to hear multiple and contrary perspectives in an era of increasing media selectivity to position and voice. Dato's commercial critique centered on duping students with entertainment; we live in a historical moment in which such a concern continues and the lecture as testimony offers a counter.

The lecture as testimony unites evidence and situates positions of import in the pursuit of temporal insight and consideration. The lecture as testimony requires an audience to acknowledge and respond to a multitude of positions and standpoints. The lecture as testimony in this historical moment is an ongoing practice for living in an age of difference, requiring the full participation of speaker and audience. Indeed, the world has shifted dramatically since Dato's 1956 critique, but what remains is an ongoing reservation about commercial and knowledge acquisition. My contention is that the practice of intellectual liberation begins with content and sentiment offered as testimony that requires witnesses intent on discernment between and among ideas. The lecture as testimony suggests that ideas matter, and sentiment tells us `why´ to listen and learn.

9.5 Testimonies of Ghosts

In a digital age, we can archive everything; this reality can obscure the fact that interpretation continues. Archived information does not come to us pre-packaged in its meaning and signification. The key to interpretation remains acknowledgment of a ghost of insight that lingers in shadows, which goes missed when efforts of undue quick and surface reads fail to recognize that which remains out of facile sight. Such information carries an interpretive bienvenue that begins conversation anew. Carolyn L. Kane interviewed John Durham Peters (2010) on the implications of a digital age, taking us to the implications of ghostly testimony. Kane interviewed Peters on questions in a digital age; its archiving urge seeks to eradicate interpretive ghosts. Peters underscored the signification power of ghosts, lamenting the loss of analog media composed of "scratches, hisses, and noise" (Kane & Peters, 2010, p. 127). Kane then countered with the assertion that computer viruses and system failures are ghosts. Peters disagreed; he differentiates a ghost from terror and insecurity. A ghost haunts without imposing. Digital precision moves the interpretive act of meeting and welcoming ghosts to active efforts to ensure their eradication.

Ghosts in the shadows dwell in the interface between the seen and the not yet comprehended. Peters contended that Hegel offered a phenomenology of ghosts in his efforts to understand the world before us; again, he laments, stating that the digital archive is the ghost buster of the 21st century. A digital age seeks to eradicate ghosts and keep them outside interpretive engagement. Peters suggests that ghosts are, however, difficult to kill. Ghosts function phenomenologically, not empirically, and evade capture by empirical recordings. Emmanuel Levinas (1961/1969) details repeatedly the fact that the physical face points to something beyond it, with an emphasis on the enigma of the phenomenological face. A digital archive holds yet another phenomenological enigma; there is something beyond the empirical recording, a ghost that lingers in the shadows.

The lecture as testimony reflects a public and digital reminder in our technological time – the interpretive power of ghosts remains. Mei Zhang (2011), in "Inspiring American and Global Audiences: The Rhetorical Power of Randy Pausch's Last Lecture in the Digital Age," makes this case both empirically and phenomenologically. Her essay examines the impact of Pausch's last lecture and his book by that name; he delivered a last lecture shortly before he died of pancreatic cancer. Pausch was a professor of computer science at Carnegie Mellon University in Pittsburgh, Pennsylvania. He conveyed his last lecture from that campus, which many listened to throughout the world via online access and widespread media coverage. Zhang

(2011) offers an outline of Pausch's final lecture, "Really Achieving Your Childhood Dreams." In the lecture, Pausch initially detailed his dreams, from his hope of playing professional football to meeting Captain Kirk of Star Trek. His stories announced disappointments that generally led to discovery of new paths. His address covered a wide range of topics, from computers and programing to the ongoing importance of persons and service. His life of learning and service kept gratitude at the center of a life of thoughtful action and contribution. He emphasized the importance of hard work as a fundamental ingredient for personal and professional success. Pausch continued an emphasis on service to others, stating that he often stayed late to work and assist his students. He contended that when met with limits, disappointments, and obstacles that acted like brick walls, one must continue moving, engaging in determined struggle. Much of life requires meeting and passing a seemingly unending series of life tests. For instance, as a prospective undergraduate student, he did not receive admission to CMU; yet, later he was successful when an interview opened doors for his work in their Ph.D. program. Tenacity guided his career with a simultaneous stress on service, fun, and enjoyment. Pausch stated: "I mean I don't know how [not to] have fun. I'm dying and I'm having fun" (quoted from Zhang, 2011, p. 61). Each day his actions announced love and care in his love of family, friends, and his projects. His lecture functioned as a testimony that united and did not divide; his speech crossed national boundaries and centered on "family values, everyday happiness, and dream fulfillment" (Zhang, 2011, p. 61). The lecture manifested coherence and fidelity (Fisher, 1984). His stories displayed a sound of truth that declared experiences that others found understandable and assisted their lives. In addressing the issue of death, "he challenged the audiences to decide whether they are a Tigger or an Eeyore from the Disney cartoon *Winnie the Pooh*, the happy character who is eager to share his zest for life or the gloomy character who keeps knowledge to himself" (Zhang, 2011, p. 61). He also used the comparison of a fish in water. Talking about fun is like a fish talking about water; the discussion is minimal and the reality of the importance of fun and water is equally fundamental to a good life. The style of his speech kept the conversation going and the audience attentive to his message; Pausch was down to earth as he discussed the inevitable end of his own life. His informal style not only kept his audience paying attention, it invited them to do something with their own lives. He pointed to transcendent values necessary for a good life: "hard work, perseverance, and enthusiasm for life" (Zhang, 2011, p. 62). The speech announced intercultural connections that united people of difference in reflection on the reality of death and the importance of living life with gratitude. The speech made him a global hero, as he transcended differences and united us with what Clifford Christians called "protonorms" (Christians & Traber, 1997). In a digital age, Pausch's lecture reached across borders. His words embraced the locality of his place and moment and simultaneously opened a conversation that many wanted to hear and to reflect upon. The power of the speech rests in Drucker and Gumpert's (2008) use of the term "glocalization" (Gumpert, 2008, p. 63). The digital world permits the lecture as testimony to reach a larger world without doing disservice to the local; the digital world can invoke the local while influencing well beyond the moment of saying. The interplay of local and otherwise is an empirical fact in a digital age, and the interpretive implications of the lecture as testimony carries within it phenomenological ghosts that call forth imagination sparked by the power of content and sentiment.

The lecture as testimony unites content and a committed position that matters, which govern the rhetoric of a text. The essay by Ramsey announced the importance of testimony,

framing the lecture as a "love letter" to students. Working within support of the lecture, Corina Stan (2016) suggests that we cannot forget the importance of Alasdair MacIntyre's (1990) emphasis on difference discussed in *Three Rival Versions of Moral Inquiry*. One cannot forget the importance of content that differs with one's own perspective. There is within a lecture of testimony more than one interpretive ghost. The lecture as testimony rejects the assumption that the student is emotionally fragile and limited to a single perspective. Problems within a complex global community require attending to what we do not want to hear, making ever more salient the interpretive richness of the lecture as testimony.

The digital world brings multiple testimonies to us, permitting an archiving of testimonies that matter in sentiment and content that house, but do not eliminate, interpretive ghosts of implications. The digital world does not jettison the lecture; it makes the lecture as testimony an increasingly accessible gift. As with any gift, one must appreciate the generosity of lecture as testimony and use it responsibly, enacting the instruction of Immanuel Kant (1996) by embracing the responsibility of `self-legislation´. In an era defined by rival traditions, the student, the listener, and the citizen must discern with thoughtful and reasoned care the phenomenological ghosts that uphold interpretive keys of imagination. The lecture as testimony reminds us that content and sentiment matter, and, simultaneously, an organized presentation is but one position. Responsibility in discerning temporal truth grows as access to information expands. The lecture as testimony ignites other testimonies made available to a global community in a digital age. It requires responsibility of self-legislation as we seek to understand a potential temporal truth coupled with a democratic reminder of the importance of eternal vigilance in the meeting and discerning between and among rival traditions. The lecture as testimony is a home for content and sentiment, responsible imagination, and interpretive insights that meet us as phenomenological ghosts. This digital age of rhetoric permits a computer professor to speak from a phenomenological place, calling for love of work, persons, and service.

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10 Self-determined Learning (Heutagogy) and Digital Media Creating integrated Educational Environments for Developing Lifelong Learning Skills

Lisa Marie Blaschke

Abstract
Defined as the study of self-determined learning, heutagogy is a learner-centered educational theory founded on the key principles of learner agency, self-efficacy, capability, and meta-cognition (knowing how to learn) and reflection. Combined with today's technologies, the theory provides a framework for designing and developing learner-centered environments that have the potential to equip learners with the necessary skills for a lifetime of learning. In addition, application of heutagogy has been to shown to promote themes of both social responsibility and justice, as well as a more democratic educational process. This chapter outlines the fundamental principles of heutagogy, or self-determined learning, and describes ways in which the theory can be applied, taking into consideration the critical and changing roles played by the student, teacher, and institution in creating a holistic, self-determined learning environment. In addition, the chapter also identifies technologies – in particular social media – that can be used to support development of self-determined learning.

Keywords: Heutagogy, Self-determined learning, Social media, Lifelong learning, Self-directed learning

10.1 Introduction

Globally there reverberates a need for democracy and social justice in education and for critical thinking in our future workers and society as a whole. In an age of fake news, alternate facts, and anti-science, it is more important than ever for learners to be equipped to independently review and critically evaluate information for its accuracy and relevance, as well as its meaningful application in professional practice. Mechanical teaching practices such as those resembling the `Nürnberg funnel´ encourage passive consumption of knowledge and pedagogical oppression, and a much more active and in-depth approach is needed in order to develop learners with the necessary skills for today's workforce. Heutagogy, or the study of self-determined learning, with its focus on learner agency and self-reflection, allows learners to take control and responsibility for their learning. Inclusion of digital media further strengthens a heutagogic approach, as these media impart special affordances in support and promotion of this type of learning (Anderson, 2010; Cochrane & Bateman, 2010; McLoughlin & Lee, 2007; Blaschke, 2016; Anders, 2015). This chapter will describe the key principles of self-determined learning, discuss creation of holistic learning environments that encompass the changing roles of learner, teacher, and institution, and provide examples of potential applications of the theory using digital media.

10.2 Heutagogy defined

Simply stated, heutagogy is the study of self-determined learning and was first described by Hase and Kenyon (2001) as:

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> an attempt to challenge some ideas about teaching and learning that still prevail in teacher centred learning and the need for, as Bill Ford (1997) eloquently puts it 'knowledge sharing' rather than 'knowledge hoarding'. In this respect heutagogy looks to the future in which knowing how to learn will be a fundamental skill given the pace of innovation and the changing structure of communities and workplaces. (Hase & Kenyon, 2001, para. 7).

The definition of heutagogy was further refined in a later Hase & Kenyon (2007) publication as "derived from the ancient Greek for 'self' […] and is concerned with learner-centred learning that sees the learner as the major agent in their own learning, which occurs as a result of personal experiences" (Hase & Kenyon, 2007, p. 112). The theory is based on and has emerged from a variety of foundational, learner-centered educational theories, such as transformational learning (Mezirow & Associates, 1990), constructivism (Vygotsky, 1978), andragogy (Knowles, 1975), self-determination theory (Deci & Ryan, 2001), capability (Stephenson, 1996), humanism (Maslow, 1943), and reflection and double-loop learning (Schön, 1983; Argyris & Schön, 1978). Its fundamental principles include learner agency, self-efficacy, capability, and meta-cognition (knowing how to learn) and reflection (Hase & Kenyon, 2001; 2007; Blaschke, 2012; 2016).

Learner-centeredness is at the heart of heutagogy, and *learner agency* is a major component of the theory. When engaging in heutagogic practice, the learner takes center stage, as she or he determines the learning path, defining learning objectives and outcomes, as well as how that learning will be assessed. The learning path is non-linear, thus allowing the learner to explore all relevant and available paths to learning; as part of this transition, the role of the instructor becomes that of a guide and a mentor in the learning process. This learner agency is a foundational premise of heutagogy, one that contributes and feeds into other principles of the theory, for example, learner self-efficacy and capability. Once the learner becomes an active agent of his or her learning, he or she begins to develop self-efficacy, which then has the impact of promoting cognitive development and positive self-perception, and reinforcing the learner's sense of accomplishment and ability while learning (Bandura, 1993). In addition, by embracing personal autonomy, the learner is placed in a position of making decisions about how and what she or he learns, driven by intrinsic motivation (Deci & Ryan, 2002). As the learner more deeply engages with the learning process, she or he undertakes a process of reflection, not only about what has been learned and how it has been learned (double-loop learning and metacognition) – but also how the new knowledge impacts his or her values and beliefs (Argyris & Schön, 1978; Schön, 1983). According to Mezirow (1990), this process of engaging in critical reflection leads to transformative learning, offering opportunities for emancipation in thinking about deeply rooted belief and value systems.

Hase & Kenyon (2007) support these views and consider learning to be "an integrative experience where a change in behaviour, knowledge, or understanding is incorporated into the person's existing repertoire of behaviour and schema (values, attitudes and beliefs) […] if learning has taken place, competencies can also be repeated and even adapted in unfamiliar, unanticipated situations" (Hase & Keynon, 2007, p. 112). While competency can be considered a stepping stone in one's learning, capability – or the ability to demonstrate competency in new environments – is the intended goal. Stephenson & Weil (1992) consider capability to be essential to the learning experience and to the long-term development of learners, as it equips them with the necessary ability to deal with the uncertainty and change of the workforce and to take on individual responsibility in decision-making. Ultimately,

heutagogy posits that giving responsibility of the learning process to the learner (learner agency) has the resulting effect of encouraging development of learner self-efficacy and capability, as well as of cognitive and metacognitive skills such as critical thinking and reflection.

Heutagogy can also be understood as a continuum of Knowles' (1975) theory of andragogy, or self-directed learning. As part of a pedagogy-andragogy-heutagogy (PAH) continuum, the learner moves from a more structured, less autonomous educational environment to an environment of higher autonomy with little or no structure (Luckin et al., 2010; Garnett, 2013; Blaschke, 2012). The theory has also been linked to research in neuroplasticity and the capacity of the brain to reorganize and adapt once the learner is confronted with cognitive dissonance and engages in critical reflection (Hase, 2013; 2016; Glisczinski, 2010).

10.3 Changing Roles: The Learner, The Teacher, The Institution

Application of heutagogy in education environments requires that the focus of teaching and learning shifts to the learner. To achieve this learner-centeredness in the education process, change must occur throughout the system, resulting in modified roles for the learner, the teacher, and the institution. The learner becomes more responsible for determining his or her learning path (objectives and outcomes) and assessing the learning, while the teacher adopts a more guiding role and the institution a role as support network, with technology providing the underlying support for furthering learning (Figure 10.1). For such a transition in the educational environment to occur, Blaschke & Hase (2015) recommend that a holistic approach to learning design must be undertaken, one that supports heutagogic design elements of exploration, creation, collaboration, reflection, and connection and sharing (within and outside of the institution).

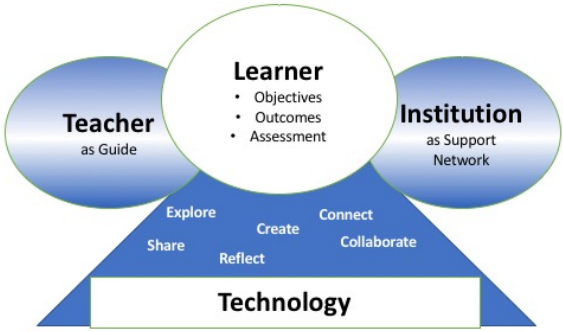

Figure 10.1: Changing roles in a holistic, heutagogic design (own Figure).

10.3.1 The Learner

As the learner is the center of the learning process, his or her role is most deeply impacted when adopting heutagogy in practice. Such a shift requires that the learner take on more responsibility for his or her learning, as she or he defines the objectives of learning and the

planned learning outcomes, as well as the criteria for assessing whether learning has occurred. As the central decision-maker in the process, the learner is forced to actively engage in learning, rather than passively consume information. Self-determined learning requires learners to take full responsibility for their learning and takes them out of their comfort zone, which can be a chaotic experience for the student. Learners may initially resist this new role, preferring earlier pedagogic methods of heavily structured teaching and learning and which place the teacher at the center of the educational process. An early student of heutagogic practice, Brandt (2012) relates her transition from passive to active, self-determined learner, stating:

> I learned how to `do´ school at a young age. Find out what the teacher wants, do it and reap the reward of good grades. The same formula worked in college […] I was skeptical when the professor encouraged us to use self-determined learning […] I stepped out of my school comfort zone and entered into my outside-of-school learning mode. I observed and joined in as we students chose our topics of interest, did our research or activity, and reported back to the class. I relished the interchange among the disciplines […] It was difficult to return to regular online classes, after having had the experience of being able to actively participate in the selection of my learning topics and activities in the summer course. I felt frustrated and forced when I had to read the articles the teachers selected, with little room for my own interest areas. (Brandt, 2012, p. 102f.)

Blaschke (2014b) reports a similar student experience in her online graduate courses, finding that students often need to be coaxed out of traditional learning approaches, thus entering a space of cognitive dissonance where transformative learning can occur; however, once they engage in and transition to self-determined learning, students struggle when returning to traditional approaches, preferring the more intrinsically motivated, heutagogic process.

10.3.2 The Learning Leader

In delivering his higher education mandate, the Malaysian Higher Education Minister emphasized the growing role of technology in education and the need for better preparing graduates for the workforce, describing the changing roles of today's student and educator as follows:

> Students today are not like students of old. They are able to learn by themselves. This is called heutagogy […] If students were mere recipients of knowledge previously, today they are co-curators of knowledge. We need to change the mindset of educators and have them rethink teaching and learning design at the tertiary level so that learning is more active, interactive, immersive, challenge-based and includes role-playing (Sani, 2017, para. 4).

As learners take further control and become the focal point of their learning, the teacher shifts from center stage to guide or mentor, from andragogic teaching practice to heutagogic learning (Hase & Kenyon, 2016). Hase refers to teachers in heutagogic environments as learning leaders, individuals who demonstrate characteristics such as an openness to change and ambiguity, flexibility, empathy, and optimism, and a desire to empower – and not control – their students (Blaschke & Hase, 2015). Learning leaders exhibit a growth mindset, instilling intrinsic motivation in learners by encouraging self-motivation and self-determination, while also promoting problem solving and allowing for failure in the classroom (Deci & Ryan, 2002; Dweck, 2006). These learning leaders create environments that move away from "chalk-and-talk" classroom environments to more creative learning spaces that encourage active learning for students, both independently and collaboratively (Adam Becker et al., 2017; Andrews, 2014). Learning leaders not only promote lifelong learning but are lifelong learners

themselves, modeling the characteristics they seek to nurture in their students. Some might argue that self-determined learning – where learning goals and paths are determined by the student – diminishes the role of the instructor in the classroom. Research into organizations that have implemented self-determined learning has found this not to be the case and has shown that giving students responsibility for their learning through performance-based and project-based learning, as well as by nurturing authentic learning, can enrich both the student and teacher experience (Andrews, 2014; Frey, 2016; Gerstein, 2013; Adam Becker et al., 2017).

10.3.3 The Institutional Network

Institutions play a significant role in supporting a heutagogic approach, allowing for and supporting the development of what Kools & Stoll (2016) call a "responsive educational system [emphasis added]" that "proactively and continuously 'scans' the environment to monitor and respond as necessary to external challenges and opportunities" (Kools & Stoll, 2016, p. 54). In creating a responsive educational system, the authors recommend incorporating a variety of measures such as establishing a shared vision of learning, supporting continuous professional development of staff, promoting mentoring of both students and staff as well as connections with the workplace professions (e.g., through collaborations, communities of practice, and partnerships), and integrating technology to support these activities (Kools & Stoll, 2016). By creating networks of support, the institution becomes a means for both teachers and students to exploit opportunities for creation, collaboration, and connecting – each innate heutagogic design elements. Examples in practice of institutional mechanisms that have been shown to support self-determined learning include: communities of practice, visionary leadership, and teacher training and mentoring (Andrews, 2014; Price, 2014; Hexom, 2014).

10.4 Technology as a Vehicle for Self-determined Learning

The recent Horizon Report as well as the World Economic Forum's vision for education both underscore the integral function of technology in education, emphasizing its continuing role in supporting lifelong learning and development of relevant workplace skills, such as collaboration and problem-solving (Adam Becker et al., 2017; World Economic Forum, 2016). Redefinition of learner, teacher, and institutional roles is only one aspect of realizing heutagogy or self-determined learning within education; incorporation of technology that supports self-determined learning is the other. Learner-centered Web 2.0 and Web 3.0 technology has been shown to promote a heutagogic design approach due to the special affordances of the technology, which "supports exploration, learner-determined learning, and personalization of learning; is non-linear in its design; promotes creation and sharing of information and knowledge; allows for collaboration in co-creation of new information and knowledge; and promotes a network of connectivity that can bridge the gap between academia and the professions, while creating personal learning environments (PLEs) and networks for lifelong learning" (Blaschke, 2016, p. 13f.; Gerstein, 2013; Sharpe, Beetham & de Freitas, 2010; Conole, 2011; McLoughlin & Lee, 2007).

A variety of technologies can be used to support self-determined learning for the purposes of exploration, creation, collaboration, connecting, reflection, and sharing – the fundamental

heutagogic design elements. Examples include social media such as Twitter, blogs, and GoogleDocs (Blaschke, 2014b; Chawinga, 2017), mobile devices and online communities of practice (Cochrane et al., 2014; Gerstein, 2013); personal learning environments (Hicks & Sinkinson, 2015); and online e-portfolios and learning journals (Blaschke, 2014a; Blaschke & Brindley, 2011). Cochrane et al. (2014) describe use of mobile devices and social media to support self-determined learning through online communities of practice, stressing the importance of focusing on "pedagogies that deal with the process of becoming, rather than pedagogies that focus upon knowledge transfer" (Cochrane et al., 2014, p.13). Halupa (2016) also cites the use of technologies such as 3D printing, electronic publishing, games, augmented reality, and crowd funding for applying heutagogic practice, as means to encourage development of critical thinking skills and creativity. Further examples of the use of digital media to support heutagogic design can be found in Blaschke (2014b; 2016; Blaschke & Brindley, 2015).

In addition to inclusion of technology, teaching practice can be adapted by including scaffolding of learning activities; providing individualized learner support; allowing for failure and student choice (learner agency); and utilizing formative assessment and learner contracts (Oliver, 2016; Blaschke, 2012; 2014a). Professional development of teachers should also be promoted, for example, through development of collaborative inquiry and self- and co-regulation skills as a pathway to building more cooperative rather than directive relationships with students as they learn (Schnellert & Butler, 2016)

10.5 Conclusion

With its focus on learner agency, self-determined learning shifts the responsibility of learning to the student, thus inspiring a more self-directed and self-regulated approach to learning, fueled by the student's intrinsic motivation that can eventually transform to self-determinedness. The framework can be positioned within institutions as a learner-centered approach that supports development of learner skills in a variety of areas central to workplace and lifelong learning: collaboration, communication, creativity, critical thinking, and learner autonomy. Combined with the power of digital media, a heutagogic approach places decision-making about the learning path into the hands of the learner, who is then guided by the instructor and supported by the institution. Although students may initially shy away from the approach, research has shown that learners can be `re-empowered´ through self-determined learning. Research by Nkuyubwatsi (2016) provides examples of learner empowerment in three different open and distance education learning environments finds that "Socially disempowered learners can, however, be re-empowered so that they take the central position in their educational transformations" (Nkuyubwatsi, 2016, para. 2), a finding also supported in research by Oliver (2016) and in the example of Brandt (2014). Any attempt to realize a heutagogic, self-determined learning environment, however, requires a holistic approach that engages all stakeholders and components of the education system.

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List of Figures (Chapter II)

List of Tables (Chapter II)

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III The Digital Turn in Practice

Best Practice Examples for the Digital Turn in Higher Education

11 Establishing a Sense of Community, Interaction, and Knowledge Exchange Among Students

Thomas Ryberg & Jacob Davidsen

Abstract
In this chapter, we share experiences from a project at Aalborg University (AAU), in which the authors designed a course using Google+ Communities for the first semester of the Communication and Digital Media programme. The main pedagogical idea was to use Google+ Communities to foster both an academic and social sense of community among the students, through encouraging interaction and knowledge exchange. Studies show that students prefer to use Facebook for academic and social purposes. Consequently, teachers have limited insight into the academic challenges facing students, which is problematic when trying to create and support an academic community. Moreover, it is problematic that the institutional system Moodle primarily is used by the teachers to push information in the direction of the students. Thus, we wanted to design a third space that would fit in-between Facebook and Moodle, and which would allow the students to experience the benefits of participating in an online community with fellow students and teachers. The study shows that teachers are crucial in developing and maintaining the online community. Nevertheless, there was also evidence that some of the online activities encouraged students to interact and exchange knowledge which fostered a sense of community.

Keywords: Problem based learning, Community, Knowledge exchange, Social media, Networked learning

11.1 Introduction

In this study, we discuss and analyse experiences from a pedagogical research and development project taking place in the first semester of the educational programme Communication and Digital Media (CDM). This programme is in the Faculty of Humanities, in the Department of Communication and Psychology at Aalborg University (AAU). Aalborg University is a relatively young university established in 1974 and it is characterised by being founded on the principles of Problem Oriented Project Work, or what has come to be known as the Aalborg PBL model (Kolmos, Fink & Krogh, 2004). In brief, this means that each semester students work in groups over 4 months with self-selected problems and produce a project report which accounts for half their ECTS for a semester (15 ECTS). Although, the concrete adoption of the PBL principles and the model vary across different programmes it is a model that underpin all programmes in the university. The research and development project took its point of departure in the learning activities related to a 5-ECTS course introducing students to Problem Based Learning as it is practiced in AAU and in the CDM programme, but also extended beyond the particular course. In the project, we used the Google+ Communities (henceforth Google+) to design an online learning environment supporting and extending the classroom based teaching and learning activities. Thus, the chapter introduces to and reflects on a concrete implementation of social media (or web 2.0 technologies) in a PBL environment within Higher Education.

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The overarching aim of the project that we discuss and analyse in this chapter was two-fold. For one thing to employ social media (or Web 2.0 technologies) to create a stronger collective learning environment amongst the first semester students and to encourage them to see each other as valuable resources for learning at a semester level. While the students in AAU work collaboratively in smaller groups, our aim was to help them establish a stronger sense of community, and increase interactions and knowledge exchange at a semester level i.e. to become learning partners at the scale of the semester and not only in the individual groups. Secondly, to support the students in gaining concrete first-hand experiences with academic practice and the PBL-principles to get them `under their skin´. The latter were part of the learning goals for the introductory course, and are not the focal point of attention of this chapter i.e. whether students successfully developed these PBL- related competences. As such, the PBL introductory course acted as a stepping stone to develop a semester-wide learning environment or scholarly community aimed at creating a stronger sense of community, establish interactions and promote knowledge exchange among the students. That is: to develop a scholarly, subject related feeling of community among the students.

A sense of community we understand as the basic idea that students feel that they belong to a community i.e. that they are together in being 'first semester students in the CDM programme', and that they can benefit and learn from each other. Interactions are the ongoing communicative activities that are required to maintaining the experience of being a community; having a joint enterprise. Knowledge exchange we understand as a type of communication where the interactions include a scholarly or subject related dimension and extends beyond purely informal and informal interaction.

In this chapter, we initially describe the context of the pedagogical development project and its impact on the design of the environment and activities on Google+. We present the rationale and reason for choosing the Google+ environment and then the pedagogical design of the environment, the learning activities, as well as the lecturers' roles. Following this we analyse the students' experiences of the environment and the activities. This analysis is based on a survey, two focus group interviews and data from Google+. Finally, we discuss the potentials and challenges of facilitating such online communities and learning environments in Higher Education.

11.2 The PBL Principles and the Introductory Course in the CDM Programme

The development project is anchored in an already existing course on Problem Based Learning at 1. Semester, CDM. A programme and course that 85 regular on-campus students enrolled in in 2015. The purpose of the course is to introduce the students to PBL as it is practiced at Aalborg. The course consists of 12 lectures and introduces the students to PBL, problem formulation, group dynamics, project management etc. The faculties and programmes introduce to PBL in different ways, but most programmes in AAU are based on the following principles (Askehave, Linnemann Prehn, Pedersen & Thorsø Pedersen, n.d):

- The problem as point of departure;
- Projects organised in groups;
- The project is supported by courses;
- Collaboration – groups, supervisor, external partners

- Exemplarity;
- Student Responsibility for learning.

These principles underpin how PBL is practiced at AAU (although with some variance across the different programmes). In practice, this means that students each semester work in groups; define their own real-world, societally relevant problems to address (often with external stakeholders); engage in long-term collaboration (3-4 months) where they – together with a supervisor – choose relevant theories and methods; carry out empirical and theoretical studies; analyse and discuss empirical data and/or theories to address their problem. The 'solution' to the problem is disseminated in a final project report that accounts for (typically) half of the students' credit for a semester (15 ECTS). Thus, it is a pedagogical model, which is heavily participant-driven, collaborative and problem-oriented and is profoundly inspired by the work in critical pedagogy (e.g. Paolo Freire and Oscar Negt). The model operates at a programme and semester level, rather than being confined to an individual course. This means that the model is implemented at a systemic level where it pervades the organisation of the entire curriculum of an educational programme. This affects the design of relations between courses and project work within a semester, as well as the physical architecture of the university. For example, students should – ideally – have their own group room. In addition, the model is applied as a university wide pedagogy, rather than being confined to particular programmes, such as medicine or engineering, where ideas of Problem Based Learning have traditionally been more pronounced than in other disciplines. To support the students in understanding the underpinning principles and how to do group work in practice many programmes use so-called P0-projects (P-zero) on 1. Semester. In the P0-projects, the students work in pre-defined groups and with a problem or case defined by the lecturers. This is also done in the CDM programme and in this way – the students get to practice problem oriented project work and collaborating with a supervisor. Later in the semester the students will work with their real semester project (often named P1-project) where they form their own groups, and decide on a self-selected problem to work with (within the thematic frame of the particular semester).

Apart from the P0-project the students at CDM are also enrolled in a 5 ECTS course on PBL (as well as two other 5 ECTS courses). This course functions as the platform and point of departure for the problem oriented project work throughout their Bachelor and Master education. It is this PBL course that we have re-designed and supplemented with activities in Google+. The purpose was two-fold. More specifically in relation to the PBL course our aim was to support the students in gaining concrete first-hand experiences with academic practice and the PBL-principles to get them `under their skin´. More broadly, our aim was to create a sense of community, interaction, and knowledge exchange amongst the students and between the students and the lecturers that extends beyond the boundaries of the PBL course. This is based on our experiences with project groups. Often project groups become quite self-contained as the semester progresses and the project work commences (Dirckinck-Holmfeld, 2016; Ryberg & Wentzer, 2011). This is the case even though the groups often work with very similar issues and problems. Furthermore, in a recent study it has become clear that the new students in CDM live a very nomadic life (Ryberg, Davidsen & Hodgson, 2016). By this we mean that they have no permanent group space or room and as such they experience less opportunities for informal sharing with the other students; and such informal sharing can be

valuable. For example, Hommes et al. (2012) studied three social networks amongst first-year medical students in Maastricht University, and through statistical analysis of the social interaction amongst groups, they found that interaction within and outside the institutional boundaries has a great impact on the students' learning outcomes. Further, Rienties, Carbonell, Alcott and Willis (2012) point out that knowledge exchange over time alternates between being internal to the groups as well as external exchange with other groups. This is one of the important reasons to experiment with digital technologies in the early semesters to support and encourage a stronger sense of community, interaction, and knowledge exchange. Our intention with the pedagogical development project was that this could potentially promote a stronger culture and practice of sharing and collaborating beyond the individual group.

11.3 ICT in the CDM Programme – For Courses and Project Work

AAU uses the Learning Management System (LMS) Moodle for course administration and to support the running of courses. The majority of courses in AAU are held as face-to-face courses, as most programmes are designed for full-time, on-campus students. This means that Moodle is used to supplement the lectures and other learning activities. In Moodle lecturers can put up descriptions of their modules, add literature, create forums, establish wikis, do quizzes etc. However, in practice there is often little interaction between students and lecturers through the LMS. While the CDM programme has employed Moodle for the past seven years to administrate and run courses it functions mostly as a repository for slides and for basic messaging from lecturers to students (Bygholm & Nyvang, 2013). Although the Moodle system in its core design is fundamentally based on a 'dialogical and interactive pedagogy' it seems that in the CDM programme (and more broadly within AAU) it is more often employed as an information system i.e. students get messages about the course, can see a list of readings, and slides will be uploaded. This seems a more common problem with institutional LMSs, and although they were designed and adopted to support collaboration and student centred learning, many critics now see the LMSs as retrograde systems that are enforcing a traditional 'pedagogy of transmission' model (Dirckinck-Holmfeld & Jones, 2009).

While the average use of the LMS within the CDM programme, is perhaps less pedagogically innovative than what might have been hoped for, it is also an educational programme that has been characterised by numerous creative experiments with ICT and learning over the years. Lecturers' in the CDM programme have previously experimented with establishing online communities with social media/web 2.0 technologies e.g. by using the platforms Elgg og Mahara (Ryberg et al., 2010; Ryberg & Wentzer, 2011). These were meant to support students': work in groups; work with portfolios; and in developing a professional and academic identity, and as we shall return to, these previous experiences have been helpful in developing the design for the current project.

Whereas Moodle is the official system available for course activities, there is not a specific system in place to support the students' group and project work in AAU. While Mahara was envisioned as a candidate to support the project work it lives a bit of secluded life, and it is not internally promoted by the IT-services department or adopted by the students. Therefore, the students often put together and compose their own solutions to support the group work, and particularly Facebook is used for communication and coordination in project groups, as well as for internal communication amongst student' in a semester (Ryberg et al., 2016;

Thomsen, Sørensen & Ryberg, 2016). Furthermore, the students combine their use of Facebook, with other popular and mainstream platforms such as Google Docs/Drive/Calendar, Dropbox and Skype to support coordination and collaboration (Khalid, Rongbutsri & Buus, 2012; Rongbutsri, Khalid & Ryberg, 2011; Thomsen et al., 2016). The new students at CDM also go through a small course developed by 5th semester students within the same programme. The purpose of this small course is for the 5th semester students to introduce the new 1st semester students to study-relevant digital technologies (Konnerup & Dirckinck-Holmfeld, 2016) and here they introduce the new students to e.g. Dropbox, Google Drive/Docs/Calendar, but also more specialised and academic types of software such as Mendeley or Zotero (which are used for managing academic references).

11.3.1 Social Media in Higher Education and Our Reasons for Choosing Google+

Since the vast majority of students, and probably most lecturers, use Facebook one could critically ask why we chose to use Google+ rather than Facebook. It is quite common amongst students in Higher Education to use Facebook as part of their studies and study life – for example for internal communication between students in a semester (Madge, Meek, Wellens & Hooley, 2009), and even in upper secondary schools, students form self-directed Facebook groups where they communicate, support and help each other e.g. with homework (Aaen & Dalsgaard, 2016). Cuesta et al. (2016) have experimented with using Facebook to build online learning communities, to help students understand academic practice, and to create study groups guided by a tutor (Cuesta, Eklund, Rydin & Witt, 2016). The authors argue that this shows positive results in relation to students (n=24) understanding of academic practice and that the tutors have an important role in creating and maintaining and open and supporting atmosphere. Madge et al. (2009) also report positive impact of students use of Facebook, but equally that lecturers should be careful in mixing the students' informal spaces with formal learning activities. Furthermore, according to Thoms (2016) the use of more recognisable systems, such as Twitter, Facebooks and Google Drive offer better opportunities to support online communities of practice, knowledge construction and learning compared to institutional systems. In general, however, there seems to be mixed experiences with employing Facebook (and social media more generally) in Higher Education for educational or course related purposes from both students' and lecturers' perspectives. In their review of 23 studies, Manca & Ranieri (2013) highlight that students are not always comfortable mixing the formal and informal spaces. Nicolajsen (2014) argued that such a mix could generate 'noise' in the students' informal spaces, but also that, specifically in relation to Facebook, this can mean that the combination of social connections and algorithmic processing influences who sees what from whom (Nicolajsen, 2014; Nicolajsen & Ryberg, 2014). In saying so, we are not suggesting that Facebook is unfit for educational purposes, as the discomfort or tensions reported e.g. by Manca and Ranieri (2013) are not limited to Facebook. They highlight more generally the clashes that can emerge when bringing social media into classroom settings. For example, Dohn (2009) suggests tensions can arise when adopting the underlying participatory, communal and informal rationale of Web 2.0 technologies into educational settings where power relations are asymmetrical and students are assessed based on a rationale of whether they have individually acquired sufficient knowledge and competence. She argues that what counts as a relevant and meaningful contributions to e.g. a Wiki can differ whether it is made

as part of an educational assignment or as part of contributing to the ongoing knowledge development in an informal community. This was also reported as part of Nicolajsen's (2014) experiment where students were asked to post and discuss academic issues in a blog format, but where the discussions did not initially develop, as the students were uncertain about what they were supposed to do. While they knew of blogs and academic assignments respectively, they were not sure of the 'genre' and the demands, when they had to post and comment for academic purposes. The same reluctance and tensions we experienced in our own practice, when we experimented with Elgg and Mahara in the CDM programme in the years 2007-2010 (Ryberg et al., 2010; Ryberg & Wentzer, 2011). Our intentions at that time were similar to the present project, but we experienced some challenges in the various implementation cycles. In the initial phases, our aim was to let the students be the main initiators of the interactions and activities in the system (Elgg and Mahara), as we felt this approach was in alignment with a more user-driven and participatory web 2.0 mindset. Thus, we encouraged students to network, blog and comment on each other's postings, but we did not enforce this through making assignments required or assess their work. This resulted in very little interaction and only a minority of the students posting any reflections, let alone interacting with other students. Contrary to our intended mindset of a student or participant driven community of interest the students in the evaluations sought for more teacher presence and teacher initiated activities (Ryberg et al., 2010). In a later implementation, we did require students to post reflexive blog posts as part of a course, which were meant also to be potentially shared with other students. However, students found the Mahara system difficult and confusing, and they could not establish an overview of the postings that were made or how to share their own posts with others (nor did we explicitly require them to do so although we encouraged it). In turn, this led our implementation and design of Mahara to become a somewhat difficult place for students to upload individual assignments – something they could have done more easily in Moodle (Ryberg & Wentzer, 2011). This leads to another question of why we did not implement our design in Moodle, rather than establishing a new environment. While recently LMSs have been portrayed as retrograde technologies that enforce a transmission pedagogy (Dirckinck-Holmfeld & Jones, 2009), it should be noted that it is equally possible to use Moodle or other institutional learning management to design both interactive and innovative courses. Prior to and after the advent of web 2.0 technologies LMSs such as Moodle (and less advanced technologies) have been employed to design pedagogically innovative courses and programmes (Buus, 2016; McConnell, Hodgson & Dirckinck-Holmfeld, 2012). For example, in the fully online master's programme for professionals `Master in ICT and Learning´ (an online programme run in collaboration between four Danish Universities in Moodle and previously FirstClass) there are vivid, interactive forum discussions and a strong sense of community among students (Dirckinck-Holmfeld, 2010). There are evidently multiple functions in Moodle to support knowledge construction and interaction. However, interface- and architecture-wise there are some advantages to Google+ (and similar social media). For example, Google+ resembles a flat whiteboard where students quickly can post text and multimodal content. In Moodle, such interactions require more steps (finding the course room, browse blocks, getting into the right forum, finding a thread etc.) and posting a video or a picture and having other's comment is a more cumbersome task than what Google+ offers (also our Moodle does not support `likes´ or `+1s´ for posts). It was with these considerations in mind, that we settled with the Google+ environment. With the design and use of Google+ we wished to create a third space in-between students informal use of social media for communication and

coordination and then the programme's formal use of the LMS. We were fully aware that during the experiment students would also be using their semester Facebook group for communication and coordination, and we did not intend the Google+ group to substitute Facebook as the informal communication forum for the students (and based on previous experiences we would not have been successful in such an endeavour). Rather, the Google+ environment was intended to be an in-between space where we could develop a scholarly and subject related community between the students, and between the students and the lecturers. An environment that would also develop beyond the more transmission oriented or informational role the use of Moodle has developed into in the CDM programme (module descriptions, readings, messages to students and uploading of slides). These findings and considerations, as briefly summarised above, lead us to argue that while the environment is an important affordance for the interaction, it is equally important to have a strong pedagogical design rationale, where the role of the lecturers is clear and that the lecturers are instrumental in scaffolding and supporting the activities in the community, as we shall return to in outlining the pedagogical design of the Google+ environment.

11.3.2 Google+ in Brief

Google+ Communities is a free, web based online platform. Apart from the web version there are also applications for smart phones and tablets. The individual community can be made private so that only invited users can participate. Users can create traditional text-postings, but they can also create posts with videos, pictures, and polls. Furthermore, users can easily share documents from Google Docs in Google+. Thus, the system offers multimodal communication forms providing more ways for the individual user to express their thoughts, ideas, and feelings. Google+ has a `+1´ button that functions similar to the `Like´ button known for instance from Facebook. While this supports an affective and informal, everyday communication it is also a way to signal presence and a sense of community in the online community. In contrast to 'classic' threaded forums (as in Moodle) all post are gathered in a common 'flat' stream similar to a pinboard with new messages on the top. This stream can quickly become chaotic and confusing as the number of posts increase, but messages can be grouped in categories and one can further use hashtags (#) to help sort the posts.

We had initially planned that each group should have their own 'room', in the form of a category. However, Google+ only supports 20 categories so instead we decided that groups should use hashtags for handing in their assignments (e.g. with a group number #P0-1 and the title of the assignment #collaborationVScooperation). In this way students could retrieve their posts later in the semester. The final design of Google+ in terms of categories became quite simple with categories for:

- Each semester (to show the possibly extension over several semesters);
- Video presentations;
- Messages from the lecturers;
- The PBL course;
- Assignments;
- Sharing of tools and resources;
  The students' council (established later in the semester).

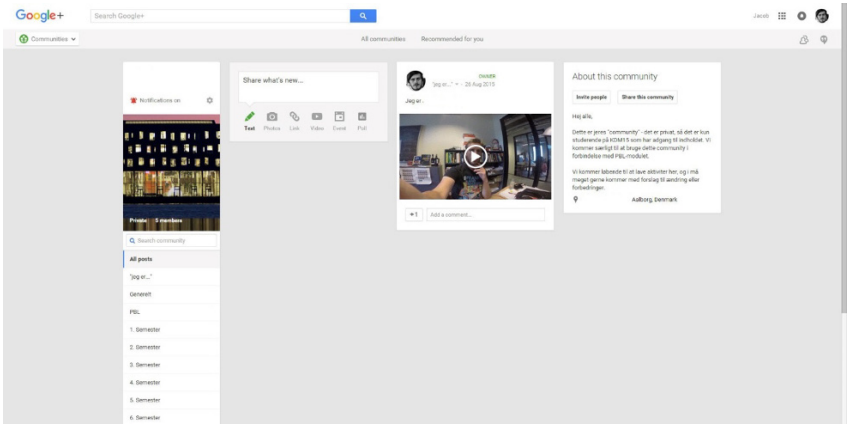

Figure 11.1: Screenshot of a Google+ Account, used by students for their group work (URL: https://plus.google.com/… [URL: private], Last accessed: 26 August 2015).

To support the creation of a sense of community, interaction and knowledge exchange we decided that all the assignments (that were all made in groups) should be shared and be available to all students in the semester, so others could read and comment. Creating assignments that are open to other students come with advantages as well as challenges. On the one hand, students can feel anxious and nervous about publishing their work for other students to inspect. On the other hand, it can be very motivating that others, beside the lecturers read their work. In many of the assignments they used diagrams and templates from the main text book in the PBL course (Holgaard, Ryberg, Stegeager, Stentoft & Thomassen, 2014) for example on problem analysis and negotiation of expectations in the group, so that they would have very similar points of departure for the assignments.

11.3.3 Pedagogical and Communicative Design of the Google+ Environment

One of the overarching aims of our pedagogical design was to create a series of activities and assignments that would: 1) position students as active contributors to a scholarly community 2) make students more aware that they are valuable resources to each other – also across the project groups. The Google+ environment and activities did not appear in a vacuum, rather they were linked to the existing face-to-face lectures, assignments and workshops. As such the Google+ environment was a form of hybrid teaching and learning environment that we sought to establish together with the students, and through combining exercises in the lecture room with activities in Google+. In the early research on PBL Illeris (1974) argued that:

"Learning happens [...] through an ongoing interplay between the individual and its surroundings, and the nature of these surrounding – physical as well as social – thus become crucial to the opportunities for learning" (Illeris, 1974, p. 121).

We sought to realise this principle by creating a routine and practice where it became natural for the students to share and show each other their notes, texts, assignments and exercises across the project groups in the semester. The goal was that the students would develop an understanding that they can learn together and find inspiration in each other's

work. This is what we have aimed to promote and support through our focus on a sense of community, interaction and knowledge exchange. These concepts are inspired by Wenger's (1998) theory on Communities of Practice (CoP), where `sense of community´ resembles what Wenger terms `joint enterprise´, interaction is similar to `mutual engagement´ and knowledge exchange can be likened to 'shared repertoire' without the concepts being identical. We understand a sense of community as a foundation stone in the semester community where students are, or become, aware of each other as members and participants. While this might sound banal there is no guarantee that a community will exist or develop amongst the students. Students could come to the lectures and work in groups without having a sense of community at the level of the semester cohort. Therefore, our aim was that students should gain experiences with how the cohort could function as a context for both their individual, as well as group based activities. The sense of community should be supported and developed through ongoing interaction covering everything from questions and comments on Google+ between the students, and between the students and the lecturers. Such interaction entails purely social, affective communication, which is an important part of creating and sustaining the sense of community, but also encompasses interaction around exercises, resources, and subject related questions. The ultimate goal was that students began to find value in each other´s work, challenge each other and share relevant resources to create a shared pool of knowledge. This, however, requires that a basic social community is established where people trust other members and are comfortable in sharing their work (Salmon, 2002).

With the introduction of Google+ as a part of the learning environment the role of both the students and the lecturers change. Whereas the lecture room is usually structured as one-way communication from lecturer to students we aimed to structure the students' participation in the Google+ environment differently. We wished for them to become active members and contributors to a scholarly community rather than being passive receivers of information. Based on the previous experiences with Elgg and Mahara (Ryberg & Wentzer, 2011) we designed a series of required assignments, as our previous experiments showed that voluntary assignments did not generate sufficient interaction and development of community. Therefore, to cultivate and facilitate a sense of community, interaction, and knowledge exchange we designed both mandatory assignments, small exercises related to the lectures, as well as some smaller informal activities that were not mandatory – all were to be uploaded to Google+:

- Personal introduction in the form of a 15 seconds' video.
- Small group assignments in relation to the lectures e.g. "write half a page describing the differences between cooperation and collaboration and find pictures that represent each of them".
- Five group assignments with point of departure in themes from the course. These were mandatory assignments that would later be assessed.
- Small polls – e.g. what kind of upper secondary education do you come from.

As lecturers, we also produced small video presentations to frame the expectancy of the format of the video production. Some students produced very advanced and creative short films, whereas others produced more basic video introductions e.g. just talking to their laptop cam, which was also the format we as lecturers had adopted. This was the only individual

assignment, but some students did the videos together. Subsequent exercises and assignments had to be made in the project groups. To the extent possible we commented on the students´ post or asked further questions. The students also commented on each other´s posts and assignments, but we did not come to a stage where students on a regular basis would do this or where spontaneous dialogues would emerge around particular assignments or topics.

11.4 Analysis – the Students' Experiences with Google+

The analysis is based on a survey (which 55 out of 72 students answered), two focus group interviews with four and five students respectively. Also, all the interactions are stored in the Google+ community and we have re-accessed this as part of the analysis. We have structured the analysis around three themes: Frequency of Google+ visits, relations between Moodle, Google+ and Facebook, and finally inspiration and knowledge exchange amongst the students in Google+. This leads us into discussions of the potentials and challenges of using Google+ (or similar platforms) to facilitate a sense of community, interaction and knowledge exchange.

11.4.1 Frequency of Visits

In the survey, we asked the students to state how often they visited the Google+ community. While we could retrieve some activity reports for Google+ via a plugin (CommunityMeter) the reports were not very detailed, and we could not see number of visitors, but only number of posts. Even though self-reporting is less accurate than actual log data, they give a hint of the students' experiences of how often they visited the community. From the survey, we could see that frequency of visits varied from 'several times a day' (13%), 'once a day' (33%), 'a number of times pr. week' (45%) and 'a few times since they started at university' (9%) (Diagram 1). Thus, the majority report that they visited the online community a couple of times per week. This indicates that the students did find the online community relevant for their study, but says very little about their interaction with the lecturers or each other.

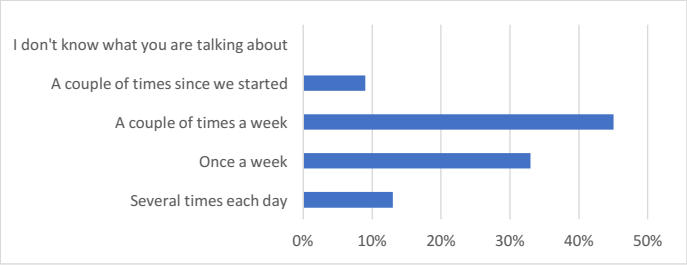

Figure 11.2: How often have you visited Google+? (own Figure).

Based on the statistics from the Google+ plugin we could further see that students' activities (postings and +1s) fluctuated but became particularly pronounced around set course activities (handing in of assignments or exercises). Thus, we can see that students' activity in the Google+ environment seems to be closely aligned with the activities initiated by the lecturers, whereas there was less spontaneous, public and subject related interaction. Although we encouraged students to ask questions in the public, many still wrote private messages to the lecturers, rather than putting them out in the open. Often, we chose to answer the question

in public to encourage others to share their questions. However, in doing so we kept the students asking the question anonymous, and just answered in the general form 'Someone brought up a good question'.

11.4.2 The Relationship Between Moodle, Google+ and Facebook

From the perspective of the CDM programme and the lecturers, the students are expected to use Moodle, and for this particular experiment also Google+. However, it is also clear that students use Facebook, Google Drive and Dropbox on their own accord. In the survey, we therefore asked students to indicate which environments were the most important study and subject-wise (Figure 11.3).

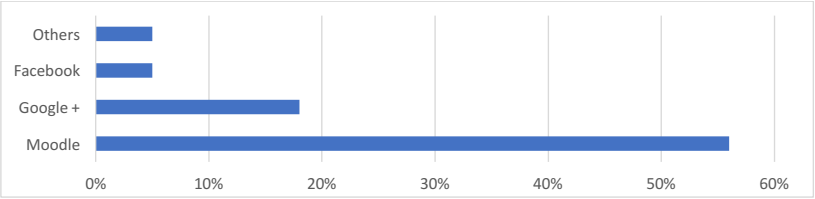

Figure 11.3: What community has had the most academic impact at the semester? (own Figure).

It is in many ways positive to see that 56% of the students indicate that Moodle is the most important system study-wise/subject-related, followed by Google+ at 33% (Figure 11.3). Finally, 10% of the students indicate that 'Facebook' or 'other services' were most important. However, even though the numbers seem to ascribe Moodle an important role, the relations between the technologies are explained somewhat differently by the students during the focus group interviews. During the interviews, several of the students rank the technologies in the following way: 1. Facebook, 2. Google+ and 3. Moodle, as illustrated in a drawing from one of the interviews (Figure 11.4).

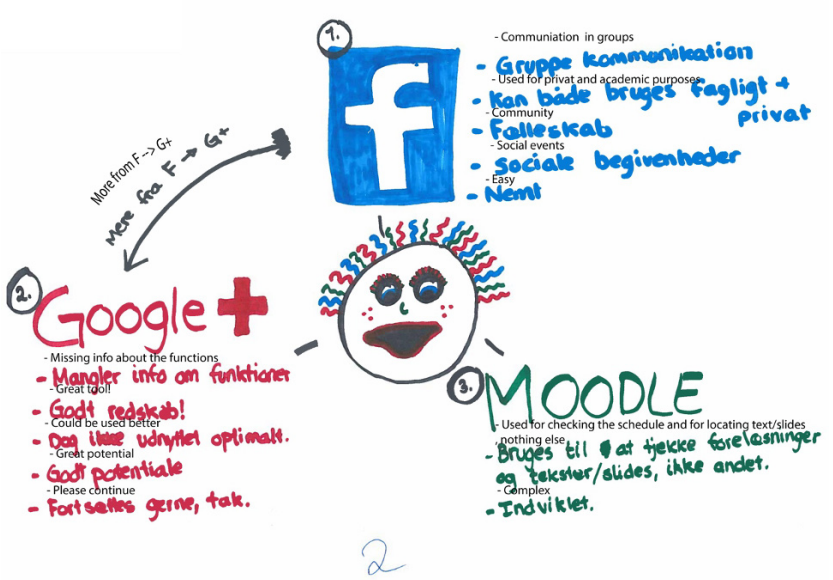

Figure 11.4: Student drawing of the relationship between Moodle, Facebook and Google+ (own Figure).

Even though the students indicate that Moodle is the most important study-wise/subject-related, Moodle is described as 'complicated' and mainly used for: 'Checking lectures and texts/slides, nothing else', whereas Google+ and Facebook to a higher degree seem to support community and interaction from the students' perspectives. This pattern was also visible from another study of 5th semester students in the same programme. In this study, Moodle came across as 'a necessary evil', and something that students had to attend to rather than something they wanted to attend to (Thomsen et al., 2016). There is an interesting tension here between what the students highlight as valuable 'subject and study-wise' and what systems they benefit most from or prefer. If we understand learning as emerging from social interaction and dialogue, then in principle, the systems better supporting interaction and exchange from a student's perspective, such as Facebook and Google+ should be held in higher regard. However, as suggested by Manca and Ranieri (2013) students are often conservative in their understanding of education:

> In a way, it seems that most students have a rather traditional vision of schooling. Their implicit pedagogies still make precise distinctions between spaces and time of learning and spaces and time for socialization and entertainment. These traditional visions of schooling and formal education tend to separate 'life' from 'studying' and 'home' from 'lectures', and students' use of Facebook consequently 'appeared to be (un)consciously replicating and reinforcing roles developed in their previous phases'. (Manca & Ranieri, 2013, p. 495)

This, they argue, also often lead students to desire more controlled and instructor led environments, and we shall return to these tensions in the final discussion.

The drawing in Figure 11.4 further illustrates that Google+ holds a potential, but that Facebook to an even higher degree support students' sense of community, particularly

regarding the social aspects. In the focus groups one of the students express that perhaps a more thorough introduction to Google+ could have changed the use of the technology:

> I think it would have helped quite a lot if we had had a small course in the beginning to become better in using this Google+ thing. For example I had difficulties navigation. It was a bit confusing, how it worked. (Student 5, Focus group 2)

Even though the current generation of students are often portrayed as 'digital natives' both in existing research and our own experiences suggest that there is a need for introductions to new platforms and a sustained scaffolding of the use, as many students are not necessarily very adept in using un-familiar technologies (Heilesen & Davidsen, 2016; Ryberg & Wentzer, 2011). Whereas we thought we had provided sufficient introduction and ongoing support some students, as the quote suggests, did feel the platform was confusing and difficult.

Interestingly, the introduction video activity that was intended as a small 'fun' ice-breaker activity was not received positively by all students. Some expressed concerns with doing the activity and did not seem too keen to 'put themselves online'. Considering the popularity of Facebook, Instagram and Snapchat this could seem somewhat puzzling, but it should remind us that study life (and particularly the first semester) is a socially sensitive situation where students have a lot at stake. That we as lecturers or institutions incorporate technologies that are the same or mimic what students use for social and informal purposes does not mean that the educational context suddenly becomes an informal and social space where students have less at stake. In fact, we did take this into consideration in designing the activity and if there were students who were uncomfortable with the video introduction, we did not chase them down or force them to do it. In the end 53 videos were uploaded (several with more than one student) and it resulted in many funny and well produced videos. Also, as videos started to emerge within Google+ reservations and concerns from other students also seemed to diminish.

11.4.3 Inspiration and Knowledge Exchange Amongst the Students

In the survey, we were particularly interested in understanding how much the students had accessed and was inspired by reading other groups' assignments. We therefore asked to which degree other group's assignments had inspired them or triggered reflections (Figure 11.5).

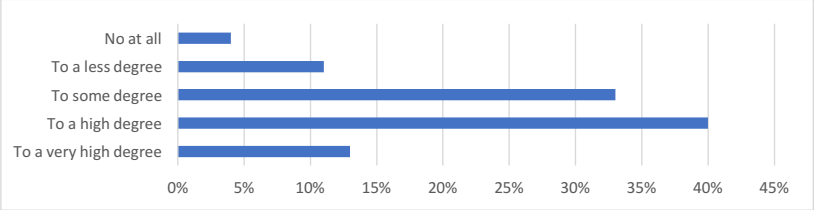

Figure 11.5: To what extent have the assignments shared by other groups led to inspiration and reflection on your own work? (own Figure).

It is quite positive that, for a majority of the students, reading other groups' work resulted in inspiration and reflections (53%) to a very high or to a high degree, and (33%) to some degree had been inspired by or had reflected on their own assignment when reading the work of

other groups. This suggests that the publicly available assignments did have an impact on the individual group's work. In the interview one of the students explain how they used other groups' assignments:

> We did it in a way where we finished our own, and then we looked at the other's (authors: assignments) to see if it was the same we arrived at, or like do we agree and then discussed it. Why do we do it? Why do they do it? It has been a good way just having something to compare with, and then as a point for further discussion. (Student 3, focus group interview 1)

So, some of the students have used other groups' assignments as a stepping stone for further reflection and discussion of their own work, and in general they seem to have been inspired by each other's work (but we do not know, to the level of detail described above, how they all worked with the assignments, as not all the students were part of the interviews).

We also queried into how other groups' activities had impacted on their own activities in Google+. In relation to this (16%) state that they to a very high and (42%) to a high degree have been influenced by other groups' level of activity (e.g. questions and posts). Also (31%) report being impacted to some degree and (9%) to a lesser degree. Finally, (2%) indicated that other groups' activities had no impact on them (Figure 11.6).

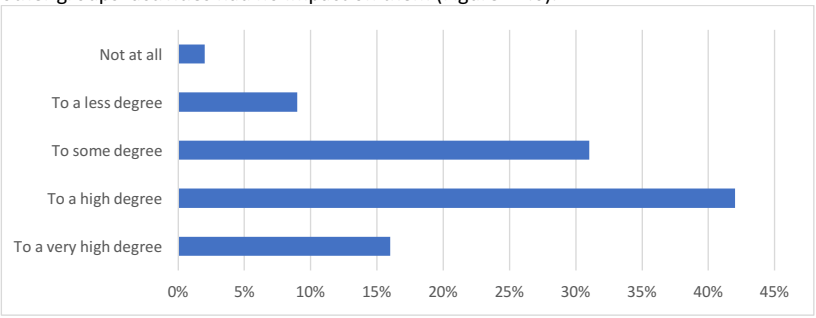

Figure 11.6: To what extent have posts or questions from other groups influenced your groups activity on Google+? (own Figure).

Even though these numbers seem to suggest a relatively positive attitude towards the open sharing of the assignments, the following narrative from one of the students also suggest a certain initial ambivalence towards the open sharing of assignments; an attitude, however, that changed over time:

> Why should I put it out there, if then nobody uses it or maybe give negative feedback. It depends a bit on how one wants to use it, I think. But I have used it a lot. I have read quite a lot of what the others wrote. I think that is one of the major changes by being here (authors: in the CDM programme) compared to what I have tried previously. It is that you are more willing to share. (Student 4, focus group 2)

This student seemed to have changed his attitude to the open sharing over the course of the experiment. From an initial skepticism towards an increased openness and willingness to share. Another student points out an alternative positive aspect of the open sharing, namely that:

> […] you don't just sit in your own bubble with a Word document. (Student 2, Focus Group 1)

These quotes indicate that students may have changed their attitude towards sharing and being part of an online scholarly community through participation in the Google+ group – and

in general the numbers from the survey suggest a positive impact in terms of becoming inspired and reflect on the work of others in relation to groups' own work. However, what is difficult for us to establish is whether this behaviour has carried over into their wider project work i.e. have the semester cohort at large developed a stronger affinity for sharing amongst each other, and amongst the project groups.

11.5 Discussion and Conclusion

The purpose of this pedagogical experiment and development project was to create a stronger collective awareness amongst the students that they can and should be important resources for each other. Even though there is a strong focus on collaboration within the project groups at AAU, our aim was to create a more supporting community at the level of the semester cohort i.e. that students would create stronger ties and potentially develop a stronger knowledge exchange culture within the entire cohort. Further, the aim was to establish a common scholarly space between the students and the lecturers. This we wished to do by designing a third space in-between the formal Moodle environment and the informal semester groups that students establish on their own on Facebook. A space that should help build a sense of community, interaction and knowledge exchange.

The experiment does indicate that it is possible to create a third space that can support the three pedagogical goals. From the survey and the analysis of Google+ participation we can see that the students have been relatively engaged and active in the Google+ community. In interviews and posts it is also highlighted as an environment the students would like to keep. It is, in our view, a very positive finding that the students found inspiration in each other's work. This was not manifest throughout the course of the experiment, as they seldom commented directly on each other's posts and work (which is something we plan to strengthen in the future by adding peer-commenting and discussion into the pedagogical activities).

Thus, we believe that we have to some degree succeeded in creating a third space for a scholarly exchange and a space that exists between the formal, institutional LMS and the informal, self-driven Facebook groups initiated by the students. However, while students seem to be positive towards the sharing and can find inspiration in each other's work, it is, as mentioned in the previous section, difficult for us to establish whether this behaviour has carried over e.g. into the students' project work. Are they more amenable than previous cohorts to share, and do they continue this behaviour in spaces that are not regulated by us, and where sharing is not required? In the present project, we have been unable to track or attempt to follow the cohort's behaviour outside the frame of the course and the Google+ community, so whether this behaviour extend beyond the reach of the particular intervention is difficult to establish at present.

Compared to the LMS the Google+-community has some architectural and interface-wise advantages as it resembles to a higher degree the social media students use in their everyday life, and it does offer a more immediate, smoother and easier way of posting e.g. multimodal content. Thus, much in line with the experiences reported by Manca & Ranieri (2013) there have been more interactions and posts than we experience normally in a course in Moodle. This, though, is difficult to compare, as we have not run the course with similar focus on online activities in our Moodle environment. However, this does not mean that there is no need for

support or introduction to the environment. Nor does it mean that the space becomes informal, a-hierarchical or collegial by adopting technologies that are more often used for informal purposes. In fact, it is important to remain attentive to the fact that students have something at stake in these social spaces; in relation to each other, as well as in relation to the lecturers. Even though we as lecturers perceive uploading an introduction video as a non-threatening ice-breaker, this might appear differently to the students. To them it might be an anxiety-inducing leap to upload a video of themselves in a semi-formal context and participate in an online community, but this is a leap we must insist that they take.

Furthermore, there are other challenges. From the experiment, it is also quite clear that the interaction and level of activity are heavily dependent on the engagement of the lecturers, and the lecturers' design of activities and spaces. As one of the students commented about their engagement with and the continuation of the Google+ space:

> It depends on them (authors: the lecturers), if they don't use it, then we don't use it either. But if they use it and say it is there we run a course through or the like, then we use it. (Student 1, Focus Group 2)

As we highlighted previously, there is a tension here. While our pedagogical intention was to encourage students to see the value of each other's work and that learning from each other is important, the students do seem to expect a level of teacher presence and teacher initiated activities as required for them to engage with the environment and the activities.
The students do simultaneously use Facebook for communication about their studies, the programme etc. and the students do need such private spaces, that are also room for mutual help, support and knowledge exchange. However, not quite at the level of sharing their assignments or moderated dialogues on subject related matters or assignments (Thomsen et al., 2016).

This also means that a challenge remains in creating and sustaining spaces that offer scholarly knowledge exchange and sharing i.e. to develop a culture where students feel a sense of community, interact with each other and exchange knowledge. A challenge lies in developing an environment that support such a culture of sharing and interacting between the students, and between the students and the lecturers. We hope that we have sown a seed in this development project, where the students will take further initiative to maintain and support a sense of community, interaction and knowledge exchange in their semester cohort – a culture that develops beyond the primarily social and practical support they have in their Facebook groups and extends to include also a greater focus on subject related matters, and helps them see that they can meaningfully act as learning resource to each other.

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12 The Students' Choice of Technology A pragmatic and outcome-focused Approach

Mia Thyrre Sørensen

Abstract
While students are increasingly bringing informal practices of social media and other digital tools into an educational context, the students' capabilities to use these to support their learning is debated. In educational technology research students are portrayed as digital experts, who are multitasking and using digital tools in new creative ways, but equally, they are reported to be uncritical users with a limited understanding of how to use technology to support learning.
In this chapter, I discuss the students' choice of ICT tools for supporting their learning and their problem and project-based group work. Based on a study carried out on 5th-semester students in the programme Communication and Digital Media (CDM) at Aalborg University (AAU), I analyse the students' motives and rationales for employing various tools. The study shows that students mainly choose mainstream commercial ICT tools e.g. Facebook, Google services and Dropbox, which are familiar to them and easy to use. I argue that the students' approach to choosing technology is a pragmatic and outcome-focused approach. The students' pragmatic approach to technology doesn't fit into either the positive nor the more negative portraits of students' use of technology. I argue that this pragmatic approach makes it (even more) important to study students' self-directed use as to understand their digital practices; to give the students a better understanding of their own practice; and provide us as educators with the ability to challenge their use.

Keywords: Networked Learning, Problem Based Learning, Students' use of Social Media, ICT, Facebook

12.1 Introduction

The students' everyday life is permeated by technology and it is increasingly intersecting with their academic life. The students bring informal practices regarding digital tools and social media into formal educational contexts (Deng & Tavares, 2015; Greenhow & Lewin, 2016). Studies show that social media can support educational activities by facilitating interaction, collaboration, active participation, information and resource sharing. Furthermore, social media influence the students' learning processes and outcomes by having a positive social and emotional impact (Greenhow & Lewin, 2016; Mazman & Usluel, 2010). However, the benefits of using social media in a learning context are contested and results and positions on the matter seem polarised.

In the diverse landscape of social media, Facebook is one of the most popular and commonly used, hence also one of the most studied platforms in educational contexts – but its educational value has also been questioned. Some researchers argue that Facebook supports the creation of a network of information, persons and resources, and affords interaction, collaboration and sharing of information and resources (Manca & Ranieri, 2013; Mazman & Usluel, 2010). Further, many students consider Facebook as a 'safe' place for interaction, active participation and discussion, and can, therefore, be seen as useable space

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for collaborative learning (Deng & Tavares, 2013; 2015; V. Rasiah, 2014). On the other hand, researchers have pointed out that Facebook can be a disturbing element for the students in relation to their study (Madge, Meek, Wellens & Hooley, 2009; Souleles, 2012; Vivian, 2011). Some researchers even warn against bringing formal education and Facebook (or other social media) together. Further, Kirschner & Karpinski (2010) show a connection between lower grades and the use of Facebook. More recently, Kirschner (2015) argues that Facebook is ill-fit for argumentation and academic discussion, as it cannot keep all the promises of supporting teaching and learning. In addition, Friesen & Lowe (2012) criticise Facebook and other social media for being heavily commercialised spaces living off conviviality over dissent. Thus, whether Facebook is a suitable tool for education is a debated issue with no clear answer.

A related and a similarly polarised picture emerges in relation to the students' use of social media to support their learning. While some view students as competent digital learners, others question the students' abilities to transfer their digital competences to learning contexts. Students using social media is often associated with ideas of multitasking and `juggling digitally´ with the activities and arrangements of their everyday life, where social media empower the students to self-organize their life and education. In the educational debate, students are occasionally portrayed as *digital natives i.e*. as digital experts or digital thinkers. This representation of the students has been criticised as one-sided or outright misleading (Bennett & Maton, 2010; Ryberg & Larsen, 2012). A study by Margaryan, Littlejohn & Vojt (2011) of university students showed, that the students had the abilities and expertise to use some technologies (also often to a greater extent than the lecturers), but only had a limited understanding of how technology might support them in their learning process.

In this chapter, I analyse and discuss a study carried out amongst 5th-semester students (app. 80) in the programme *Communication and Digital Media* (CDM) at Aalborg University (AAU). I analyse the students' motives and rationales for adapting and using various ICT-tools for supporting their studies. While many studies are mapping what technologies students use, there seems to be a lack of studies covering their motives and rationales for using these technologies (Deng & Tavares, 2015; Henderson, Selwyn & Aston, 2015).

At AAU, Problem Based Learning (PBL) is the pedagogical foundation and it is practised across all educational programmes. With an academic problem as a starting point, the students work in groups over an extended period of time (3-4 months) to prepare a joint project report. During the course of this work, it is the students' own responsibility to plan and manage the work process including what technologies to use for collaboration and communication. In this study, a team and I have focused on the students' use of various digital technologies to support their group work and collaboration in the preparation of the project report and their motives and rationales for using these tools.

In the final discussion, I return to the above discussion on whether students should be portrayed as digital experts or not.

12.2 The Background of the Study

Since the inauguration of Aalborg University in 1974, a particular PBL model has been developed and employed at AAU across the entire university (Holgaard, Ryberg, Stegeager, Stentoft & Thomassen, 2014; Kolmos, Fink & Krogh, 2004). At every semester, the students work with Problem Based Learning, where project work provide a framework for the formulation, analysis and solving of an authentic and self-selected problem. The students

work with their problem in groups of typically 4-6 students. The students' study time is equally divided between the project and project-supporting course-work. The courses are designed to support the students in their problem-oriented project work, by providing introductions to relevant theories and methods that students can employ in their project work. The project work lasts 3-4 months and during this time, the project groups prepare a joint project report (app. 100 pages) that discusses their problem, method, theory, methodology, analysis and their findings. In this process, the students go through different types of inquiry: problem identification, problem formulation, theoretical and methodological inquiry, data collection, analysis and discussion. In this way, the project work is quite similar to e.g. the process of doing research (albeit on a smaller scale).

When students begin in the CDM programme, they are introduced to the principles of PBL and to digital tools, which may support their project work. The introduction of digital tools takes place in a course concerning 'study relevant networked technologies,' designed and taught by a subset of the 5th-semester students of the same program. The planning of the course and the teachings are the central task in a course module on the 5th semester. In this module, half of the 5th Semester students are expected to use their own experiences of study-relevant technologies to teach the 1st-semester students. Thus, they have to reflect on their own use, participate in 'future workshops' (design workshops), develop digital learning materials and organise lectures over two days for first semester students. Although the 5th semester students have a high degree of freedom in choosing relevant technologies, the 1st semester students should be introduced to and gain experience with certain types of tools: collaboration tools (e.g. Evernote, Google Drive, Droptask), reference tools (e.g. Zotero, Mendeley) presentation/visualization tools (e.g. Mindmeister, Prezi), networking tools (e.g. Diigo, Twitter, LinkedIn, Google +), word processing (e.g. Word, Google Docs), and information search tools (e.g. library research databases, Google Scholar) (Konnerup & Dirckinck-Holmfeld, 2016).

In this study, we have focused on the subset of 5th-semester students in CDM (N=80) who had to teach 1st semester, as they were in the process of reflecting on their own use of technology and therefore seemed to be a particularly relevant sample to observe, interview and survey.

12.3 Data collection

This study is based on a survey and five qualitative interviews. Furthermore, we have conducted observations during the fifth-semester students' Future Workshop.

12.3.1 A Survey on the Students' Use of ICT

A survey was distributed to the subset of students teaching first semester students (N=80). The other half (N=92) worked with a different type of learning design task. The distribution of the students in the two groups was completely random. The overall response rate was 89% (71/80).

The survey was divided into four parts:

1. Use and knowledge of specific ICTs. The aim this part of the survey was to investigate students' use and knowledge of different ICT tools. They were

presented with a list of tools and they had to select one of the following options: "I don't know it", "I know it but I don't need it", "I know it but use a better alternative", "I know it and would like to start using it" and "I know it and use it". The type of statements was inspired by Rogers (1995) as adopted in Khalid, Rongbutsri & Buus (2012) who made a survey distributed to a wider population across Aalborg University. Also, some of the listed ICTs were chosen on basis of this study. Furthermore, we asked whether they believed they had a good understanding of how ICT tools can support problem-based project work.

2. ICTs used for various study-related activities. In the second part of the survey, students were asked to select their most commonly used ICT tools for various activities related to the problem-oriented project work and their course work. The students had the opportunity to select predefined tools and to add tools that were not listed.
3. Influential factors on the ICT choices of the students. In addition, we inquired into changes or stability in terms of the students' use of ICTs over time (1-4 semester). They were further asked to which degree other people (such as educators, supervisors, family, friends and fellow students) had had an impact on the ICT used for project work. In addition, they were asked whether their prior knowledge of ICTs (before starting at University) had had an impact on which technologies they used for educational purposes
4. Motives for choosing or not choosing specific ICTs. The fourth and final part consisted of two open questions: "Briefly describe what has motivated you to use ICTs tools for project work" and "Briefly describe your motives for not using particular ICTs for project work". We used open questions to allow the students to answer in their own terms and to gain possibly 'unusual responses' (Bryman, 2004). To analyse this part of the survey we have subsequently created post-coding tables and grouped the answers in categories that emerged from our analysis.

12.3.2 Qualitative interviews

We have made four individual interviews with students from the 5th semester CDM and one interview with a 7th-semester student who holds a BA in CDM. We used a semi-structured approach to these interviews i.e. the scripting of the interview was structured, but also flexible and open to exploring interesting themes emerging in the interview situation (Kvale & Brinkmann, 2009).

12.4 Main Results from the Survey

In the first part of the survey, the most known and used ICTs were: Facebook (100 %), Google Docs (90 %), Dropbox (82 %), Skype (73 %), Google Drive (63 %) and the reference tool in MS Word (56 %). The other tools listed were not used by the majority of students (e.g. the reference tools, RefWorks [6 %] and Zotero [3%]). The same pattern emerged in the second part of the survey where we inquired about ICTs used for various purposes related to the project work. Here Facebook was the most used tool for Communication and discussion in the project group (97%), Sharing content in the project groups (87%), Communication and content sharing with fellow students outside the project group (96 %), and discussion of course content (77 %). Google Docs, Dropbox and Google Drive were commonly used ICT tools as

well. Google Docs was the preferred tool for planning and structuring within project groups (56%) and 73% use it for content sharing. It should be noted that we had omitted Facebook as an option in this category – even so, 24% added it under the option`other´. Furthermore, the majority of students indicated that they had predominantly used the same ICTs throughout the first two years of the programme (79% answered to 'a very high degree' or 'high degree' whereas 21% answered to a moderate degree). 43% answered that they understood `to a very high´ or `high degree´ how ICTs can support PBL, whereas 45% answered, `to a moderate degree´.

In the third part of the survey, we inquired about who had had an impact on students' choices of ICTs. Here 'fellow students' emerged as the most important influence (80 % answered 'high' or a 'very high degree'), while the impact of lecturers, supervisors and friends were characterised by greater diversity; a high impact for some students and minor or none impact for a great deal of students. Thus, there was no clear trend, although 'family' had a distinctively smaller impact on the ICT choice of the students. 62 % of the students 'agreed' or 'strongly agreed' with the statement: 'My knowledge of ICTs prior to University has had an impact on what tools I use for my project work'.

These results are very much in line with an earlier study made by Rongbutsri, Khalid & Ryberg (2011) since this study also found that students' prior knowledge can have an impact on the selections of ICTs in the project groups. That study also found that the most common used ICTs were Dropbox, Facebook and Google services (their study covered a broader sample of students across Aalborg University). Furthermore, in a recent paper from Guerra (2015), it was investigated which technologies 23 project groups from an engineering education at Aalborg University used for project work. Similar to our study, Facebook turned out to be the most used tool for communication and collaboration. These studies indicate that Facebook is a popular tool to support group work at Aalborg University across different educational programs. In both our study and that of Rongbutsri et al. (2012) it was furthermore clear that tools which students found complex, such as reference tools, were often not adopted.

To analyse the open parts of the survey, we have thoroughly read the answers multiple times and developed broader categories. For the first question, this has led to the four overarching categories summarised in Table 12.1. In the students' statements, regarding motivation to use ICT in their project work, the word 'easy' appears several times. 'Easy' emerges as the keyword for describing their motivation and reason for using technology for project work. Technology seems to be an essential part of the student's problem-oriented group work since their experience is that the ICT tools eases a multitude of processes in the project work. Among others, they mentioned communication, collaborative/cooperative work processes, sharing of files and content, planning and coordination.

In relation to the students´ statements about motives for not choosing particular technologies, we identified seven different categories. A majority of the statements (70% 44/63) was related to four of the seven categories as presented in Table 2. Containing 19 of 63 statements, the dominant category was, that if an ICT seems to be too complex or difficult to use, then it is not used.

Table 12.1: Categories identified related to the question: `Briefly describe what has motivated you to use ICT tools for project work´

Categories	Examples of Statements
1: ICT makes group work related processes easier (41%, 29/71)	It facilitates the many parts of the project report, it facilitates sharing documents with many, it facilitates co-writing in the same documents. It facilitates group work, both in terms of planning and sharing of content. It is easy and everything is stored in one place. It will ease project work a great deal What motivates me is if the program eases the process
2: Good for communication and collaborative/ cooperative work processes (27%, 19/71)	Easy way to see each other's work and easy way of communicating They enhance the communication in the group It is necessary to share information and communicate with each other when you delegate tasks between one and another It is the place where we communicate when we have not gathered physically It is easy to get in contact with each other and share things The need for communication with the project groups as well as sharing of files and cooperation in terms of writing
3: Good for sharing files and content (20%, 14/71)	It makes it easy and quick to share files with each other and can give an overview of the work Easy way to share material with one's group For practical reasons. A way to share and get an overview. Simple communication with other group members It is easier to organise and share project content
4: Good for planning and coordination (13%, 9/71)	It makes it easier and gives a better basis for coordination when we work more people together in a project group. Use of ICT-tools makes it easier to coordinate with other group members To get more structure in terms of schedules, group meetings and supervisor meetings It gives an overview and structures the work process

Table 12.2: Categories identified related to the question `Briefly describe your motives for not using particular ICTs for project work´

Categories	Examples of statements
1: When ICT seems too	Some tools are more complicated than other alternatives

complex and difficult (30%, 19/63)	Some tools can become too advanced but I would never deselect all ICT-tools If the tools seem to be too complex If it becomes too difficult or confusing, then it is deselected Deselected those which have seemed to be difficult and unnecessary Not user-friendly I deselect them if they become too complex and the time which is required to figure out how to use the tools takes too long
2: The ICTs I use work for me, I don't need others (14%, 9/63)	The ICT-tools I have used so far have worked fine so I don't need anything else If an ICT-tool works for me, I do not need to use new or other ICT-tools Using those I know work for me. Therefore alternatives are deselected
3: Lack of knowledge of ICTs (14%, 9/63)	Deselection of ICT-tools can perhaps be caused by a lack of experience with using these particular ICT tools No knowledge of these ICT-tools No knowledge Do not have knowledge of most of them
4: Not relevant (13%, 8/63)	If we do not find them relevant/necessary If they are not relevant If they are not necessary

In the following analysis, I return to these open questions, as well as the interviews with students.

12.5 Analysis

12.5.1 More time for Project Work

In the interviews, the students describe the decision process and criteria for choosing ICT-tools for the project work. The selection of ICT-tools for the project work is a group process, often occurring shortly after the group formation in the beginning of the project period. In the group, the students briefly discuss their experience with different tools and quickly design an IT-infrastructure for their project work based on which tools they have found useful in earlier projects.

When the students choose their ICT-tools, the main priority is to work on their project report. Across the interviews and the survey, students express, that the primary purpose of using ICT-tools in the project work is to qualify the project work and make the collaboration easier. In the interview, Student 1 expresses the criteria of choosing ICT in this way:

> It must be good, usable, simple and above all benefit the process. (Interview, Student 1)

The descriptions from the interview and the statements from the survey about the motivation for choosing ICT (Table 12.1) indicate that the students, in general, are capable creating successful IT-structures. They are successful in making the project work, including collaboration, communication, sharing and planning, easier.

One of the prominent rationales behind the students' choice of tools, is, that the ICTs should

free up time and not steal time from the production of the project report. Easy acquisition, use and accessibility of a tool are deciding factors in their choice of tools, as high complexity of a tool is the primary reason for not using or dropping a tool. In the interviews, the students ascribe a great importance to tools that just work without any trouble. Student 2 says:

> Interviewer: Is it a deciding factor, that a tool is easy to acquire and easy to use?
> Student 2: Absolutely, it is. It (the ICT-tools) must not take the time from the main focus that is the project report. I see it as something that just is there and working. It's like a good soccer referee – he does not take focus, but keeps track of things. (Interview, Student 2)

Throughout the students' descriptions from the interviews and the statements from the survey on motives for choosing and not choosing ICT-tools, it seems the decision process is based on a kind of cost-benefit analysis. In this cost-benefit analysis, the benefits of using a specific ICT-tool and the immediate usefulness of the tool are evaluated against the time that is needed to master it. The primary goal is to identify the collection of tools, which is going to free up the most time and resources for project work.
Henderson, Selwyn & Aston (2015) have found a similar approach to technology among the students at two Australian universities. The focus of the students was aimed at `what worked best´ for them. When the students described the advantages of using technology in relation to education, the focus was on logistics, not learning. The use of technology was very much a question of management of university life and timesaving was a crucial factor when the advantages of using technology were described. Henderson et al. (2015) describe the students' use of technology as 'study-focused', 'logistical', 'safe' and 'outcome-focused'.

12.5.2 Why Change what Works

In the survey, a majority of the students agreed to the statement `My knowledge of ICTs prior to University has had an impact on what tools I use for my project work´. A majority of the students indicate that they have predominantly used the same ICTs throughout the first two years of the study programme. The interviews confirm that prior knowledge of ICTs plays an influential role in the students' choice of tools. The students admit that they often choose tools they are already familiar with:

> We have been presented with many different tools, but personally I have only used those I already knew. (Interview, Student 3)
> I found what I thought was most useful for me, and so I sit a little arrogant and think, then I do not need more. It has worked well so far, so why even think innovatively/new. (Interview, Student 1)

> Interviewer: How did you reach it (the agreement of group tools)?
> Student 2: A matter of experience, people had experiences with the tools, and there were no problems, so people saw no reason to change it because it worked already [...] They were tools people knew in advance. (Interview, Student 2)

In many ways, the students' preferences for tools they know, are a consequence of the 'more time for project work'-strategy. They have good experiences with these tools and they do not want to use resources on mastering new tools. In the above statements, we found a "why change what works"-attitude. We have identified the same opinions in the student's statements on their motive for not choosing a tool in the survey result (Table 12.2). The three most prevalent categories in terms of students' motives for dropping or not choosing a tool are: 1. When ICT seems too complex and difficult, 2. The ICTs I use already work for me, I don't need others and 3. Lack of knowledge of ICTs. The third category, 'lack of knowledge of other ICTs' and the 'why change what works'-attitude, both suggest that the students are not

explorative in relation to acquiring new tools. In the interviews, some of the students express, with an underlying notion or an apologetic reasoning, that they ought to be more explorative and show more awareness and consideration of the use of new tools. Some of the students wish that they were more competent and that the study programme played a bigger role in relation to the students' use of ICT. During the Future Workshop we observed, students expressed that they had not been properly introduced to various ICTs themselves. The students suggested that the study programme should take greater responsibility for introducing the students to ICT. The apologetic attitude can be read as an insecurity and ambivalence amongst the students in relation to their own ICT-use and competences.

12.5.3 The Choice and Use of Facebook

Across the survey and the interviews, students state that they use Facebook for various activities in the project work. Through Facebook, they communicate, share files, coordinate and organise group work. Examples of this are discussions in chat rooms, reviewing group member´ written text, organisation of work, for sharing files such as papers, pictures from books, and messages from the supervisor. This makes Facebook the most used tool for the project work.

Facebook meets all of the above-stated criteria: It is easy to acquire, use and access, and every student has a profile and is familiar with the platform. More essential, the students state that Facebook makes the group work easier and the communication more efficient. In the interviews, the students especially emphasise two advantages of using Facebook as a tool for project work; Facebook brings together their personal- and university life and Facebook makes the group members constantly connected.

> It is so much a part of your everyday life; it is actually easier to have it as ICT tools because you can also use it for everything else. (Interview, Student 5)
> You have your group with you all the time in one way or another. You can always get in touch with them. (Interview, Student 4)
> It's easy just sharing a link and agree on what to do with this and that because people are on Facebook anyway or get a push notification on their phone. In that way, I think it is an irreplaceable tool and without comparison, because people are always available. They are not on their student mail all the time. (Interview, Student 2)

In many ways, Facebook appears as an integral part of students' everyday practices, which they have implemented into study-related contexts. Students in the interviews describe the choice of the platform as a `matter of course´.

However, even though the students consider Facebook efficient, well-functioning and even irreplaceable, several students in the interview express an ambivalence in relation to the use of their preferred tool:

> I think it (Facebook) works well. But I think you get the impression of that you are a little wrong in using Facebook for these things. … not because they (the lecturers) say it is decidedly wrong but the impression has been that they wanted us to use something else. (Interview, Student 4)

> Interviewer: Which ICT tools will find most relevant to support the project work and why?
> Student 1: It annoys me to say Facebook, but it's probably the fact that Facebook is so good. It is right up our alley. It is so fast and it is surprisingly easy. But it is not what it really is intended for. (Interview, Student 1)

The ambivalence, that Student 4 and Student 1 express, is similar to the ambivalence and

insecurity, which underlies the students' description of their ICT-use in general. In practice, the students' IT-infrastructures seem to be successful in many ways for the project work. But when the students are asked about their ICT-use, more of them get doubtful about their IT-infrastructure as they feel that they should be using a 'proper' tool. The students seem to have an impression, that lecturers would prefer that they used different tools because Facebook is not considered as a 'proper' collaboration tool. However, the strength of Facebook is that it is an integral part of the students' everyday life, and this makes it difficult for the students to find a viable alternative.

12.5.4 A joint Facebook Group for the Semester Group

In the interviews, the students note that most of their communication related to their studies takes places in a joint Facebook group established for their semester cohort. This mirrors the findings from the survey, where Facebook was described as the preferred tool to communicate with other students in the cohort (96%).

The students in the interview list various types of activities and communication taking place in the joint Facebook-group. They make a distinction between social and academic purposes. As activities with social purposes, the students mention information and communication about events and parties and sharing pictures from said parties. Thus, Facebook is an important part of the students´ social life at the University and it supports community among the students in a semester cohort. This echoes Madge, Meek, Wellens & Hooley (2009) who found that the platform functioned as a part of the 'social glue' among university students and moreover it helped students settle into the university life.

For academic purposes, the students mention activities such as sharing information and helping each other with practical aspects e.g. sharing files and academic literature, information about cancelled lectures, enrolments for exams etc. These findings resonate well with the study by Vivian, Barnes, Geer & Wood (2014) and Dalsgaard (2014).

In our study, Facebook seems to be an important platform both for the social cohesion and as a platform, where the students can support and help each other with practical-academic matters, even if it only gives us limited insight into the students' exact use of the platform. As Aaen & Dalsgaard (2016) have pointed out, the self-directed use of Facebook amongst students is an underrepresented area in educational studies compared to studies of how lecturers have used Facebook to support particular learning activities.

12.6 Final discussion

The analysis shows a gap between the students' actual use of ICT and then the rhetoric and polarised debate, which characterises the discussion of social media in education, as well as the student's abilities or inabilities to use ICT in an educational context. Discussions I outlined in the introduction of this chapter. The students don't appear as digital experts, who use technology in new and creative ways. Nor do they appear as non-competent users, who are unable to exploit the possibilities of the technology or let themselves get overly distracted by social media.

The data presents a more complex picture of the students' use of and engagement with technology, though. The technology is an integrated and essential part of the students' group work, and the ICT tools help the students manage different processes in the project. However, the students will drop a tool, if it is too complex, and they seem non-explorative and

conservative when they choose technology. Furthermore, the ICTs used by the students are commercial and generic tools (for e.g. communication and sharing), whereas more specialised and academic tools (e.g. reference tools) seem to be either unknown or deselected.

The gap, we have identified, between the student actual use of ICT and the rhetoric on the students' use and abilities to use of ICT, correspond approximately to the gap between 'the state of art' and 'the state of actual', identified by Henderson, Selwyn, Finger & Aston (2015) when studying students' engagement with technology at two Australian universities. 'The state of art' and 'the state of actual' referrer to what there might be achieved through technology-enabled learning, and to the realities of technology use within contemporary university contexts, respectively. They point out a need for a shift of focus in the discussion of technology-use at universities; from 'the state of art' to 'the state of actual'. With two different perspectives: a student logistic perspective and a student learning perspective on the students' engagement with technology, they found that the students' use of technology primarily were aimed at the logistic of their student life and that their use primarily can be characterised as knowledge consumption rather than support of active learning.

Inspired by Henderson, Selwyn, Finger & Aston (2015), we can view the students' engagement with technology from the two different perspectives. Using this distinction, the students seem to have their focus on logistics, when they describe their motives and rationales for adapting and using ICTs. The students highlight the ease of use, adaption and access as crucial criteria of whether a tool is useful or not, and describe, the ICTs doing the collaboration and project work easier as the primary motive for using them. This substantiates that the student perspective on and engagement with technology being primary logistic. For the students, ICT seems to be a question of performing well and making the project work and collaboration run as smoothly as possible. The students' adaption and use of technology can be characterised as outcome-focused and pragmatic.

While others often miss and demand students using technology to support active learning rather than passive knowledge consumption, this study shows the project-oriented PBL-model requires that students use technology to support their active learning in the collaboration and management of group work. Even though their choice of tools seems to be routine, and the choice of familiar over more complex tools may seem as shortsighted decisions with no particular focus on learning, the students do manage to create ICT infrastructures that successfully support them in the problem-based project work. However, the student learning perspective may seem to be present in the minds of the students to a very limited degree.

Technology is an integrated part of the students' everyday life and much of their use of technology seems to be internalised practices. Especially Facebook appears integrated and the use internalised in a way where the distinction between the students' university and everyday life becomes blurred. However, the students consider this as natural and advantageous in relation to their project work. The students' use of technology seems to be for what they consider 'mundane things' and maybe without much reflection. Other studies of ICT-use by students at AAU indicate that small creative practices hide behind the routine choice of tools and their description of their digital practice in general terms. Tolsby (2009) studied the students' use of a virtual environment in their project work and showed how the students created shared space for their project work, which they accommodate and structured according to their own practices. Ryberg, Davidsen, & Hodgson (2016) found, that

the students shifted dynamically between technologies. They chose technology accommodating the task and the phase of their project work, and they had the abilities to create a successful transition between the different technologies as well as between the physical and digital spaces.

In addition to the above, the students express an uncertainty and ambivalence against their own use of ICTs. This uncertainty or ambivalence can be understood in several ways, though. We can interpret the uncertainty of the students as an expression of an actual uncertainty in relation to their own use and a desire to improve their ICT-competences. The students' uncertainty can also be seen, however, as an indication that their use is an internalised part of their everyday practice, and they have not made any special considerations or reflections about it before. This characterises the general relation to technology. Most of us tend to overlook the role of digital technologies in our everyday; we "tweet", "post" and "like" using social technology without reflecting much on how we interact with the technology (Selwyn, 2014). Finally we can interpret the uncertainty can as a lack of correlation between, what the students experience as the best way to use the ICT in a given situation and implicit expectations from the study programme, educators, researcher or what one ought to do as a 'proper' student i.e. as expressing a gap between actual and an imagined, ideal practice. The students' experience of this lack of correlation may be a reflection of the lack of correlation of the rhetoric of technology-enhanced learning, 'the state of art' and their actual use, 'the state of actual'.

How should we as educators react to the students' pragmatic approach to technology? The students' pragmatic approach to and internalised use of technology makes it important to study students' self-directed use to understand their digital practices. To bridge the gap between 'the state of art' and 'the state of actual', an increased understanding of digital practices of the students is needed by educators, as well as by the students themselves. The project-oriented PBL–model could be a part of the question on how to bridge by forcing the students to use ICTs for active learning and by creating a frame, where a more active use of ICT is the most 'useful'. But we need to find ways to help the students to understand their own digital internalised practices as well as find ways to challenge their current use and pragmatic attitude to technology.

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13 Addressing EAP Students` Needs in the Tertiary Context On the Use of Digital Course Books in English for Language Teaching Academic Purposes

Agnieszka Gadomska & Jarosław Krajka

Abstract
Together with a growing interest in English for Specific Purposes (ESP), also English for Academic Purposes (EAP) as a separate branch of English for Language Teaching (ELT) is gaining more and more attention. While the provision of ready-made teaching resources is adequate in many branches of ESP, the EAP teacher frequently faces the challenge of finding, assembling and digitizing materials for in-class use. The purpose of the chapter is to reflect on EAP learners' needs in the digital era, learner autonomy, teacher training implications and the issues of materials development, in specific, on the role of IT based course books and tools for teaching academic writing.

Keywords: EAP, Academic writing, Digital course books, Learner autonomy, Teacher training

13.1 Introduction

It is undeniable that digital natives, and especially the generation born in the mid-1990s, have entered the tertiary level of education.

> They have spent their entire lives surrounded by and using computers, videogames, digital music players, video cams, cell phones, and all the other toys and tools of the digital age. Today's average college grads have spent less than 5,000 hours of their lives reading, but over 10,000 hours playing video games (not to mention 20,000 hours watching TV). Computer games, email, the Internet, cell phones and instant messaging are integral parts of their lives. (Prensky, 2001, p. 1)

This has serious implications for planning curricula, syllabi and lessons. In fact, educationalists should blend pedagogical and content-related objectives with technological and academic skills that would have to be achieved through careful task design or selection based on learners' needs and teacher qualifications. Prensky (2001) claims that the challenges are hard as the current generation speaks a different language, multitask, expect immediate feedback and gratification, prefer games and hypertexting, work most effectively when networked. However, digital immigrants, i.e. their teachers in most cases, must adapt to their learners' needs and expectations. Therefore, the issues of "teachers-as-learners" and "learners-as-teachers" autonomy are crucial for the success of the teacher training programmes. Much has been said about the role of technology in changing philology students' motivation and expectations (Gadomska & Krajka, 2015; Gadomska & Krakowian, 2017; Gajek, 2016). Much has been also said on the role of technology in changing research and writing (Gadomska, 2016a; Gadomska 2016b; Gadomska & Krakowian, 2017).

> No other academic skill has been influenced more by the fast development of Internet technology than academic research and writing. The changes are evident in terms of locating, evaluating and documenting sources, using new media, genres, software, applying new methods and tools boosting reading, critical thinking, and study skills. Moreover, our current students are digital natives who expect modern, interactive, flexible methods and techniques used to teach academic skills. All these aspects influence not only the academic writing syllabus but also teacher qualifications and skills. (Gadomska, 2016a, p. 43)

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However, more attention should be paid to the methods and techniques of using course books in the classroom with the help of technology. Digital versions allow interactive individualization, language immersion, instant practice and feedback. Moreover, they are plastic/flexible enough to be adjusted to the demands of users, groups, time and mode. Therefore, it is the intention of the authors to show in practical terms how academic writing instruction with the use of visualisation, Interactive Whiteboard (IWB) and digital coursebooks can fulfill the complementary objectives of academic skills acquisition and teacher autonomy development.

13.2 EAP learners' needs in the digital era

13.2.1 English for Academic Purposes as a Subbranch of ESP

English for Specific Purposes is one of the branches of ELT, English Language Teaching, and, in further context, one of the areas of study in theoretical and applied linguistics. These two are quite interlinked as nowadays ESP researchers are interested not only in pedagogy but also in its place in the context of genre, corpus studies, identity and ethnographic approaches (Paltridge & Starfield, 2005, p. 106ff.). What is commonly known as ESP is "the special discourse used in specific settings by people sharing common purposes." (Ruiz-Garrido et al., 2010, p. 1). According to Dudley-Evans and St. John, ESP can be characterised by two major groups of factors:

Absolute Characteristics:

- "ESP is defined to meet specific needs of the learners,
- ESP makes use of underlying methodology and activities of the discipline it serves,
- ESP is centered on the language appropriate to these activities in terms of grammar, lexis, register, study skills, discourse and genre" (Dudley-Evans & St. John, 1998, p. 5).

Variable Characteristics:

- "ESP may be related to or designed for specific disciplines,
- ESP may use, in specific teaching situations, a different methodology from that of General English,
- ESP is likely to be designed for adult learners, either at a tertiary level institution or in a professional work situation. It could, however, be for learners at secondary school level,
- ESP is generally designed for intermediate or advanced students and most ESP courses assume some basic knowledge of the language systems" (Dudley-Evans & St. John, 1998, p. 5).

For Hutchinson and Waters (1987), ESP is "an approach to language teaching in which all decisions as to content and method are based on the learner's reason for learning." (Hutchinson & Waters, 1987, p. 6); however, it is not teaching specialized varieties of English as such, not a special form of the language, different in kind from other forms, as it belongs to a larger area of all language use. The term "specific" in ESP refers to the particular purpose of learning English and learners' "professional career" (Day & Krzanowski, 2011, p. 5). There is a special focus on the question of how people learn rather than what people learn. The foundation of ESP lies on a very useful perception of specific language needs.

As more and more specialisms started to appear together with the development of ESP, researchers differentiated various branches of ESP courses. Hutchinson and Waters situated ESP as a branch of EFL in opposition to GE, General English, also referred to as EGP, English for General Purposes. The abovementioned branch is later on divided into three main types of

ESP, namely English for Science and Technology, English for Business and Economics, and English for Social Sciences. Each branch is then consistently separated into two groups: EAP – English for Academic Purposes, and EOP – English for Occupational Purposes. The latter is also known as EVP – English for Vocational Purposes or VESL – Vocational English as a Second Language. At the next level emerging groups depend on the particular type of learners (Hutchinson & Waters, 1987, p. 16ff.). Similarly, Basturkmen (2006) divided the area of ESP teaching into three main branches: EAP (English for Academic Purposes), EPP (English for Professional Purposes) and EOP (English for Occupational Purposes, Basturkmen, 2006, p. 6). This division presents ESP fields and provides conclusions connected with the extension of ESP. In addition, Alcaraz-Varó in 2000 introduced a specific term related to ESP, "English for Professional and Academic Purposes" (EPAP), which merges profession with education (quoted in Fortanet-Gómez, Palmer-Silveira & Ruiz-Garrido, 2010, p. 1).

It is this last notion, which can be made even more transparent by calling it "English for Language Teaching Academic Purposes" (ELTAP), which is the topic of the present research. The distinctive nature of ELTAP is stressed by the fact that ELTAP learners are language users, acquiring the target language at the C1/C1+ level of proficiency within the areas of academic reading, writing and presentations skills, and, at the same time, language researchers, observing patterns of language use, finding regularities and aberrations, creating activities for learners. This dual nature of ELTAP users makes the metacognitive reflection over one's own language use and language learning a must, which is the reason why ELTAP learner/teacher autonomy is going to be evoked in the subsequent part of the present paper.

While every good teacher of English is potentially a good teacher of ESP, he or she needs special help and training. The teacher who is new to ESP needs advice, guidance and support from those teachers who already have the necessary experience. As it is pointed out by Strevens, "becoming an effective teacher of ESP requires more experience, additional training, extra effort, a fresh commitment, compared with being a teacher of General English" (Strevens, 1988, p. 43). In contrast, there are implications for ELT teachers because of increased educational demands and less teacher-training programmes. Since "teacher education is an enabling condition for language education" (Howard & Brown, 1997, p. 117), integrating more specific teacher education programmes into curriculum review and emphasize teacher autonomy techniques to the advantage of the promotion of learning. Thus, ELTAP teachers should also reflect upon their own style of teaching and consistently improve the weakest aspects.

Abbot distinguishes three responsibilities of ESP teachers: preparation of materials, student's motivation and the content. A teacher ought to adapt the content of the course to current level of students' knowledge in order to engage them into the process of learning. In addition, an EFL teacher plays a key role in finding a suitable way of teaching in a particular classroom, using not only common techniques, but also performing needs analysis of the students and institution where the course is going to take place (quoted from Astika, 1999, p. 32).

Fortanet-Gómez et al. listed a few challenges for ESP practitioners:

- become familiar with the specialist subject (carrier content);
- become familiar with the language of the subject (real content);
- become familiar with the teaching of adult learners, and large/heterogeneous groups;

- become familiar with materials evaluation, design and development;
- be ready to spend time on evaluating, designing and developing materials;
- be ready to review, pilot test and update materials;
- be creative, imaginative and flexible;
- be ready to accept new challenges and overcome anti-scientific attitudes;
- be ready to rely on expert colleagues' knowledge and professional experience;
- be ready to take into account students' specialist knowledge (Fortanet-Gómez et al., 2010, p. 158).

These challenges prove that material providers should have a proper degree of knowledge of target discipline, some teaching experience, interest in teaching ESP and interest in preparing materials based on authentic sources. To facilitate learning of English, a teacher plays different roles depending on the situation in a classroom as well as on students' needs. It is highly recommended for teachers to know what is conceptual structure of a theme and what key patterns of the ESP usage mean. Moreover, teachers should exploit their pedagogical skills and establish learning objectives with respect to the student's own expectations (Fortanet-Gómez, Palmer-Silveira & Ruiz-Garrido, 2010, p. 159). Therefore, EAP instruction in the English philology curriculum (termed here English for Language Teaching Academic Purposes, ELTAP) demands not only building language proficiency within receptive and productive skills, but also increasing learner awareness of strategy use and one's own target language production. Due to these factors, the issues of "teachers-as-learners" autonomy are crucial for the success of the teacher training programme.

13.2.2 Learner Autonomy in the EAP Classroom

Ever since the beginning of the 1980s autonomy has been given a considerable amount of attention and has been defined in a variety of ways. Most working definitions are based on the idea that autonomy is one of the features of a learner. To start with, for Holec (1981) it is "the ability to take charge of one's own learning" (Holec, 1981, p. 3), for Benson and Voller (1997), "situations in which learners study entirely on their own; a set of skills which can be learned and applied in self-directed learning; an inborn capacity which is suppressed by institutional education; the exercise of learners' responsibility for their own learning; the right of learners to determine the direction of their own learning" (Benson & Voller, 1997, p.1f.). Another definition presents an autonomous learner as a person "who is totally responsible for all of the decisions concerned with his learning and the implementation of those decisions […] There is no involvement of a teacher or an institution. And the learner is also independent of specially prepared materials" (Dickinson, 1987, p. 11). According to Littlewood (1996), "an autonomous person [is] one who has an independent capacity to make and carry out the choices which govern his or her actions. This capacity depends on two main components: ability and willingness […] Ability depends on possessing both knowledge about the alternatives from which choices have to be made and the necessary skills for carrying out whatever choices seem most appropriate. Willingness depends on having both the motivation and the confidence to take responsibility for the choices required." (Littlewood, 1996, p. 428) The issues of planning, monitoring and evaluating his or her learning are also stressed by Little (2004).

Quite robust literature exists on the features of autonomous learners, which are highly relevant to adult ELTAP course participants as the target audience of the present research. For Breen and Mann (1997), the following aspects are crucial when reflecting on self-direction in a language learning context:

1. learners have resources available which they are in charge or in control of;
2. they are in an authentic relationship to the language they are learning and have a genuine desire to learn that particular language;
3. they have a robust sense of self that is unlikely to be undermined by any actual or assumed negative assessments of themselves or their work;
4. they are able to step back from what they are doing and reflect upon it in order to make decisions about what they next need to do and experience;
5. they are alert to change and able to change in an adaptable, resourceful and opportunistic way;
6. they have a capacity to learn that is independent of the educational processes in which they are engaged;
7. they are able to make use of the environment they find themselves in strategically;
8. they are able to negotiate between the strategic meeting of their own needs and responding to the needs and desires of other group members. (Breen & Mann, 1997, p. 134ff.)

Candy (1991) mentions a number of personality features which predispose learners for autonomy, most notably, being methodical and disciplined, logical and analytical, reflective and self-aware, persistent and responsible, venturesome and creative, independent and self-sufficient, interdependent, interpersonally competent and flexible. According to Candy (1991), autonomous learners demonstrate curiosity, openness and motivation, show confidence and have a positive self-concept. They "have developed information seeking and retrieval skills, have knowledge about and skill at learning processes and develop and use criteria for evaluating" (Candy, 1991, p. 459ff.).

Rather than regard learner autonomy in the absolute black-and-white terms, it is useful to view it as a process of gradual growth of learner's abilities to self-direct their learning, to slowly establish greater control over the learning process or gain more insight into most effective styles and strategies. Thus, this is where the concept of degrees of autonomy (Nunan, 1997) comes in useful, as it clearly indicates how learners' age, their learning progress or their perceptions concerning learning influence the extent to which the learner can be conscious and aware of the need to manage their own learning (Little, 1991). Taking levels of autonomy into consideration, Nunan's model comprises five levels of implementation, i.e. "levels for encouraging learner autonomy. Some of these are more readily incorporated into teaching materials than others" (Nunan, 1997, p. 194). The levels are as follows: awareness, involvement, intervention, creation and transcendence, and the ELTAP learner gradually moves up the autonomy ladder, becoming more and more active, starting to make more choices, modifying/adapting tasks or creating materials on their own.

Table 13.1: Levels of implementation of autonomy (Nunan, 1997, p. 195).

Level	Learner action	Content	Process
1	Awareness	Learners are made aware of the pedagogical goals and content of the materials they are using.	Learners identify strategy implications of pedagogical tasks and identify their own preferred learning styles/strategies.
2	Involvement	Learners are involved in selecting their own goals from a range of alternatives on offer.	Learners make choices among a range of options.
3	Intervention	Learners are involved in modifying and adapting the goals and content of the learning programme.	Learners modify/adapt tasks.

4	Creation	Learners create their own goals and objectives.	Learners create their own tasks.
5	Transcendence	Learners go beyond the classroom and make links between the content of classroom learning and the world beyond.	Learners become teachers and researchers.

Learner autonomy in the English for Language Teaching Academic Purposes context, therefore, means starting to incorporate more and more methodological principles acquired throughout the teacher training module in the process of English for Academic Purposes learning.

13.2.3 Language Strategy Training for Computer-mediated Writing Instruction

One of the major methods towards the development of learner autonomy is gaining an effective mastery of well-orchestrated, properly selected, consciously intertwined and task-relevant language learning strategies. The previous research into strategy training in the digital era of today encompassed, among others, classroom-based investigation and awareness-raising tasks in online learning environments (Ranalli, 2009); development of learner awareness and language use through engagement in computer-supported collaborative writing in a second language (Blin & Appel, 2011); activation of particular metacognitive strategies through bidirectional peer-to-peer scaffolding conducted via Computer-Mediated Communication contexts (Cheng, 2010), implementation of Web 2.0 technologies to promote technology literacy, expand German language proficiency and cultural knowledge, and integrate standards-based best practices in the teaching of second languages (Bustamante & Moeller, 2013). Most research attention has been devoted to explicit strategy training in computer-assisted vocabulary acquisition from the written context (e.g., Li, 2009), where a variety of strategies could be employed across cognitive, compensatory, metacognitive and social categories when students learned vocabulary through sustained reading within the computer-mediated environment.

However, even though strategy use while learning vocabulary has proved to be effective, numerous problems have appeared that need careful attention of Computer-Assisted Language Learning (CALL) instructors. Ranalli (2009) draws attention to the fact that even though much emphasis on strategy training has been placed for vocabulary instruction, many of these vocabulary strategies are underused or misused by learners. Moreover, the teacher attempting to integrate learner training in the use of such strategies into classroom instruction faces a number of challenges: a shortage of appropriate training materials, a lack of expertise on the part of the teacher, and ingrained habits or even resistance on the part of the learner (Ranalli, 2009). While CALL learner development has traditionally focused on training students to use computer applications (contextual confidence in selected procedures) in order to accomplish specific tasks or to become autonomous users of CALL materials, O'Bryan (2008) finds it incomplete, claiming the major emphasis of learner strategy training should be to help them make informed decisions while interacting with CALL materials and teaching computer skills and language-learning strategies specific to CALL.

The research of Bustamante and Moeller (2013) yielded the following issues as contributing to effective strategy training programme: hands-on experience; convergence of technology, pedagogy, and content; discussion and reflection on pedagogy; and technology

implementation into the classroom. It is especially the second aspect, namely effective blend of technological, pedagogical and content-related objectives, that would need to be achieved through careful task design. When collaborative activities are used for learner strategy training, according to Pawan et al. (2003), are mainly limited to "social monologues" if not guided by the instructor. Similarly, Liang (2010) notices that when synchronous online peer response groups were used in an unstructured fashion, meaning negotiation, error correction, and technical actions seldom occurred and that social talk, task management, and content discussion predominated the chat.

13.3 Teaching Academic Writing in the Digital Era

13.3.1 Academic Writing Curriculum and Resources for English Philology B.A. Students

Academic Writing is one of the most demanding courses at the tertiary level of education. It is the ultimate skill as its main objective is to prepare students to write the B.A. Thesis and finally the M.A. Thesis. However, during the studies it is a service course, trained to be used in other classes, where writing is involved. Very often it is integrated with the reading course. The world of academia has been recently involved in a debate on "ELFA [English as Lingua Franca Academic] paradigm which depends on dichotomies such as Native Speaker (NS) vs. Non Native Speaker (NNS), or NS vs. ELFA" s(Tribble, 2016, p. 30) and its role in designing English for Academic Purposes writing curriculum. However, the authors of the article will focus on designing the writing programs for English Philology students, where "imposing the national or native models" is not "unfair" (after Tribble) but rather sine qua non.

> Intellectual/Rhetorical approaches […] have their origins in the Rhetoric and College Composition tradition in North America (Raimes, 1993), and have drawn on the idea of Process Writing (Flower and Hayes,1977; White and Arndt, 1991). Intellectual/Rhetorical approaches are still very widely used in a range of published EAPWI materials, particularly those that focus on essayist literacy (see Oshima and Hogue, 2014) and the written components of public examinations such as IELTS (Fava-Verde, Manning and Nukui, 2012). (Tribble, 2016, p. 31f.)

Another approach (Leki, 1998) focuses more on the process and concentrates not on imposing models to be imitated (that is the final product) but rather on skills to be mastered in order to enable students to logically discuss in writing one's research, opinions and facts.

It "[encourages] individuals to take more responsibility for their own learning. By means of discussion, tasks, drafting, feedback, revisions and informed choices, students can make clearer decisions about the direction of their writing" (Jordan, 1997, p. 168). Moreover, the tasks involve: self-editing, peer review, drafting, revising, editing, which all add to the learner's autonomy (Gadomska & Krakowian, 2017, in print).

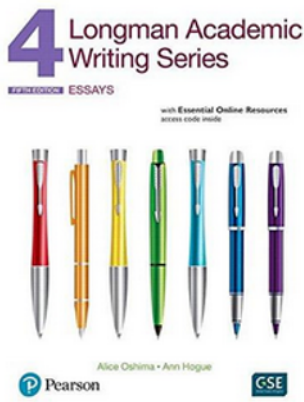

Figure 13.1: The newest edition ("with Essential Online Resources") of the highly popular course book by Oshima and Hogue (URL: https://www.pearson.ch/LanguageTeaching/SkillsPractice/ Writing /EAN/9780132915694/Longman-Academic-Writing-4-Essays. Last accessed: 16 April 2017).

Academic Writing in the English Language Learners tertiary education curriculum has dramatically evolved in recent years thanks to digital technology. Even the long awaited newest edition of Academic Writing Level 4 by Oshima and Hogue (former title: Writing Academic English) has turned digital despite its misleading cover message (Figure 13.1). It "allows students and teachers to better assess the writing process. Teachers can now monitor student performance to personalize learning and increase student motivation." (Pearson Longman, 2017, backcover-text)

The present B.A. level academic writing course curriculum at SWPS University bases on Macmillan's series Academic Skills: Skillful Reading and Writing (3 and 4). It is, however, supplemented with activities from Oshima and Hogue, especially those that focus on sentence structure, sentence types and sentence problems. While Skillful course provides a digibook, digi practice and additional resources and even the digi markbook all to be used in self-study and blended modes, including a variety of activities for the IWB usage, Oshima and Hogue rely mostly on pen-and-paper-based activities.

The publisher offers a digital student's book as well as a teacher's digital version. They both contain the same content as the printed versions, yet they can be used on a computer or an Interactive Whiteboard. This "[enables] easier navigation through the pages, a zoom function to create better student focus, and a personal annotation resource for helpful classroom notes" (Bixby, 2017, p. 6). In addition, the IT-based version contains video and audio materials, online practice activities, unit and progress tests, methodological articles, electronic grade book (in the teacher book).

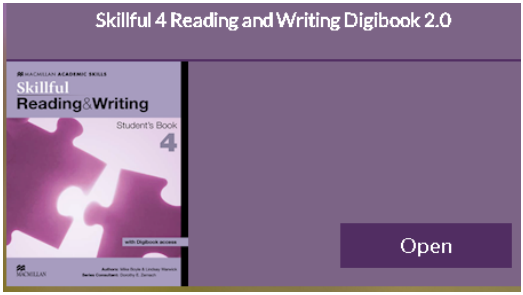

Figure 13.2: Screenshot of *Skillful* 4 digibook access view (Bixby, J., Kisslinger, E., & Zemach, D. E. [2017], *Skillful: Reading & Writing*. Oxford: Macmillan Education., URL: http://www.macmillanskillful.com/. Last accessed: 4 April 2017).

Skillful authors promote the process approach, providing intellectually-inspiring reading and speaking resources introduced to build up not only language skills but also academic skills, including critical thinking skills, which the previous editions of Oshima and Hogue lack. The "Reading and Writing" component of the series has been integrated with "Listening and Speaking." It is all to build the intellectual connections between a student and the world, to provide necessary resources and skills as students at the university level are expected to explore the topics further, to find their particular significance. Sara Hannan from Oxford Brookes University claims that "[at]university level, it is hoped that students are able to notice [...] biases in the writing and speaking of others, as well as consulting expert opinion and research in the formation of their own ideas. It is also hoped they will learn to spot inferred as well as literal meaning. This demonstrates they are able to exercise critical judgements" (Hannan, 2014, p.2).

13.3.2 The Case Study

The case study concerns the current SWPS University Academic Writing B.A. 4 course (that is the 4th semester of B.A. studies program). The course book used is Skillful: Reading and Writing 4. The case illustrates the methodology and practice of conducting an IT-supported class with the focus on identifying facts, speculation and opinion, and academic referencing. The students first discuss questions on the cultural and linguistic legacy (illustration/ stimulus with a poster size image and unit video introducing the topic) based on Unit 6 from their course book. The aim of this activity is to brainstorm and stimulate a discussion. A teacher can ask students to give the picture a title and write the proposals directly on the image (thanks to the IWB technology). It is also a teacher's decision whether or not to show a short video illustrating the topic and conduct a listening activity. If the time doesn't allow- these activities are ideal for self-study (Figure 13.3).

Figure 13.3: Screenshot of Unit 6: Introducing the topic: learning objectives, class discussion, embedded video material (Bixby, J., Kisslinger, E., & Zemach, D. E. [2017], Skillful: Reading & Writing. Oxford: Macmillan Education., URL: http://www.macmillanskillful.com/. Last accessed: 4 April 2017).

Then students review vocabulary (extra digital practice is provided for computer or IWB usage); next they do pre-reading activities focusing on using headings to understand the gist, practicing skimming technique (extra digital practice – putting headings into the proper order, Figure 13.4).

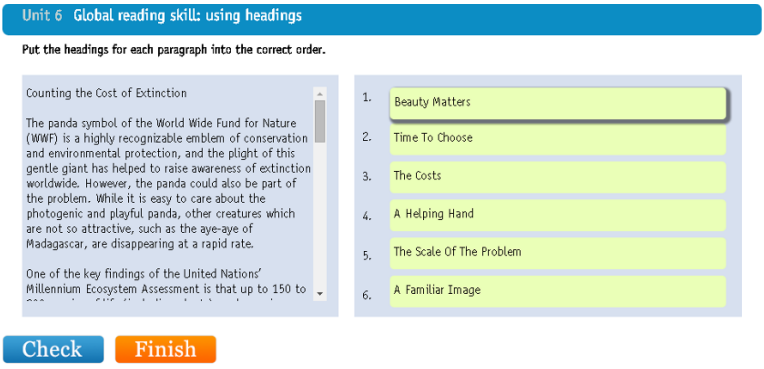

Figure 13.4: Screenshot of Unit 6: Reading comprehension online practice: dragging headings into proper order (Bixby, J., Kisslinger, E., & Zemach, D. E. [2017], Skillful: Reading & Writing. Oxford: Macmillan Education., URL: http://www.macmillanskillful.com/. Last accessed: 4 April 2017).

Next students practice differentiating between facts, speculations and opinions and the resulting in-text documentation based on the reading – here text annotation IWB tools might be useful. A teacher can use a variety of colours or a magic pen tool to highlight particular elements (Figure 13.5). Such activities provide immediate feedback and are reusable.

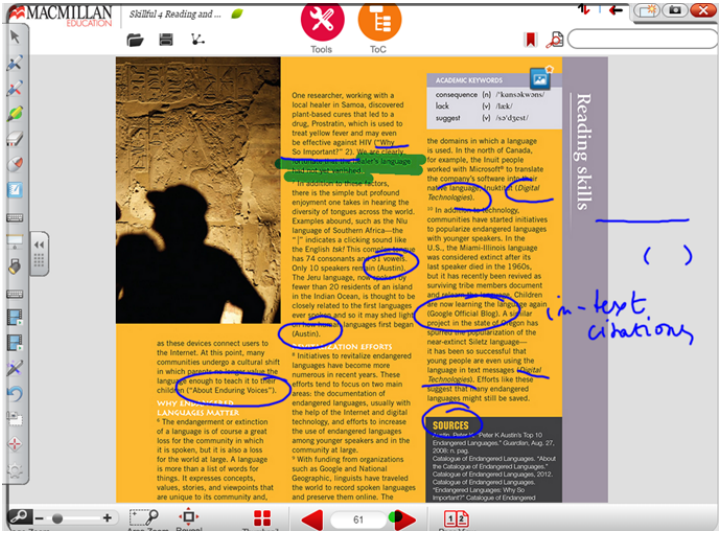

Figure 13.5: Screenshot of the IWB-based Unit 6 activity with the use of Smart Board annotation tools (Bixby, J., Kisslinger, E., & Zemach, D. E. [2017], Skillful: Reading & Writing. Oxford: Macmillan Education., URL: http://www.macmillanskillful.com/. Last accessed: 4 April 2017).

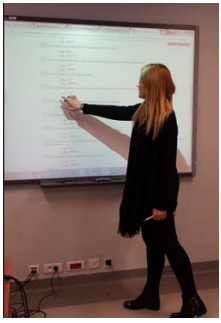

Figure 13.6: A student doing an online multiple choice activity (fact vs. opinion) on the Interactive Whiteboard (own picture).

If the time allows, a variety of reliable online resources for the practice of recognizing facts and opinions may be used (Figure 13.6).

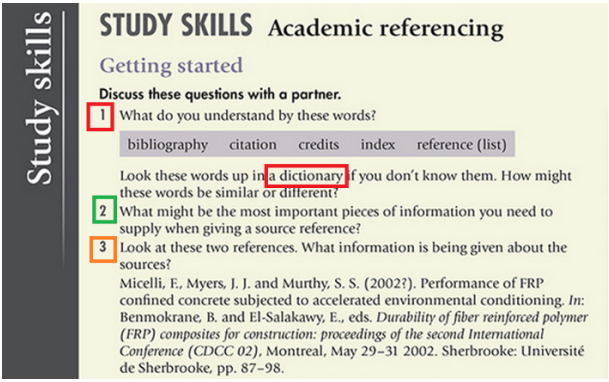

Figure 13.7: Screenshot of Unit 6 *Skillful*: academic referencing practice (Bixby, J., Kisslinger, E., & Zemach, D. E. [2017], Skillful: Reading & Writing. Oxford: Macmillan Education., URL: http://www.macmillanskillful.com/. Last accessed: 4 April 2017).

In addition, the unit focuses on word formation and the use of relative pronouns. Finally, the writing section is aimed at practicing writing about changes and definition writing. As in each chapter, the last page is devoted to "Study Skills," this time: to academic referencing – an issue of fundamental value.

The topic is closely connected with the previously practiced skill, i.e. of differentiating between facts, opinions and speculations. The teacher may discuss the following terms: plagiarism, bibliography, citation (in-text citation), reference list, footnotes, etc. (Figure 13.7).

With the IWB technology, a teacher can refer to an online dictionary or use Owl at Purdue Site (pointing to particular examples, using sample essays and highlighting with IWB tools, Figure 13.8).

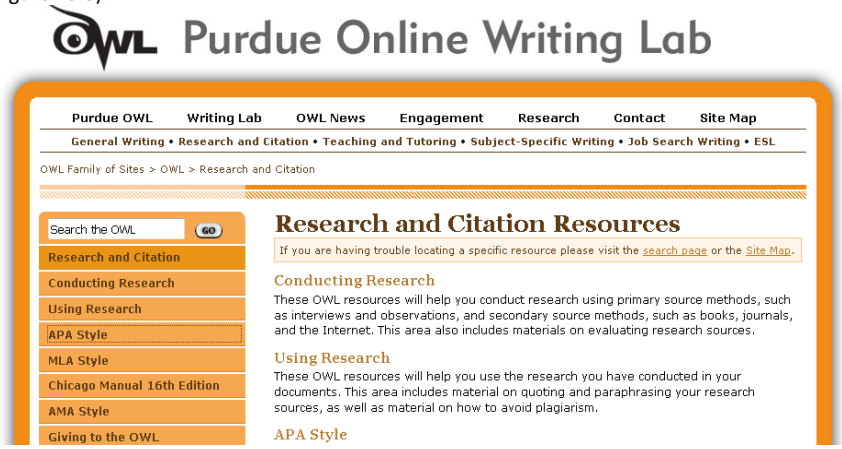

Figure 13.8: Screenshot from the highly renowned Owl at Purdue Writing Lab (The Online Writing Lab at Purdue [OWL], URL: https://owl.english.purdue.edu/, last accessed: 4 April 2017).

For exercise 3, a teacher can use The Citation Machine and conduct an interactive activity with the immediate formative assessment provided (Figure 13.9).

By filling in the form for a particular book (might be a course book even) a student practices producing a bibliographic entry and at the same time learns how to use online citation programs. At any moment, a teacher can redirect a student to Owl at Purdue resources or to Oshima additional materials or any other reliable online resources.

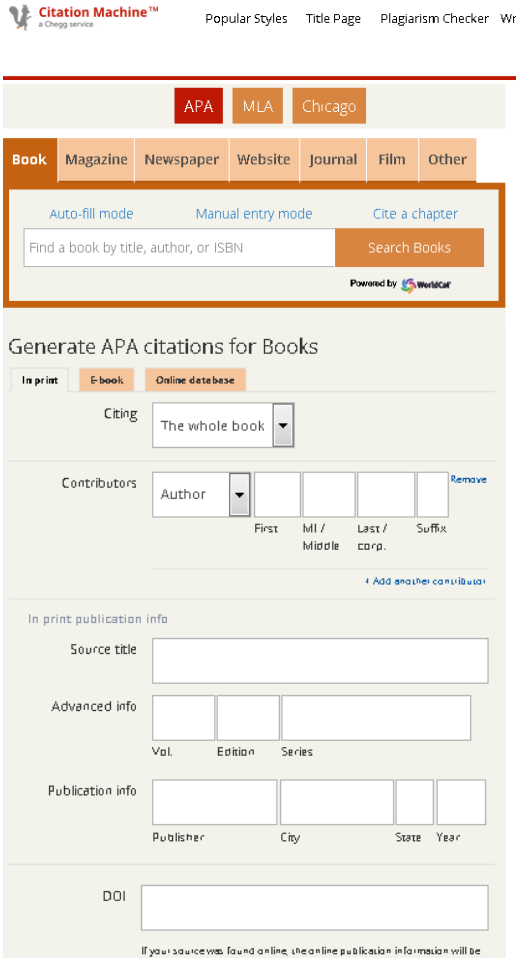

Figure 13.9: Screenshot from *Citation Machine* (URL: http://www.citationmachine.net /apa/cite-a-website, last accessed: 4 April 2017).

13.3.3 The Language of Instruction

It is undeniable that the IT-supported environment has influenced the language of instruction. The question may even arise how much writing is in the writing class nowadays as it seems that students mostly google, fill in, reorder, choose, drag, drop and print. The interactive board is like a big tablet, but it does allow handwriting and printing (with the touch keyboard). It has been observed that, although at first glance, it seems a more difficult task, the young generation used to typing with both thumbs, prefers a keyboard. Moreover, thanks to technology, they are bombarded with stimuli, receive immediate feedback and are able to multitask. That is the world they know and expect (Figure 13.10). However, it is the role of a teacher to select the activities and adapt them to the needs of the users and learning objectives. Otherwise, the technology can turn against us.

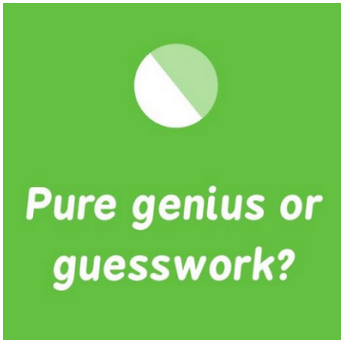

Figure 13.10: Screenshot from a student mobile device of digital feedback provided by Kahoot (URL: https://kahoot.com/, last accessed: 4 April 2017).

13.4 Conclusion

Even though some research into strategy training in computer-mediated environments has been done, not many studies have actually attempted to investigate the interrelation between growth of learner autonomy and teacher autonomy, as well as the interrelation between teacher-as-learner proficiency development and student teacher methodology skills build-up. Some of our previous studies concerned the topic of diagnosis of language learning strategies used in the digital learning environments, either individually (Burzyńska & Krajka, 2015a) or in telecollaboration (Burzyńska & Krajka, 2015b; Marczak & Krajka, 2016). At the same time, previous research concentrated upon training active or student teachers of English in the use of interactive materials, online course books and e-learning courses (Gadomska & Krajka, 2015; Krajka, Możejko & Gadomska, 2016). Thus, it is the intention of the present paper to go one step further and show in practical terms how academic writing instruction with the use of visualisation, Interactive Whiteboard (IWB) and digital coursebooks can serve the parallel purposes of academic skills acquisition and teacher autonomy development.

Digital course books allow interactive individualization, language immersion, instant practice and feedback. Moreover, they are plastic/flexible enough to be adjusted to the demands of users, groups, time and mode. They save time and effort. With the immediate

access to the Internet and text annotation tools of the Interactive Whiteboard, the teacher and students have immediate access to the unlimited resources, sites and visuals. Authentic materials stimulate, facilitate and entertain. In addition, the approach based on the provided food for thinking (the reading materials, discussion questions, video materials) guarantees that the students have something to write about and are forced to use appropriate vocabulary and formulate their own opinions. The approaches prevailing so far in the academic writing curriculum (especially at the B.A. level) seemed to focus on the linguistic aspects of the writing process and relied on students' self-study skills and interests outside the school curriculum. However, with the observed decline in reading literacy and the growing role of technology in learning/teaching, these approaches seem no longer valid.

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14 Inclusive Digital Technologies for People with Communication Disabilities

Ulla Konnerup

Abstract
Suffering from communication disabilities limits a person's ability to participate in communicative and social interactions, public democratic debates and learning activities. The possibility of trying out ideas and opinions is weakened and it might have an impact on the ability to tell one's life story and to process inner thoughts. Consequently, it may affect the sufferer's self-understanding and lead to psychological problems. If it is not possible to find alternatives and compensation strategies for telling your story, presenting who you are, and participating in meaningful dialogues, it is likely that your intellectual level will gradually decrease. Advances in information and communication technologies (ICT), such as smartphones, tablets, and Internet connectivity, have contributed to the integration of many aspects of communication and learning strategies. Thus, new methods to enhance inclusion and empowering people with communication difficulties are offered. However, more knowledge about how learners with special challenges benefit from ICT in their communication and learning and what kind of technology that qualify rehabilitation is needed. Based on research with people suffering from aphasia after a brain injury this chapter will demonstrate how digital technologies can support sufferer's in acquiring some new ways to re-engage people in communicative relations and learning activities.

Keywords: Communication disabilities, Inclusion, ICT, Identity-formation learning, Empowerment, Participation

14.1 Introduction

In recent years, digital technologies have developed rapidly, leading to new features and possibilities within different learning arenas and for different groups of learners. Whether digital technologies enhance the learning and increase the outcome is a complex issue to measure, some will argue even impossible (Passey, 2013, p. 2). Ross, Morrison & Lowther (2010) conclude in a research on past and present technology mediated learning that "educational technology is not a homogeneous 'intervention' but a broad variety of modalities, tools, and strategies for learning. Its effectiveness, therefore, depends on how well it helps teachers and students achieve the desired instructional goals" (Ross, Morrison & Lowther, 2010, p. 19). Tamim, Bernard, Borokhovski, Abrami, & Schmi (2011) agree by stating that the contribution of digital technology in education depends on a range of factors such as context, persons and pedagogy (Tamim, Bernard, Borokhovski, Abrami, & Schmid, 2011, p. 17). To get an insight into how technologies contribute to learning it is recommended to conduct research within each of the mentioned factors (Tamim, Bernard, Borokhovski, Abrami, & Schmid, 2011).

Learners are not a singularity. In the Danish primary school and within education for special needs an individual lesson- and education plan must be written for every pupil (Ministeriet for Børn, Undervisning og Ligestilling, 2016) and every pupil must learn "as much as possible" (Undervisningsministeriet, 2010). In a UK educational context The Department for Education

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have similar recommendations “learning should accommodate learner´s individual needs, their interest and aptitude, so they can gain to the greatest possible level (Passey, 2013, p. 103). Learners with limited opportunities are widely different depending on their specific cognitive, physical, socio-emotional challenges. However, their needs and potentials benefits from digital technology mediated learning are insufficient in the research literature. Developing scientific grounded approaches to teach and learn within an increasingly digitalised, world learners with special needs must not be neglected.

The digitalisation of learning and communication have indeed a potential to change the lives of people with communication disabilities by compensating or substituting for their disabilities. A wide range of digital tools and software enable the use of multiple ways of communication (voice, text, and gestures, emoji’s and symbols) and the Internet and web 2.0 facilitate engagement with others, getting access to information and knowledge and hence facilitate communication, interaction, and learning.

The Convention on the Rights of Persons with Disabilities (2006) is addressing the rights and needs of persons with disabilities. The role of ICT is promoted as a disruptive force in enabling the inclusion of persons with disabilities across life domains. ICT is specifically identified as an enabler for accessibility to systems and services, for access to information, to uphold freedom of expression, and to meaningful habilitation and rehabilitation. (United Nations, 2006). Several articles raise the need of affordable and accessible technology to realize the rights of persons with disabilities. Central is article 21, Freedom of expression, opinion and access to information, which says:

> States Parties shall take all appropriate measures to ensure that persons with disabilities can exercise the right to freedom of expression and opinion, including the freedom to seek, receive and impart information and ideas on an equal basis with others and through all forms of communication of their choice, as defined in article 2 of the present Convention, including by: (a) Providing information intended for the general public to persons with disabilities in accessible formats and technologies appropriate to different kinds of disabilities in a timely manner and without additional cost; (b) Accepting and facilitating the use of sign languages, Braille, augmentative and alternative communication, and all other accessible means, modes and formats of communication of their choice by persons with disabilities in official interactions. (United Nations, 2006, Article 21)

The European Commission (EU) mentions people with disabilities in their Disability Strategy 2010-2020 and eight areas for action are identified: Accessibility, Participation, Equality, Employment, Education and training, Social protection, Health, and External Action in which ICT is considered as a key tool for inclusive education and for promoting equity in educational opportunities for people with disabilities (Europa Commission, 2015).
Even though the UN and EU have strategies for inclusion of people with disabilities and have visions of ICT as an enabler to empowerment and learning, many people face barriers in their everyday lives that make it difficult for them to participate fully in their communities due to communication disabilities.

This chapter will contribute to the research field of digital technologies and learning, particularly emphasising the needs of learners with specific challenges, through findings from two research cases. Both cases concern people with communication disabilities after a brain injury, aphasia, and how web-based environments are used in the rehabilitation. Case 1 is about a web-based virtual environment, case 2 is on rehabilitation in an immersive virtual environment.

14.2 Identity and Learning

Communication plays a major role in identity formation and according to social learning theories, learning and identity-formation are closely linked (Vygotsky, 1934). Identity is created through communication and collaboration in communities and must be maintained and sustained throughout a person's life, retold through language with narratives and images. Inspired by Vygotsky, Lave and Wenger (1991) introduced the concept of situated learning. They emphasize that knowledge and skills must be contextualized and pedagogically structured as reflections of everyday situations and that learning is a process where the learner becomes involved in a community of practice, representing beliefs and behaviours. Situated learning theory is in line with Vygotsky's social development theory (1978), where he claims that social interaction plays a fundamental role in the development of cognition, language and identity. Besides considering learning as a means of developing practice, learning can also be viewed as a means of development and change of identities (Wenger, 2000). It is crucial for learning, identity, and self-esteem to be part of a community, both with peers and with family and friends. Three focal points of communities of practice are 1) a shared repertoire, 2) a joint enterprise and 3) a mutual engagement. In a virtual community of practice people have the opportunity to share experiences, meanings, and repertoire, and thus create a shared history a shared culture.

14.3 Cases

Both cases were part of research projects conducted as cooperation between "The Institute for Language, Speech and Brain disorders" in Aalborg and Aalborg University. Data from case 1 were collected in 2006, whereas data from case 2 were collected in 2011. In both cases the research method were qualitative and phenomenological inspired – which means though qualitative interviews, focus group interviews virtual ethnography.

14.3.1 Aphasia

To understand the group of learners it is important to understand the implications and the diversity of aphasia. Aphasia is an impairment of the language functions due to a brain injury. Aphasia takes many forms and influences a person's ability to produce and understand speech/language, to read, write, spell, and calculate. Aphasia may also be accompanied by other disorders, such as paralysis, cognition problems, and a lack of concentration. People with aphasia often exist in worlds of chaos and confusion, in which language and interplay with surrounding environments are shattered (Hjernesagen, 2016; Konnerup, 2015).

To suffer from aphasia after a brain injury is first and foremost associated with limitations in speaking and understanding spoken language. Though, the consequences and constraints are far-reaching. Language and processing language influence identity formation. Suffering from aphasia often prevents the person from being an active citizen and family member, and most significant is that people with aphasia (PWA) feel a loss of identity (Konnerup, 2015; Shadden & Agan, 2004). Communication disabilities is often interpreted as a loss of competencies and ability to take responsibility for oneself and others (Worrall et al., 2011, p. 309). For this reason, PWAs are at high risk of being marginalized and socially excluded (Shadden, Hagström & Koski, 2008).

Suffering from communication difficulties might have an impact on the ability to tell one's life story, process inner thoughts, and thus, may affect the sufferer's self-understanding and lead to psychological problems (Simmons-Mackie & Elman, 2011, p. 314).There is great risk that PWAs will experience changes in the ways people relate to them after the brain injury. It becomes difficult to maintain social relationships so their greatest loss is often a reduction in the fluidity and flexibility in which communication allows navigation of the complex challenges of life's social actions and interactions. Loss of communication competence has crucial implications for social life, identity, thinking, cognition, and learning. The loss reduces intellectual activity since the brain might be used less, especially if a person has dropped out of the labour market (Konnerup, 2015). If it is not possible to find alternatives and compensation strategies for telling your story, presenting who you are, and participating in meaningful debates, it is likely that your intellectual level will gradually decrease. "It is often said that a person's language is at the level of his intelligence. It is probably largely correct. But the opposite also applies: Your intelligence is on par with your language" (Goldberg, 2005, p. 109). Thus, it is crucial that rehabilitation facilitates alternative ways of communicating, presenting oneself and developing new forms of action.

The research by Worrall, Sherratt, Rogers, Howe, Hersh, Ferguson, and Davidson (2011) about what PWAs really want according to WHO´s International Classification of Functioning, Disability and Health (ICF), demonstrates that their primary goal in the different stages of rehabilitation is to get re-engaged in social and family activities (Worrall et al., 2011, p. 309). For decades, researchers and practitioners have focused on the psycho-social aspects of living with aphasia and have been working on interventions to re-connect PWAs to social life (Parr, 2007; Pound, 2000). There is an emerging theoretical shift from focusing on recreating and relearning the lost language to also incorporating quality of life and participation in society as part of rehabilitation. Though, research on the impact, concrete interventions, materials, and resources for ICT-mediated rehabilitation are still needed.

14.3.2 Case 1

The objectives of this case were to establish video-conference-based distance learning services for PWAs to extend and improve their rehabilitation. The specific aims were to give PWAs the opportunity to learn or relearn ICT, to increase their overall communication skills, to strengthen their participation in public debates and to increase their self-reliance in relation to e-commerce and e-banking (Dirckinck-Holmfeld, Konnerup & Petersen, 2004). The speech therapy was conducted via synchronous videoconferencing, and the weekly assignments were sent by email beforehand. The project developed over time. From using expensive videoconferences and email, to using Internet-based Skype.

Because of a midterm evaluation noticing that is was difficult for the PWAs to navigate between different icons as e.g. Internet Explorer and Microsoft Mail, which were very alike, a web based learning environment, called Basecube, was designed especially for the PWAs needs. The PWAs put special demands to the interface design. It must be easily accessible, user-friendly and dynamically adapted to the individual´s needs and disabilities. To meet any cognitive problems, all features in BaseCube are viewable in one personal entry (Figure 14.1). By using pictures, colors, and icons the design should trigger the user to get ideas, remember, interact, manipulate, experiment, affect emotions and stimulate to act BaseCube integrated dynamic tools which made it easier to navigate among email, exercises, news, calendars,

forums, etc. The courses were orchestred by the speech therapist and the content was a mix of individual exercises and debating points for the whole group of participants.

There are 3 kinds of debate in Basecube, marked with different colors. One used for the one-one communication that takes place in relation to training between PWA and speech therapist; a second that serves for dialogues in the community and a third for discussions related to an article.

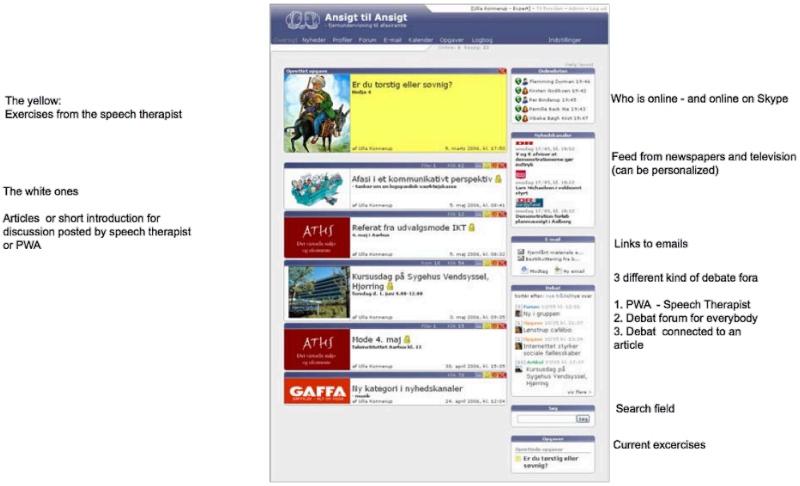

Figure 14.1: Screenshot of a personal start interface of BaseCube (URL: private).

Besides the personalized entry, every participants in BaseCube had the possibilities to present themselves by making a profile. It was visible for all participants in BaseCube, with links to relevant data, audio and written blogs, and important sites. PWAs and 6 speech therapists were users of BaseCube in the project period.

Figure 14.2: Screenshot of a profile in BaseCube (URL: private).

14.3.3 Lessons Learned

Research results from case 1 indicates that interacting with and participating in a media-rich web-based community of practice strengthen cognition, communication, and, in a broader sense, personal and social mastery (Konnerup & Schmidt, 2006). The web-based training was flexible and promoted motivation and commitment. There was a high degree of involvement from the PWAs' relatives (Dirckinck-Holmfeld et al., 2004).

Evidence based research on the impact of rehabilitation has suggested that intensive intervention (i.e., eight hours or more per week) is necessary to gain language improvement (Bhogal, Teasell, Foley & Speechley, 2003; Cherney & van Vuuren, 2012). In a traditional rehabilitation course with attendance at the rehabilitation centre it is both expensive for society and exhausting for PWA to engage in that many sessions of interventions. Case 1 addresses this need for high-intensity training. A focus interview with the participants revealed that they spent up to six hours a day training using features afforded in BaseCube orchestred by their speech therapist (Konnerup & Schmidt, 2006, p. 116). The project participants expressed great satisfaction with the web-based training, especially the activities in BaseCube and what the activities led to on the Internet. In the interview the PWAs highlight the importance of a single point of entry for both Internet, mail, exercises, newsfeed and communication (Dirckinck-Holmfeld et al., 2004)

Originally, Basecube was mainly considered for formal learning. Over a very short period it, however, turned out to become a social community for the PWA. They felt secure in the Basecube environment and they were attracted to the discussion fora it possible to communicate with pictures, photos, movies, or audio. Newsfeed to their preferred newspaper awakened their curiosity, one link led to another and they got occupied surfing on the Internet, which had seemed too difficult for them beforehand. As a part of the research the researchers and the PWAs discussed BaseCube and what it had meant to the users in a discussion fora. The following outline represents three statements from different PWAs:

> BaseCube have taught me to watch video (on the Internet) the whole night - ironman on Hawaii/ New Zeeland, because I and can search the internet, I´m no longer afraid to do anything wrong – I know how to save things on the Internet. I dare to make a fool of myself – that makes my wiser. My curiosity, the safeness, and my eager to be with other people is driving me. (PWA 1)
>
> Being busy with the filler (she is reconstructing her house), I MUST have a look on our site - what is going on, what are you doing. Basecube has become a part of my life, I´m addicted. (PWA 2)
>
> BaseCube is GOLD. I´m agreeing with you, O - and well written. When I started this course, I could not find my passwords, my usernames, the digital language and so on - I pressed the wrong bottom and I could not surf the internet. I was exhausted. But now - awesome - I couldn't live without Basecube - my workplace - a very vivid workplace. (PWA 3)

Using words as *our place* and *my workplace* and commenting on each other's contributions to the debate makes it obvious that they feel personally committed. BaseCube have defined the Internet, rehabilitation exercises, and emailing and made it manageable.

The relatives expressed great enthusiasm that PWAs were up to date with news, and could do some of the tasks they had in the family before, e-shopping, e-bank etc. It balanced the division of labour in the family. Finally, the research revealed that the ICT-mediated training enabled the PWA to negotiate their identity, by showing who they were and had been using pictures in blogs, debate fora and chats (Dirckinck-Holmfeld et al., 2004; Konnerup & Schmidt, 2006).

BaseCube is developed in 2004, the same year as Facebook, but before it was known publicly. 2004 was also the year that the concept of digital social media are reflected both in research and in the general public and related to the term web 2.0 (Klastrup, 2016) As mentioned BaseCube has a lot of the same features and tools as the significant characteristic of social media. It allows user generated content accommodated to a variety of technologies and features for communication and learning practices (Dalsgaard & Sorensen, 2008). Several Web 2.0 services are often centred around the individual's profile and a personal network of people. It is possible to create smaller or larger groups for private activities. With a personal network, it is possible to share different types of content produced by the user, e.g. pictures of family, status updates recipes, holidays, small movie.

Summing up the findings from case 1, besides formalized speech therapy, BaseCube provides many options for communication and learning. According Konnerup & Schmidt (2006) the participants:

1. Communicate and learn by various forms of perception and modalities;
2. Interact with people at their same standing;
3. Can choose between various learning and communication strategies;
4. Get an opportunity for self-reflection and self-presentation via profiles and weblogs;
5. Get an increased extent of independence;
6. Get a strengthening of cognitive functions;
7. Become able to take responsibility for their own learning and the sense of being a part of and being “present” in a community of practice.

Several of the features in BaseCube are similar to what social media offer today.

14.3.4 Case 2

Case 2 concerns a six-week rehabilitation online course for 9 PWAs, conducted by 6 speech therapists. The course was a part of a project on offering speech therapy in the immersive virtual world, Second Life (SL).[14] It comprises the development of an avatar[15]-mediated rehabilitation and the initiative is based on experiences from case 1. The results of case 1 revealed that web-based learning environments with tools and features like in social media had a potential to stimulate communication, interaction and learning by using various forms of perception and modalities with peers and speech therapists. Web-based communication training from own home enable PWAs to take responsibility for their own learning. In case 2 the learning environment is 3D. By letting the participant be represented by a virtual human, a so-called avatar the feeling of presence should be strengthened and invite to more immersiveness in the scenarios and narratives. The objective was to investigate whether being able to do things like horse-riding, shop new shoes, windsurfing or travel to Paris virtually could stimulate the brain and consequently the language and the ability to renegotiate the identity. The courses were based on social interactions and activities in a community-centred perspective.

[14] See Article `Second Life´ in Wikipedia, the free encyclopedia. URL: http://en.wikipedia.org/w/index.php?title=Second_Life&oldid=653591747. Last accessed: 27 May 2017.

[15] A visual representation of a person (Internet user), e.g., in the form of a cartoon character, a three-dimensional figure, or a photo of oneself.

SL is a free online world that people can enter, explore, and interact in by accessing the Internet. Using a keyboard and mouse, the users control a graphical digital representation of themselves: an "avatar" (Carr & Pond, 2007, p. 34). The easy web-based access from home computers makes SL fit for rehabilitation. SL is, in many ways, a virtual replica of the real world. It is possible to personalize a user's environment with a small amount of money. Some would argue that the graphical appearance could be more realistic; however, research has shown that a photographically real display does not increase users' feelings of social presence more than other parameters, such as minimal cues (Sanchez-Vives & Slater, 2005, p. 337). The person that controls an avatar can decide its behaviour and personalize its appearance. Age, gender, race, height, and weight can be changed with a few mouse-clicks. It is possible to rent or buy land, build houses, buy spaceships and much more. Avatars can fly and teleport, giving the user a degree of self-control and self-representation. SL is, without comparison, the virtual environment with the most users and is the most frequently referenced in research. It was founded by Linden Lab in San Francisco in 2003. By 2014, there were more than one million regular users (`residents´, as they are called, `Second Life´, 2015). During the project the primary learning space in SL was a place called Wonderful Denmark (WD). The design is based on a very well-known (in a Danish context) fictive provincial town called Korsbæk. Korsbæk is known from a television series called Matador, which first aired on Danish television in 24 episodes from 1978 to 1981. The series is about life in a small town, and you follow the town's inhabitants from 1928 to 1947. Korsbæk has become a shared heritage for most Danes.

Figure 14.3: Screenshot of a very known shop in Korsbæk in Second Life: Wonderful Denmark, 2010.

Environments like SL offer such features as embodiment, presence, collaboration, user-centeredness, context-awareness, and cross-real interactions to enhance users' learning experiences. Through avatar mediation, the environment stimulates bodily immersion and interaction, affording users the semantics of place, including deixis, indexical language, and body orientation (Rehm & Konnerup, 2012).

14.3.5 Lesson Learned

The research data in case 2 were collected partly as qualitative interview with 10 participant and 6 speech therapist, partly by virtual observations of online training sessions, which also were videotaped. The data revealed that the PWAs to great extent were capable of immersing themselves in the interactions and scenarios of SL, leading them to experience a high degree of presence (Konnerup, 2015). By offering a variety of ICT features and multimodal communication tools and by meeting a variety of perception modes, the virtual environment

offers a possibility to act and communicate. The avatar mediated rehabilitation has shown to facilitate alternative ways and compensation strategies for telling your story, presenting who you are, participating in meaningful social interaction cognitive training, and renegotiation of identity. The embodied interactions and the feeling of immersiveness and presence seem to prompt words and interactions. Immersiveness is the subjective impression in a comprehensive and realistic experience (Dede, 2009, p. 66). Sensory information causes users to forget that they are in a mediated environment, leading them to believe and behave as if they were in the real world (Sanchez-Vives & Slater, 2005, p. 332; Schroeder, 2010, p. 3; Slater, Usoh, & Steed, 1994). Immersion can lead to presence, which is "a state of consciousness that may be concomitant with immersion, and is related to a sense of being in a place" (Slater & Wilbur, 1997, p. 1). In brief, one could say that presence is how immersion makes you feel. Schroeder (2010) noted that, in the context of virtual environments, "the feeling of ´being there´ makes users feel they are together in the same (virtual) space" (Schroeder, 2010).

Horse-riding is one of the activities that is mention in by the PWAs that make them feel present and make them feel immersed. During the observisions you often hear "hush" and "ihhh" from the riding participants. It is obvious that it is mainly activities that contain some degree of action that provide the greatest degree of immersion. In an interview Helen describes this directly in her interview:

> Helen: Well, it's obvious to do things with a horse and a bike. They are action. It is quite super uh. I like the horse especially because it's new for me to get on a horse. Uh, bike I am more used to, but it is a great feeling, because you ARE on the bike ... like when you bike down to the supermarket, and you also feel that you go somewhere ... and you turn and all.

Figure 14.4: Screenshot of a horseback riding in Second Life: Wonderful Denmark, 2010.

In rehabilitation, such parameters as embodiment and a sense of presence have demonstrated positive effects for learning tasks (Konnerup, 2015; Phillips, Ries, Kaeding & Interrante, 2010)

According to specific training practices, naming, categorization, selection, orientation, and spatial disabilities SL is well suited to PWAs with a type of aphasia called anomic (involving problems with prepositions). Furthermore, persons suffering from Wernicke's aphasia[16] have immersed themselves, been associating, and been using a lot of (correct) words to describe

[16] PWA with serious comprehension difficulties. They often say many words or series of words that don't make sense with realizing it.

their actions and experiences. By contrast, SL might be difficult for PWAs with audial processing problems, at least when the quality of the sound is poor.

Figure 14.5: Screenshot of Michael´s avatar and the Tram in Second Life: Wonderful Denmark, 2010.

Michael suffers from Wernicke aphasia. He tells about and incident with a tram. Standing on the rails he gets surprised by the tram, and his fright of being hit makes him speak spontaneously:

> Michael: It was like before, in the evening, suddenly, traces ... sport sprint ... strain, train, it is...
> Speech therapist: The tram?
> Michael: Yes, a trolley ... tram on the rails. Yes, the tram, on the rails. Then, I say to my wife: Watch out... I better hurry across the road before I get hit, before the tram gets here. Suddenly it is close... I think it is awesome... hahahaha, that it suddenly...

The PWAs also enjoyed being in the company of others and travelling to places they had been to. The recognisability environment and landmarks stimulated the memory and their language. Some PWAs had a more peripheral participation role. This could be due to their personalities, the aphasia, or their lack of written and verbal skills. Nevertheless, in the SL, participants are visible through the presence of avatars. Through shared experiences and a shared repertoire with other participants, the creation of a common culture, narratives, chats, and any other kinds of interactions that contribute to strengthen their perceptions of their own identities give visibility to the other participants. Thus, the participants have a relationship with the space. It is familiar, and several express joys in meeting the known buildings and persons.

14.4 ICT Mediated Rehabilitation – Changed Practices

An overall objective of both cases was to investigate whether the ICT, especially web-based communities provide opportunities for qualifying rehabilitation both in terms of language, social relations and in relation to recreate itself and its identity after a brain injury.
Digital tools and their role in pedagogy an education is constantly changing. Through the 1990s and the 2000s, most technologies in rehabilitation were tools for improving speech and language production through transmitting, sending, receiving, and reading. Technologies with communicative, participatory, and opinion-making dimensions as in the two cases have great potential, but are still in their infancy (Code & Petheram, 2011; Dirckinck-Holmfeld et al., 2004; Konnerup, 2015; Konnerup & Schmidt, 2006; Petheram, 2004).

Implementation of new technologies gives rise to reflection on the existing practice. In relation to the two cases both the conceptual understanding of suffering from aphasia and to the pedagogy for working together with PWAs. Practice and the role of the speech therapy has shifted from having a primary goal of optimizing the language production and the communicative competence to also including language as access to learning, identity, participation and interaction. ICT and web-based methods have the potential to fulfil the UN´s conventions and EU´s digital strategies for persons with disabilities. Mediated by the digital tools PWAs are given possible tools to re-learn, compensate, or substitute for their lost communication abilities.

Thus, the role of the speech therapist role is changing to be scaffolders, mentors and facilitators. The content and teaching materials in BaseCube environments are, as mentioned, orchestrated by the speech therapist, but personally designed and relevant to each PWA. The digital learning environments offer several perceptual forms and multimodal communication; written, visual and auditory approaches. Often a combination of various modes that support each are used. For example, a PWA, with difficulties in maintaining the auditory soundtrack in the memory can solve a problem if the same content can be read in print and heard as audio; reading competence supports the auditory understanding. The interactive possibilities of social media facilitate web based spoken and written dialogue and collaboration and thus, a suitable framework for learning environment when learning is considered as situated learning in a community of practice.

14.5 Conclusion

From the above studies, it can be concluded that ICT and web-based community rehabilitation has a potential for PWAs. Rehabilitation is changing from re-building the injured brain to concerning the whole person and the communicative potential, each person contains. The opportunity to train and learn at home has given PWA the opportunity to show their strengths and competencies. The virtual and digital learning methods offer some opportunities to put the cognitive rehabilitation into a socio-cultural perspective and let the motivation become driving force for the linguistic rehabilitation. The virtual environment is independent of time and place, allows for active participation in the PWAs´ premises in terms of energy pattern, communicative strategy, time and fields of interest. Formal and informal learning processes are integrated and merged into each other. Using either formalised virtual environment or social media the PWAs have the time and tools to communicated, presenting themselves on an equal footing as other persons, and thus renegotiate their identity.

When the medium is changing, it is likely that the cognitive strategies change. Digital technologies, thus, have a potential to poke and prompt the language and thus develop a new and different form of communication and give a kind of alternative voices to people with communications disabilities empower learners with special challenges.

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List of Figures (Chapter III)

List of Tables (Chapter III)

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Appendix

A technical-didactical Perspective on the Digital Turn in Higher Education – an Informatic-Approach

15 Trace-Based Multi- Cristeria Preselection Approach for Decision Making in Interactive Applications like Video Games

Hoang Nam Ho, Mourad Rabah, Samuel Nowakowski & Pascal Estraillier

Abstract
The decision-making in games is essential to make them more automated and smart. A decision algorithm performs its calculations on the set of all the possible solutions. This increases the computation time and may become a combinatorial explosion problem if we have a huge solution space. To overcome this problem, we present our work on relevant solutions preselection before making a decision. We propose a two-steps strategy: i) the first step analyses the system's traces (users past executions) to identify all the potential solutions; ii) the second step aims to estimate the relevance, called utility, of each of these potential solutions. We get a set of alternative solutions that can be used as an input to any decision algorithm. We illustrate our approach on the Tamagotchi game.

Keywords: Interactive adaptive system, Traces, Prediction, Utility, Multi-criteria decision-making

15.1 Introduction

The video games naturally belong to the family of interactive applications. These types of applications are seen as a sequence of successive activities and events realized between the user and the system (Brun & Beaudouin-Lafon, 1995). These activities are the main components that must be carried out in order to have an organization as well as a structure of the interactions, or scenario in an interactive application. Our work considers the application control by unfolding the scenario structure. We confine the interactions during the application execution into the contextualized blocks called situations (Pham, Rabah & Estraillier, 2015). A situation is a system's component where some system's actors interact using local resources in a specific context to achieve one or more common objectives. Thus, the users in an interactive application execute and participate in successive situations until they reach a goal predefined by the designer. With this hypothesis, the application execution relies on the sequence of different situations. We want to optimize the situations chaining that composes the interactive application like video games by the use of the artificial intelligence (AI). AI in video games includes several areas to be dealt with, such as: automatic dialogue between the computer and the player (Hanson & Rich, 2010), diagnostic (Bourg & Seemann, 2004), complex problem solving (Bourg & Seemann, 2004), decision-making (Parsons & Wooldridge, 2002), etc. In this article, we are interested in the decision support in applications, especially video games, structured in situations.

A video game is an ideal testing ground truth for AI areas and in particular for the decision-making aspect. Their rules are generally well defined and deterministic, which make easily to structure the games' execution in the chain of situations. With this structuring, when the current situation has been completed, we have a global state vector representing the actual system's attributes. Depending on this state vector, the situations chaining logic will determine the appropriate situation to follow among those available. This choice is based on

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a Multi-Criteria Decision-Making (Köksalan, Wallenius & Zionts, 2011). A general decision-making process comprises five steps in which the last four are repeated throughout the application execution (Ho, Rabah, Nowakowski & Estraillier, 2014):

- Initial step: it defines the main objective that the users want to achieve.
- Step 1: all of the criteria will be determined in order to evaluate these contributions to the objective's achievement.
- Step 2: this step provides the weights of each criterion determined in the step 1.
- Step 3: it analyses all the possible solutions in order to identify the candidates for the decision algorithm.
- Step 4: this step aims to perform the decision algorithm to all of the candidates identified in the step 3 to get a better candidate.

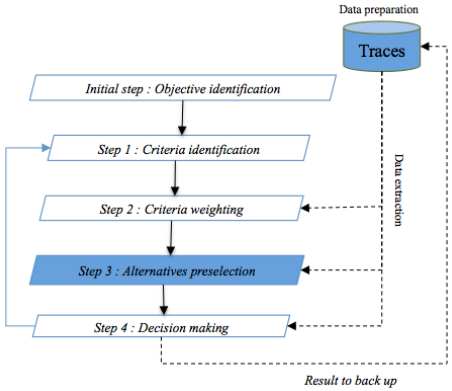

Figure 15.1: Process of Multi-Criteria Decision-Making (own Figure).

Besides, the observation and the evaluation of the application execution are often based on the analysis of large volumes of data bearing contextualized information collected during the execution, called traces (Laflaquière, Settouti, Prié & Mille, 2006). These traces contain valuable information about users' skills, past habits, past behaviour and achievement; if we use traces, they can help us to improve the overall decision process (Doumat, Egyed-Zsigmond & Pinon, 2010). Hence, we propose to improve the decision-making process by using traces of previous executions. A traces system collects all the traces generated by the users during the interaction with the system. Then, these traces serve to analyse in the decision-making process.

By combining the decision and the trace aspect, we (Ho, Rabah, Nowakowski & Estraillier, 2014) have proposed a general trace-based multi-criteria decision process (illustrated in Figure 15.1). We have taken the classic decision process and we have added the traces analysis in the last three steps, such as: the criteria weighting (step 2) (Ho, Rabah, Nowakowski & Estraillier, 2014), the decision-making algorithm (step 4; Ho, Rabah, Nowakowski & Estraillier, 2015; 2016) and the alternatives identification (step 3), the main purpose of this article.

The set of candidate solutions for the decision process is built during `Alternatives preselection´ step just before the `Decision-making´. This shortlisting is not computed by the decision algorithms (Köksalan, Wallenius & Zionts, 2011; Russell & Norvig, 2010). In our situation-based context, we do not want to apply these algorithms to perform the decision-making on all the available situations because some of them are not possible or not relevant at a given moment. If we still perform the decision technique on them, the computation time will raise uselessly due to the complexity of the decision algorithm. The work described in this paper deals with this preselection problem. We propose to reduce the number of available situations that the decision method will analyse. We identify among all the available situations those that can be executed according to the current system's state. This state is a set of attributes that contribute to the application execution. The question is: among all available situations, how to preselect a set of candidate situations (called *alternatives*) for the decision-making during the application execution by using the traces generated in previous executions? We propose in this article a trace-based preselection approach that can preselects a set of alternatives for the decision-making in the situation-based context.

To experiment our approach, we conceived a prototype of a well-known Tamagotchi game. It is an interactive application where a user has to take care of a virtual pet. The application execution can be divided into a reduced set of different situations as: *feeding*, *sleeping*, *healing* ... We will use examples from this case study all along the paper to illustrate the various introduced concepts.

The paper is organized as follows. The next section will present briefly the positioning of our approach in relation to the existing researches around the reduction of the possible solutions. The section 0 introduces the Trace-Based System (TBS) that we use to collect the traces generated during the application execution. These traces will be used in our proposed approach, described in the section 0. The case study based on Tamagotchi game is presented in section 0 to illustrate our approach and to show its performances. Finally, section 0 concludes the paper and gives some perspectives for further research.

15.2 Related Research

The multi-criteria decision-making aims to find a solution from a set of alternatives by synthesizing data from different points of view and according to different parameters from different sources. There exist a variety of methods to solve the decision-making as WSM (Weighting Sum Model; Triantaphyllou, Shu, Sanchez & Ray, 1998), WPM (Weighting Product Model; Triantaphyllou, Shu, Sanchez & Ray, 1998) and MAUT (Multi-Attributes Utility Theory; Russell & Norvig, 2010). Besides, the multi-criteria decision problem can also be solved by applying some out-ranking methods as PROMETHEE (Taillandier & Stinckwich, 2011; (Behzadian, Kazemzadeh, Albadvi & Aghdasi, 2010) or ELECTRE (Corrente, Greco & Słowiński, 2013; Hatami-Marbini & Tavana, 2011). However, all of these methods still focus on finding the final solution with two hypothesis that are: i) all the criteria have been weighted, ii) the set of alternatives is available. Regarding these two hypothesis, this paper aims mainly to overcome the point ii) and provide an alternatives preselection method. Our method is general and could be integrated to any decision algorithm to complete the decision process.

Concerning alternatives preselection using system's traces, there are only few existing studies that consider these aspects. Among them, Case-Based Reasoning (CBR; Riesbeck &

Schank, 2013) is a method that explores the obtained traces during the previous executions to improve the preselection. CBR imitates the human reasoning and tries to solve new problems by reusing earlier experiences. For each encountered problem, the past experiences keep track of the problem and of the applied solution to this problem, called a *case*. The main idea of CBR is based on the assumption that similar problems have similar solutions because, in practice, it is often more efficient to solve the same problem with the chosen solution from the previous time when the problem was encountered. We realize that the objective of CBR and of our preselection strategy has some similar points. CBR measures the similarity between the current problem and the past recorded ones and tries to apply the chosen solution at that time, which also have been recorded. If several solutions have been considered in the past for the same problem, the data mining techniques are used to assess for the more appropriate one (Guo, Hu & Peng, 2011). This case-based approach is used in several types of video games. For example, a CBR system, integrated into the Civilization C-evo game (Sánchez-Pelegrín, Gómez-Martín & Díaz-Agudo, 2005), is used to help the players select an action to do when he encounters a problem that has never occurred. The system filters the closest cases using a measure of similarity to calculate the gain level of each case. The case with the highest gain will be recommended for the players. In RoboCup (the Robot Soccer Championship), CBR is applied to build a planned strategy for robots by using the past experiences (Karol, Nebel, Stanton & Williams, 2004; Marling, Tomko, Gillen, Alex & Chelberg, 2003). CBR also demonstrated its performance in designing of robots' behaviours in uncertain, dynamic and real-time environments (Ros, Arcos, de Mantaras & Veloso, 2009). Finally, Ontañón and Ram (2011) focus on techniques that allow non-experienced users to create video games by using CBR.

Burke (2007) and Cheetham (2003) calculate the distance to determine which items can be recommended for the user. The distance increases when the similarity is weak. However, the main distance approach's drawback is the computation time. In this kind of approaches, we must consider all the data when we want to compute the distance with the current state. They do not support a model that allows avoiding re-computing the distances while having new data. In (Dang, Pham, Champagnat & Rabah, 2013), authors use the Linear Logic to identify all possible alternatives in the situation-based applications; the Linear Logic analyses the inputs of the current situation called *pre-conditions*. This method is very intuitive because it just performs the verification between the pre-conditions that are part of the situation's structure, and the current system's state. However, this method needs the situation structuring with the pre-conditions definition and the Linear Logic does not provide a quantified measure for alternatives' matching as a distance in the distance approach above. It only preselects structurally the enabled situations. This kind of measure is necessary to compare and sort the possible situations according to some relevance indicator.

In our work, we deal with a situation-based interactive application and we want to provide a reduced preselected set of situations for the decision algorithm according to the current system's state. As with CBR approach, we get the current system's state and then we make a decision using some recorded information related to previous executions, called *traces*. These traces allow us to determine what are the situations that have been chosen in the past in similar context. To apply this principle, we need to integrate a traces management system. Based on the collected traces, we calculate the probability of being executable for each situation among those available. In order to reach this problem, we are interested in supervised learning (Cornuéjols & Miclet, 2011), an automatic learning technique that we try

to infer the rules and the models from an observed and validated database. In our context, we have a traces base containing the previous executions; we can apply the existing methods in supervised learning to build a model that can predict all the relevant situations. Among the methods of supervised learning, we con- sider the four most commonly used methods (Tan, Steinbach & Kumar, 2006), which are: Naive Bayes, Neural Network, k-Nearest Neighbours, Support Vector Machine (SVM) to retrieve the best solution for the considered problem. Among them, we retained the Naive Bayes method (Ho, 2015), as described in section 0, which can be used to compute the executable probability for each situation.

Besides, we are trying to solve a multi-criteria problem. It means that we should take into account the outcome or what we call the *utility* (Podinovski, 2014) for each possible alternative regarding the set of criteria. Based on the utility, we can estimate the outcome that each alternative will get when it is chosen. The notion of *utility* has often been used in AI system and is part of reinforcement learning technique (Sutton & Barto, 2012). This type of technique allows learning from experiences in order to obtain a quantitative gain during the time. A utility-based system is used to estimate the action's gain if this one is chosen. All of the potential actions are considered on a variety of factor (Mark, 2008). One of the most popular examples of a utility-based AI system is `The Sim´ (Evans, 2009).[17] Each potential action in this game is evaluated on all of the current needs to estimate their capacities of satisfaction. Each action is associated a weighted sum to determine which action is the best at the given time. The action with the highest score will be the one chosen. Moreover, in (Dill & Mark, 2010; 2012), the authors have shown how to use utility theory to model the decision and apply it in the video games. The Q-learning method (Watkins, 1992) is another typical method for reinforcement learning. However, the execution time of Q-learning increases with the number of examples in the database. Thus, it is not suitable for the real-time processing that is required in video games. We have chosen to transpose the notion of *utility* into our situation-based context in order to estimate the impact that each situation will have if it is chosen to be executed.

To sum up this section, in order to solve our problems, we propose to combine two complementary points of view:

- The first one is to use the system's actual state to predict what are the potential situations according to past system executions.
- The second one is related to the multi-criteria aspect. It concerns the definition of a value of *utility* for each potential situation. This value is a combined utility estimation according to each considered criterion. The situation's utility of a criterion is the value that measures the criterion gain if we execute this situation. Based on the utility value, we can reduce the set of potential situations obtained above to get a set of alternative solutions for the decision-making.

Our approach is based on the traces generated during the interaction between the user and the system. Before describing in detail our preselection approach, we present in the following section our traces system.

[17] See also: Jeuxvidéo.com: Les Sims passent les 100 millions, http://www.jeuxvideo.com/news/2008/00025410-les-sims-passent-les-100-millions.html. Last accessed: 31 May 2017.

15.3 Trace-Based System in Interactive Situation-Based Application

A Trace-Based System (TBS) is a system that allows to collect and to analyse traces (Settouti, Prié, Cram & Champin, 2009). We start this section by introducing some TBS related concepts.

- *Observer*: an observer is associated with each relevant event that occurs during the application execution and describes what happens in the application.
- *Trace*: a trace is a sequence of data generated by any action regarding an object or an event occurring during the system's execution. A trace is also defined as a set of temporally situated elements.
- *Trace model*: each trace can be associated with a model, called trace model that formally represents the corresponding traces. It contains the properties and attributes concerned by the traces, as: time, date, user id, performed action...
- *m-Trace*: m-Trace is a trace associated with its model.

Figure 15.2 gives an example of a m-Trace in the Tamagotchi case study. On the left of the figure, there is the description of users' actions: situations where he was involved. The central part shows the used trace models. There is three trace models associated with three types of observers: System, Situation and Criteria. On the right side, we have the obtained m-Traces. For instance, we can notice from the collected traces that: the user named Alain launched the application the 1st of September 2014; he started by executing the situation feeding followed by the situation sleeping; before entering the situation feeding, the Health criterion value was 0.2 and on the exit this value increased to 0.8, etc. This whole figure is called m-Trace and a system that manages m-Traces is a m-Trace-Based System.

Several TBS architectures have been published. Despite the diversity of TBSs, they still respect the following process: i) traces collection, ii) traces transformation and iii) traces analysis.

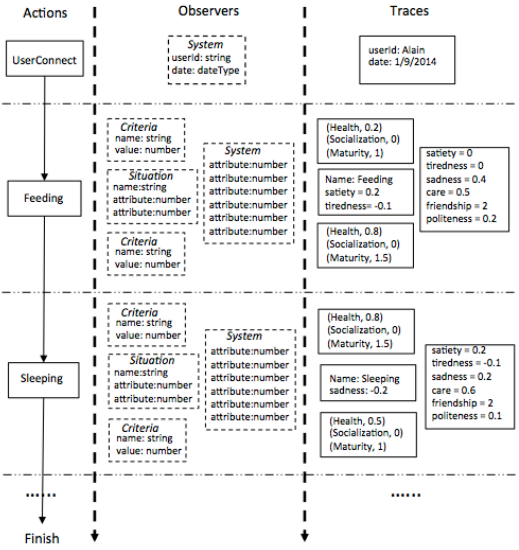

Figure 15.2: Example of m-Trace in the case of Tamagotchi (own Figure).

15.3.1 Traces Collection

This component is devoted to traces collecting and recording. We consider the interactive applications where users interact with the system by executing a sequence of situations. Users should choose one situation according to the current state at each application execution step. We define three observers associated with the trace models to describe the traces:

- *System observer*: it is responsible for retrieving system's and users' information.
- *Situation observer*: it observes the situations' related information as situations transitions.
- *Criteria observer*: it verifies the criteria fulfilment that is computed by a particular function predefined by the application's designer.

Regarding these three observers, we observe the application execution and we obtain the m-Trace as such of Figure 15.2. All the collected m-Traces in this phase are called primary traces. A primary trace (the raw collected trace) is defined by a triple of $\{V, S, C\}_t$ that describes the application execution at the moment t where:

- $V=(att_1, att_2,\ldots,att_m)$ is a set of attributes that describes the current system's state.
- $S = sit_i$ is the executed situation.
- C is the set of values of the defined criteria.

During the application execution, we collect the information according to this defined model

above, we will get a primary traces base, called T_P. These traces will be used in the following traces transformation phase.

15.3.2. Traces Transformation

This phase receives the primary traces and transforms them into the suitable format according to our requirements. In our context, we need a base of traces in which each record describes its context: what is the system's state, what situation has been executed, what are the criteria fulfilment changes after the situation execution. The transformation will select the meaningful information according to our needs to build a transformed traces base. A transformed trace base is denoted by T_T) where each transformed trace contains these following elements:

- $\Omega = \{V \times S\}$: is the set of the system's state vector V and the executed situation S. A record in Ω has the following format:
- $\langle V=(att_1, att_2, \dots, att_m), S = sit_i \rangle$
- $\Delta = \{C_{before} \times S \times C_{after}\}$: represents the set of criteria before and after executing the situation S. Each record in Δ is represented by:
- $\langle \{\gamma_{before}(h)\}, S = sit_i, \{\gamma_{after}(h)\} \rangle$

15.3.3 Traces Analysis

It analyses the obtained traces from the transformation phase. In our work, the trace analysis is used to apply the proposed strategy described in the next section.

15.4 Trace-Based Multi-Criteria Alternatives Preselection Strategy for Decision Making

This section presents our strategy to reduce the alternatives space state for the decision-making. To achieve this, we use the transformed traces base T_T obtained in the section 0. Our method contains two steps:

1. the prediction of the potential situations.
2. the estimation of the potential situations' utility.

The first step consists of evaluating the executable ability of all the available situations. We estimate how often each situation has been chosen in the past executions according to system's actual state. This value is based on situations selection frequency in system's traces and is used as a prediction indicator for possible future use. We thus obtain a set of probabilities associated with all the situations. A potential situation is the one that its probability is above a threshold predefined by the designer or the user. If a situation is considered as potential, we will add it to the set of potential situations.

The second step computes for each potential situation identified above its relevance according to the defined criteria. This measure, called *utility*, helps users to compare the alternatives' relevance at a given time. A potential situation is considered as an *alternative* if its utility is above a predefined threshold. The combination of these two steps helps us to determine what are the alternatives for the decision-making and to quantify their potential impact on the application's criteria fulfilment.

15.4.1 Prediction of the potentials Situations

Figure 15.3 describes our trace-based probability prediction strategy during the application

execution. We use Ω extracted from the transformed traces base T_T (*cf.* 15.3.2) to perform the analysis. The obtained traces are analysed to predict what are the potential situations according to the current state and a user defined acceptance threshold.

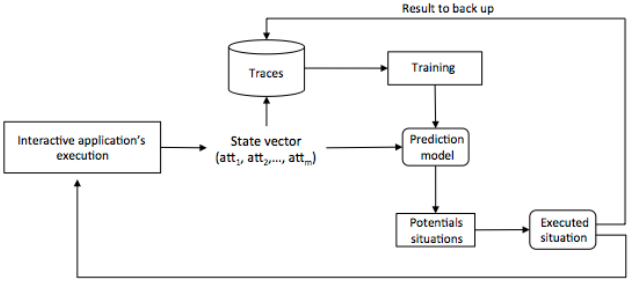

Figure 15.3: Trace-Based Situations Probability Prediction Process (own Figure).

To perform the prediction computations, we use the data mining technique because this kind of technique is efficient to explore and analyse a large amount of data. Among several existing techniques as Naive Bayes (Domingos & Pazzani, 1997; Hand & Yu, 2001), Neural Network (Tan, Steinbach & Kumar, 2006), k-Nearest Neighbours (Wu et al., 2007), Support Vector Machine (Vapnik, 2000), we decided to use Naive Bayes. Our choice is motivated by the following points:

- We consider the traces as the primary data for our computations. The traces may contain heterogeneous information that may be of any type. Not all of the above techniques can process both numerical and non-numerical values, while Naive Bayes does. For instance, the Neural Network or Support Vector Machine cannot compute with the non-numerical data. Actually, the Naive Bayes is suitable when we add any data type to enlarge the traces.
- The computation time and the complexity to analyse the data with Naive Bayes are less than with other approaches. The Neural Network and the Support Vector Machine require many parameters and the performance of these methods depends strictly on the choice of these parameters.
- k-Nearest Neighbours is simple and understandable, but it cannot create a training model as with the other methods. Naive Bayes can create the model faster than the others and we do not have to re-estimate the whole model when adding the new data.

We will use the Naive Bayes to preselect a set of situations. We need to predict all the available situations that can be potential for the next execution step according to the current system's state. This state represents the attributes of the observed system at the end of the current situation execution. For each situation, we compute the probability of its executable ability (detailed below). We obtain a set of probabilities related to all the available situations. A potential situation is the one that has an executable probability above a defined threshold set by the designer or the user. If a situation is potential, we add it to the set of potential situations Pot. The detailed process is presented in the following algorithm.

Input: the current state vector *V*, the set *S* of *n* available situations sit_i and the threshold *s*

1: **let** $Pot = \emptyset$ (set of potential situations)

2: **for all** $sit_i \in S$ **do** (*i* from 1 to *n*)

3: **compute** $Predict(sit_i)$

4: **if** $Predict(sit_i) \geq s$ **then**

5: $Pot = Pot \cup \{sit_i\}$

6: **end if**

7: **end for**

Output: the set of potential situations *Pot*

Figure 15.4: Algorithm 1: Prediction of potential situations (own Figure).

The executable probability of the situation sit_i according to the state vector $V=(att_1, att_2,\ldots,att_m)$, called $Predict(sit_i)$ is computed by:

$$Predict(sit_i) = \frac{P(sit_i/V)}{\sum_{i=1}^{n} P(sit_i/V)} \quad (1)$$

with $P(sit_i/V)$ is the posterior probability of the situation i given the state's vector V, it is calculated by:

$$P(sit_i/V) = P(sit_i) \times \prod_{j=1}^{m} P(att_j/sit_i) \quad (2)$$

In (2), we must compute $P(att_j/sit_i)$. This computation depends on the type of value of att_j. All the attributes that we consider in our context have numerical values[18] and respect the normal (Gauss) distribution, so the probability of the attribute att_j given the situation sit_i is computed with:

$$P(att_j/sit_i) = \frac{1}{\sqrt{2\pi} \times \sigma_j^i} \times e^{\frac{-(att_j - \mu_j^i)^2}{2\times(\sigma_j^i)^2}} \quad (3)$$

with μ_j^i and σ_j^i are respectively the mean and the standard deviation of the attribute j for the situation sit_i.

After computing for each available situation its executable probability, we verify this value by comparing with the threshold *s*. If it exceeds the defined threshold *s*, the situation is considered as a *potential situation* and all the potential situations constitute the input set of situations for the second step, the utility estimation.

15.4.2 Utility Estimation

To estimate the utility for each potential situation obtained in the previous step, we consider a part of the transformed trace above. From the transformed traces base T_T, we extract Δ, a set that contains, for each potential situation identified in the section 0, the criteria value

[18] For non-numerical values, we use normal likelihood as in our work on criteria weighting (Hatami-Marbini & Tavana, 2011.

changes resulting from the situation's execution. This step aims to estimate for each potential situation its utility, which represents a given situation impact on the criteria accomplishment progress during the previous executions. Δ may contain several records for the same situation since one situation may have been executed several times in the past.

To estimate the utility of a criterion, we start by computing the deviation *d* of each criterion accomplishment before and after the situation's execution. The deviation of each criterion *h* in j^{th} record in *Δ* is computed by:

$$d_h^j = \gamma_{after}^j(h) - \gamma_{before}^j(h) \quad (4)$$

If we have a traces base of q records, the overall deviation of the criterion h is computed by:

$$d_h = \frac{\sum_{j=1}^{q}\left(\gamma_{after}^j(h) - \gamma_{before}^j(h)\right)}{q} = \frac{\sum_{j=1}^{q} d_h^j}{q} \quad (5)$$

We use the computed deviation to define our utility function $u(d_h)$ where p_h represents the deviation threshold defined by the designer or by the user. The utility function is applied on each criterion. The value of the utility of the criterion h is computed based on the deviation given in (5). The detail of the utility function is described in (6).

$$u(d_h) = \begin{cases} -1 \quad if \quad d_h \\ 0 \quad if \quad d_h = 0 \\ \frac{d_h}{p_h} \quad if \quad 0 < d_h < p_h \\ 1 \quad if \quad d_h \geq p_h \end{cases} \quad (6)$$

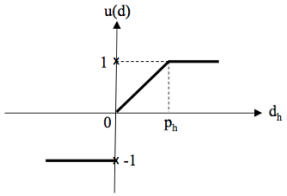

Figure 15.5: Utility function (own Figure).

Input: the set of potential situations *Pot*, the set of *m* criteria

1: **let** *Cand* = ∅ (set of alternatives)

2: **for all** $sit_i \in Pot$ **do**

3: **let** $U = \emptyset$ (set of criteria that have positive utilities)

4: **for all** *h* **do**

5: **compute** $u(d_h)$

6: **if** $u(d_h) > 0$ **then**

7: $U = U \cup \{h\}$

8: **end if**

9: **end for**

10: **if** $size(U) \geq K$ **then**

11: $Cand = Cand \cup \{sit_i\}$

12: **end if**

13: **end for**

***Output**: the set of alternatives Cand*

Figure 15.6: Algorithm 2: Utility estimation of the potential situations (own Figure).

As depicted in Figure 15.6, if the deviation is negative (i.e. the executed situation has decreased the criterion accomplishment), the value of the corresponding utility will be obviously negative. If the deviation is over a threshold p_h, the criterion accomplishment has increased enough after the situation's execution; the value of utility is 1. The value of the utility is equal to 0 if the criterion accomplishment does not change. Otherwise, the value of utility is d_h/p_h: the more the value of deviation approaches the threshold, the more the value of utility approaches to 1.

We apply this approach to compute the utility of all the *m* criteria of the application for each potential situation obtained above. A potential situation is considered as an *alternative* for the decision-making process if there exist at least *K* criteria out of *m* criteria whose utility values is over 0.[19] Otherwise, we consider it as a *non-alternative*. All of the identified alternatives constitute the set of alternatives for the decision-making.

15.5 Case study: Tamagotchi Game

We wish to define an illustrative interactive application to demonstrate our approach. The chosen application had to be suited for situation-based structuring: the application execution can be divided into independent sequences performed in a given fixed context. These sequences will correspond to different system's situations. During the execution, the system's state will change according to each particular context. The application execution is hence situations linking all along the execution. To perform the next execution step, the system and/or the user has to choose the next situation to execute in the set of current candidates (alternatives) among all the available situations. Further- more, we looked for a case study with a small set of situations, small state space and reduced set of criteria, in order to be easy to implement, to observe and to explain. We have chosen the Tamagotchi game because it meets the hypothesis above.

15.5.1 Description of the Tamagotchi Game

The game describes the life of a virtual pet, named Tamagotchi.[20] The user that plays Tamagotchi should perform many actions in order to keep the pet alive. We consider its life from the beginning: Tamagotchi was originally an egg and the user must take care of it since

[19] Of course, we might use more advanced rules by applying for instance a multi-criteria weighting approach as in our precedent work, Hatami-Marbini & Tavana, 2011.

[20] URL: https://en.wikipedia.org/wiki/Tamagotchi. Last accessed: 29 May 2017.

its hatching. This game can be structured with situations. The user must successively execute these situations to play the game. When the user comes to the end of a situation, he will obtain an output system's state and he has to decide among the available situations the one to execute at the next time. The purpose of this case study is not to offer a complete game, but to have a prototype that will allow us to illustrate and validate our proposition.

Table 15.1: Tamagotchi's attributes

Attribute	Value	Description
satiety	[0, 1]	The Tamagotchi's satiety admits a value of 0 (he is hungry) up to 1 (he is not hungry)
tiredness	[0, 1]	Very tired (0) → Not tired (1)
sadness	[0, 1]	Maximum sadness (0) → Minimum sadness (1)
Care	[0, 1]	This value describes the care to be given to the Tamagotchi. The higher the value is, the less care is needed
friendship	Integer	The total number of Tamagotchi's friends
politeness	[0, 1]	Impolite (0) → Polite (1)

We have identified seven situations that are: *feeding*, *cleaning*, *playing*, *healing*, *sleeping*, *socializing* and *educating*. We do not describe in detail all these situations; their names are explicit enough. Once one situation is completed, we must choose the one among 7 situations to continue the game execution. Then, we define the system's state using the 6 Tamagotchi's attributes: *satiety*, *tiredness*, *sadness*, *care*, *friendship* and *politeness* as described in the Table 15.1.

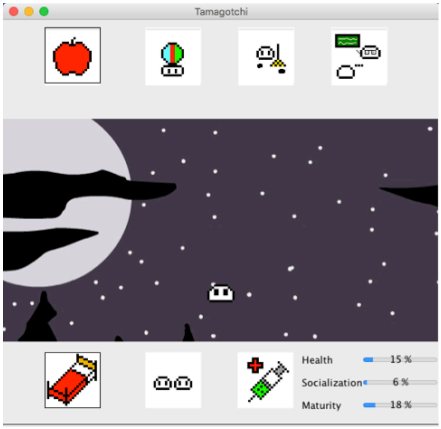

Figure 15.7: Screenshot of Tamagotchi game's interface by Hoang Nam Ho (non-public, non-distributed version, *cf.* http://www.theses.fr/2015LAROS024, last accessed: 14 April 2017).

If the user wants to play this game, he has to choose, at each step, among the 7 available situations, which is the most suitable one according to the current system's state. Besides, we have defined the 3 criteria to evaluate the game's objective. The first criterion is to keep the Tamagotchi alive until the end of the game, named health. The second criterion concerns the Tamagotchi socialisation. This criterion aims at increasing the Tamagotchi's social level, called socialisation. The last criterion is to educate the Tamagotchi and evaluate its maturity, named maturity. The formulas for calculating the values of the three criteria are described by Ho (2015). These functions are defined by the game's designer. The interface of the Tamagotchi's game is shown in the Figure 15.7**.**

The users connect the different situations among the 7 available ones. They should be careful to keep the Tamagotchi alive. Indeed, some users' activities can lead to his death. We do not discuss all of the game's rules in this article. The completed description of these rules is presented by Ho (2015). We then describe how to apply our alternatives preselection approach when the user finishes one situation.

15.5.2 Application of alternatives preselection Approach

Our preselection approach is divided into two phases: the potential situations identification and the estimation of their values of utility. We have a traces base to perform the computation (see below). We extract from the primary traces base T_P two transformed traces bases (Ω and Δ as described in the section 15.3.2.). The Figure 15.8 and the Figure 15.9 give a sample of the traces that we have in the TBS. Figure 15.8 (corresponds to a subset of Ω) and Figure 15.9 (corresponds to a subset of Δ) defined in section 0.

Phase of potential situations identification

Viewer

Relation: Tamagotchi

No.	satiety Numeric	tiredness Numeric	sadness Numeric	care Numeric	friendship Numeric	politeness Numeric	**situation** Nominal
1	0.97	0.42	0.93	0.31	2.0	0.1	healing
2	0.47	0.7	0.06	0.68	6.0	0.47	socializing
3	0.48	0.29	0.21	0.02	6.0	0.67	healing
4	0.62	0.59	0.34	0.27	7.0	0.32	playing
5	0.03	0.51	0.35	0.46	8.0	0.33	feeding
6	0.39	0.19	0.53	0.85	0.0	0.71	sleeping
7	0.46	0.34	0.2	0.35	4.0	0.49	socializing
8	0.56	0.83	0.42	0.8	5.0	0.95	cleaning
9	0.24	0.76	0.57	0.78	1.0	0.24	feeding
10	0.38	0.3	0.29	0.78	1.0	0.65	playing
11	0.56	0.45	0.55	0.74	0.0	0.42	sleeping
12	0.46	0.63	0.09	0.59	0.0	0.91	playing
13	0.48	0.14	0.14	0.31	4.0	0.36	sleeping
14	0.97	0.52	0.47	0.8	3.0	0.61	socializing
15	0.07	0.22	0.66	0.32	0.0	0.39	feeding
16	0.2	0.55	0.62	0.69	9.0	0.82	feeding
17	0.45	0.1	0.07	0.61	1.0	0.58	playing

Figure 15.8**:** Sample of Tamagotchi traces for Probability Prediction (own Figure).

Each record in Figure 15.8 has 6 attributes and 1 situation (the last element is the executed situation, for example: playing, sleeping, feeding...). We have built a Tamagotchi prototype to collect real data from the game execution. Our traces base is available to test our method.[21] Statistically, we have 9315 traces that contain 2261 feeding situations, 188 cleaning situations, 559 playing situations, 1935 healing situations, 2217 sleeping situations, 1548 socializing

[21] Tamagotchi Traces (prediction): https://app.box.com/s/crnfq1t7stn4i8rehaqrg9ce6sd mbxsz. Last accessed: 28 May 2017.

situations and 607 educating situations. We used this information to build a database for our prediction model.

To define the prediction model we started with a training phase. We carried out all of the records from the TBS of the format depicted in 15.8 and we applied the approach presented in section 0. Since the type of value of 6 Tamagotchi's attributes is numerical, we need to compute the mean and the standard deviation of each attribute. The set of the obtained means and the standard deviations is our potential situations prediction model.

To illustrate how to identify potential situations using the obtained prediction model from a new state vector, we present the following example. If the observed state vector during the application execution is: *V = (satiety = 0.03; tiredness = 0.26; sadness = 0.04; care = 0.09; friendship = 2; politeness = 0.7)*. We want to check what are the situations that can be executed according to this observed state vector. We describe in detail a calculation of the executable probability of the situation *feeding* with $\mu_{satiety}^{feeding} = 0.18$ and $\sigma_{satiety}^{feeding} = 0.016$ that are respectively the mean and the standard deviation of the *satiety* attribute. In order to compute the posterior probability of the situation *feeding* given the state vector *V*, noted $P(feeding/V)$, we must apply (3) in the section 0 to compute for each attribute its posterior probability given the situation *feeding*. We give an example of the computation of the attribute *satiety*, the value of $P(satiety = 0.03/feeding)$ is:

$$P(satiety = 0.03/feeding) = \frac{1}{\sqrt{2\pi} \times 0.016} \times e^{\frac{-(0.03-0.18)^2}{2\times(0.016)^2}} \approx 0.00002$$

The probability of all the remained attributes is computed in the same way to obtain: P(tiredness = 0.26/feeding), P(sadness = 0.04/feeding), P(care = 0.09/feeding), P(friendship = 2/feeding) and P(politeness = 0.7/feeding) that are used to compute the posterior probability as defined in (2). The probability of the situation feeding according to the traces base Ω is computed with P(feeding) = 2261/9315.

$$\begin{aligned} P(feeding/V) = {} & P(feeding) \times P(satiety = 0.03/feeding) \times \\ & P(tiredness = 0.26/feeding) \times P(sadness = 0.04/feeding) \times \\ & P(care = 0.09/feeding) \times P(friendship = 2/feeding) \times \\ & P(politeness = 0.7/feeding) \approx 0.17 \end{aligned}$$

We then compute the posterior probability for all the situations given the state vector V. And we apply (1) to calculate the executable probability of each situation with the defined threshold s = 10% (its value depends on the application). We obtain the set of the potential situations summarized in the 15.2.

Table 15 2: Results of probability prediction of potential situations (own Figure).

Situation	Prediction probability	Result
feeding	**27.21%**	**potential**
cleaning	0.018%	non-potential
playing	**16.93%**	**potential**

healing	**26.93%**	**potential**
sleeping	4.92%	non-potential
socializing	**23.99%**	**potential**
educating	0.002%	non-potential

According to the Table 15 , the set of potential situations is composed of: feeding, playing, healing, and socializing. However, for the moment, this is only statistical prediction. The resulting set does not take into account the multi-criteria aspect. Actually, there may be some situations with a high prediction probability, but which do not lead to satisfactory criteria accomplishment. Therefore, we proceed with the second step of our preselection strategy, the utility estimation.

Phase of Utility Estimation

Each entry in 15.9 represents the information about the 3 above defined criteria. Each one contains 3 values of the criteria fulfilment before executing the chosen situation and 3 new values after executing the chosen situation. This traces base is available to test our method.[22]

Relation: Tamagotchi

No.	healthBefore Numeric	socializationBefore Numeric	maturityBefore Numeric	situation Nominal	healthAfter Numeric	socializationAfter Numeric	**maturityAfter** Numeric
1	0.77	2.47	0.44	socializing	1.79	6.03	2.96
2	1.79	6.03	2.96	healing	0.58	6.11	4.36
3	0.58	6.11	4.36	playing	1.14	7.17	2.41
4	1.14	7.17	2.41	feeding	0.65	8.18	2.84
5	0.65	8.18	2.84	sleeping	0.9	0.27	0.53
6	0.9	0.27	0.53	socializing	0.95	4.1	2.25
7	0.95	4.1	2.25	cleaning	1.77	5.21	4.87
8	1.77	5.21	4.87	feeding	1.21	1.29	0.37
9	1.21	1.29	0.37	playing	1.17	1.15	0.98
10	1.17	1.15	0.98	sleeping	1.2	0.28	0.22
11	1.2	0.28	0.22	playing	1.59	0.05	0.16
12	1.59	0.05	0.16	sleeping	0.79	4.07	2.15
13	0.79	4.07	2.15	socializing	1.82	3.24	2.02
14	1.82	3.24	2.02	feeding	-0.05	0.33	0.45
15	-0.05	0.33	0.45	feeding	0.82	9.31	7.56
16	0.82	9.31	7.56	playing	1.09	1.03	1.58
17	1.09	1.03	1.58	sleeping	0.85	2.24	0.5

Figure 15.9: Sample of Tamagotchi traces for Utility Estimation (own Figure).

Now, we will estimate the utility of the four potential situations identified above using the traces of the format of those presented in Figure 15.9**.** For this step, we must define three thresholds for the three criteria. In our case, these values are set as: $p_{health} = 0.4$, $p_{socialization} = 1$, $p_{maturity} = 1$. These thresholds should be defined by the application's designer or by the user. This value depends strictly on the type and the nature of each criterion. We do not indicate how to quantify precisely the thresholds; we just present an example that has also been experimented (*cf.* Ho 2015). In general, the value of these thresholds is defined experimentally. Once the thresholds have been defined, we apply (5) and (6) to compute the utility for each obtained potential situation and for each criterion. The result is summarized in the Table 15.3.

Table 15.3: Results of utility estimation of potential situations (own Figure).

[22] Tamagotchi traces (utility): https://app.box.com/s/cesfm0ych3qgev176je3bbky01ethu0t. Last accessed: 27 May 2017.

Situation	Utility of			Result
	Health	Socialization	Maturity	
feeding	**1**	**0.2**	0	**alternative**
playing	-1	1	-1	non-alternative
healing	**1**	0	**1**	**alternative**
socializing	-1	**1**	**0.6**	**alternative**

If we set K to 2, i.e. a situation must have at least 2 positive utility values out of the 3 criteria (*cf. 15.4.2*), according to the utility estimation presented in Table 15., there are only three situations (feeding, healing and socializing) that improve the utility of the considered criteria based on the traces analysis. If we follow one of these situations, we should better fulfil the application criteria. We can conclude that the result of our alternatives preselection process is the set of the 3 situations above.

We can now apply any decision algorithm to make the final choice or let the user to select the situation to execute. At any time during the Tamagotchi's execution, our approach preselects only the candidate situations for the decision-making. The user has the right to choose any situation to perform even if it is neither useful nor potential.

14.5.3 Evaluation and Discussion

We have realized the performance tests in order to validate the efficiency of our approach.

Comparison of methods of Potential Situations Preselection

First, we have evaluated the performance of our proposed preselection approach. As described, our proposition contains 2 steps: potential situations prediction and utility estimation. The result of the utility estimation phase depends on the set of potential situations, which is the result of the first phase of our approach. We have carried out of the performance of the prediction phase, so it relies on the efficiency of the method that we used. We have used Naive Bayes among all the four methods (Naive Bayes, k-NN, Neural Network and SVM) cited in the section 2 as algorithm to build a prediction model. To demonstrate the difference between these methods, we have used the Weka software.[23] In Table , we summarized the correct rate (measured with Weka) and the needed time (in time units) to compute the prediction model using the 4 data mining methods mentioned above and in section 0. We use the traces base obtained as in Figure to perform the evaluation.

We can see that the correct rate of k-NN technique is the lower. The difference in the correct rate between the three other methods is not significant while the computation times for SVM and Neural Network are longer than for Naive Bayes. We also can see that Naive Bayes is more efficient in terms of computation time for our approach and this test explains how the Naive Bayes is optimal in our context.

[23] Weka is a workbench that contains a collection of visualization tools and algorithms for data analysis and predictive modeling., Hall et al., 2009.

Table 15.4: Performance comparison of the 4 methods: Naive Bayes, k-NN, Neural Network, SVM (own Figure).

Methods	Correct rate	Time for building model
Naïve Bayes	83.42%	1 unit
k-NN	78.2%	Do not need model
Neural Network	83.8%	108.5 units
SVM	85.92%	6.8 units

In terms of utility aspect, we have mentioned the reinforcement learning approach to resolve our preselection problem. We have discussed in the related work, why this kind of approach is not appropriate for real-time application, especially in video games. Besides the time reason, we have also identified another problem of the system's state space. Precisely, in reinforcement learning, we need to know exactly the set of actions to perform and the set of system's states. In our context, the system's state is dynamic. It is composed by 6 numerical values and their values change after one situation's execution. These values are continuous, therefore we cannot know exactly how many system's states are in the application.

If we compare our approach to the two existing approaches, the Linear Logic and the Distance approach, mentioned in the section 0. The similarities between the three approaches point out that our approach identifies the results as well as the two others. For example, our approach computes the probability of the execution's ability for each situation; the Distance approach computes a distance index, whereas the Linear Logic approach does not return a quantified measure for each preselected situation as the two others. Besides, the Linear Logic needs to verify the current state with the pre-conditions (in the situation's structure). It depends strictly on the states transition. While the Distance method and our approach do not need to consider the predefined structure of the situation (even if the structural analysis in our case improves the temporal performances of our approach); we need only the current state to compute. Our method must also define the threshold *s* and the thresholds *p* to predict potential situations and to estimate their utilities for each criterion, but the performance of the Distance approach is lower than Naive Bayes according to the 15.4.

Comparison of Methods of Potential Situations Preselection

Furthermore, we have tested the integration of our approach in the multi-criteria decision-making algorithms, which are WSM, MAUT and PROMETHEE II to evaluate the contribution of our preselection approach in a real application. We have chosen the three algorithms because they represent the three multi-criteria decision families mentioned in the section 0: weighting approach (WSM), utility approach (MAUT) and out-ranking approach (PROMETHEE II). For each algorithm, we have realized two tests: one with the decision using our alternatives preselection and the other without our preselection approach. We observed the computation time for 20 decisions and we obtained the results shown in Figure 15.10, 15.11 and Figure 15.12.

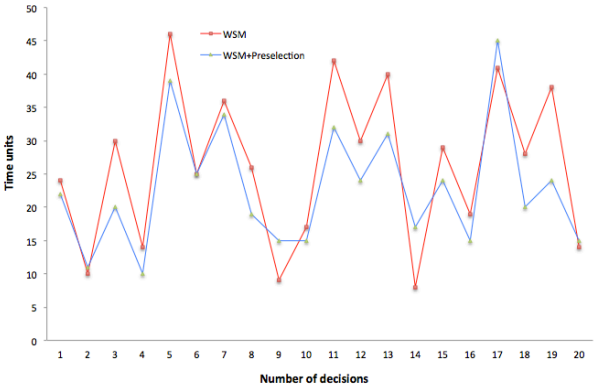

Figure 15.10: Computation time comparison for the decision method WSM with and without our alternatives preselection approach (own Figure).

We observe that the computation time is often lower with the decision with alternatives preselection. If we apply the alternatives preselection before making the decision, we can decrease the number of alternatives and the decision-making does not take into account all the available solutions but only the relevant ones.

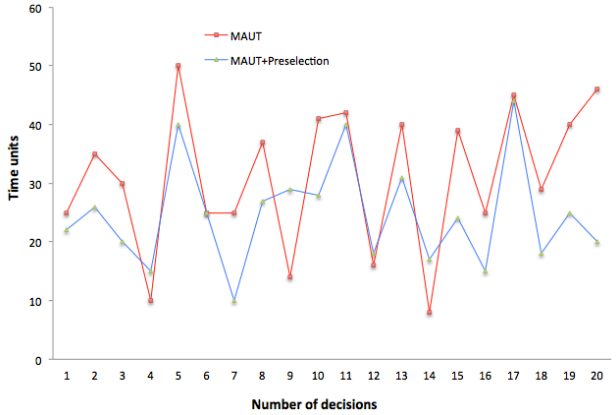

Figure 15.11: Computation time comparison for the decision method MAUT with and without our alternatives preselection approach (own Figure).

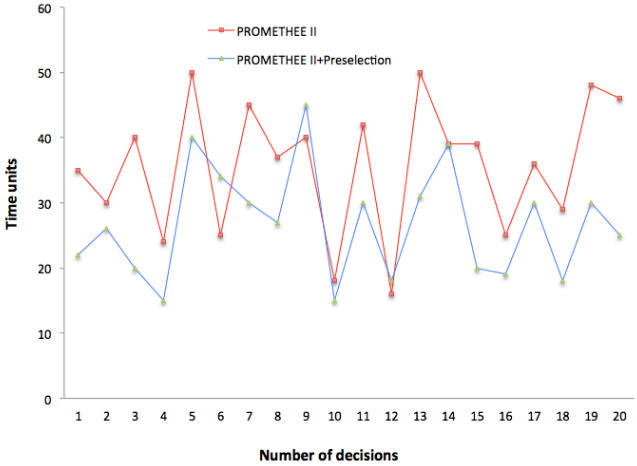

Figure 15.12: Computation time comparison for the decision method PROMETHEE II with and without our alternatives preselection approach (own Figure).

However, there exist some cases where the computation time with the integration of our approach is higher than the decision without our approach, for example in Figure (the decision number 9, 14, 17), Figure (the decision number 4, 9, 14) and the Figure (the decision number 6, 9, 12). The reason is that in these cases all the available situations are considered as alternatives. Therefore, the computation time is higher due to the payload of running the alternatives preselection algorithm. Nevertheless, in the general case, we can notice the best performance results of our preselection approach. Although the difference in the computation time for each decision is not significant between the two strategies, this difference becomes important if we consider the whole application execution time necessitating many decisions during the application execution. Furthermore, this difference grows when the set of application's situations increases.

14.5.4 Limitations

Our approach has some limitations. It is efficient only if we have enough trace records. During the initial executions, we do not have enough information to compute a reliable prediction model. Besides the quantity of the available traces influences directly the implementation of our approach and consequently the relevance of the obtained alternatives preselection. During the first execution, we do not have enough traces to build the prediction model. In this case, users must decide by themselves.

Another key issue of our method is the setting of the thresholds s and p. We should avoid choosing high values because it is just indicative relevance limits to check the probability and the utility. Experimentally, the value of s should be $5\% \leq h \leq 10\%$ and the value of p should be chosen according to the type and nature of the considered criteria. The choices of the values of the thresholds used in this article are applied only to the Tamagotchi game. For other applications, we must perform several tests to obtain an optimum threshold value. The number of preselected alternatives depends on these values.

15.6 Conclusion

In this paper, we have presented a strategy for situations preselection in situation-based interactive systems. Our approach is based on the analysis of the generated traces during the execution process. We have created a Trace-Based System adapted to our context. Then we applied a Naive Bayes technique in order to analyse these traces to build a prediction model that helps us to identify what situation can be potential for executing according to the current system's state and the past execution. In this step we take into account the situations frequency use in past executions. We then estimate the utility according to all the defined criteria for each obtained situation in the previous step. Based on the utility values, we identify what are the alternatives for the decision-making. Our approach does not modify the structure of the situations. We only use the system's past states, recorded as system's traces.

The main contribution of this paper is the preselection of alternatives for the decision algorithm using system's traces in order to reduce the decision-making analysis time. We have applied it on a Tamagotchi game case study to illustrate our approach and we have compared it to other existing approaches to show its efficiency. Our current work is devoted to parameters weighting. Even if most of the parameters are dependent on the application, we want to propose a generic method to tune these parameters.

Our preselection approach is intended to be integrated into a multi-criteria decision system that can be applied to different types of interactive applications such as: serious game, e-education. It should be noted that our approach could be generalized to other structures than situations. Our approach could be adapted as our needs. Our future work focuses on integrating our overall trace-based decision process into an Intelligent Tutoring System (ITS) under development in our laboratory.

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16 Analysis of Means for building Context-Aware Recommendation System for Mobile Learning

Larysa Shcherbachenko & Samuel Nowakowski

Abstract
One of the rapidly developing tools for online learning is learning through mobile environment. Therefore, developing and improving of mobile learning environment is an active topic now. One of the ways to make learning environment more accurate to user's needs is to use his context. Context of user consists of current context in online learning environments and physical context. This paper concentrates on physical context and way to improve user's experience in learning environment by using it. For this an ontology-based system is presented and Learning Context ontology was extended for user context ontology. Set of use-case scenarios is provided to show situations which will be covered by such approach.

Keywords: Context, Context-awareness, Adaptive learning, Learner-centred learningn, Mobile learning

16.1 Introduction

In recent years, we are witnessing a rising interest in and acceptance of Vygotsky's Social Development Theory (Wertsch & Sohmer, 1995), connectivism (Siemens, 2005) and other modern pedagogical theories, which argue for learners' active involvement in the learning process and construction of knowledge through social interactions.

Success in online teaching and learning can largely depend on the available means or tools students have to be connected to pedagogical resources. These, in turn, rely on information related to the learners' current context in online learning environments, as well as in online social networks, instant messaging systems, and furthermore physical context as locations, current activity or place. Such information reveals how present is the student and what could the accurate resource it could be interesting to recommend to enforce his learning strategy. If employed in an appropriate way, this information can greatly increase the learning efficiency.

One of the main development of the online presence approach concerns mobile learning environments. Indeed, mobile learning environments have to take into account many parameters of the learners' context including location, current state of mind, activity and user's environment. Furthermore, mobile learning environment, because of the world wide deployment of smartphones, are one of the most active developing fields now: for example, e-learning applications take 10% of all mobile applications (Focus RH, 2017). Thus, designing an app which is able to recommend the appropriate pedagogical resource according to the physical context of the learner is an important challenge. Learners are connected through the mobile phone, and this mobile phone is like a "part of them". So, for efficient user-application interaction mobile phone should provide an automatic adaptation of its content and system behaviour to learner state and needs.

The purpose of this project is to provide design of individual learning environment that will improve learner productivity and help him not to lose motivation to study by providing needed

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learning material in an appropriate time and situation. This design based on ontology approach. m-LOCO project (Torniai, et al., 2008) inspired us to make this work. In this project, authors provide an ontology-based framework that capture contextual information in mobile learning environments and use it for providing recommendations. Also, there was considered spatial and temporal attributes as main characteristics of user context. Proposed project uses extended notion of user context provided in paragraph 2.1 and doesn't take in account internal structure of learning object. Instead of using internal structure of learning object it uses annotations of learning objects and relationship between them provided in LOM ontology. Such approaches allow to concentrates on providing recommendation, not on building learning object.

The paper is structured as follows. Section 2 offers an overview of the literature as regards user context and e-learning ontologies usages to model user's needs. Section 3 is dedicated to the presentation of designed system and providing context-aware recommendations. Section 4 presents the analysis of the designed system and discussion about future works. In our case, we use the term of context.

16.2 Related Work

Context-aware applications have been the subject of debates among researches in different domain areas. Based on the requirements and characteristics of each of these domains, the term "context" has been interpreted in different ways and different approaches have been applied to capture the contextual information. One of these domains is Ubiquitous Learning environment. In particular a ubiquitous learning environment encompasses two underlying contexts, namely the learning context and the mobile context.

16.2.1 Definition of Context

Definition of context can be various in different areas or when it was selected from different point of views (Bazire & Brézillon, 2005). We make use of following notion of context: "context is any information that can be used to characterize the situation of an entity. An entity can be a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and applications themselves" (Anind, 2001).

In suggested project, context dimensions are time, physical user's activity (walking, biking, running etc.), user's location and calendar information.

Learning situations were presented as a set of parameters: 1) learning activity; 2) learning content; 3) learner – is a user involved in learning process; 4) context of the learner. All learning situations are related to a specific domain.

16.2.2 Formal Description of Domain

For providing common underlying language of the items in domain, ontology approach is chosen.

In this research interlinked set of ontologies is used. These ontologies represent in a formal way all learning situations.

Learning content should be structured, clear, atomized and be divided in small pieces. This will allow system to recommend them as independent pieces of knowledge. Combining them, the system provides the user appropriate material to help him to optimize time that he can spend online.

Several metadata standards are present for description of learning objects. The Dublin Core metadata initiative (dublincore, 2017) contains base description of learning resources, but it does not contain attributes describing the pedagogical perspective of a document. Also, there is IEEE LOM (Learning Object Metadata) that was developed under (imsglobal, 2006) and its extension for France LOM-FR (LOM-FR, 2017). IEEE LOM has technical standards, recommended practices, and guidelines that make using this standard simpler. Technical standards allow taking into account more details about learning objects to make recommendations more accurate. So, in this work LOM-FR will be used.

To keep attention on the main problem of this paper, assume that learning items were already provided with LOM annotations. According to the best practices of reusing domain ontologies, most of using ontologies was inherited. Therefore, consequent existing ontologies will be used for describing learning system:

- LOM-FR;
- Learning Context ontology (IntelLEO - Intelligent Learning Extended Organisation, Deliverable D3.2 IntelLEO Implementation Framework, 2010);
- User Model ontology (IntelLEO - Intelligent Learning Extended Organisation, Deliverable D3.2 IntelLEO Implementation Framework, 2010);
- User Context ontology;
- Competences ontology (IntelLEO - Intelligent Learning Extended Organisation, Deliverable D3.2 IntelLEO Implementation Framework, 2010);
- Mobile ontology (Torniai, et al., 2008);
- Activities ontology (IntelLEO - Intelligent Learning Extended Organisation, Deliverable D3.2 IntelLEO Implementation Framework, 2010).
- Annotations ontology (IntelLEO - Intelligent Learning Extended Organisation, Deliverable D3.2 IntelLEO Implementation Framework, 2010)
- Below, there are brief descriptions of all mentioned ontologies.

LOM (Learning Objects Metadata) represent data model for describing learning objects, relationships between them and properties vocabularies. This model allows building hierarchical structure of learning objects that allows navigate easily through learning objects. Architecture of specified data model consists of 9 categories that contain sub-elements. Sub-elements can be simple objects or can contain element. We will operate LOM objects as solid independent items for providing recommendation, therefore, we don't need description of internal structure of LOM object (such as Paragraph, Section, Table etc.). Reusability of learning objects, aid in discoverability, and facilitating learning objects interoperability properties belongs to LOM data model that make it efficient to design e-learning system.

Learning Context Ontology describe learning situations: learner activity and result of it, time when activity takes place, online environment where it takes place etc. This data will be used for analysing user's behaviour and determining his preferences.

User Model ontology provides formal representation of learner: his basic information, goals and preferences.

User Context ontology represents context of learner based on concepts such as Time, Place, Calendar, PhysicalActivity. Figure 16.1 illustrates this ontology. It is based on (Madkour, Driss, & Maach, 2013) User Context ontology.

Competences ontology provides information about level of skills that has subject. Subject can be represented as user or LOM object. This ontology allows competences cooperation of current user state and state that he wants to achieve.
Mobile ontology provides information about equipment (smartphone) that was needed to use this system.
Activities ontology allows modelling learners activities as reading, quizzing etc.

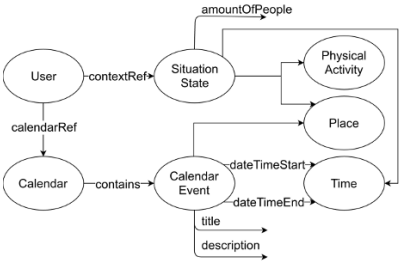

Figure 16.1: User context ontology (own Figure).

Annotations ontology allows modelling user's ratings of materials for keeping it as user's history. Figure 16.2 illustrates basic ontologies interaction and relationships which are connected by properties. In particular, learner (um:User) with some competence (c:CompetenceLevel) and physical context (uc:SituationState) opens smartphone (a:DeliveryMedia) and start using designed application (lc:LearningContext). While using application user gets recommendation to read some learning material (LOM) and make activities (a:Activity). Results of working with learning objects, for example, activity execution, are written to his history (ann:Annotation).

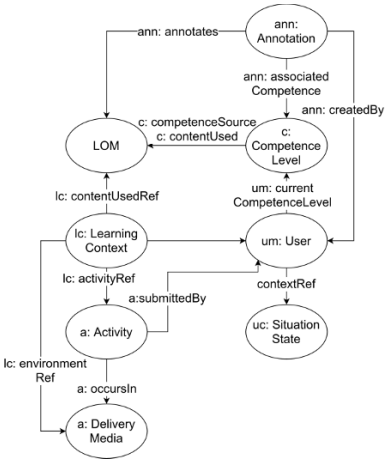

Figure 16.2: Ontologies structure (own Figure).

16.2.3 Pedagogical Approach

In eLearning context, learner should often process and work with information and tasks by himself. This makes him responsible for his learning process: time, speed, effectiveness. Therefore, this approach is `Learner centred´.

There are various possible models of interaction that can be present in e-learning system: learner to instructor, learner to learner, learner to content, learner to context. To focus on recommendation of e-learning items, learner to context approach is used. This system doesn't have teacher, it provides automated methods to recommend materials, evaluate and check user's knowledge.

Learning cycle of proposed system is designed in this way:

- Setting profile;
- Setting goals;
- Choosing courses. (They have linear structure);
- Study by taking items or quizzes (provide evaluation of part or whole studied topic) that are recommended by the system. If learner gets bad results system gives him recommendation to repeat this material after some time

User state consists of the following parts: profile, preferences, current knowledge, short / long term goals etc.

Learner profile is based on information provided by him. It includes learner's preferences. User model contains learner profile, dynamic information that derived from user's history, behaviour and material generated by user.

16.3 Results

Despite of the fact that provided recommendation system take in account long-term user's goal, it makes simultaneous recommendation and doesn't provide plan for future learning. When user opens system at the first time, he makes his model by fulfilling some profiling information. Then, while using the system, it specifies user's model. While user was out of the system, his model can be changed. To take into account these changes, user's calendar will be used.

Considering user as person that support life-learning approach. In this case, it has some learning strategy.

Therefore, following user's characteristics can be specified:

- User has e-learning resource system that specifies material that user learns by its own or in school / university (e.g. university system that provides structured learning content divided for lessons. Assume that learning content already has LOM annotations);
- Make planning in calendar and connect calendar events to learning material in e-learning resource system if it is possible. If it is not, user comments events by adding keywords or topics that was considerate on event. Also, user makes notes was event accomplished or not.

16.3.1 Architecture of Learning Environment

Smartphone was considered as equipment from user's side. Hard ontologies representations

(e.g. XML files) we stored in repositories as presented on Figure 16.3. Ontology repository is the persistent storage on ontologies data (Schmidt & Winterhalter, 2004).

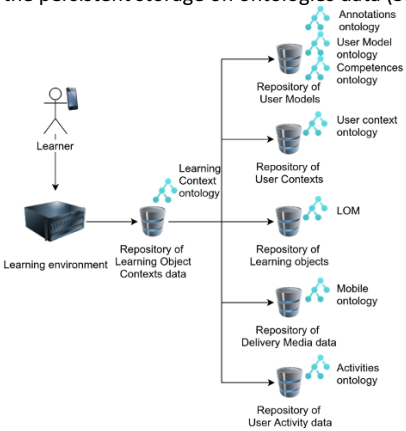

Figure 16.3: Architecture of learning environment (own Figure).

Actions provided by the system when the user opens the application are provided bellow. First, it gathers information about user's context:

- His local time;
- Where he is (location);
- His activity (understudied by user's speed);
- Suggest approximate amount of people who surround him (many people, few people, nobody);
- Check if headphones are plugged in or not;
- Check does user moves close to the specific coordinate.
- Second, it checks user's calendar:
- Process all events, which were happened from the last opening session. Processing events mean enrich user model with abilities that user get or enlarge while he wasn't in system. If the learning event was specified in calendar and learning material is attached system should analyse LOM description of learning object and add its result to model of user;
- Determine upcoming user events and extract user simultaneous needs;
- Predict time that user could spend at system;
- Then, system makes recommendation:
- Determine and range domains, topics or keywords that will be interesting based on gathered information and base information like user's profile, user's history, long-term goals etc.;
- Find existed user knowledge in these areas. It will be useful if user forget some material and will want to refresh material. Also, it is easier to learn new material by making associations rules with present material;
- Make recommendation of learning material as presented on Figure 16.4.

16.3.2 Design of Recommendation System

E-learning services depend on purpose of system. Some examples are voice reader, voice recorder, spell checker, quizzes engine, viewer (text, audio, video) etc.

Type of activity is determined as composition of educational learning resource type (evaluation, questioner, guide etc.) and technical format.

LOM allows making composite learning object with combination of atomic learning objects. Learning object can be presented as combination of learning pattern and learning data. Learning pattern is way of learning data representation. Examples of learning pattern are different types of quizzes (yes / no question, with one right answer, many right answers etc.), video / audio / text material with / without quizzes inside / at the end etc.

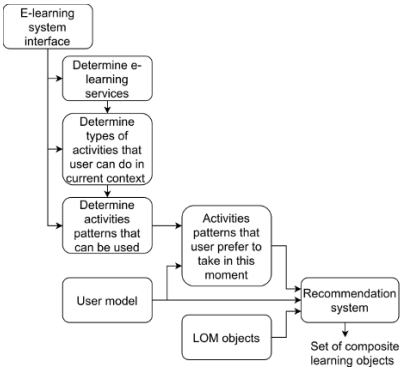

Figure 16.4: Structure of the proposed recommendation system (own Figure).

Figure 16.4 shows structure of recommendation system in terms of e-learning services, activities patterns and composite learning objects.

16.3.3 Use Case Scenarios

Consider three possible use-cases (UC) of using system.

Use Case 1: User is a student. University provides him with an e-learning resource system that contains a lot of different learning materials with different types for each subject. Also, he uses calendar for planning his time. In this calendar, user provides detailed information of events such as description, topics and place. Now, user is going by tram to lessons. Usually he has few different lessons in day. So, he has a big variety of things to repeat: some staff for preparing to lessons, for future events, things that he like etc. To cope with this amount of learning material, user uses provided system. This system doesn't make choice for him, but it provides user with recommendations what to study in current period of time taking in mind his day planning and amount of time, that he could spend at system. After system approve with user amount of time that he plans to study it provide him with learning material.

Use Case 2: After that, in the evening, user walking in the park and open system. System gets information about his context and proposes him appropriate audio material. When he

comes to cafe and sit there, learning system provides him another recommendation (quizzes, text material or video material if user have his headphones plugged in).

Use Case 3: Also, as mentioned in (Siadaty, et al., 2008), learner can use such system for viewing and repeating all relevant material in preparing to some event like test, exam, etc. In ideal case, system will determine user's knowledge gaps in area specified by user and give him appropriate learning material. One of ways for determining user's gaps was presented in work (Bauman & Tuzhilin, 2014).

16.4 Conclusions

In this work, we design the architecture of context-aware e-learning system. To enrich user's model with user context that give opportunity to accurate recommendation. To demonstrate the performance of designed system we set three use-cases. Our next step will be to implement to whole system and to evaluate its' effectiveness in real environment. One of the ways for future work is to connect calendar events with learning objects provided in external e-learning resource system and then take them in to account when measure growing user's competence outside of provided system.

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List of Figures (Appendix)

List of Tables (Appendix)

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