Effective Design of Blended MOOC Environments in Higher Education

Von der Fakultät für Mathematik, Informatik und Naturwissenschaften der RWTH Aachen University zur Erlangung des akademischen Grades eines Doktors der Naturwissenschaften genehmigte Dissertation

vorgelegt von

Ahmed Mohamed Fahmy Yousef (M.A.)

aus Fayoum, Ägypten

Berichter:

Universitätsprofessor Dr.-Ing. Ulrik Schroeder

Universitätsprofessor Dr. phil. Marold Wosnitza

Tag der mündlichen Prüfung: 10. Juni 2015

ABSTRACT

Over the past five years, Massive Open Online Courses (MOOCs) have a remarkable ability to expand access to a large scale of participants worldwide to attend free online courses, beyond the formality of the higher education systems. MOOCs have unique features that support a movement toward a vision of lifelong and on-demand learning for those who are working full time or have taken a break from formal education. Despite their popularity and the large scale participation, a variety of concerns and criticism in the use of MOOCs have been raised. The original concept of MOOCs that aims at breaking down obstacles to education for anyone, anywhere and at any time is far away from the reality. In fact, most MOOC implementations so far still follow a top-down, controlled, teacher-centered, and centralized learning model. Endeavors to implement bottom-up, student-centered, truly open, decentralized, and distributed forms of MOOCs are exceptions rather than the rule. Moreover, the lack of human interaction is the major limitation of the existing MOOCs. Other limitations of MOOCs include pedagogical problems concerning assessment and feedback, the lack of interactivity around the video content, as well as the complexity and diversity of MOOC participants. Furthermore, a major problem with MOOCs is the ignorance of the importance and benefits of face-to-face communication. These limitations raise some serious concerns on what role MOOCs should play, or how they should fit into the higher education landscape as an alternative model of teaching and learning and a substantial supplement.

Therefore, the aim of this dissertation is to shine new light to address these limitations. The new design paradigm of blended MOOCs (bMOOCs) that aim at bringing in-class (i.e. face-to-face) interactions and online learning components together as a blended environment can resolve some of the hurdles facing standalone MOOCs. In fact, the bMOOCs model has the potential to foster student-centered learning, provide effective assessment and feedback, support the interactive design of the video lectures, consider the different patterns of participants in the MOOC, as well as bring the benefits of face-to-face interactions into the MOOC environment.

This dissertation followed the case study research methodology and the user-centered design approach, in order to design, implement, and evaluate the L^2P-bMOOC platform. The main contributions are: a theoretical framework that compile and analyze the accumulated literature that has been conducted on Video-Based Learning and MOOCs between 2008 and 2015, a cluster of different patterns of MOOC stakeholders to build a deeper and better understanding of their behaviors, a design dimension and criteria catalogue for effective bMOOC environments, the conceptualization and implementation of the L^2P-bMOOC platform, an evaluation procedure for usability and effectiveness of bMOOCs, and opportunities for future work in the area of bMOOCs.

ZUSAMMENFASSUNG

Im Laufe der letzten fünf Jahre haben Massive Open Online Courses (MOOCs) viel Aufmerksamkeit erlangt, weil sie einen freien Zugang zu höherer Bildung für jeden ermöglichen und damit eine „Revolution des Lernens“ einleiten könnten. Sie verfolgen die Vision des Lebens-begleitenden auf-Bedarf-Lernens. Trotz ihrer Popularität und in Einzelbeispielen großen Teilnehmerzahlen zeigt sich, dass MOOCs den mit ihnen verbundenen Versprechungen häufig nicht gerecht werden. Das von den Protagonisten ursprünglich avisierte Konzept der Demokratisierung von Bildung, das Hochschulkurse für jeden, überall und jederzeit, ohne formale Voraussetzungen in Form von Online-Kursen bereitstellt, hat sich bislang nicht bewahrheitet. Studien belegen, dass vor allem Hochschulabsolventen Kurse zur Aktualisierung ihres Wissens berufsbegleitend nutzen.

Ein weiteres neues Konzept betrifft die Umsetzung neuer Lernmodelle: Lernen von anderen in einer selbst-organisierten Gemeinschaft. Auch in diesem Punkt sind MOOCs in der Realität von diesem Potenzial noch weit entfernt. Die meisten MOOC-Implementierungen verwirklichen ein lehrerzentriertes und zentrales Top-Down Lernmodell. Wirklich offene, dezentrale, studierenden-zentrierte Formen bilden eher die Ausnahme.

Zu den häufig kritisierten Einschränkungen von MOOCs gehören pädagogische Probleme bezüglich Beurteilung von und Feedback zu Lernleistungen, beschränkte Interaktivität zwischen den Lernenden, sowie die Heterogenität und Diversität der MOOC-Teilnehmer. Diese Einschränkungen resultieren in Forschungsfragen darüber, welche Rolle MOOCs spielen sollen und wie sie als ein alternatives, ergänzendes Modell des Lehrens und Lernens in die Hochschullandschaft passen.

Das Ziel dieser Dissertation ist es, MOOC betreffende Einschränkungen zu beleuchten. Als ein Ansatz wird das neue Design-Paradigma von Blended MOOCs (bMOOCs) identifiziert. Es verfolgt das Ziel, unterrichtliche (d.h. Face-to-Face) Interaktionen und Online-Learning-Komponenten in einer gemischten Umgebung zusammenzuführen, um einige Hürden derzeitiger MOOCs abzufedern. Das bMOOCs Modell hat das Potenzial, studierenden-zentriertes Lernen zu fördern, effektive Beurteilungen und Feedback zu ermöglichen, die interaktive Gestaltung Video-basierter Vorlesungen zu unterstützen, unterschiedliche Ziele der MOOC-Teilnehmer zu beachten sowie die Vorteile der Face-to-Face-Interaktion einer MOOC-Umgebung zu integrieren.

Die Dissertation verfolgt einen qualitativen Forschungsansatz mit Fallstudien und Design-basierter Forschung, um die bMOOC-Plattform L^2P-bMOOC systematisch zu entwerfen, zu implementieren und zu bewerten. Die wichtigsten Beiträge sind:

- ein theoretisches Rahmenwerk zur Analyse des Stands der Forschung zu den Forschungsbereichen über Video-basiertes Lernen und MOOCs,
- eine Kategorisierung verschiedener Ziele von MOOC-Beteiligten, um ein tieferes und besseres Verständnis ihrer Verhaltensweisen zu erlangen,
- ein Katalog über Design-Dimensionen und Kriterien für effektive bMOOC-Umgebungen,
- die Konzeption und Umsetzung der L^2P-bMOOC-Plattform sowie
- ein Bewertungsverfahren für Bedingungen von Benutzerfreundlichkeit und Effektivität.

ACKNOWLEDGEMENTS

In the Name of Allah, the Beneficent, the Merciful

I wholeheartedly Praise Almighty God for giving me the vision, power, spirit and endurance to complete this research. In addition, this dissertation would not have been possible without the support of my advisors, fellow colleagues, students, friends and family with whom I'm indebted for their contribution in this dissertation[1].

In particular, there are no proper words to convey my deep gratitude and respect for my supervisor, Prof. Dr.-Ing. Ulrik Schroeder. I'm thankful for his great support, patience, and inspiring me to become a self-independent researcher. He has gone beyond the call of supervisor to assume the role of academic father, he also demonstrated what a brilliant and hard-working scientist can accomplish. Thank you, Ulrik!

My sincere thanks must also go to Prof. Dr. Marold Wosnitza, for acting as co-supervisor, his passion for research and many fruitful and inspiring discussions and opportunities provided for my research are invaluable to me toward improving my work.

Furthermore, I wish to extend special thanks to Dr. Mohamed Amine Chatti, for his support, advice, mentorship and the fun we had while working together during my project. His ideas and comments allowed me to conduct research substantial to this dissertation for which I'm truly appreciated. Thanks, Mohamed!

I cannot forget also, the generosity, guidance and support from Prof. Dr. Erika Ábrahám (Theory of Hybrid Systems at the RWTH Aachen University) in my most difficult time.

This dissertation would also not have been possible without the support of my fellow research group members. So, there is no way to express how much it meant to me to have been a member of the Learning Technologies Research Group (LuFG Informatik 9), in the Computer Science Department at RWTH Aachen University, as well as the Center for Innovative Learning Technologies (CiL) of RWTH Aachen University. Indeed, working together with LuFG Informatik 9 and CiL team members is a pleasure and friends like them make the saying by Henry Ford “Coming together is a beginning. Keeping together is progress. Working together is success” most reasonable. I would also like to thank all of my students who contributed to my research projects: Narek Danoyan and Imran Ahmad.

I'm immensely thankful for all the moral support I received from former colleagues of the Telecooperation Lab at Technische Universität Darmstadt. I wish to particularly thank

[1] This research was supported by a grant from the Deutscher Akademischer Austauschdienst (DAAD), under the program German Egyptian Research Long-term Scholarship (GERLS), for which I'm indebted.

Prof. Dr. Max Mühlhäuser for having me as a visiting researcher in Summer 2012. On the same note, I would like to thank Dr. Guido Rößling, Dr. Hani Salah, Dr. Kai Michael Höver, Nina Jäger, and Elke Halla.

Last but not least, I deeply thank my parents for their unconditional trust, timely encouragement, and endless patience. It was their love that raised me up again when I got weary. A special thanks to my younger brothers Mr. Mahmoud Fahmy and Captain. Mohamed Fahmy for their love and affection. Thanks to the rest of my family for being so wonderful and for taking such great care of me.

Ahmed

CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

Introduction

Over the past few years, MOOCs have led the new revolution in e-learning, by providing limitless opportunities for thousands of learners to participate in free higher education courses online. The emergence of MOOCs as a new Technology-Enhanced Learning (TEL)[2] model has the potential to change the existing higher education landscape. MOOCs have unique features that make it an effective TEL approach in higher education and beyond (Yousef, Chatti, Schroeder, Wosnitza, & Jakobs, 2014b) [3]. MOOCs provide numerous opportunities to open up learning, and to offer a wide range of choices in different areas and disciplines, for a massive number of participants all over the world to attend free online courses without any admission requirements (Liyanagunawardena, Adams, & Williams, 2013). Furthermore, MOOCs support a movement toward a vision of lifelong and on-demand learning for those who are working full time or have taken a break from formal education (Kop, Fournier, & Mak, 2011).

This chapter begins with a motivation about the research subject in MOOC models and introduces the necessary background. It will then go on to define the main research questions. Section 1.4 is concerned with the methodology used for this dissertation. Section 1.5 summarizes major contributions and, finally, section 1.6 outlines the overall structure of this dissertation.

1.1 Motivation

The current MOOC literature categorizes MOOCs into two main types, namely connectivist MOOCs (cMOOCs) and extension MOOCs (xMOOCs) (Daniel, 2012). cMOOCs provide a space for self-organized learning where learners can define their own objectives, present their own ideas, and collaboratively create and share knowledge. cMOOCs enable learners to build their own networks via blogs, wikis, Google groups, Twitter, Facebook, and other social networking tools outside of the learning platform without any monitoring from the teacher (Kruiderink, 2013). On the other hand, for higher education institutions, the choice about how to use the MOOC environment to

[2] Terminologies such as eLearning, TEL, and learning technologies are rather synonymous and are used interchangeable within this dissertation.
[3] Citations and References are revised according to the 6th edition of the APA format.

educate thousands of learners is more related to content based xMOOCs that provide limited communication space between the course participants (Gaebel, 2013). Unlike cMOOCs, communication in xMOOCs happens within the platform itself (Yousef et al., 2014b).

Much has been written on MOOCs about their design, effectiveness, case studies, and the ability to provide opportunities for exploring new pedagogical strategies and business models in higher education. In fact, most of existing MOOCs are especially interesting as a source of high quality content including video lectures, testing, forms of discussion and other aspects of knowledge sharing. However, one important obstacle that prevents MOOCs from reaching their full potential was rooted in behavioral learning theories. In other words the running MOOCs so far still follow the centralized learning model using the traditional teacher-centered education that controls the MOOCs and its activities. Efforts in student-centered MOOCs, based on connectivism and constructivist principles that emphasize the role of collaborative and social learning are exceptions but not the rule (Yousef et al., 2014b). Other criticisms have been raised concerning the use of MOOCs namely, assessment and feedback (Hill, 2013), the lack of interaction around video content (Grünewald, Meinel, Totschnig, & Willems, 2013), as well as the ignorance of face-to-face communication (Schulmeister, 2014). The integration of MOOCs in higher education context is a matter of discussion and needs a number of challenges to be fulfilled. Among these challenges questions about hybrid education, role of learning analytics, assessment and certification, completion rates, and innovation beyond traditional learning models (Yousef, Chatti, & Schroeder, 2014d).

1.2 Blended MOOCs

Blended learning has been widely identified as a combination of face-to-face and online learning activities (Friesen, 2012). As an instance of blended learning, blended MOOCs (bMOOCs) aim at bringing in-class (i.e. face-to-face) interactions and online learning components together as a blended environment, taking into account the important openness factor in MOOCs.

On the way to address MOOC challenges in higher education context, the new design paradigm of bMOOCs can resolve some of the hurdles facing standalone MOOCs (Bruff, Fisher, McEwen, & Smith, 2013). In fact, the bMOOC model has the potential to bring human interactions into the MOOC environment, foster student-centered learning, provide effective assessment and feedback, support the interactive design of the video lectures, as well as consider the different patterns of participants in MOOCs (Yousef, Chatti, Schroeder, & Wosnitza, 2015d).

MOOC providers have already piloted the bMOOC concept within a higher education context. The overall feedback showed positive results. These include offering students with a wide range of learning materials from highly respected universities (Loviscach, 2013; Sandeen, 2013a), enhancing university reputations and achieving a sustainable competitive advantage in terms of attracting more students (Sandeen, 2013a), and engaging alumni (Fabris, 2015). On the other hand, there were some open issues including a) the diversity of MOOC participants (Yousef, Chatti, Wosnitza, Schroeder, 2015a) b) lack of balance between the online and offline learning experience (Bruff et al., 2013), c) lack of integration between the MOOC platform and the institutional learning system (e.g. LMS) (Ghadiri, Qayoumi, Junn, Hsu, & Sujitparapitaya, 2013; Griffiths, Chingos, Mulhern, Spies, 2014), d) the provided MOOC syllabus does not cover the required university curriculum for credit (Bruff et al., 2013), e) the lack of effective assessment and feedback (Derek Bok Center, 2014), f) the lack of interactivity around the video content (Grünewald et al., 2013), g) the adherence to a teacher-centered i.e., centralized learning model (Griffiths et al., 2014; Yousef et al., 2014b).

Furthermore, quality assurance is a core design factor in TEL, for providers' as well as for participants' communities. Different literature reviews provide a wide range of standards addressing the design of effective TEL environments. These standards include methods for content design, page layout, visual arrangements, use of illustrations, and colors. Nevertheless, not all of them can be used to design a successful bMOOC. Hence, the quality of bMOOC design needs to be explicitly and clearly defined. This is the case because bMOOC environments have specific requirements which include scalability, and openness. One needs to take into account their own unique processes, products, and services (Yousef et al., 2014b).

1.3 Research Objectives

E-Learning at RWTH Aachen University, Germany is supported by the learning and teaching platform[4] (L^2P) used by 30,000+ students and teaching staff. L^2P allows professors and lecturers to offer and manage their courses (i.e., lectures, seminars, exercises etc.) Furthermore, L^2P applies interactive assessment methods e.g. surveys, tests, with auto correction and feedback possible (Schroeder, 2009). The new development of L^2P (2013) follows a student-centered approach by providing a platform where students can take an active role in the management of their learning environments, through self-organized dashboards and group workspaces.

The major objective of this dissertation is to investigate the effective design of L^2P-bMOOC, as a bMOOC platform on top of the L^2P platform. This approach of integration bMOOCs into traditional university programs fills a gap in the literature by represent the intersection between cMOOCs (i.e., benefits of network learning, OER, student centered learning and flexibility), xMOOCs, (i.e., providing high quality content, well-structured lectures, and teacher-based assessment) and higher education context (i.e., giving

[4] The abbreviation L^2P stands for, Lehr- und Lern platform, (https://www3.elearning.rwth-aachen.de).

participants direct feedback, coaching, and scaffolding) within a formal higher education institution. Following this introduction, this dissertation considers the following aspects:

Higher Education Context: So far MOOC providers haven't offered official academic accreditation from their home institutions. Thus, integrating bMOOCs into traditional academic programs requires flexible pedagogic approaches such as, effective use of face-to-face interactions complemented by online synchronous and asynchronous MOOCs activities, utilizing of open assessment models and providing direct feedback and scaffolding to support and improve the learning experience, within the light of the heterogeneous landscape of participants.

Usability: According to the International Standards Organization (ISO) web usability is defined as "the extent to which a site can be used by a specified group of users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use" (Tse et al., 2010; Whitehead, 2006; Nielsen, 2002).

Effectiveness: The new global wave of MOOCs has attracted an incredibly diverse population of international participants and they have different motives and perspectives when participating in MOOCs. This study aims at a comprehensive evaluation of MOOCs from different perspectives. A multi-level effectiveness evaluation of L^2P-bMOOC was applied that considers the different patterns of MOOC stakeholder perspectives.

Hence, the specific research questions of this dissertation are:

- What are the current limitations and challenges of bMOOC in higher education context?
- Who are MOOCs participants and what motivates them when enrolled in such a course?
- What are the design dimensions which need to be considered when developing bMOOC environments?
- What are the criteria and requirements to ensure the quality of learning in a bMOOC framework?
- How to effectively design and integrate bMOOC environments in a higher education context?
- What is the learners' perception of satisfaction with the usability of L^2P-bMOOC?
- Does the L^2P-bMOOC meet the various goals of bMOOC participants?

1.4 Research Methodology

This work employed case study research methodology, seeking for exploring new processes or obtain an in-depth feedback based on the learning experiences often with data collected over a period of time. The approach of this dissertation is depicted below and is based on the work of (Yin, 2003).

Moreover, it was considered that quantitative measures would usefully supplement and extend the improvement of L^2P platform. This dissertation focus on the main stages of research activity when planning and undertaking a case study; the crucial stages are: review and analyze the accumulated literature that has been conducted on MOOCs between 2008 and 2015, design and developed of L^2P-bMOOC platform, selecting the case studies, collecting and analyzing the data, interpreting data, and reporting the findings.

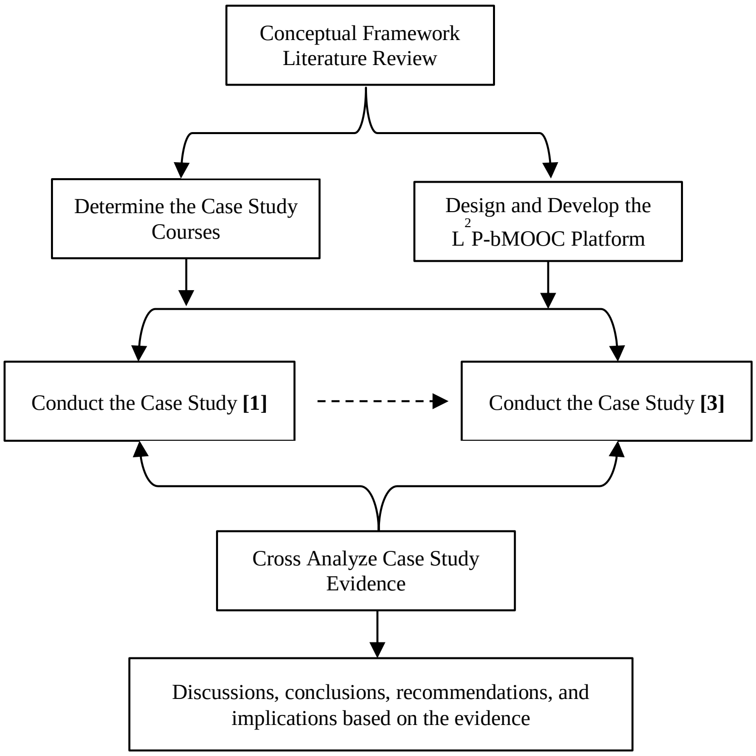

Figure 1: Case study research methodology (Adapted from, Yin, 2003)

1.5 Contributions

As argued above, the focal point of this work is to investigate the usability and effectiveness of the L^2P-bMOOC platform in a higher education context. Key to this is putting an emphasis on empirical and experimental field work throughout the dissertation: both in design dimensions and criteria of bMOOC environments, and evaluation with users. This dissertation provides the following contributions:

- **MOOCs Background**
    - Compile and analyze the accumulated literature that has been conducted on MOOCs between 2008 and 2015 to build a deep and better understanding of key concepts in this emerging field.

- Summarize the main challenges facing MOOC development from pedagogical and technological perspectives.

- **Blended MOOCs Design Dimensions and Criteria**
    - Analyze and cluster the different patterns of MOOC stakeholders to build a deeper and better understanding of their behaviors.
    - Identify 73 criteria for effective MOOC environments classified into the pedagogical and technical requirements.
- **Implementation of L^{2}P-bMOOC Platform as Proof of Concept**
    - L^{2}P-bMOOC platform as a collaborative video annotation tool, aims at shifting away from traditional MOOC environments where learners are limited to viewing video content passively towards a more dynamic and collaborative one.
    - Learning analytics module in L^{2}P-bMOOC, it focus on the application of learning analytics from a learner perspective to support self-organized and network learning in MOOCs through personalization of the learning environment, monitoring of the learning process, awareness, self-reflection, and recommendation.
    - Peer review module for supporting open assessment based on context Specific rubrics in L^{2}P-bMOOC.
- **Evaluations of the developed concepts and applications including:**
    - Evaluation of the usability and effectiveness of L^{2}P-bMOOC [**Case study 1**].
    - Evaluating the value of learning analytics module in L^{2}P-bMOOC [**Case study 2**].
    - Evaluating the effectiveness of peer review module in L^{2}P-bMOOC [**Case study 3**].
    - Identifying future research opportunities in the area of bMOOCs that should be considered in the future development of bMOOC environments.

1.6 Dissertation Outline

The dissertation at hand is composed of seven themed chapters. Chapter 2 begins by laying out the theoretical background of the research, and looks at how MOOC technologies enhance students' learning outcome and summarizes the main challenges facing MOOCs development and highlights some possible scenarios that will support TEL researchers they seek to address these challenges.

Chapter 3 is concerned with the conceptual approach of L^{2}P-bMOOC by looking at ideas that contributed to an understanding of the main design decisions and seeking input from key stakeholders in order to consider what criteria might best serve the higher education requirements.

Chapter 4 presents the iterative design process of implementing and evaluating of the L^{2}P-bMOOC. The chapter highlights the main prototyping stages of L^{2}P-bMOOC, which focused on particular parts, like the overall system architecture and the bMOOC workspace. The second part of this chapter reviews the experience of a pilot phase with real courses in more detail.

Chapter 5 focus on an application of learning analytics from a learner perspective to support bMOOC experiences in higher education, through personalization of the learning environment, monitoring of the learning process, awareness, self-reflection, and recommendation. Furthermore, we presented the details of a study we conducted to evaluate the usability and effectiveness of the learning analytics module in the L^2P-bMOOC.

Chapter 6 presents the details of a study conducted to investigate the effectiveness of using peer assessment on learners' performance and satisfaction in L^2P-bMOOC.The results show that flexible rubrics have the potential to make the feedback process more accurate, credible, transparent, valid, and reliable, thus ensuring the quality of the peer assessment task

Finally, chapter 7 summarized different aspects of the work done in this dissertation. The conclusion gives a brief summary and critique of the findings and outlines possible extensions as well as future challenges.

CHAPTER 2

Fundamentals

In recent years, the new innovative forms of TEL such as flipped classrooms, and most prominently MOOCs, have had a remarkable impact on eLearning systems. It is no surprise that they are also transforming the way we learn as well as how we teach. Currently, MOOCs are being offered with increased frequency and success in educational institutions for all learners' levels and in all subject areas, as well as for lifelong learning programs. This chapter follows the development of Video-Based Learning (VBL) implementation from their beginning as content delivery media to today's trend MOOCs pointing out a range of frameworks and strategies to build a deep and better understanding of key concepts in this emerging field. The systematic reviews in this work have four purposes as follows[5]:

- Firstly, critically analyze the research on VBL published in 2003-2015 to build a deep understanding on what are the educational benefits and effectiveness that VBL has on teaching and learning.
- Secondly, define and describe the flipped classrooms model, briefly note its historical foundations and address common misconceptions
- Thirdly, compile and analyze the state of MOOC research that has been conducted from 2008-2015 and summarize the main challenges facing MOOC development from pedagogical and technological perspectives.
- Fourthly, review the research that has examined current trends in bMOOC that appear to hold the brightest promise for the optimal model of integration.

---

[5] Parts of this chapter have been published in:

Yousef, A. M. F., Chatti, M. A., & Schroeder, U. (2014a). Video-Based Learning: A Critical Analysis of The Research Published in 2003-2013 and Future Visions. In *eLmL 2014, The Sixth International Conference on Mobile, Hybrid, and On-line Learning* (pp. 112-119).

Yousef, A. M. F., Chatti, M. A., Schroeder, U., Wosnitza, M., Jakobs, H. (2014b). MOOCs - A Review of the State-of-the-Art. *In Proc. CSEDU 2014 conference*, Vol. 3, pp. 9-20. INSTICC, 2014.

Yousef, A. M. F., Chatti, M. A., & Schroeder, U. (2014d). The State of Video-Based Learning: A Review and Future Perspectives. *International Journal On Advances in Life Sciences*, *6* (3 and 4), 122-135.

2.1 Video-Based Learning

VBL is now recognized by TEL researchers as a powerful learning resource in online teaching activities (Tripp & Rich, 2012). VBL has a long tradition as a learning approach in educational settings. Figure 2 shows the evolution of using audio-visual materials in classrooms from 1945 until today. The first experiments started during the Second World War. Soldiers were trained with a combination of audio and film strips (Hovland, Lumsdaine, & Sheffield, 1949). As a result, the static film strips helped to increase their skills while saving a lot of time. By the late 1960s educational television was used as an extra tool in classrooms. Also, teachers were confronted with videos of their own lessons to reflect on their teaching methods and improve their performance (Santagata, 2009). In the 1980s, VHS videotapes enabled quantum leap in the field as it became much easier to use videos in classrooms. But still learners were passive and could only watch the video. This changed with the rise of digital video CDs in the mid-1990s. Teachers could now add multimedia control and assessment tools by using the video on a computer. Thus learners became much more active than before. During the 2000s, classrooms got connected to the internet and interactive digital video and video conferences became possible as well. Since then, new technologies such as smartphones and tablets in combination with social media platforms such as YouTube, have contributed to increasing online social interaction and have made it easier than ever to integrate video applications in education (Snelson, Rice, & Wyzard, 2012; McCarthy, 2010).

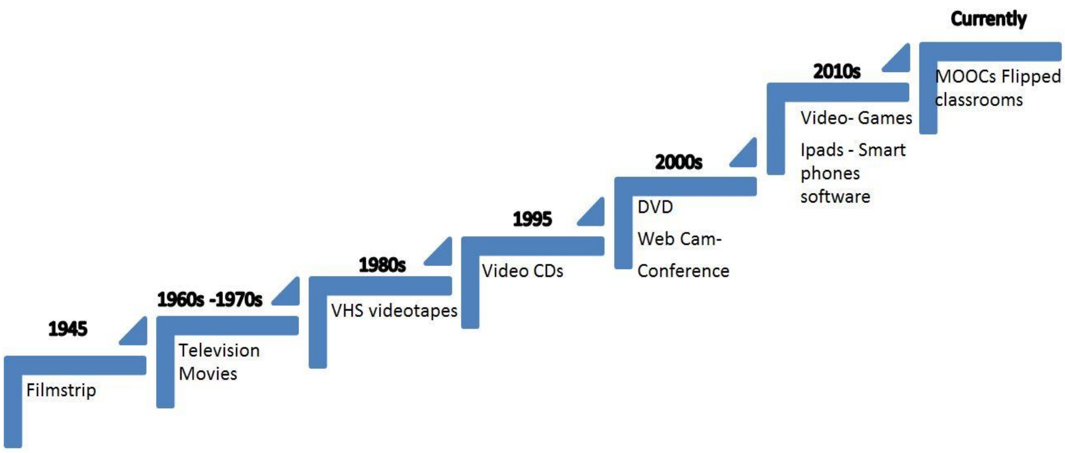

Figure 2: Evolution of VBL

There is a broad consensus among TEL researchers that VBL represents an effective learning method that can replace traditional classroom-based and teacher-led learning approaches. First of all, videos can help students by visualizing how something works (Colasante, 2011) and show information and details that would be difficult to explain by text or static photos (Sherin & van Es, 2009). In addition, videos can attract students' attention, thus motivating them and engaging them to increase their collaboration. Using videos thus leads to better learning outcomes (Zhang, Zhou, Briggs, & Nunamaker Jr. 2006). Moreover, video can cater to different learning styles, specifically students who are 'visual learners' (Calandra, Brantley-Dias, & Dias, 2006). Additionally, several studies investigated the positive effect of VBL on social skills (Zhang et al., 2006).

This section critically analyzes the research on VBL to answer the following questions:

- What are the educational benefits that VBL has on teaching and learning?
- How do VBL technologies enhance students' learning outcome?
- How do educators and researchers design VBL environments?
- How is VBL used to improve teacher's and learner's reflection?
- What are possible applications of VBL in open and networked TEL environments?

In order to answer these questions, a set of selection criteria were identified as follows:

- Studies must focus on VBL in educational development. Studies on video coding and semantic retrieval of video were excluded.
- Experimental or empirical case studies on how learners learn with and from videos were included. Studies of video recording strategies were excluded.
- Studies that focus on ability of teachers to reflect on their teaching via video recording were included
- Studies evaluating the VBL activities and effectiveness in education were included. Studies that focused on video-games and video conferencing tools were excluded.

This resulted in a final set of 76 peer-reviewed studies, which met the selection criteria above. Figure 3 shows the number of VBL publications between 2003 and 2014, which were found to be relevant for this review.

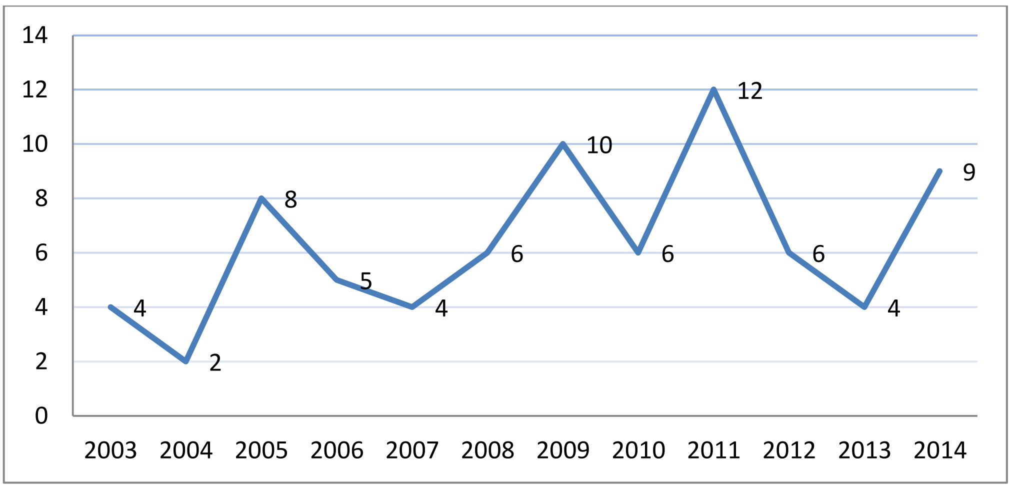

Figure 3: VBL studies by publication year.

The cognitive mapping approach (McDonald, Daniels, & Harris, 2004) was applied as a classification technique for dividing the VBL literature into four dimensions relevant to the research questions, namely effectiveness, teaching methods, reflection, and design (see Figure 4).

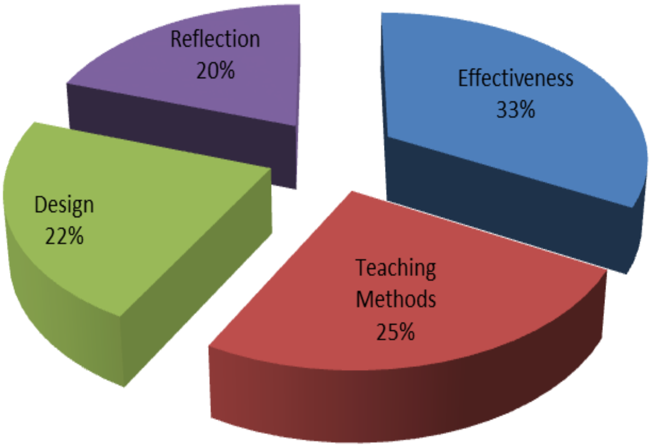

Figure 4: Visual representation of the VBL dimension (Yousef et al., 2014d).

In order to capture the information gained from the literature analysis, Figure 5 illustrates an overview of VBL field, which has been partitioned into four categories and thirteen sub-categories.

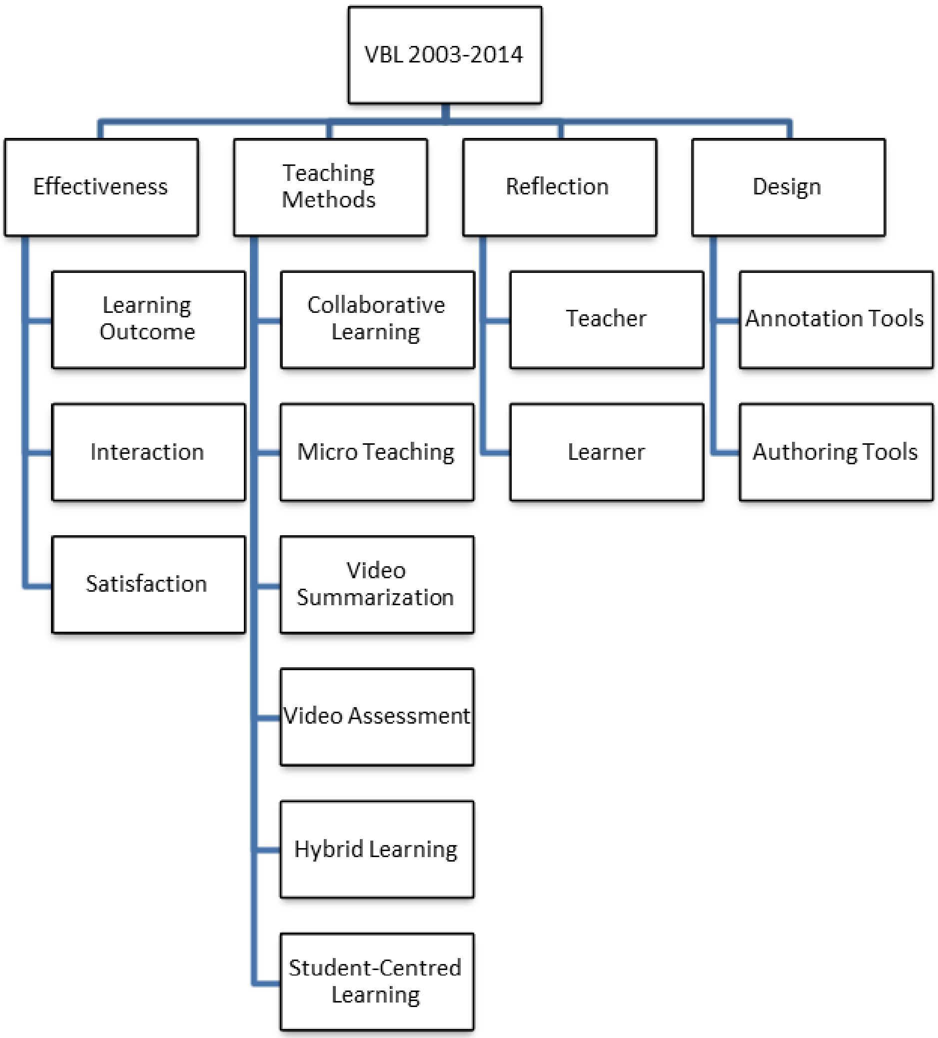

Figure 5: VBL cognitive map (Yousef et al., 2014d).

This part critically discusses the most common VBL research based on the cognitive map dimensions that have been identified in Figure 5, namely effectiveness, teaching methods, reflection, and design. A systematic review method was conducted for this critical discussion, which aims to contrast and combine results from several studies into a single scientific work (Fink, 2005; Tranfield, Denyer, & Smart, 2003).

2.1.1 Effectiveness

The effectiveness of VBL has received a great deal of attention from academic scientists. 33% of the studies reviewed in this thesis examined the effectiveness of VBL. Most of the reviewed case studies asserted the efficacy and usefulness of VBL as a powerful medium to be used in education. Each study was analyzed for the following characteristics: research goal, subject, target group, sample size, and summary of results (Yousef, Chatti, Schroeder, 2014a). The following parts discuss the effectiveness of VBL in terms of learning outcome, interaction, and learners' satisfaction.

Learning Outcome

A learning outcome (or achievement) can be described as knowledge, skills, and abilities that learners have to achieve as a result of the learning process (Merkt, Weigand, Heier, & Schwan, 2011). Many TEL scholars believe that VBL has the potential to promote the learning outcome. VBL can, for instance, present knowledge in an attractive and consistent manner (Fearing, Bachman, Holzman, Scott, & Brunt, 2010; Sherin & van Es, 2009). Furthermore, Kay and Edward (2012) and Balslev et al. (2005) compared VBL supported by a cognitive approach with text-based learning. The results showed statistically significant differences in improvement of learners' skills. Moreover, the authors reported that learners liked the cognitive approach followed in the study, in which knowledge was generated through step by step learning in video lectures. In addition, Lin and Tseng (2012) and Hsu et al. (2013) conducted two studies to investigate the effect of different VBL designs to improve English language skills of K-12 pupils. The findings indicated that the groups which used VBL outperformed the other groups. Other studies reported the invaluable impact of using VBL in improving teachers' performance. The results asserted that using videos as educational tools improved teaching methods and increased the learning outcome (Calandra et al., 2006; Santagata, 2009; Kersting, Givvin, Thompson, Santagata, & Stigler, 2012; Kuter, Gazi, & Aksal, 2012).

On the other hand, some studies indicated that there were no statistically significant differences between teaching with videos and other methods, thus making them equivalent (Comeaux, 2005; Lindgren, Pea, Lewis, & Rosen, 2007; Donkor, 2010). Moreover, Chuang and Rosenbusch (2005) stressed the importance of the pedagogical aspect for an effective VBL experience. The authors pointed out that solely using videos without pedagogical approach does not make sense. The authors emphasized that video technology should go side by side with pedagogy, and provide a constructivist framework to engage learners to learn with videos. Equally important, Giannakos et al. (2014) highlighted the importance and benefits of applying learning analytics to support teachers and students. Learning analytics helps in guiding learners to the appropriate learning materials for improving the use of their courses. This can be achieved by aggregating and analyzing learners' interactions with other available learners' data. Learning analytics opens new research directions on VBL courses about accessing recommendations for future learning activities. This means, that issues related to data privacy, ownership, sharing, and access need to be resolved (Yousef et al., 2014a; 2014d).

In sum, the reviewed studies indicate that there were conflicting results from using VBL in educational environments as some found it valuable while others reported no significant results. There was, however, an agreement among researchers that VBL in conjunction with appropriate pedagogical methods has the potential to improve the learning outcome (Yousef et al., 2014a).

Interaction

Improved interaction and communication among participants is another factor in the efficacy of VBL. DeLoache and Korac (2003) reviewed some case studies of using videos with infants. The authors pointed out that video story indeed improved communication between children. Hakkarainen and Vapalahti (2011) investigated learning with video in the forum-theatre. This study showed that VBL can enhance interaction among learners and improve the ability to solve every day social problems. Recently, Shen (2014) evaluated the effects of VBL in nursing simulation practice using the "experimental group and control group" method. The results of this investigation showed that, nurses in the experimental group received significantly higher scores in the final evaluation of catheterization, communication skills, and satisfaction than the nurses in the control group.

On the contrary, Muhirwa (2009) investigated VBL in TEL environments in Africa and pointed out that VBL had a lesser role in increasing interaction among learners. This was due to the facts of poor internet connectivity, limited access to computers, and lack of trained instructors in Africa. Poor technology infrastructure is an additional obstacle that prevents learners from Africa from actively participating in VBL, as only 25% of Africa presently has access to electricity (Yousef et al., 2014b).

In general, it seems that the low level of interaction among learners negatively correlates with learning outcomes. It is suggested that increasing communication and social interaction strategies is the first step in encouraging the efficacy of learning outcomes.

Satisfaction

The level of learning satisfaction is an important marker in evaluating the effectiveness of VBL environments. Zhang et al. (2006) examined the level of satisfaction through interactive VBL in a study involving 138 students. The results of that study showed that students who used a TEL environment that provided interactive instructional video reported higher levels of satisfaction than those in the control group, without video.

Moreover, it has been shown that learning with videos have an impact on the emotional side of the learners' behaviour (e.g., real-life interaction, incorporate the different sound and musical effects that can fit the emotional contents of the learning subject) and that videos can improve the attention to the subject of the lecture in addition to the positive impact on the learners' motivation level (Montazemi, 2006; Nikopoulou-Smyrni & Nikopoulos, 2010; Verleur, Heuvelman, & Verhagen, 2011).

2.1.2 Teaching Methods

Dale's cone of experience presents how information is understood, processed, transferred, and maintained as knowledge within the learning process (Dale, 1969). Figure 6 shows the learning experience flow according to Dale's cone.

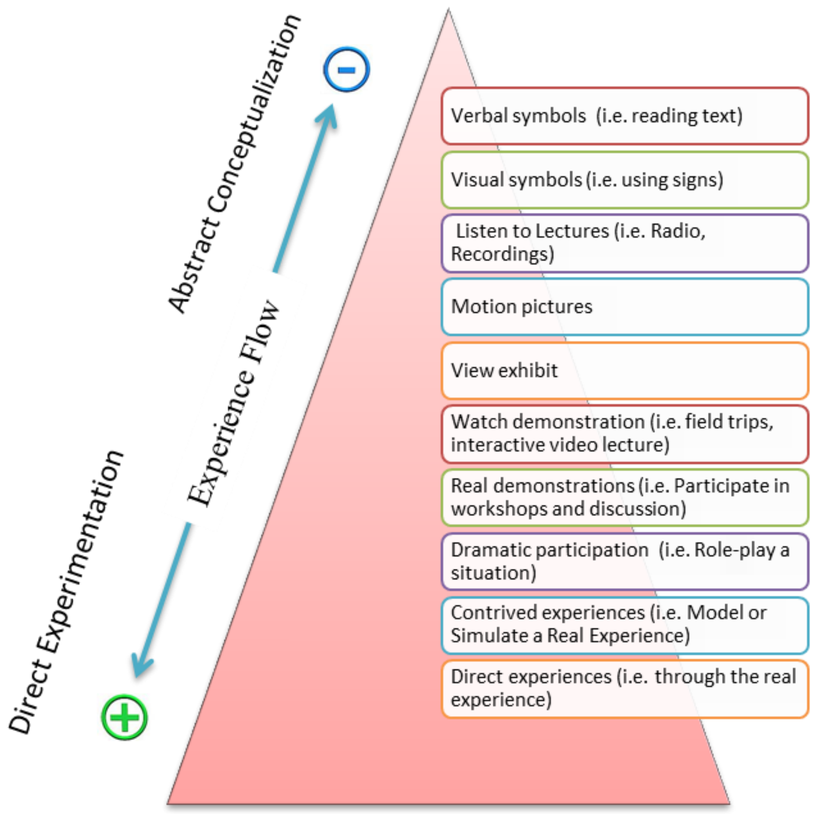

Figure 6: Cone of experience. Adapted from (Dale, 1969).

According to Dale's cone, the most effective methods stand at the bottom. These methods involve direct experience, practical and hands-on workshops, which compel learners to better remember their activities. Interactive videos belong to this category as they enable learners to interact with the video materials through annotations, discussions, and assessment. Educationists and scholars use a broad range of teaching methodologies in VBL environments in order to increase the value of interactive videos. In this literature review, collaborative learning is a key aspect which underlies most of the studies. Other methods involve micro teaching, video summarization, video assessment, hybrid learning, and student-centered learning.

Collaborative Learning

In video-based collaborative learning, which focuses on developing, discussing, and exploring alternatives rather than directions, learners are able to share responsibilities for their learning (Zahn, Hesse, Finke, Pea, Mills, & Rosen, 2005; Zhang et al., 2006; Goulah, 2007). Most of the reviewed studies validate the efficacy and usefulness of collaborative VBL, where learners can develop their problem-solving abilities via collaboration with others (Greenberg, & Zanetis, 2012). For learners working cooperatively in teams, these studies reported various educational benefits, including: shared goals, ideas, resources, activities, and support for each other (Petko, Reusser, Noetzli, Krammer, & Hugener, 2003; Wiecha, Gramling, Joachim, & Vanderschmidt, 2003; Hung, Tan, Cheung, & Hu, 2004; Choi, & Johnson, 2005). For instance, Pea and Lindgren (2008) investigated which collaboration design patterns are used by learners when they have access to a Web-based video collaboration platform. Five collaboration patterns were identified: collective interpretation, distributed design, performance feedback, distributed data coding and video-based prompting. These patterns support learning by providing knowledge and allowing learners to discuss and find solutions.

Micro Teaching

The micro teaching method was used in some studies as a teaching practice with a smaller class size and a shorter session time (e.g., four to nine learners in a class that is held for five to ten minutes). Educators are able to give learners some quick and easy feedback on their learning performance through video podcasts (van Zee & Roberts, 2006). Finlay et al. (2008) reported that learners' responses on micro teaching with video podcasts were very positive. The authors, however, noted that a video 10 minutes in length was too long for many learners and found that the shorter video podcasts (4-5 minutes) have the advantage of giving greater flexibility in micro teaching lessons. Woodruff (2014) investigated video lectures with a small group of students within the autism in a series of art lessons.

The main conclusion was that students with autism spectrum develop their artistic skills and retain more art content knowledge with highest grades than through traditional teaching classes. Other studies showed that micro teaching provides a friendly and supportive learning environment (Brantley-Dias, Dias, Frisch, & Rushton, 2008; Seidel, Blomberg, & Renkl, 2013).

Video Summarization
Video summarization technique extracts important information and provides short but informative summaries of the lecture content (Fu, Wang, Cheng, & Hou, 2008; Chang, Wu, & Yang, 2011a). Chang et al. (2011b) designed a keyword-based video summarization learning platform (KVSUM) which provides a keyword cloud as a textual surrogate to support learners in organizing their videos' information, assisting them in following the videos, and reducing the learning time.

Video Assessment
A video assessment is a short video that simulates real life activities and provides possible responses to several daily problems. Learners are asked to select which of the responses they would take in these circumstances. Afterwards, teachers discuss each response and evaluate learner's responses (Donkor, 2011; Qiao & Beling, 2011).

Hybrid Learning
Hybrid learning has become another important TEL model. Hybrid learning integrates online learning and traditional face-to-face classroom together (Karlsen, 2005; Chenail, 2011). Pang (2010) conducted a study by following a hybrid learning approach that uses video-based learning materials in a Physical Education course. In this course, the trainer can review a video of the learner's actions, pick out the wrong actions, and provide feedback. Then, students can reflect, find out mistakes. The experiment shows that 80.9% of learners think that the video review indeed improved their physical skills. In other studies, Shih (2010) and Kırkgöz (2011) investigated a hybrid learning approach supported by video lectures for an English speaking course. The study showed that the learners made noticeable improvement in their oral communication skills, and that they were satisfied with the blended learning model.

Student-Centered Learning
Most of the reviewed VBL studies followed a teacher-centred approach. Only 15% of studies have focused on student-centered learning (Gainsburg, 2009; Smyth, 2011). These studies don't depend on teachers as content providers. They aimed at providing a free space for students to be active participants in their learning environment, interact to build and construct knowledge, and get mutual support to make decisions using reflection and critical judgment. Their results further support the idea of the potential of online learner-content environments.

2.1.3 Design

Several researchers in TEL have explored how to design effective VBL environments. Annotation and authoring tools are the most used design tools in the reviewed VBL literature (Yousef et al., 2014a; 2014d).

Annotation Tools

Annotation means adding notes, comments, explanation, and presentational mark-ups to be attached to a document, image, or video (Rich & Hannafin, 2009). In VBL, annotation refers to the additional notes added to the video, which help in searching, highlighting, analysis, retrieval, and providing feedback, without modifying the resource itself (Khurana & Chandak, 2013). Moreover, video annotation provides an easy way for indexing, discussion, reflection, and conclusion of content (Schroeter, Hunter, & Kosovic, 2003; Wang, Hua, Song, Hong, & Dai, 2007).

Colasante (2011) examined the integration of a video annotation tool (MAT) into the learning and assessment activities of a third-year "Physical Education" course at RMIT University. This tool allowed learners to select and annotate parts of a video. These annotations were then used by students and teachers to discuss, receive feedback, reflect, and evaluate their learning and teaching practice. The results showed that MAT was effective for receiving feedback from teachers and peers. However, some issues regarding the quality of the collaborative input from peers were noted.

Moreover, feedback in VBL is recommended for several reasons, it provides an easy way for discussion and reflection on the video content, provides scaffolds for learners to support self-reflection and self-assessment (Colasante, 2011; Yousef et al., 2014b).

Authoring Tools

A number of studies have developed a wide range of authoring tools for VBL content. The primary function of these authoring tools is to increase the interactivity with the VBL environment, thus engaging learners in the learning process (Chunwijitra, Berena, Okada, & Ueno, 2012). The following tools were used in various VBL environments:

- Synchronize lecture note: The aim of this tool is to synchronize a video stream with the presentation slide by means of video clip timing (Chunwijitra et al., 2012).
- Content summarization tool: This tool is able to extract summary information from lecture videos and provide it to the learners automatically (Wouters, Tabbers, & Paas, 2007; Yang, Huang, Tsai, Chung, & Wu, 2009).
- Digital Video Library: This tool uses indexing to enable content-based search for particular information of a video lecture (Milrad, Rossmanith, & Scholz, 2005).

- Discussion forum: A space integrated in the VBL environment where learners can discuss and share common interests or goals on a learning topic (So, Lossman, Lim, & Jacobson, 2009; Huang, & Hung, 2013).

As an illustration, the College of Engineering at the University of California, Berkeley has launched an online Master's program in integrated circuits. This project embeds VBL modules for library research methods. In this program, the library plays a significant role in providing the teaching resources and instruction to help learners succeed in their studies. The results manifested a positive impact on the university library and encouraged the development of facilities and services, such as using digital video library to enhance personalized interaction with learners (Loo, Ngo, Hennesy, Quigley, & McKenzie, 2014).

2.1.4 Reflection

There is great interest among researchers and educators in using VBL to support teachers' and students' reflection on their teaching and learning activities (Kong, Shroff, & Hung, 2009; Tripp & Rich, 2012; Borko, Jacobs, Seago, & Mangram, 2014).

Teacher Reflection

Video recording of classroom lessons enables teachers to reflect on their teaching (van Es & Sherin, 2006). Teachers can record their own teaching, watch what they did in the classroom, think about it, and reflect on the performance using both individual and collaborative reflection (Wu & Kao, 2008; Calandra, Brantley-Dias, Lee, & Fox, 2009).

Studies examined both individual and collaborative reflection. 85% of the studies on reflection in VBL noted that teachers prefer to reflect on their teaching performance with colleagues (van Es & Sherin, 2006; Wu & Kao, 2008; Sherin & van Es, 2009). Similarly, Calandra et al., (2008 and 2009) stressed that the teacher's reflective process should be collaborative where groups of teachers provide comments or feedback to each other. Several reflection methods were used, e.g., daily reflection, weekly reflection, and end of semester reflection (Santagata & Angelici, 2010; Santagata & Guarino, 2011). Only 15% of studies examined self-reflection where teachers reflected individually on their teaching. Teachers used video-taped lesson analysis and wrote comments for self-reflection (Halter, 2006). Likewise, Gainsburg (2009) implemented video annotation tools to scaffold, structure, and transform teacher reflection.

Recently, video reflection has been used for pre-service teacher education. Blomberg et al., (2014) explored the use of two VBL courses, to determine pre-service teachers' ability to reflect on classroom video. The study found that the video recording distinctly impacts the pre-service teachers' reflection patterns. On the contrary, Cho and Huang (2014) investigated the relationship between pre-service teachers' beliefs and video-based reflection activities on a wiki. The authors found that cognitive beliefs partially influenced reflective writing and questioning activities on wikis.

Recording classroom activities is also important for learners to reflect on their own learning experience, evaluate their performance, and get a clearer overview of their learning progress. Video recordings further help learners in review prior to exams (Kong et al., 2009; Odhabi & McCaleb, 2011). Dalgarno et al., (2014) discussed three common methodologies in which learners are helped to reflect and make connections between their academic learning and their own practical learning. These methodologies were: work-integrated learning programs, inquiry-based learning designs, and simulation. The authors recognized the role of rich media technologies such as videoconferencing, web conferencing and mobile videos in learners' self-reflection and connection of university classrooms to sites of professional practice.

Recently, the proliferation of new open VBL models, such as flipped classrooms and MOOCs has changed the TEL landscape by providing more opportunities for learners than ever before. The flowing sections give an account of the future perspectives carried out from the critical analysis of the VBL literature.

2.2 Flipped Classrooms

The flipped classroom is an instance of the VBL model that enables teachers to spend more time in discussing only difficulties, problems, and practical aspects of the learning course (Montazemi, 2006; Tucker, 2012). In flipped classrooms, learners watch video lectures as homework. Each video lecture comes with a short online quiz as a formative feedback. The class is then an active learning session where the teacher use case studies, labs, games, simulations, or experiments to discuss the concepts presented in the video lecture (Calandra et al., 2006).

Bishop and Verleger (2013) define the flipped classroom as interactive learning technique that includes: a) Group learning activities inside the classroom time and b) computer-based learning outside the classroom, as presented in Figure 7.

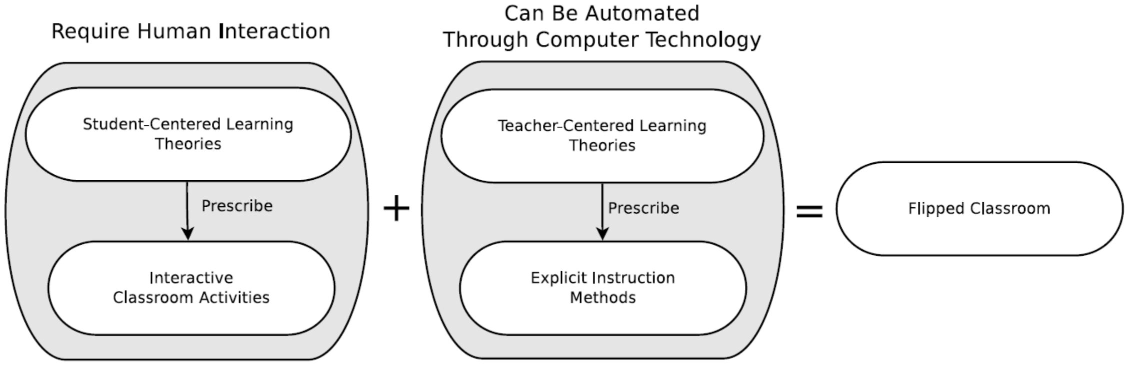

Figure 7: The Flipped Classroom (Bishop & Verleger, 2013)

Build on the outcomes from the previous studies, a suggested flipped classroom definition is a pedagogical strategy which encompasses several teaching and learning practices split into homework and on-campus activities. Some practices, such as watching video lectures, fall into the home activities. On campus, learners are supposed to conduct their collaborative project or laboratory work and engage in discussions with their peers and teaching staff. On the other hand, teachers plan learning activities, give feedback, and evaluate learners' work. Figure 8, illustrates the activities in the flipped classroom in more detail (Yousef et al., 2014d).

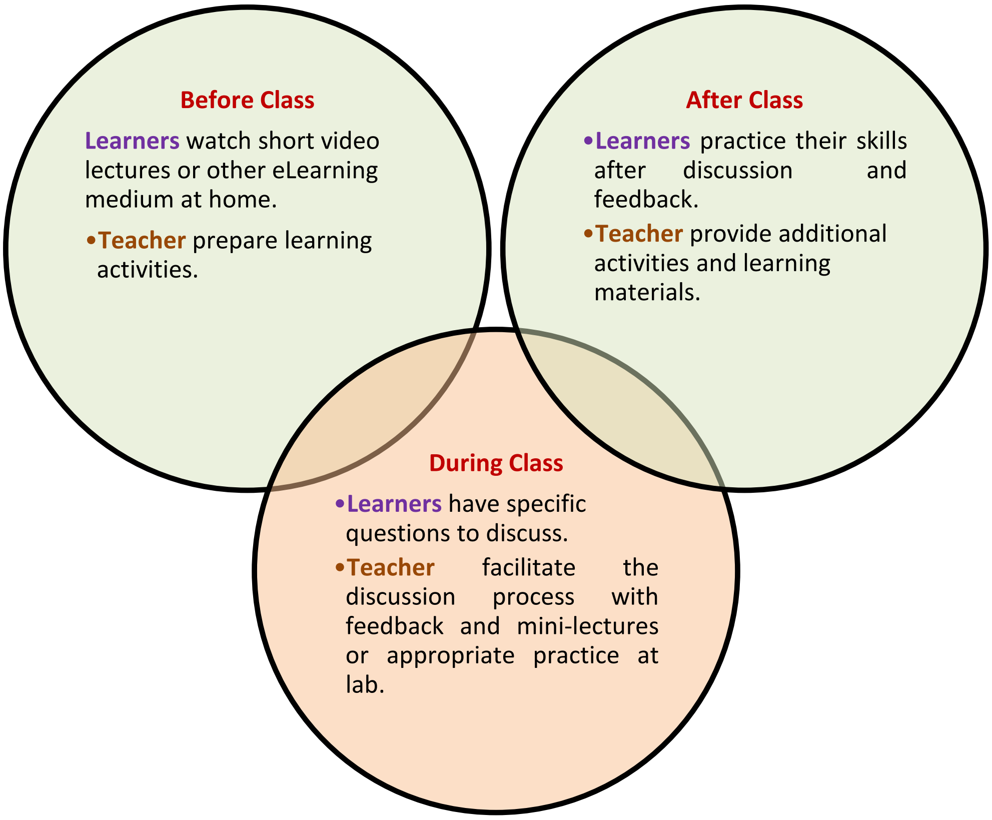

Figure 8: Flipped classroom activities (adapted from Yousef et al., 2014d)

The flipped classroom model has been successfully applied in the higher education context. This section outlines two case studies that investigated the impact of flipped classrooms on student achievement and engagement.

2.2.1 The University of Western Sydney

The flipped classroom has been examined in the first year management accounting unit at the University of Western Sydney in autumn semester 2013. It consists of two main parts: individual instruction outside of the classroom by assigning learners weekly reading of selected chapters (offline) and a variety of online activities which are developed to assist students in better understanding the learning topic (online learning). The in-class time was devoted to in-depth discussions, problem solving, demonstration, tutorials, and mastering the material through collaborative learning exercises and direct feedback (face-to-face). This course had 259 formal learners who were enrolled and have completed the learning course. The most interesting finding was that the majority of learners reported that they have received sufficient instructions and feedback. In addition, they appreciated the quality of the learning material, flexibility, time saving and online activities with the formative feedback. However, the unexpected finding was that some learners did not like the course design because it required learners to complete too many assignments, which was time-consuming (Du & Taylor, 2013). This study, however, did not report on the impact of flipped classroom on learning outcomes.

2.2.2 Capital University

Wilson (2013) investigated the potential of the flipped classroom model for enhancing learning outcomes in an undergraduate statistics course for social science majors at Capital University in Ohio. The author designed a flipped classroom environment, in which the majority of learning materials were moved out of the classroom and lectures focusing on real-world practices of statistics were given during in-class time. Quizzes were used to measure the learning outcome.

- The quizzes accounted 10% of a learner's overall grade.
- In-class assessments constituted 15% of a learner's grade and were conducted daily.
- Collaborative learning in form of group homework to be completed outside the class accounted 20% of the final grade.
- Final exam accounted 55% of a learner's overall grade.

Learners were asked to evaluate the learning activities that are most helpful for their learning objectives. The students' evaluations of these activities fell into the "somewhat helpful" to "very helpful" categories and resulted in 48% for reading quizzes, 96% for in-class activities, and 91% for group homework. Moreover, the study showed that learners' performance was better in the flipped classroom compared to the traditional class from the previous year. Furthermore, the participants had a higher level of satisfaction with the flipped classroom approach (Wilson, 2013). The limitation of this experiment is that, the number of course participants was only 25 learners.

2.2.3 Flipped Classroom Pros and Cons

The flipped classroom approach involves a range of advantages for learners including:

- Flexibility: The flipped classroom helps learners to meet a diverse range of their needs by doing several activities outside the classroom (Wilson, 2013; Herreid, & Schiller, 2013).

- Student-centred learning: This learning model provides a variety of opportunities for learners to be self-organized and self-independent (Santagata, 2009). Teachers are no longer the only source of knowledge.
- Scaffolding: In flipped classrooms, learning occurs in small learning groups. The teacher's role has been shifting towards facilitating the learning experience by supporting learners in discovering the tools that they need for learning and providing them with the needed guidance and feedback (Bishop & Verleger, 2013; Herreid, & Schiller, 2013).

The flipped classroom model, however, suffers from several limitations. These include:

- Lack of motivation: Learners with low motivation or bad learning habits do not pay full attention to out-class activities, such as watching videos, reading materials, or completing assignments at home (Wallace, 2013). As a solution, educators recommended assigning a pre-class quiz on the video material in order to increase the learners' motivation.
- Class structure: Most of the studies that examined flipped classrooms mentioned that the separation between in-class and out-of-class activities is not clearly understood by the learners. Bishop and Verleger (2013) recommended that the various learning activities in a flipped classroom should be clearly described at the beginning of the learning process.
- Assessment and feedback: The flipped classroom model emphasizes the role of problem-based learning and project-based learning. This requires creative assessment methods beyond traditional multiple-choice examinations in order to effectively gauge the learner's performance in both individual tasks and group projects (Bishop & Verleger, 2013; Wilson, 2013).

2.3 MOOCs

The term "openness" has received a great deal of attention from the higher education institutions, due to the growing demand for lifelong learning opportunities. Open Educational Resources (OER) represent a first implementation of openness in higher education. The concept of OER describes any educational materials that can be used and re-used in teaching and learning. These materials are openly available and free of charge (Schuwer & Janssen, 2013). They have been widely used as rich and powerful learning resources by educators and students alike. OER, however, have two main limitations: they lack human interaction and do not reach massive numbers of learners (Yousef et al., 2014d).

In 2001 the Massachusetts Institute of Technology (MIT) introduced the term of Open CourseWare (OCW) as a TEL platform in order to provide their curricula material for everyone at no cost. The key difference between OCW and OER is that OCW are more specific and structured as courses than the public OER library. OCW succeeded in assisting self-organized learners who do not meet the MIT admission requirement but are interested in an OCW course (Brown, 2013; Yousef et al., 2014d). The criticism against OCW mainly focuses on the customization necessary to match each institute curriculum requirements and the lack of direct feedback due to the one-way design of interaction. Nonetheless, the impact of OER and OCW on learning outcome has been the subject of much study. Meanwhile, at several universities, researchers were beginning to offer MOOCs to deliver courses to tens or even hundreds of thousands of participants around the globe. Usually, these are structured, video-based courses with some quizzes and discussion forums. Indeed, this raise some serious concerns on what role MOOCs should play, or how they should fit into the higher education landscape as an alternative mode of teaching and learning and a substantial supplement.

The amount of academic research around MOOCs has increased rapidly in the last few years. This published literature discusses different theoretical and practical perspectives on the use of MOOCs, including numerous design and implementation details. These publications are however still in their infancy, and a systematic classification of MOOC literature is still missing. The purpose of this part is to compile and analyze the state of MOOC research that has been conducted from 2008-2015. A template analysis was used to map the conducted studies on MOOCs into seven dimensions, namely: concept, design, learning theories, case studies, business model, targets groups, and assessment. This classification schema aims at providing a comprehensive overview to foster a common understanding of key concepts in this emerging field for readers who are interested in MOOCs (Yousef et al., 2014b).

Since research in MOOCs is still an emerging field, there were only two studies analyzing the accumulated academic literature of MOOCs:

- Liyanagunawardena et al. (2013) provides a quantitative analysis of 45 peer reviewed studies that have been con-ducted from 2008-2012 and provides a general discussion based on a categorization into eight dimensions, namely introductory, concept, case studies, educational theory, technology, participant focused, provider focused, and other.
- In addition, the motivations and challenges are the main focus of a study conducted by Hew and Cheung (2014). The authors reviewed the current published literature focusing on the use of MOOCs by instructors as well as students in order to summarize the state of MOOCs concerning the motivations and challenges of using these new learning environments. The main findings of this study were that, the quality of MOOC education and the assessment of student work are the major challenges in MOOCs.

As compared to Liyanagunawardena et al.’s and Hew and Cheung’s studies, this study added a wide range of peer-reviewed publications that have been conducted between 2008 and 2015 and provide a quantitative as well as qualitative analysis of the MOOC literature. Moreover, a template analysis was applied to categorize the state of MOOCs into several dimensions. This study further identifies critical challenges that have yet to be addressed and suggests new research opportunities for future work in the area of MOOCs.

2.3.1 Method

The research was carried out in two main phases including data collection followed by template analysis of the literature review.

Data Collection

The reviews literature was collected by applying the scientific research method of identifying papers from internet resources (Fink, 2005). This method includes three rounds. Firstly, reviews 7 major refereed academic databases[6] and secondly 18 academic journals[7] in the field of education technology and e-learning indexed by Journal Citation Reports (JCR), using the search terms (and their plurals) “MOOC”, “Massive Open Online Course” and “Massively Open Online Course”. These two rounds resulted in 148 peer-reviewed papers to be included in this study. Thirdly, applies a set of selection criteria as follows:

- Research must focus on MOOCs in pedagogical, social, economic, and technical settings. Studies with political and policymakers views were excluded.
- Papers providing experimental or empirical studies from actual observations and case studies with scientific data were included.
- Papers presenting a new design of MOOCs were included. Studies with personal opinions or learner’s anecdotal impression were excluded.

This resulted in a final set of 98 peer-reviewed publications which fit the criteria above (93 academic papers, 4 international reports, and 1 dissertation). Table 1 illustrated the number of MOOCs publications between 2008 and 2015 which were found to be relevant for this study.

Table 1: MOOCs papers by publication year

Year	2008	2009	2010	2011	2012	2013	2014	2015	Sum
N of publication	1	1	3	8	11	61	8	5	98

[6] Education Resources Information Center (ERIC), JSTOR, ALT Open Access Repository, Google Scholar, PsychInfo, ACM publication, IEEEXplorer, and Wiley Online Library.

[7] American Journal of Distance Education, Australian Journal of Educational Technology, British Journal of Educational Technology, Canadian Journal of Learning and Technology, Communications of the ACM, Continuing Higher Education Review Journal, Educational Technology Research and Development, Educational Theory, eLearning Papers Journal, Frontiers of Language and Teaching, International Journal of Innovation in Education, International Journal of Technology in Teaching and Learning, International Review of Research in Open and Distance Learning, Journal of Asynchronous Learning Networks, Journal of Computer Assisted Learning, Journal of Interactive Media in Education (JIME), Open Praxis Journal, The European Journal of Open, and Distance and E-Learning (EURODL).

The second phase was using Template Analysis as classification technique for mapping MOOCs literature in several dimensions (King, 2004). In the first level of template analysis, as carefully read the MOOCs literature to be familiar with the domain context. Afterwards, in the second level the concrete codes (themes) were formulated, based on the understanding of the studies domain and using the existing classifications by Liyanagunawardena et al. (2013) and Pardos and Schneider (2013) as a reference to test reliability and credibility. Then, seven codes were identified as follows:

1. **Concept** included aspects in the literature which referred to the concept e.g. definition, history, and MOOCs types.
2. **Design** included design principals e.g. pedagogical and technological features.
3. **Learning theories** that have built the theoretical background of the conducted MOOC studies.
4. **Case studies** e.g. experimental and empirical studies.
5. **Business models** that have been followed in the different MOOC implementations.
6. **Target groups** included aspects which referred to learner characteristics.
7. **Assessment** included different types in MOOCs e.g. e-assessment, self-assessments, and peer-assessment.

After having a stable code template, several internal meetings were held to discuss each code and create a mapping of the 98 publications that were selected in this review into the seven identified codes as depicted in Figure 9. This template analysis has been done manually using printout tables.

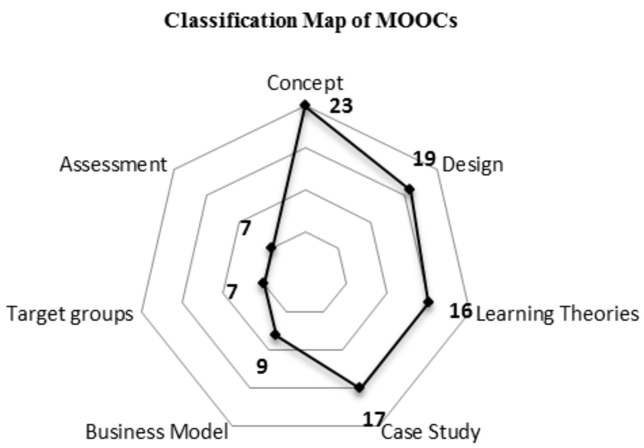

Figure 9: Classification Map of MOOCs literature (Yousef et al., 2014b)

2.3.2 MOOC Discussion

A systematic review method was conducted to analyze and critically discuss the MOOCs state-of-the-art based on the template analysis dimensions (codes) that have been identified in previous section. Which aims to contrast and combine results from several studies into a single scientific work (Fink, 2005; Tranfield, Denyer, & Smart, 2003).

Concept

The first dimension in our analysis is "concept". Nearly 25% of the literature reviewed in this paper focus on the MOOC concept. To clarify the MOOC concept three aspects have been considered in the reviewed literature, namely definition, history, and types.

MOOC Definition

Various definitions have been provided for the term MOOC by describing the four words in the MOOC acronym. The key elements of MOOCs are depicted in Figure 10:

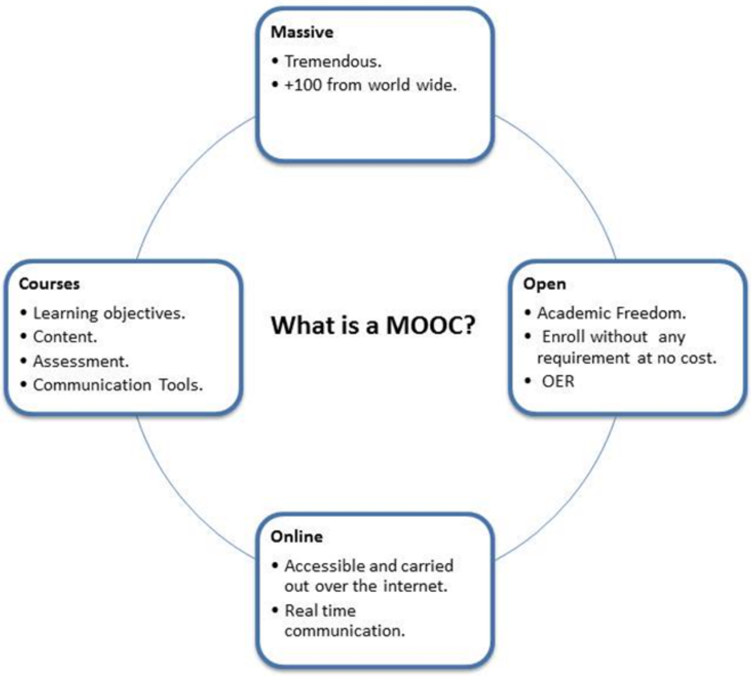

Figure 10: Key elements of MOOCs (Yousef et al., 2014d)

- **Massive(ly)**: In MOOCs, massiveness reflects the number of course participants. While most of the MOOCs had few hundred participants some courses reached over 150,000 registrations (Allen & Seaman, 2013; Russell, Klemmer, Fox, Latulipe, Duneier, & Losh, 2013). Massive refers to the capacity of the course to expand to large numbers of learners (Anderson & McGreal, 2012). The challenge is to find the right balance between large number of participants, content quality, and individual needs of learners (Laws, Howell, & Lindsay, 2003; Esposito, 2012; Brown, 2013).

- **Open:** Openness includes four dimensions (4Rs) Reuse, Revise, Remix, and Redistribute (Peter & Deimann, 2013). In the context of MOOCs, it refers to providing a learning experience to a vast number of participants around the globe regardless of their location, age, income, ideology, and level of education, without any entry requirements, or course fees to access high quality education. Openness can also refer to providing open educational resources (OER) e.g. course notes, PowerPoint presentations, video lectures, and assessment. (Anderson & McGreal, 2012; Schuwer, Janssen, & Valkenburg, 2013).
- **Online:** the term online refers to the accessibility of these courses form each spot of the world via internet connection to provide synchronous as well as asynchronous interaction between the course participants, (Brown, 2013; (Schuwer et al., 2013). In some variations of MOOCs (e.g. blended MOOCs), learners can learn at least in part face-to-face beside the online interaction possibilities (Stewart, 2013).
- **Courses:** The term course is defined in higher education as a unit of teaching. In MOOCs it refers to the academic curriculum to be delivered to the learners, including OER, learning objectives, networking tools, assessments, and learning analytics tools (Allen and Seaman, 2013; Voss, 2013).

MOOC History

Dave Cormier and Bryan Alexander coined the acronym MOOC to describe the "Connectivism and Connective Knowledge" (CCK08) course launched by Stephen Downes and George Siemens at the University of Manitoba in 2008 (Boven, 2013).

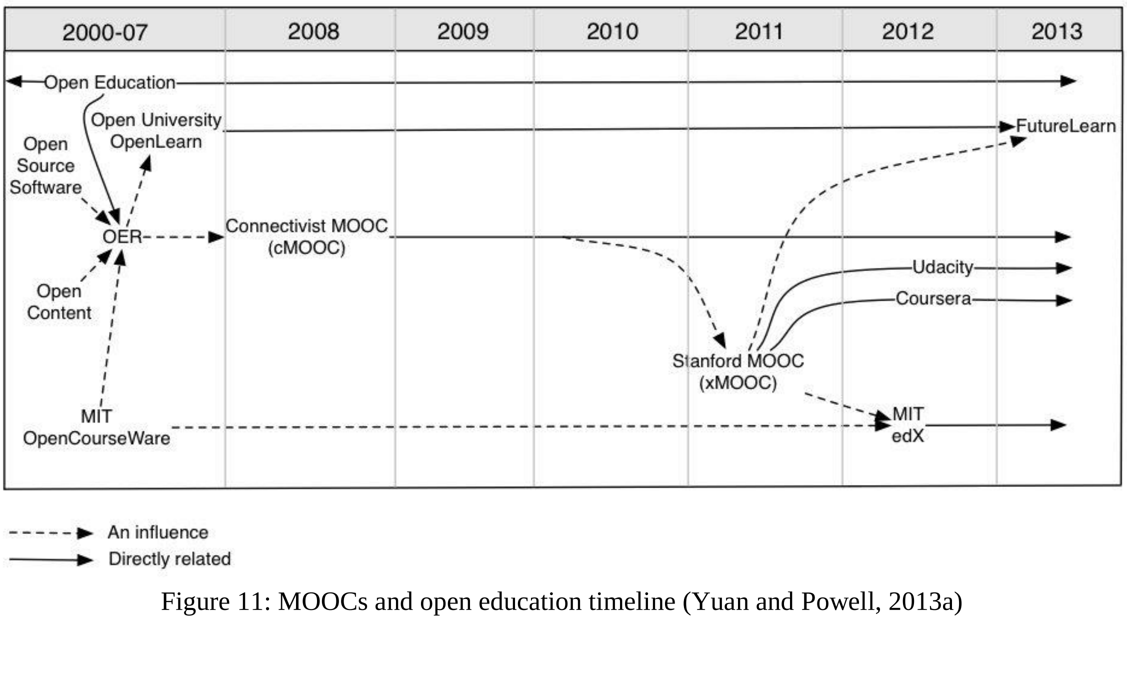

Figure 11: MOOCs and open education timeline (Yuan and Powell, 2013a)

This new form of learning and teaching has led Stanford University to offer three online courses in 2011 (Yuan and Powell, 2013a; Rhoads, Berdan, & Lindsey, 2013). These courses significantly succeeded in attracting a big number of participants, thus turning a qualitative leap in the field of MOOCs. Driven by the success of the Stanford MOOCs Sebastian Thrun and Peter Norvig started to think about MOOC business models and launched Udacity as a profit MOOC model in 2012 (Peter and Deimann, 2013). Two other Stanford professors Daphne Koller and Andrew Ng have also started their own company Coursera which partnered with dozens of renowned universities to provide a platform for online courses aiming at offering high quality education to interested learners all over the world. (Schuwer & Janssen, 2013; Dikeogu & Clark, 2013). Additionally, Massachusetts Institute of Technology (MIT) and Harvard University launched edX as a non-profit MOOC platform. Figure 11 shows the MOOC and open education timeline (Yuan and Powell, 2013a). Although these MOOCs platforms have different objectives, they share the focus on building large learning networks beyond the traditional teaching environments.

MOOC Types

The current MOOC literature categorized MOOCs into two main types "cMOOCs" and "xMOOCs" (Smith & Eng, 2013). Moreover, new forms have emerged from xMOOCs. These include "smOOCs" and "bMOOCs". Figure 12 shows the different types of MOOCs and their underlying learning theories.

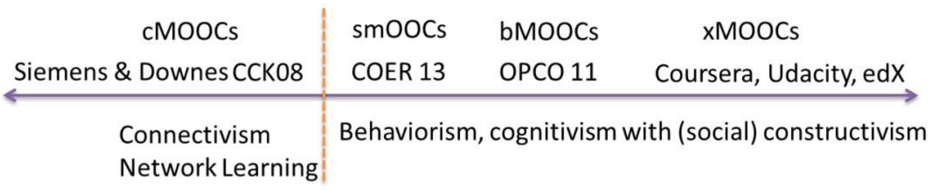

Figure 12: MOOC types (Yousef et al., 2014b)

The early MOOCs launched by Downes and Siemens (CCK08) were driven by the connectivism theory and were thus referred to as connectivist MOOCs (cMOOCs). cMOOCs provide space for self-organized learning where learners can define their own objectives, present their own view, and collaboratively create and share knowledge. cMOOCs enable learners to build their own networks via blogs, wikis, Google groups, Twitter, Facebook, and other social networking tools outside the learning platform without any restrictions from the teacher (Kruiderink, 2013). Typical cMOOC topics may be taken with assessment or without assessment. Peer and self-assessment were used to grade formal learners' assignments or tests based on pre-defined rubrics that improve participants' understanding of the course content. Thus, cMOOCs are distributed and networked learning environments where learners are at the center of the learning process. Figure 13 depicts the key concepts of cMOOCs.

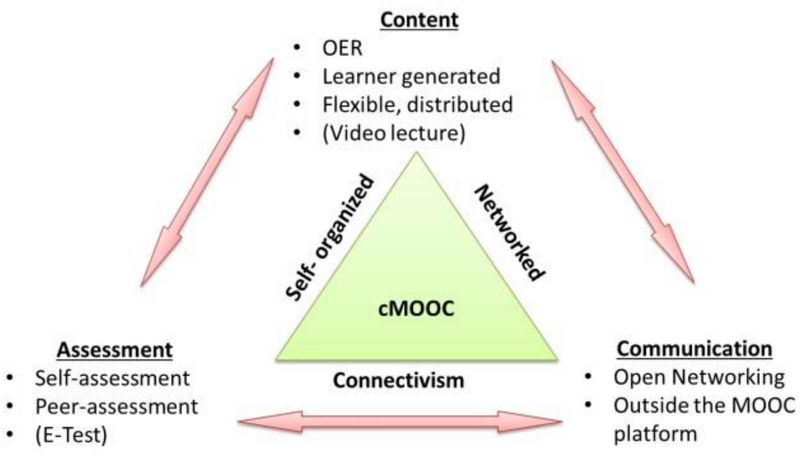

Figure 13: Key concepts of cMOOCs (Yousef et al., 2014b)

On the other hand, extension MOOCs (xMOOCs) e.g. Coursera, edX, and Udacity follow the behaviorism, cognitivist, and (social) constructivism learning theories. In fact, in xMOOCs, learning objectives are pre-defined by teachers who impart their knowledge through short video lectures, often followed by simple e-assessment tasks (e.g. short quizzes, eTest) (Daniel, 2012; Kruiderink, 2013; Stewart, 2013). Only few xMOOCs have used peer-assessment. Moreover, xMOOCs provide limited communication space between the course participants (Gaebel, 2013). Unlike cMOOCs, the communication in xMOOCs happens within the platform itself. The key concepts of xMOOCs are shown in Figure 14.

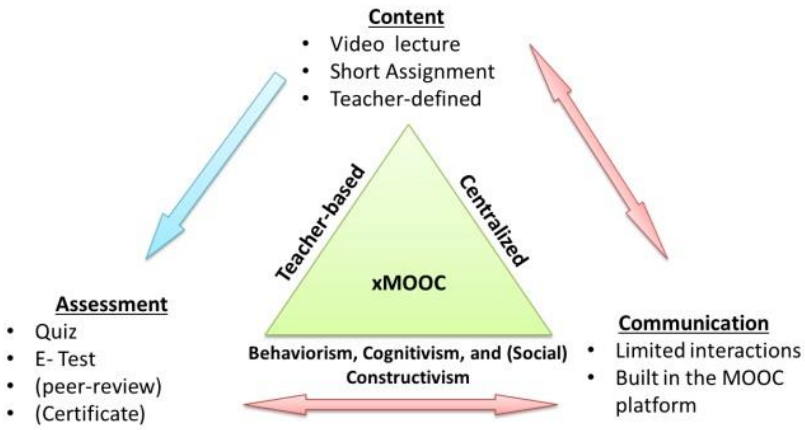

Figure 14: Key concepts of xMOOCs (Yousef et al., 2014b)

Recently, new forms of MOOCs have emerged. These include smOOCs as small open online courses with a relatively small number of participants (e.g. COER13) and blended MOOCs (bMOOCs) as hybrid MOOCs including in-class and online mediated instruction (e.g. OPCO11). These kinds of courses are delivered to an audience on a seminar form with flexibility ways that participants can explore and discuss information on a chosen topic (Daniel, 2012; Coates, 2013; Gaebel, 2013).

Design

The reviewed studies on MOOCs design distinguish between pedagogical design principles that can engage learners to attend the courses and technological design principles that can make the MOOCs more dynamic.

Pedagogical Design Principles

Most of the teachers and researchers believe that MOOCs cannot completely replace traditional learning (Ovaska, 2013). As a consequence, there is an increasing focus on hybrid MOOCs (Szafir and Mutlu, 2013). In order to encourage learners to complete the course, Vihavainen, et al., (2012) offered bMOOCs with support of scaffolding of learner's tasks using a purpose-built assessment solution and continuous reflection between the learner and the advisor. In other studies, the integration of social networks in bMOOCs added new value in learner's interactions and activities (Morris, 2013; Calter, 2013).

McCallum, Thomas and Libarkin, (2013) designed alphaMOOCs (aMOOCs) as a mix of cMOOCs and xMOOCs by building collaboration teams. McAndrew (2013) designed a project-based MOOC (pMOOC) by structuring the offered MOOC around a course-related project. Guàrdia, et al., (2013) analyzed the learners needs in a MOOC and presented a set of pedagogical design principles that focus on improving the interactions among learners. Bruff, et al., (2013) discussed some pedagogical design ideas that provide guidance on how to design bMOOCs. The authors focused on competency-based design, self-paced learning, pre-definition of learning plans (objectives, schedules, and assignments), as well as open network interaction and collaboration tools that rise motivation and avoid losing interest and drop out from the course. And, Grünewald, et al. (2013) suggested peer-assistance through the course to solve learning difficulties. Furthermore, Lim et al., (2014) stressed that peer discussion groups and scaffolding can support online collaborative learning in MOOCs.

Technological Design Principles

MOOCs are include several technology features that support different important activities in the learning experience such as interaction, collaboration, evaluation, and self-reflection (de Waard et al., 2011b; Fournier, Kop, and Sitlia, 2011). The tools used in the reviewed literature can be classified into three main categories, namely collaboration, assessment, and analytics tools.

Most of the MOOCs provide collaboration work spaces that include several tools to support learners in communicating with each other such as forums, blogs, video podcasts, and social networks (McAndrew, 2013; Mak, Williams, and Mackness, 2010). In MOOCs it is difficult to provide personal feedback to a massive number of learners. Different e-assessment methods are applied in MOOCs. While most of xMOOCs use traditional forms of e-assessment such as eTests and short quizzes, cMOOCs rather focus on self-assessment such as reflection logs or diaries, or by essay feedback questionnaires (Maclellan, 2001; Kulkarni, 2013), and peer-assessment (Kellogg, 2013; Spector, 2013).

Learning Theories

How learners learn through MOOCs? In other words, how they absorb, process, build, and construct knowledge? This is a simple question, but the answer is quite complicated. Behaviorists and cognitivists believe that learning experience is a result of the human action with the learning environment (Kop & Hill, 2008). Constructivists, by contrast, believe that learning is an active process of creating meaning from different experiences and that learner learn better by doing (Anderson & Dron, 2011). In the last years, technology has changed the way we learn as well as we teach (Viswanathan, 2013). And, the social Web has provided new ways how we network and learn outside the classroom. These opportunities are reflected in recent learning theories and models. These include connectivism which views learning as a network-forming process (Siemens, 2005; Kop, 2011; Tschofen & Mackness, 2012; Martin, 2013) and the Learning as a Network (LaaN) theory which starts from the learner and views learning as a continuous creation of a personal knowledge network (Chatti, 2010a; Chatti, Schroeder, & Jarke, 2012c).

Back to the main question how learners learn through MOOCs? Let's remind ourselves that, MOOCs are running in two major categories: cMOOCs and xMOOCs. CCK08 was the first MOOC designed based on the principals of connectivism (Kop et al., 2011). The aim of CCK08 – and other cMOOCs – is to build and construct knowledge through the interaction in learner networks (Bell, 2011; Chamberlin & Parish, 2011; Cabiria, 2012). Rodriguez (2013) pointed out that some cMOOCs indeed succeeded to improve the learner's motivation. On the other hand, xMOOCs were based on the behaviorism and cognitivism theories with some (social) constructivism components that focus on learning by doing (i.e. experimental, project-based, or task-based) activities. This wave of MOOCs is similar to the traditional instructor-led courses offered at universities that are organized around video lectures, and e-assessment. Most of the researchers in the reviewed literature put a heavier focus on xMOOCs as a new model of learning and teaching in higher education (Rodriguez, 2012; Milligan, Littlejohn, & Margaryan, 2013). Few researchers stressed the importance of social components in xMOOCs. Blom et al., (2013) reported that xMOOCs become more social using collaboration tools e.g. forums and wikis. Purser et al., (2013) suggested that the idea of peer-to-peer in collaborative learning helps learners to improve their learning outcome in xMOOCs.

In general, cMOOCs reflect the new learning environments characterized by flexibility and openness. On the other hand, xMOOCs offer high quality content as compared to cMOOCs. To fill this gap, hybrid MOOCs have been proposed to combine the advantages of both cMOOCs and xMOOCs (McCallum et al., 2013).

Several case studies of MOOCs have been discussed in the reviewed literature. Table 2, compares the different case studies in terms of learning theories, design elements, structure, tools, and assessment (Malan, 2013). Six case studies were selected that are representatives for different MOOC types. CCK08 was selected to represent cMOOC models (Fini, 2009; Bell, 2010; Mackness, Mak, Williams, 2010; Rodriguez, 2013). From xMOOCs typical edX as non-profit courses and Coursera as profit courses were chosen (Machun, Trau, Zaid, Wang, & Ng, 2012; Cooper & Sahami, 2013; Portmess, 2013; Rodriguez, 2013; Subbian, 2013; Hoyos, Sanagustín, Kloos, Parada Organero, & Heras, 2013). In addition, OPCO11 as an example of bMOOCs and COER13 and MobiMOOC as examples of smOOCs (de Waard et al., 2011a; Koutropoulos, et al., 2012; Romero, 2013; Arnold, Kumar, Thillosen, & Ebner, 2014).

Table 2: Comparison of MOOCs case studies

Compare Item		CCK08	Typical edX Course	Typical Coursera Course	OPCO11	COER13	MobiMOOC
Learning theory	Connectivism	√	-	-	-	-	(√)
	Behaviorism	-	√	√	-	-	-
	Cognitivist	-	√	√	-	-	(√)
	Social constructivism	-	-	-	√	√	-
Assessment	E-Assessment	(√)	√	√	√	√	√
	Peer-Assessment	√	-	(√)	(√)	-	-
	Self-Assessment (e.g. logs, diaries, and questionnaires)	-	-	-	-	(√)	(√)
Openness	Profit	-	-	√	-	-	-
	Open registration	√	√	√	√	√	√
	Download Material	-	√	(√)	(√)	(√)	√
Form	Formal Learning	(√)	(√)	(√)	(√)	-	-
	Informal Learning	√	√	√	√	√	√
Learning Tools	Video Lecture	√	√	√	√	√	√
	Face-to-Face	-	-	-	(√)	-	-
	Blogs, forums, social network	√	√	√	√	√	√
	Lecture Note, PPT and PDF	√	√	√	√	√	√

√ Completely (√) Partly - Not supported

These different MOOCs share some common features that focus on video-based lectures, the support of open registration and informal learning, and the use of social tools. Most of the MOOCs apply traditional e-assessment tools (e.g. E-Tests, short quizzes, MCQ). Peer-assessment is mainly used in cMOOCs and bMOOCs and self-assessment rather in smOOCs. The majority of the reviewed case studies implement the behaviorism, cognitivism, and constructivism learning theories. Only few case studies (e.g. CCK08 and MobiMOOC) include elements that are borrowed from connectivism, such as personal learning environments and open networking.

Business Models

The initial vision of MOOCs was to provide open online courses that could reduce the cost of university-level education and reach thousands of low-income learners (Cusumano, 2013; Teplechuk, 2013). Nevertheless, new business models have been launched e.g. in Coursera, Udacity, and Udemy. These business models are heralding a change in the education landscape that poses a threat to the quality of learning outcome and future educational pathways (Schuwer & Janssen, 2013; Yuan, and Powell, 2013b). Due to the huge budget that has been spent to develop MOOC platforms, MOOC providers are fighting to come up with new business models to satisfy their investors (Freeman & Hancock, 2013; Guthrie, Burritt, & Evans, 2013).

Ruth (2012) reported his overview of potential business models such as offering courses for free and learners pay for certification, examination, and teaching assistance. Coursera, for instance, offers additional examinations for certificates. The question here is whether these certificates will be accepted. Green (2013) believes that if the universities provide MOOC credits, this will be a potential route to accept these certificates in the real market. To achieve this, MOOCs should meet the market needs by providing high quality content as well as high quality outcome (Gallagher and LaBrie, 2012; Lambert & Carter, 2013).

Target Groups

Some demographics studies have been conducted to analyze target groups in MOOCs by determining their locations, age group, and learner patterns. One major goal of MOOCs was to reach low-income learners particularly in developing countries. Studies, however, have shown that the vast majority of MOOC participants were from North America and Europe. Only few participate from South East Asia and fewer from Asia and Africa (Clow, 2013; Liyanagunawardena et al., 2013; Stine, 2013). This is consistent with the analysis of 2.9 million participants registered in Coursera from 220 countries around the globe (Waldrop, 2013).

Possible obstacles that could prevent learners from Africa and Asia to take part in MOOCs include the poor technology infrastructure. Only 25% of Africa has electricity access (WEO, 2012). And Africa has the lowest internet access all over the world with only 7% (Sanou, 2013). Asia is a continent with many different cultures and languages.

Thus, language issues could be a barrier to participate in MOOCs. Stine (2013) and de Waard et al., (2011b) noted that around 50% of the participants from 31-50 age groups, which indicates that informal learners have more interest in MOOCs. Several studies have reported a high drop-out rate that reflects the learner patterns in MOOCs (Waite, Mackness, Roberts, & Lovegrove, 2013). Hill (2013) identified five patterns of participants in Coursera, as shown in Figure 15.

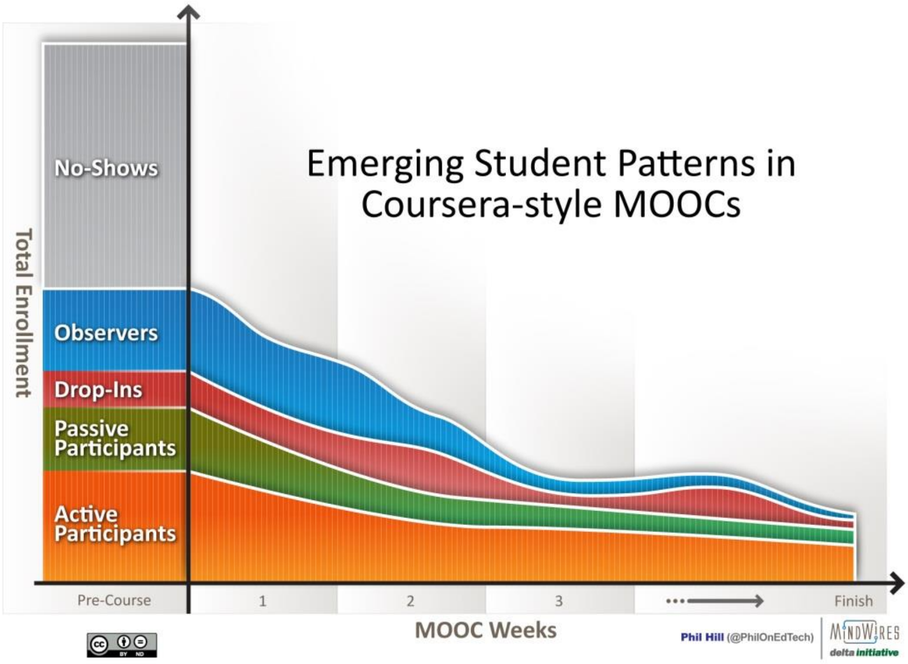

Figure 15: Pattern of participants in Coursera (Hill, 2013)

The vast majority were No-Shows participants who register but never log into the course. Secondly, observers who read content or discussions without submitting any assignments. Thirdly, Drop-ins participants who are doing some activities but do not complete the course. Fourthly, Passive participants who take the course and do tests but do not participate in the discussion. Fifthly, Active participants who regularly do all assignments and actively take part in the discussions.

Some studies explored pedagogical approaches to engage Observers, Drop-ins, and Passive participants to be active learners through e.g. game-based learning (Romero, 2013), social networking that help learners to create their own personal learning environments (Guàrdia, Maina, & Sangrà, 2013), and project-based learning (Irvine, Code, & Richards, 2013; McAndrew, 2013).

Assessment

The ability to evaluate vast number of learners in MOOCs is indeed a big challenge (Yin & Kawachi, 2013). Thus, assessment is an important factor for the future success of MOOC. So far MOOC providers didn’t offer official academic accreditation from their home institutions, which might indicate that the quality of learning outcome in MOOCs is different from university courses (Gallagher & LaBrie, 2012; Sandeen, 2013b). Currently, MOOCs are only providing a non-credit certificate e.g. completion, attendance, or participation certificate. In the reviewed literature, three main types of assessment were conducted in MOOCs, namely e-assessment, peer-assessment, and self-assessment.

E-Assessment

E-assessment practices are comprises closed questions such as multiple-choice questions and automatically grading learners' assignments (Stödberg, 2012). E-assessment is often used in xMOOCs to gauge student performance. These include exams with multiple choice questions based on machine grading (Conrad, 2013). This implementation of assessment is applicable in limited number of exercises regarding low-order cognitive skill. It is, however difficult to apply e-assessment in exercises that require higher-order cognitive skills, due the nature of these exercises which are based on the creativity and imagination of the learners (Majchrzak & Usener, 2012; Sandeen, 2013a).

Peer-Assessment

Topping (1999) reviewed the state-of-the art of peer assessment in higher education and defined peer assessment as "an arrangement in which individuals consider the amount, level, value, worth, quality, or success of the products or outcomes of learning of peers of similar status". Peer-assessment was used in cMOOCs and xMOOCs to review essays, projects, and team assignments. These assignments are not graded automatically, but learners themselves can evaluate and provide feedback on each other's work. This method of assessment is suitable in exercises that require higher-order cognitive skills, which do not have clear right or wrong answers (O'Toole, 2013). Cooper and Sahami (2013) point out that, some learners in peer-assessment grade without reading the work to be reviewed or do not follow a clear grading scheme, which negatively impacts the quality of the given feedback. Therefore, more criteria and indicators are needed to ensure that peer-assessment is effective.

Self-Assessment

Self-assessment is not a new method for evaluation. Boud and Falchikov (1989) identified self-assessment as "the involvement of learners in making judgements about their own learning, particularly about their achievements and the outcomes of their learning". However, self-assessment is still not widely used in MOOCs. Sandeen (2013a) and Piech, et al. (2013) identified some self-assessment techniques. These include model answer as tool to students to cross check if the marks they scored are in tune with the model answers set by the educators, and learning analytics where the learners can self-reflect on their achievements. Maclellan (2001) and Kulkarni (2013) specified other techniques related to self-assessment included reflection logs and diaries.

2.3.3 MOOCs Challenges

Regardless of the several debates, both for and against MOOC, the fact is that MOOCs have succeeded in attracting thousands of participants worldwide per course. Despite their increasing popularity, MOOCs further require key stakeholders to address a number of challenges. The following sections address the critical challenges and outline possible future visions in MOOC research.

Lack of Human Interaction

The lack of human interaction is a critical issue in MOOCs, both for learners and for professors. The problem is that participants are effectively cut off from face-to-face interaction during the learning process in MOOCs. Professors at top-ranked universities who have already offered MOOCs argue that MOOCs are not equivalent to the same classes experiences held on their own campuses (i.e. face-to-face courses on similar content). This issue is related mainly to course structure and thus to the quality of learning outcomes (Hollands & Tirthali, 2014; Schulmeister, 2014). This is consistent with Bill Gates vision, which considers MOOCs not as stand-alone online courses, but recommends them in a blended-learning approach. By the same token, he also, emphasizes the important importance and benefits of face-to-face instruction in the learning process at higher education institutions (Young, 2012). Thus, there is a need for solutions to foster interaction and communication between MOOC participants by leveraging face-to-face interactions with online learning activities, creating what can be a flexible and effective model for higher education institutions.

Lack of Interaction Around the Video Content

Video lectures are the primary learning resources presently used in MOOCs. However, one of the most crucial issues with current MOOCs is the lack of interactivity between learners and the video content (Grünewald et al., 2014; Zahn, Krauskopf, Kiener, & Hesse, 2014). Several studies on the nature of MOOCs address the linear structure of video lectures to present knowledge to learners in a passive way (Yousef et al., 2014a; Yousef, Chatti, Schroeder, Wosnitza, 2014c). Therefore, there is a need for new design techniques to increase the interactivity and flexibility with video lectures in MOOCs.

Identity Verification and Authentication

Identity verification of MOOCs participants is a crucial challenge in order to authenticate the learners' certificates. Moreover, many learners enrolling in MOOCs are looking for certification to promote their career or complete post graduate studies (Hew & Cheung, 2014). Most MOOC providers issue certificates of completion to the course participants.

These certificates, however, are not recognized by educational institutions and companies.

Coursera addresses this challenge by providing an identity verification method called “Signature Track" that uses two biometric identity techniques, namely face photo and typing patterns. In this method, the enrollment process requires participants to submit a web cam photo to be checked with the photo from the participant’s official ID such as a passport or a driving license. Additionally, the method requires that the participant establish a typing pattern profile by typing a short paragraph that can be used throughout the course to verify that the person submitting the assignment is indeed the participant who enrolled in Signature Track (Maas, Heather, Do, Brandman, Koller, & Ng, 2014).

Plagiarism and Copyright Concerns

Copyright is an important factor for the future success of online education, especially MOOCs (Hollands & Tirthali, 2014; Marshall, 2014). The main challenge is how to validate original work and how to prevent plagiarism? Coursera reported dozens of incidents of plagiarism especially in humanities courses. The technical solution can be a plagiarism-detection software, which is however expensive and time consuming (Hollands & Tirthali, 2014). Peer reviews can also be an option to solve this problem. In this case, clear criteria and rubrics are needed to ensure that peer review is effective.

Personalized and Adaptive Learning

Due to the massive number of MOOC participants and their diverse learning styles, the possibility of creating adaptive and personalize learning experiences is required (Hollands & Tirthali, 2014). The challenge is how to support self-organized leaning in networked learning environments? How to provide a wide range of educational material to meet the different needs of the MOOC participants?

Completion Rate

MOOCs are facing high drop-out rates in average of 95% of course participants (Hill, 2013; El-Hmoudova, 2014). One of the potential reasons for that is the complexity and diversity of MOOC participants’ perspectives. This requires an understanding of the different patterns of MOOCs participants and their perspectives when participating in MOOCs. Hew and Cheung (2014), for instance, reported four reasons why learners sign up for MOOCs: a) interest in new technology, b) extend current knowledge, c) collect completion certificates as many as possible, and d) learning as a personal challenge. The high drop-out rate can also be explained by the lack of motivation and the failure to follow the course activities. The issue of high drop-out rates could be addressed by targeting specific audiences that are fully interested in the course. This may reduce the number of participants, but can ensure that they are active in the course (El-Hmoudova, 2014; Santos, Klerkx, Duval, Gago, & Rodríguez, 2014).

Language proficiency and cultural background

The participants in MOOCs come from all over the world. They speak English in different levels and have different cultural believes. Thus, the examples used in MOOCs should be given in such a way that they can be understood by everyone regardless of the cultural background. Moreover, MOOC providers should consider the diversity in cultural values such as symbols food, animals, and everyday objects (Jona & Naidu, 2014; Yousef et al., 2014c). In addition, the level of language proficiency can be a source of misunderstanding the video lectures. MOOC providers, thus, need to have knowledge on how to teach non-native speakers (Hollands & Tirthali, 2014; Yousef et al., 2014c).

Libraries Issues

There is a mutual relationship between educational institutions and university libraries. On the other hand, libraries are meaningless if they cannot provide services for the learners. Where and how do these library services fit into the context of MOOCs is a challenge at hand. Higher education institutions are providing MOOCs to thousands of potential learners at a time all over the globe. Does it mean that the libraries should provide these students with their services as well? Moreover, MOOCs raise significant question about legal and policy issues in terms of licensing resources. One can argue that MOOC participants are not officially enrolled in the university, and by this they do not have the rights to access these licensed resources. At the moment, there is no clear answer, or consensus about the position and role of licensed libraries in MOOCs (Hoy, 2014).

Costs of MOOCs

If educational institutions and universities decide to use MOOCs for teaching and offering their courses on the Web for free of charge, they will incur additional costs to their budgets. The major cost in MOOC production is not just the nature of the delivery platform. One has to consider about the number of participants in MOOCs, the university administrators, and the teaching assistance offered for supporting the learning activities. Furthermore, the quality of the video lecture is very important for learners’ satisfaction and the participants should receive good technical support from the institution. Last but not least, one has to take into account the necessity for implementing special features such as learning analytics, recommendation systems, social communication tools, virtual labs, assessment methodologies, and gamification (Freeman & Hancock, 2013; Hollands& Tirthali, 2014).

Learning Analytics

In MOOCs it is difficult to provide personal feedback to a massive number of learners. Several MOOC studies recommended to apply learning analytics tools to provide feedback, monitor the learning process, identify difficulties, discover learning patterns, and support learners in reflecting on their own learning experience (Yousef et al., 2014c). Thereby, issues related data privacy, ownership, sharing, and access need to be resolved (Fournier, Kop, & Durand, 2014).

Assessment

The ability to evaluate vast number of learners in MOOCs is a formidable challenge (Yin, & Kawachi, 2013). Thus, assessment is an important factor to the future success of MOOC-based online education. Currently, MOOCs only provide a non-credit certificate e.g., completion, attendance, or participation certificate. In most of the studies (60%) teachers carried out the assessment use e-tests, i.e., short quizzes containing for example multi-choice and short answer questions. These tests are still limited in evaluating learners' assignments effectively (Cooper & Sahami, 2013). It can therefore be assumed that the self-assessment and peer-assessment are helpful to strengthen the learners' and teachers' self-confidence and improve their own learning exercises in MOOC. Further work is required to establish the viability of open assessment software that enabling learners to measure and evaluate themselves via peer-assessment, self-assessment and electronic assessment.

2.4 Blended MOOCs

The common approach of blended learning refers to a convergence of in-class interactions (i.e., face-to-face) and online learning components (i.e., technology-mediated instruction) in order to improve learning by applying a number of eLearning technologies, including pedagogical richness to meet students' educational goals (Osguthorpe & Graham, 2003; Graham, 2006). The present question: Is there an opportunity to integrate the existing MOOC courses as a blended learning model in higher education? In other words, how and why are higher education institutions engaging with MOOCs?

Anant Agarwal, CEO of edX, highlights that the leaders of higher education institutions as well as those of MOOCs providers are moving towards adapting large MOOCs to small classrooms, to create a blended model of learning (Agarwal, 2013). This is, therefore, a great opportunity to resolve some of the hurdles facing stand-alone MOOCs. However, this proposal is not without its challenges. Fundamental questions that have now arisen about the optimal model of integration, credit recognition, content licensing, and the impact on learning outcome remain unanswered.

Although MOOCs are open for massive number of participants without any entry requirements, they are not open from a copyright perspective. Thus, the option for higher education institutions to take an existing MOOC and apply it in their educational system without involving the MOOC providers is quite complicated (Loviscach, 2013; Yousef et al., 2014d). For instance, Coursera does not permit users to reproduce, retransmit, redistribute, or publish any material from its profit platform (Coursera, 2015).

> "In consideration for your agreement to the terms and conditions contained here, Coursera **grants you a personal**, non-exclusive, non-transferable license to access and use the Sites".
>
> "You may not take any Online Course offered by Coursera or use any Statement of Accomplishment as part of any tuition-based or for-credit certification or program for any college, university, or other academic institution without the express written permission from Coursera".

Non-profit platforms have similar restrictions, edX, for instance, stresses that the learning material and the offered courses are for personal use, and users are not allowed to give or provide access to these learning materials to any individual or entity except as provided under edX's terms (edX, 2015).

> "The content on the Site is protected by United States and foreign copyright laws. Unless otherwise expressly stated on the Site, the texts, exams, video, images and other instructional materials provided with the courses offered on this Site are for your **personal use in connection with those courses only**"
>
> "When you take a course through edX, you will not be an applicant for admission to, or enrolled in, any degree program of the Member as a result of registering for or completing a course provided by such Member through edX. **You will not be entitled to use any of the resources of the Member beyond the online courses provided on the Site**, nor will you be eligible to receive student privileges or benefits provided to students enrolled in degree programs of the Member"

Through this, it is clear that the use of copyrighted materials without written permission (i.e., contract, cooperation agreement) is not available for Coursera and edX courses. Thus, the institutions aiming to integrate MOOCs into their educational systems need to consider the copyright policy when using content from MOOCs platforms. Loviscach (2013); Sandeen (2013b) and Schulmeister (2014) labelled two scenarios of integrating MOOCs in formal university courses as a blended learning approach:

- **Content licensing**: Integrate an existing MOOC (internally or externally produced) into the campus-based courses (i.e., for formal students) and universities accepting their successful courses for credits within approval from the home institution.
- **Internationalize campus-based courses**: Universities open their local courses to everyone and the extended blended learning version is available to students enrolled at the university with face-to-face class lectures.

2.4.1 Content Licensing

The scenario of content licensing has the greatest acceptance among higher education institutions (Sandeen, 2013b). Therefore, they use a cooperative agreement between their universities (i.e., campus-based courses) and MOOCs providers as the basis for their legal relationship. Many universities have already announced agreements to pilot the bMOOC model (Loviscach, 2013; Sandeen, 2013b). In that light, this section presented are case studies which demonstrate the bMOOC model in higher education settings.

San José State University

San José State University (SJSU) partnered with edX in the fall of 2012 to provide a “Circuits and Electronics” course as a part of the bMOOC pilot experiment. 87 SJSU on-campus students watched the MOOC video lectures on their own. Then they practiced problems as homework. Afterwards, the students met the faculty professor during class time to discuss the concepts presented in the video lecture. Meanwhile, they took part in small-group activities, worked in team projects and did quizzes to check their progress. This bMOOC achieved high success. In the bMOOC-based class 90% of the students passed the final exam, as compared with 55% in the traditional class of the previous year (Ghadiri et al., 2013). Even though the overall feedback showed positive results, there were some open issues, such as the lack of interaction between students and the video content, and the lack of integration between the MOOC platform and the campus Learning Management System (LMS). Furthermore, the course was scheduled and led by the university professor in a linear way. Therefore, students were more involved in the class time activity more than the online practice.

Vanderbilt University

Vanderbilt University integrated a Stanford Machine Learning course into a graduate course in machine learning at Vanderbilt University during the fall 2012 semester. The start of Stanford MOOC was compatible with the scheduled beginning of the Vanderbilt Semester. This course ran over 10 weeks and students were required to watch lecture videos, complete quizzes and do assignments, participate in collaborative discussion on Coursera platform. However, this MOOC did not cover all the topics required in machine learning curriculum at Vanderbilt. That's why the Vanderbilt professor decided to assign students with additional exercises e.g. identifying topics for reading, which were discussed in weekly face-to-face in-class sessions (Bruff et al., 2013).

The students of this bMOOC demonstrated more enthusiasm for learning, expressing their satisfaction with the good design of video lectures and the high quality of the learning materials. They also acknowledged this bMOOC as a powerful tool for self-paced learning. However, the students were more effective in classroom discussions than in the online discussions through Coursera platform (Bruff et al., 2013).

Massachusetts Bay Community College

Massachusetts Bay Community College (MassBay) entered into a partnership with edX to offer an adapted version of MIT's "Introduction to Computer Science and Programming." This adapted version was known as Small Private Online Courses (SPOCs) and used locally with on-campus students. It offered credit upon completion (Schworm, 2012). Students watched edX's 6.00x video lectures, performed online exercises accompanied by practice problems, and submitted online homework. Moreover, students received 50-minute face-to-face sessions weekly in order to support them with additional tutorials, scaffolding, and feedback from MassBay professor. A total of 16 students completed this course and received 3 college credits (MassBay, 2013).

Antioch University

Antioch University was the first US institution to begin accepting Coursera MOOC for credit with formal faculty approval. Through this new agreement, Antioch University received approval from Coursera to offer college credit for their BA degree. In October 2012, Antioch University announced a pilot program in cooperation with two Coursera courses developed by the University of Pennsylvania: Modern and Contemporary American Poetry, and Greek and Roman Mythology. Each course was facilitated by an Antioch University professor who provided course content, learning resources, and supported communication among course participants, encouraged them to actively involve themselves in their learning process, and created and managed supplemental exercises and projects focusing on collaborative learning experiences (Antioch University, 2014).

> Tex Boggs, Antioch University Los Angeles president said: "We are excited about having this groundbreaking opportunity to work with Coursera to provide students with even greater benefits from the unique learning opportunity offered by the Coursera MOOCs" (Antioch University, 2014)

> Daphne Koller, the co-founder of Coursera, acknowledged that "We're excited at the possibility of having students use our courses as credit toward a degree at Antioch University, while also benefiting from enhanced learning opportunities in the classroom. We look forward to expanding the pilot to include more courses and more students." (Antioch University, 2014).

A well-known problem with the US higher education system is the enormous tuition fees required to complete a four-year degree (Schulmeister, 2014). Thus, through this kind of partnership between US institutions and MOOCs, providers can reduce student costs to complete their college degree as well as costs for adult learners who work full-time or have taken a break from formal education due to the high cost (Antioch University, 2014, Yousef et al., 2015a).

The University System of Maryland

Ithaka S+R[8] conducted a study with the University System of Maryland to investigate the potential use of interactive online learning platforms in fourteen MOOCs on Coursera platform that had been embedded in blended learning formats. The most interesting finding was that the provided MOOCs were not specifically designed to be integrated into traditional campus lectures, thus it required extra effort to adapt the learning content to fit the curriculum in an on-campus environment (Griffiths et al., 2014). The study further lists their findings:

- Teaching staff found no significant differences between the bMOOCs outcomes and the traditionally-taught sections.
- In general, teaching staff reported that the bMOOC model considerably reduced class time.
- Learners in these bMOOCs were somewhat better than the others in traditional classes in terms of pass rates and grades on common assignments.

2.4.2 Internationalize Campus-based Courses

This form of MOOC integration seems to address some of the limitations facing content licensing models namely, the fixed dates of MOOCs are rarely suitable for the semester schedule (Loviscach, 2013) and the syllabus provided does not cover the required university curriculum for credits (Bruff et al., 2013).

Colgate University

Colgate University joined the edX platform to provide a bMOOC of the popular “Advent of the Atomic Bomb” course (Hames, 2015). The course involves old and young alumni and interactive online components, such as online discussions, a collaborative timeline, wiki pages, Twitter groups, and interactive video conferences, was complemented with traditional face-to-face lectures (Hilger, 2014). The professor of this course, Karen Harpp, reported that using bMOOC provides a great opportunity to expand the Colgate University alumni network by bringing alumni with many years of experience to share their knowledge with the younger former students (Fabris, 2015).

> "They provide a wide perspective from different ages and from different disciplines" Karen Harpp (Fabris, 2015).

This course considers the potential of bMOOCs to support informal learning as well as ongoing development (i.e., lifelong learning) through creating an online channel for alumni engagement.

[8] Ithaka S+R is a research and consulting service that helps academic, in making the transition to the online environment. http://sr.ithaka.org/people/about-us

Wellesley College

Wellesley College, a small women's liberal arts college outside of Boston, has joined edX, to offer an "Introduction to Human Evolution" seminar in September 2013. This seminar consisted of only 14 formal students, but was expanded to more than 19,000 informal participants (Bernstein, 2013). The edX platform offers a fantastic opportunity to deliver high quality online learning, which is an attractive feature that enhances collaborative discussions and widens the concept of traditional classroom settings (Hilger, 2014).

Harvard College

Harvard College is a unique academic community located within Harvard University. In the fall of 2013, researchers from Harvard College examined four HarvardX courses taught in the blended model, hosted on an edX platform named "The Einstein Revolution," "China," "Concepts of the Hero in Classical Greek Civilization," and "Science and Cooking." The overall evaluation mean to three of the courses in the blended model was lower than the previous versions of the courses taught in the traditional model, while the overall response to the "China" course was very similar. The majority of those who participated in these courses reported that the high quality of the bMOOC content was very useful for them. Participants who prefer the bMOOC model expressed the flexibility in learning as the most important feature impressed them (Derek Bok Center, 2014).

On the other hand, participants who were averse the bMOOC model expressed their dissatisfaction with the course design and interaction methods, as well as the integration of the face-to-face sessions. The feedback gathered from these pilot courses underlined the need for a new, blended course design in order to encourage learners to take an active role in the learning process (Derek Bok Center, 2014).

2.4.3 Blended MOOCs Merits and Critiques

MOOCs that are taught using the blended format promise to find the greatest acceptance in the higher education landscape and play a vital role in recognition for credit with university approval. However, if a MOOC is to form part of a degree course, needs to consider a wide range of challenges e.g., quality assurance, learning objectives, teaching methods, assessments, and uncontrollable costs of MOOCs development, that must be taken into account when integrating bMOOCs into traditional higher education. Figure 16 concludes the merits and critiques of the bMOOCs models.

Content Licensing

Merits

- Offering students with a wide range of learning materials from highly respected universities (Loviscach, 2013; Sandeen, 2013b).
- Benefits of much of the flexibility and convenience of MOOCs technologies while interlacing the benefits of the face-to-face classroom interactions (Bruff et al., 2013).
- Enhance university reputations and achieving a sustainable competitive advantage in terms of attracting more students (Sandeen, 2013b).
- Reduce student costs to complete their college degree (Antioch University, 2014).

Critiques

- Limited interactions with the video content and computer-based assessment (Yousef et al., 2014c).
- bMOOC participants are more effective in classroom discussions rather than the online discussions (Bruff et al., 2013).
- The lack of integration between the MOOC platform and the campus Learning Management System (LMS) (Ghadiri et al., 2013; Griffiths et al., 2014).
- The dates of the MOOCs rarely suitable for the semester scheduled (Loviscach, 2013).
- The syllabus provided has not covered the required university curriculum for credit (Bruff et al., 2013; Griffiths et al., 2014).
- The MOOC provider would charge the university variable fees for course development (Kolowich, 2013).
- Original lectures serially arranged, making it difficult rearranged to suit the local curriculum objectives (Griffiths et al., 2014).

Internationalize Campus-based Courses

Merits

- Engage alumni (Sandeen, 2013b; Fabris, 2015)
- Course dates are suitable for the start and end of the university academic calendar (Loviscach, 2013)
- bMOOC content became more appropriate to cover the university curriculum (Bruff et al., 2013)
- Replace more traditional learning management systems (Sandeen, 2013b)
- Impetus professors to create high quality materials as well as improve their teaching methodologies (Derek Bok Center, 2014).

Critiques

- Learners who participated in the online activities perform worse compared to those who more engaged in the in-class sessions (Derek Bok Center, 2014).
- Courses needed reengineered in order to fit most effectively into a larger program curriculum (Griffiths et al., 2014; Derek Bok Center, 2014).
- Follow a teacher-centered model (Griffiths et al., 2014; Yousef et al., 2015a).

Figure 16: Merits and critiques of the bMOOCs models

2.5 Summary

This chapter illustrated the academic publications, which are fundamental for understanding what the educational benefits and effectiveness are that Massive Open Online Courses (MOOCs) have on teaching and learning. First presented is an overview of the current research in the field of Video-Based Learning (VBL) and outlined existing approaches for classifying them. Second, introduced is a description of the flipped classrooms as a pedagogical strategy which encompasses several teaching and learning practices and analyzed of how flipped classrooms can split into homework and on-campus activities. Third, compiled and analyzed is the state of MOOC research that has been conducted from 2008-2015. A template analysis was applied to analyze and categorize the MOOCs literature into 7 dimensions, namely concept, design, learning theories, case studies, business models, target groups, and assessment. Further identified are critical challenges that have yet to be addressed and suggested opportunities for future work in the area of MOOCs. Fourth, introduced the new design paradigm of blended MOOCs (bMOOCs) and appreciation it as an alternative MOOC model that can resolve some of the hurdles facing standalone MOOCs. Therefore highlighted are the merits and critiques of bMOOC implementations. This dissertation would promote the effective design of bMOOCs in a higher education context. The next chapter focuses on the conceptual approach L^2P-bMOOC in order to facilitate the design dimensions and deliver of these new learning experiences in our academic institutions.

CHAPTER 3

Conceptual Approach

In the previous chapter, bMOOC has been outlined as one promising avenue that aims to resolve some of the drawbacks facing MOOCs. The process of designing bMOOCs is still in the experimental stage. This raises the question of what are the promises and challenges of bMOOCs in teaching and learning. The following chapter describes the arising challenges in bMOOC settings in higher education. Furthermore, it derives a new conceptual approach of L^2P-bMOOC, which addresses these challenges and purpose design dimensions for the effective integration of bMOOCs in a higher education context[9].

3.1 bMOOC Challenges

Different approaches to design and embed bMOOC environments into the higher education landscape have been proposed in MOOC literature (Bruff et al., 2013; Ghadiri et al., 2013; Ostashewski, & Reid, 2012).These approaches, however, still suffer from several limitations: a) the diversity of MOOC participants b) lack of balance between the online and offline learning experience, c) lack of integration between the MOOC platform and the institutional learning system (e.g. LMS), d) the provided MOOC syllabus does not cover the required university curriculum for credit, e) the lack of effective assessment and feedback, f) the lack of interactivity between learners and the video content, g) the

[9] Parts of this chapter have been published in:

Yousef, A. M. F., Chatti, M. A., Schroeder, U., & Wosnitza, M. (2014c). What Drives a Successful MOOC? An Empirical Examination of Criteria to Assure Design Quality of MOOCs. In *Advanced Learning Technologies (ICALT), 2014 IEEE 14th International Conference on* (pp. 44-48). IEEE

Yousef, A. M. F., Chatti, M. A., Wosnitza, M., & Schroeder, U. (2015a). A Cluster Analysis of MOOC Stakeholder Perspectives. RUSC. Universities and Knowledge Society Journal, 12(1), 74-90.

Yousef, A. M. F., Chatti, M. A., Wosnitza, M., & Schroeder, U. (2015a Spanish Version). Análisis de clúster de perspectivas de participantes en MOOC. *Monográfico: Los MOOC:¿ una transformación radical o una moda pasajera?*, *12*(1), 74.

adherence to a teacher-centered (i.e., centralized learning model). Can that change? Does current higher education have a voice of its own, recognizing the potential of bMOOCs to support new pedagogical approaches?

In fact, the limitations clarified above, hindering higher education institutions from maximizing the potential benefits of bMOOC settings, and this creates some significant gaps between what are MOOCs presently offer and what is exactly higher education institutions need (Griffiths et al., 2014). The major question that arises is how to effectively integrate bMOOCs in a higher education context? This leads to a number of challenges that need to be addressed: a) dealing with diversity in bMOOC environments, b) increasing online and offline human interactions, c) integrating the bMOOC platform within the university learning system (e.g. LMS), d) considering local curriculum objectives, e) providing effective assessment and feedback mechanisms, f) increasing interactivity between learners and the video content, g) shifting from the centralized teacher-centered learning model to a student-centered one. Therefore, the chapter at hand is addressing these challenges and derives design dimensions for the effective integration of bMOOCs in a higher education context.

3.2 A Cluster Analysis of MOOC Stakeholder Perspectives

MOOCs are developed for multiple stakeholders, each with their own motivation. This raises a serious question about the different patterns of MOOC stakeholders and their perspectives when participating in MOOCs. In order to address the diversity issue in MOOCs, this section presents cluster analysis patterns of MOOCs stakeholders' perspectives to create a meaningful picture of the MOOC community that should be considered in the development of MOOC environments.

3.2.1 Cluster Methodology

This cluster analysis follows the action research methodology. Action research is an interactive inquiry process that allows researchers to examine the results of several research phases in a collaborative context with data-driven collaborative analysis to understand the underlying identified problem (Heller, 2004). The study consists of three phases. Firstly, designs a survey to collect and identify different goals from MOOC stakeholders when they participate in MOOCs. Secondly, transcribes and analyzes the survey data using different concept mapping analysis methods. Thirdly, discuss the main characteristics of each MOOC stakeholders cluster.

Survey Design

The data analyzed here were gathered from an open-ended question at the beginning of a two page Likert-scale questionnaire about the quality of MOOCs, in order to collect feedback from different MOOC stakeholders concerning the objectives behind participating in MOOCs. The first part of the questionnaire consisted of questions related to the participant's demographic profiles, experience in TEL, and the main open-ended question was "**What are your goals/objectives when providing MOOCs?**" (for professors) or "**What are your goals/objectives when participating in MOOCs?**" (for learners). The second part of the questionnaire consisted of closed-ended questions that aimed to identify specific criteria that needed to be considered when designing and implementing MOOCs. The results of the criteria analysis will be discussed in section 3.4. This part focuses on the analysis of the responses to the open-ended question above in order to cluster the different MOOC stakeholder perspectives.

A wide sample of MOOC stakeholders were invited to participate in the survey. A total of 205 completed the survey (107 learners who had participated in one or more online courses and 98 professors who had taught at least one MOOC). Only 158 respondents answered the open-ended question from the first part.

Participants

The demographic profile of this survey was divided into professors (as MOOC providers) and learners. More precisely, the participants were on a voluntary basis as follows:

- **Professors**: 76 professors who had taught a MOOC completed this survey: 41% from Europe, 42% from the United States and 17% from Asia.
- **Learners**: 82 learners participated in the survey. A slight majority of these learners was female (53%). Of the learners, 14% were aged between 18 and 24 years, 23% between 25 and 29, nearly 13% between 30 and 34, 13% between 35 and 39, and 37% over 40. About 36% were Bachelor's students, 40% Master's, 12% PhD, and 12% at high school and other levels. All of them had taken one or more online courses, and 92% had prior experience with MOOCs. These learners came from 41 different countries and cultural backgrounds in Europe, United States, Australia, Asia, and Africa.

3.2.2 Data Analysis

By the end of the survey period, data had been collected from 158 responses (N = 158) to the main open-ended question "What are your goals/objectives when participating (providing) in MOOCs?", reflecting different MOOC goals and perspectives. The initial intention was to split up the analysis of the survey results based on the learners' and professors' perspectives and analyze the interest patterns within these two groups. After analyzing the results, no significant differences were found between the two groups. Thus, the decision was to merge the two groups and analyze the whole dataset to highlight the main clusters of MOOC stakeholder perspectives. The inductive category development method was used for applying qualitative content analysis (Mayring, 2003). Afterwards, the Leximancer concept analysis approach was applied (Smith &

Humphreys, 2006) and finally, the Nvivo 10 cluster coding similarity approach was conducted (Richards, 1999) to perform an automatic analysis of the conceptual content of the survey answers. The following sections give a detailed report of the results from the analysis phase.

Inductive Category Development Method

Mayring's qualitative content analysis method was developed in the 1980s, to analyze open-ended surveys and interviews transcripts (Mayring, 2003). This inductive category development included six iterative steps as shown in Figure 17.

The inductive category development method was iteratively applied within several development cycles. The cluster analysis process was started with two TEL experts, by formulating an initial description of the meaning of a cluster and writing a memo about it. Then creating an initial version of the categories around the core terms: hybrid learning, design, flexibility, quality of content, lifelong learning, collaborative learning, openness, and student-centered learning. Within a feedback loop the definition of each category was discussed to ensure that the two experts had a similar understanding of the category meanings. After that, two experts who have experience with MOOCs and who had been working independently from each other started mapping all the survey responses to these categories. The result of this step was two lists of categories marked with the text segments that are very relevant to each category.

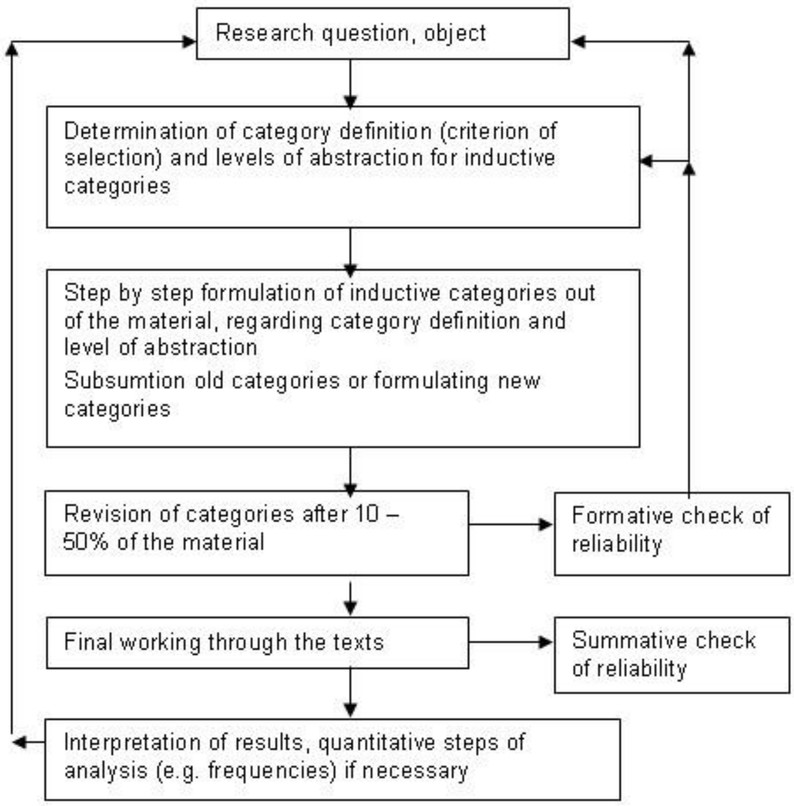

Figure 17: Inductive category development method (Mayring, 2000)

Those lists were confirmed by applying the inter-rater reliability statistical formulas to measure the agreement achieved. Table 3 shows the results of inter-rater reliability between the two experts based on Cohen's kappa and Krippendorff's alpha.

Table 3: Results of the inter-rater reliability test between the two experts

Coding	Percent Agreement	Cohen's Kappa	Krippendorff's Alpha	N Agreements	N Disagreements	N Cases
Expert 1 & Expert2	87.3%	0.848	0.848	138	20	158

The Cohen's kappa and Krippendorff's alpha coefficients for inter-rater reliability are 0.848, thus indicating a high level of agreement (87.3%) in the mapping of the responses to the categories.

Leximancer Concept Analysis Approach

In addition to the manual inductive category development method, the Leximancer concept analysis tool was applied to perform the clustering analysis of the survey responses. Leximancer is an automated text mining method that extracts the main concepts from the survey responses. In Leximancer, concepts are not merely keywords, but focused clusters of related, defining terms as conceptualized by the text author (Leximancer, 2013). The procedures behind Leximancer are based on Bayesian statistical theory, where fragmented pieces of evidence can be used to predict what is actually happening in a system (Smith & Humphreys, 2006).

Leximancer assisted us in analyzing and clarifying the quantitative findings of the textual content from the survey responses and illustrating them as concept dimensions of MOOC patterns through the processes of (1) conducting semantic concept retrieval of MOOC stakeholder objectives, (2) viewing concept maps of objectives in graph format, and (3) clustering the concepts into piles to show how they are related to each other (Cretchley, Gallois, Chenery, & Smith, 2010; Smith & Humphreys, 2006; Watson, Smith, & Watter, 2005).

In order to upload the survey data into the Leximancer system, a CSV file was created with the 158 survey responses. The concept map was automatically generated by extracting the most important concepts from the MOOC stakeholder objectives. The algorithms used to generate this concept map do not only analyze well-structured text, but also text where the stakeholders used dot points or short answers. This concept map illustrates a deeper look at how objectives are related to each other, as shown in Figure 18. Each concept on the map represents some of the MOOC stakeholder objectives reported in the survey. Each concept has a colored text that indicates the relationship of this concept to other concepts with the same color in the map. The colored lines do not only consider the relationship among the same concepts group (i.e., with the same cluster), but also the intersections between different concepts groups.

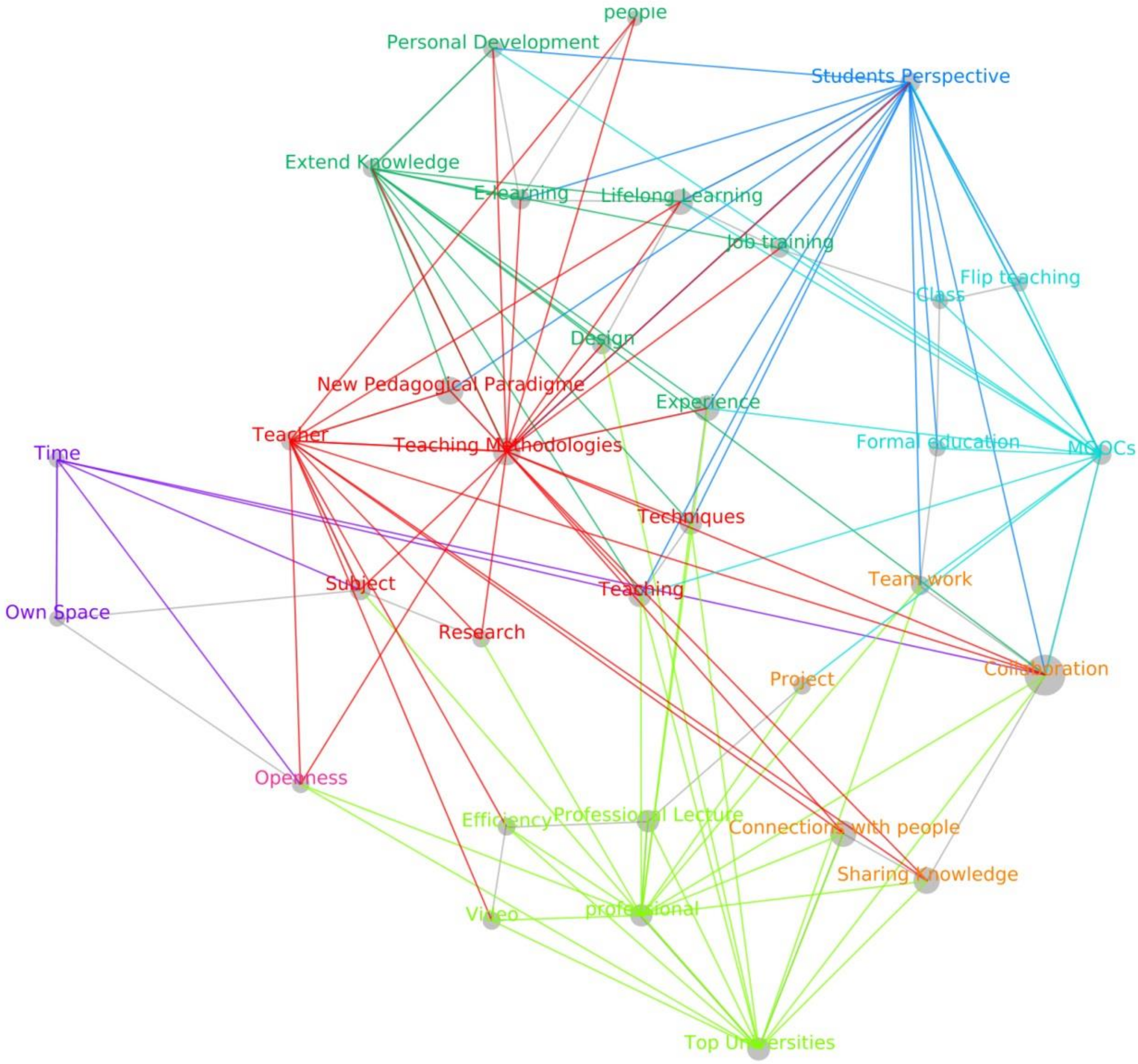

Figure 18: MOOC objectives concept map generated by Leximancer (Yousef et al., 2015a)

In a next step, Leximancer groups related concepts that co-occur with other concepts in the map. As a result, similar concepts are clustered together, as illustrated in Figure 19.

The final step in the Leximancer analysis is to identify the label that best represents each cluster. In order to attach significant labels to the clusters, the concept labels that the Leximancer system proposed were checked and then combined them with the category labels that have been used in Mayring's inductive category development analysis in the previous section. As a result, the following eight clusters were confirmed: *blended learning, instructional design and learning methodology, flexibility, high quality content, lifelong learning, network learning, openness, and student-centered learning*.

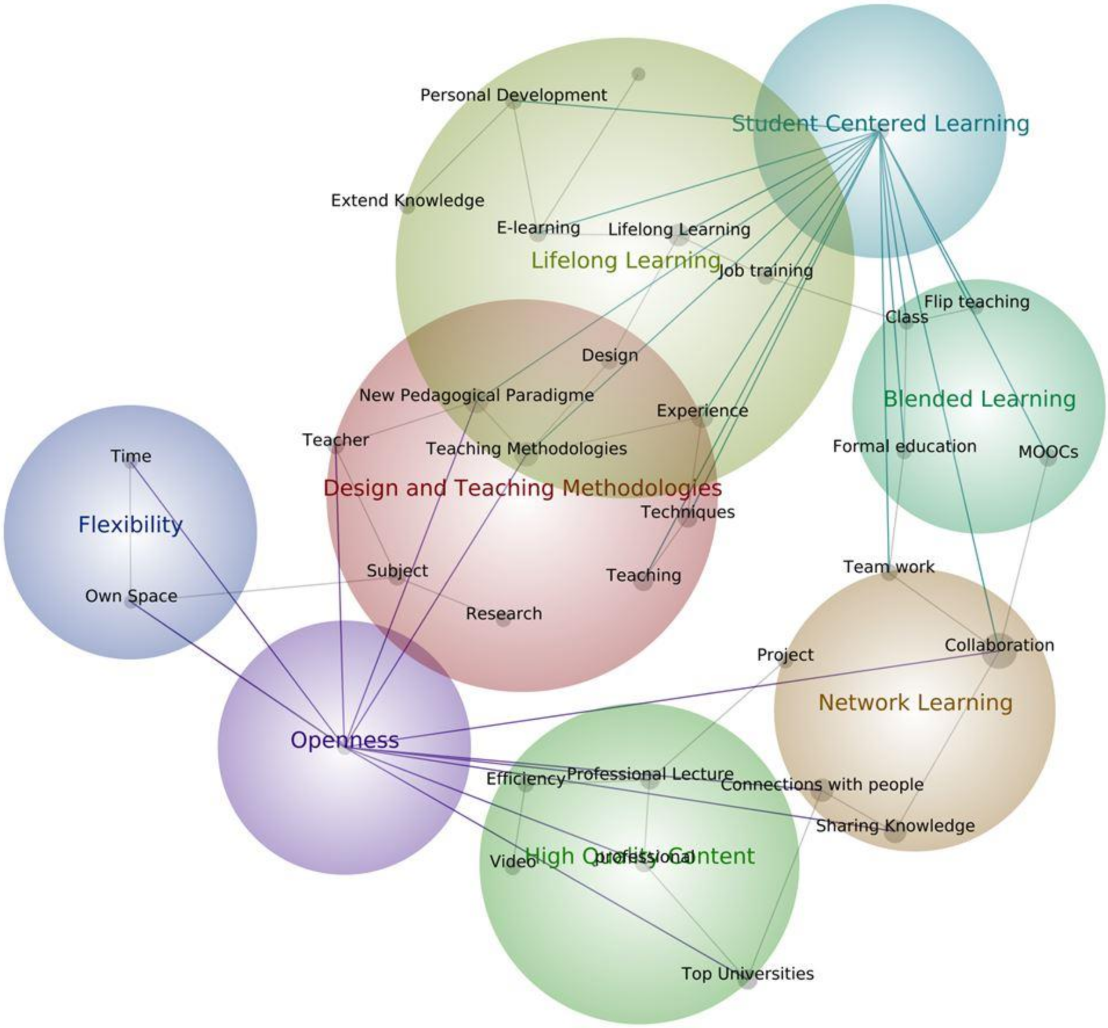

Figure 19: Clustering of MOOC stakeholder objectives (Yousef et al., 2015a)

The clustering results were validated by applying the inter-rater reliability coefficient between the mapping of the responses to the cluster labels provided by the two experts and Leximancer. Table 4 presents the results of pairwise percent agreement, pairwise Cohen's kappa, and Krippendorff's alpha. The high Cohen's kappa and Krippendorff's alpha coefficients for inter-rater reliability (0.893) reveal an accurate clustering of the responses.

Table 4: Results of the inter-rater reliability test between the two experts and Leximancer

Coding	Avg. Pairwise Percent Agreement	Avg. Pairwise Cohen's Kappa	Krippendorff's Alpha	N Cases
Expert 1 & Expert 2 & Leximancer	91.139%	0.893	0.893	158

Figure 20 shows the different patterns of MOOC stakeholders (i.e., their goals when participating in MOOCs). The next step in the analysis investigates the relationship among these clusters by applying the Nvivo 10 cluster coding similarity approach (Richards, 1999).

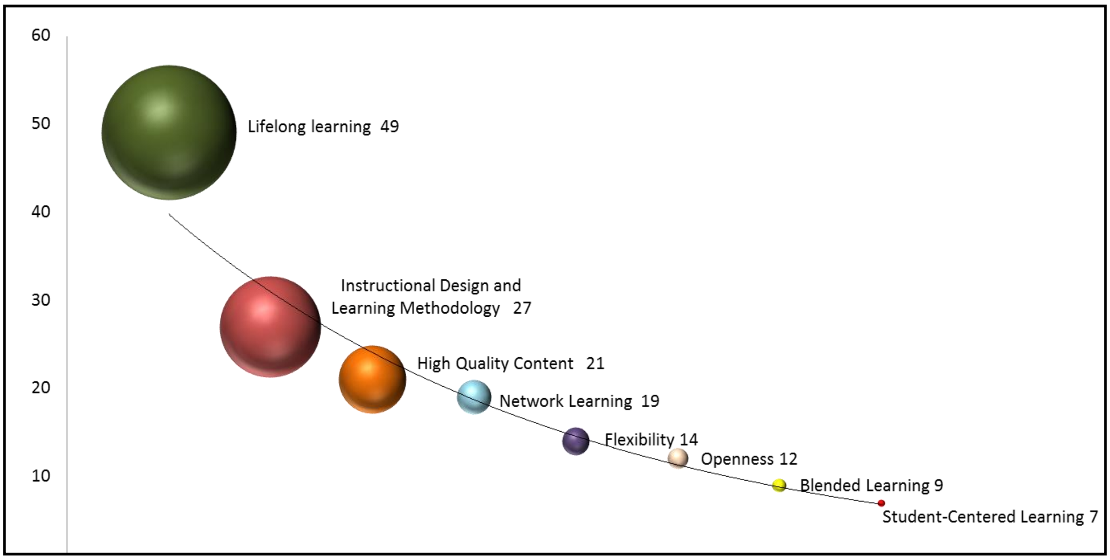

Figure 20: Number of participants in each cluster (N=158) (Yousef et al., 2015a)

Nvivo 10 Cluster Coding Similarity Approach

A similarity metric is a statistical method used to calculate correlation among clusters. The Nvivo 10 cluster coding similarity approach allows the clustered data to be analyzed in terms of similarities in attribute values based on Pearson's correlation coefficient, Jaccard's coefficient, and Sørensen's coefficient (Bazeley & Jackson, 2013; Richards, 1999).

The final eight clusters of MOOC stakeholders and the responses associated with each cluster were provided as input to Nvivo 10. Then the coding similarity metric was applied to measure the similarity between these clusters. The result was a horizontal diagram that shows similar items on the same branch and dissimilar items on different branches, as shown in Figure 21. There is little work that attempts to find the relationship between stakeholder motives when involved in MOOCs and the type of MOOC itself. The result of the cluster coding similarity provides the opportunity to detect potential relationships between stakeholder objectives and MOOC type. As shown in Figure 21, the blended learning, flexibility, high quality content, and instructional design and learning methodologies clusters are tied together in the first branch. This grouping reflects the main features of xMOOCs characterized by a replication of traditional educational practices driven by formal learning institutions. xMOOCs have predefined course structures, focus on the provision of high quality content, and follow teacher-led instructional design methodologies. Moreover, xMOOCs provide flexible access to a wide range of learning materials and offer the opportunity to bring together online and face-to-face learning.

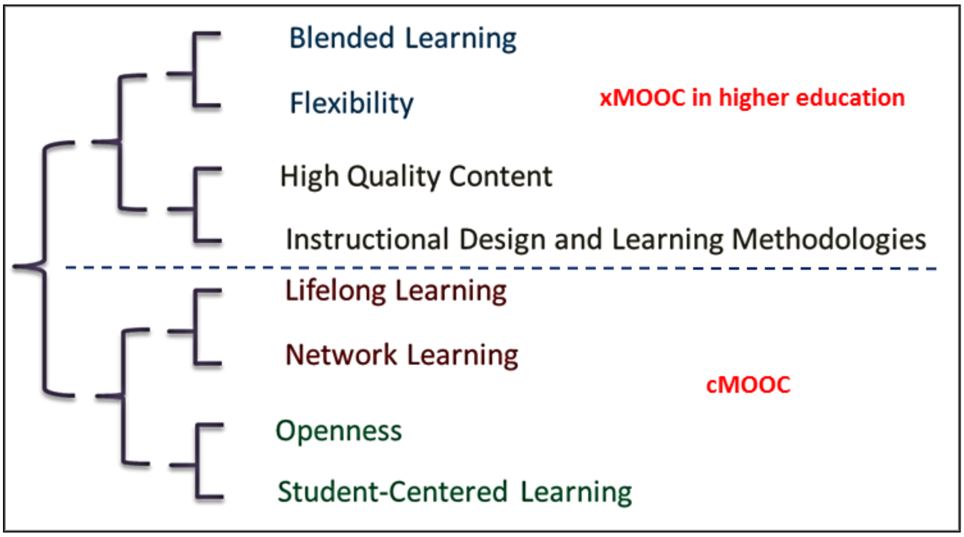

Figure 21: MOOC stakeholders cluster coding similarity (Yousef et al., 2015a)

On the other hand, lifelong learning, network learning, openness, and student-centered learning are grouped together in the second branch. This grouping reflects the main characteristics of cMOOCs. Unlike xMOOCs, which focus on formal learning, cMOOCs are often used to support open, networked, self-organized, and lifelong learning. This kind of learning tends to be experimental, spontaneous, and free from rigid curricula; thus offering new opportunities for personal development (Fernández, 2013).

Table 5 illustrates the degree of support of the eight MOOC stakeholder perspectives in cMOOC, xMOOC, and higher education context. None of these environments provides a full support for all MOOC stakeholder perspectives.

Table 5: Stakeholder perspectives in cMOOC, xMOOC, and higher education context

Clusters	cMOOCs	xMOOCs	Higher Education
Blended Learning	(√)	(√)	(√)
Flexibility	√	(√)	-
High Quality Content	-	√	√
Instructional Design and Learning Methodologies	-	√	√
Lifelong Learning	√	√	(√)
Network Learning	√	(√)	-
Openness	√	(√)	(√)
Student-Centered Learning	√	-	-
√ Completely (√) Partly – Very limited support			

3.2.3 Cluster Analysis Discussion

The specific objective of this analysis is to cluster the main stakeholder objectives behind participating in MOOCs. The previous sections presented the details of the clustering analysis of MOOC stakeholder perspectives. In short, the main perspectives include blended learning, flexibility, high quality content, instructional design and learning methodologies, lifelong learning, network learning, openness, and student-centered learning. This section focuses on the discussion of the clustering results by performing both a quantitative and qualitative analysis.

Quantitative Analysis

Figure 20 shows the clustering results and the number of participants in each cluster. Nearly one third of MOOC stakeholders (49 out of 158) consider lifelong learning as the main objective behind their participation in MOOCs. Of the participants, 30% were interested in instructional design and learning methodologies, and high quality content. The remaining clusters, i.e., network learning, flexibility, openness, blended learning, and student-centered learning include relatively fewer participants.

The high number of participants assigned to the lifelong learning cluster can be explained by the demographic information in the survey. In fact, the majority of the respondents (82%) were adults aged over 30 years, where 46% were over 40. These results are consistent with those of Liyanagunawardena et al.'s (2013), de Waard et al.'s (2011a), and Hill's (2013) studies, which showed that most of the participants who have participated in MOOCs are adult learners over the age of 30, and are often referred to as lifelong learners.

Qualitative Analysis

The aim of the qualitative analysis is to build a deeper and better understanding of MOOC stakeholder perspectives. This can help MOOC providers in designing and implementing successful MOOC environments that address the different goals of their participants. The MOOC stakeholder perspectives in each cluster are described in the following sections (Yousef et al., 2015a).

Blended Learning

Blended learning has become an important TEL model by integrating online and traditional face-to-face learning (Yousef, et al., 2015a). In this study, 5.7% of MOOC stakeholders reported that their primary goal for participating in MOOCs was to enhance their classroom learning and to improve relationships with teachers and peers. However, MOOC platforms were designed to deliver direct to participants worldwide, not for third party (i.e., universities) to incorporate within their own courses (Griffiths et al., 2014). Therefore, these findings further support the idea of extending the existing university LMS to deliver their local courses in bMOOC format, seem to be the suitable environment to consider the education requirements that, might fit most effectively with the higher education context.

Some representative objectives in the cluster are: “enhancing capabilities”, “acquiring better study habits”, and “getting used to new technologies for learning”, “try to reduce the effort of the teacher with students in his class without losing quality”, “to experiment interactivity at a distance and integrating MOOCs with traditional classes”, and “to support face-to-face learning with Technology-Enhanced Learning”.

Flexibility

One of the successful factors in MOOCs is flexibility (Mackness et al., 2010). Along that line, 9% of MOOC stakeholders reported that the major reason for their participation in MOOCs was the ability to access information and resources at a time and a place convenient to them. Some objectives included in this cluster are: “learning at my own pace”, “diversity of learning material”, and “communicate with peers synchronously as well as asynchronously across space, time, and pace”.

High Quality Content

This cluster reflects the significance of high quality content to empower and engage people around the world to participate in MOOCs. High quality content was a major goal for 13% of the participants. Some of the objectives in this cluster are: “to learn from the best universities all over the world”, “to gain experience from top universities”, and “get free online courses from the world’s leading universities”.

Instructional Design and Learning Methodologies

The instructional design and learning methodologies cluster represents 17% of MOOC stakeholders. The focus in this cluster is on a pedagogical design that can engage learners to attend courses, and on technological design criteria that can make MOOCs more dynamic. Participants in this cluster mainly aimed to investigate new learning methodologies and to research innovative instructional design approaches. Some representative objectives are: “provides some scaffolding for learners”, “learn complementary techniques”, “to promote a new pedagogical paradigm for personal knowledge management”, and “learning how to develop and organize effective MOOCs or flipped classrooms”, and “how to investigate some new component of assessment methods”.

Lifelong Learning

MOOCs open doors for new lifelong learning opportunities (Kop et al., 2011). This cluster stresses the advantage of MOOCs for those who are working full-time or have taken a break from formal education. Of the stakeholders, 31% consider lifelong learning as the main objective behind their participation in MOOCs. This high number reflects the fact that people are tending to learn through MOOCs for their personal or professional interest rather than obtaining an official academic degree. Representative objectives for this cluster are: “self-improvement for career advancement”, “professional development”, and “MOOCs open the mind to expand my horizon and ongoing learning for job requirements”.

Network Learning

This cluster reflects the original concept of early cMOOCs launched by Downes and Siemens (CCK08), which are based on connectivism. In the network learning model, learners are allowed to network together for developing, discussing and exploring alternatives, and for sharing responsibilities for their learning. Of the participants, 12% had network learning as a major goal behind their participation in MOOCs. Some representative objectives are: “working cooperatively in groups”, “share goals, ideas, resources, activities” and “supporting each other”.

However, one of the most crucial issues with the current bMOOCs is the lack of interactivity between learners and the video content (Grünewald et al., 2013). Several studies on the nature of MOOCs address the linear structure of video lectures to present knowledge to learners in a passive way (Yousef et al., 2014a; Zahn et al., 2014). Therefore, there is a need for new design enables learners’ collaboration and interaction around a video lecture, thus supporting network learning in MOOC environments.

Openness

This cluster reflects the 4Rs that characterize openness, i.e., Reuse, Revise, Remix, and Redistribute (Peter & Deimann, 2013). Openness also refers to accessing open educational resources (OER), e.g., course notes, PowerPoint presentations, video lectures and assessment, thus providing a learning experience to a vast number of participants around the globe regardless of their location, age, income, ideology, and level of education, without any entry requirements or course fees. This cluster represents 7.6% of MOOC stakeholders in our study. Some representative objectives are: “provide materials that are easy-to-update”, “the most important one, all of the courses are free”, “how I learn with OER”.

Student-Centered Learning

Student-centered learning puts the learner at the center of the learning activity (Chatti, 2010b). Student-centered MOOCs focus on the interests of the learners rather than teachers and providers. They provide a space for learners to be active participants in the learning process and to get mutual support. In our study, only 4.4% of MOOC stakeholders mentioned student-centered learning as a goal. Representative objectives in this cluster are “put myself in the shoes of a student”, “learn in a semi-organized structure as opposed to an organized 'school' system", "self-regulated", and "self-reflection on the learning process and the impact of different learning designs from a learner perspective".

3.2.4 Cluster Analysis Summary

The diversity of MOOC participants is not only related to the cultural and demographic profile, but also to the motives and perspectives when enrolled in MOOCs. The clustering resulted in a set of eight groups. The cluster with the highest number of participants is lifelong learning (49), followed by instructional design and learning methodologies (27), high quality content (21), network learning (19), flexibility (14), openness (12), blended learning (9), and student-centered learning (7). The computation of the similarity between the clusters, which indicates the relationships between the same, resulted in two bigger clusters. One reflects the characteristics of xMOOCs contain of high quality content, instructional design and learning methodologies. The other reflects the characteristics of cMOOCs and contains lifelong learning, network learning, openness, and student-centered learning. According to this clustering, the number of participants with goals related to cMOOCs (87) was found to be slightly higher than those interested in xMOOCs (71). However, most MOOC implementations continue to focus on xMOOCs that follow a top-down, controlled, teacher-centered, and centralized learning model. Thus, more emphasis needs to be put upon the implementation of bMOOC that combine of formal and informal learning model which opening up the local academic programs for external participants through online delivery of content in conjunction with in-class face-to-face communication to meet the goals of a wide range of participants.

These results may not be generalizable due to the limited number of participants who responded to this survey. Despite the low response rate, the heterogeneous profiles and goals of the respondents makes this sample valid in this field. The analysis of the collected dataset provides a major step forward in the understanding of MOOC stakeholder perspectives.

3.3 bMOOC Design Dimensions

The introduction to this chapter outlines a number of significant challenges hindering the integration of bMOOC in higher education. These include issues related to diversity factors, human interaction, eLearning systems, appropriate curricula content, accuracy of assessment, interactive video components, and centralized learning model. In order to address the diversity issue in MOOCs, a cluster analysis study is conducted. A set of eight clusters are emerged from qualitative and quantitative data analysis as presented in section 3.2. This analysis reveals that MOOC participants have heterogeneous expectations and perspectives. In order to derive possible bMOOC design dimensions, a mapping between bMOOC challenges and the different clusters of stakeholder perspectives is created, as can be seen from Figure 22.

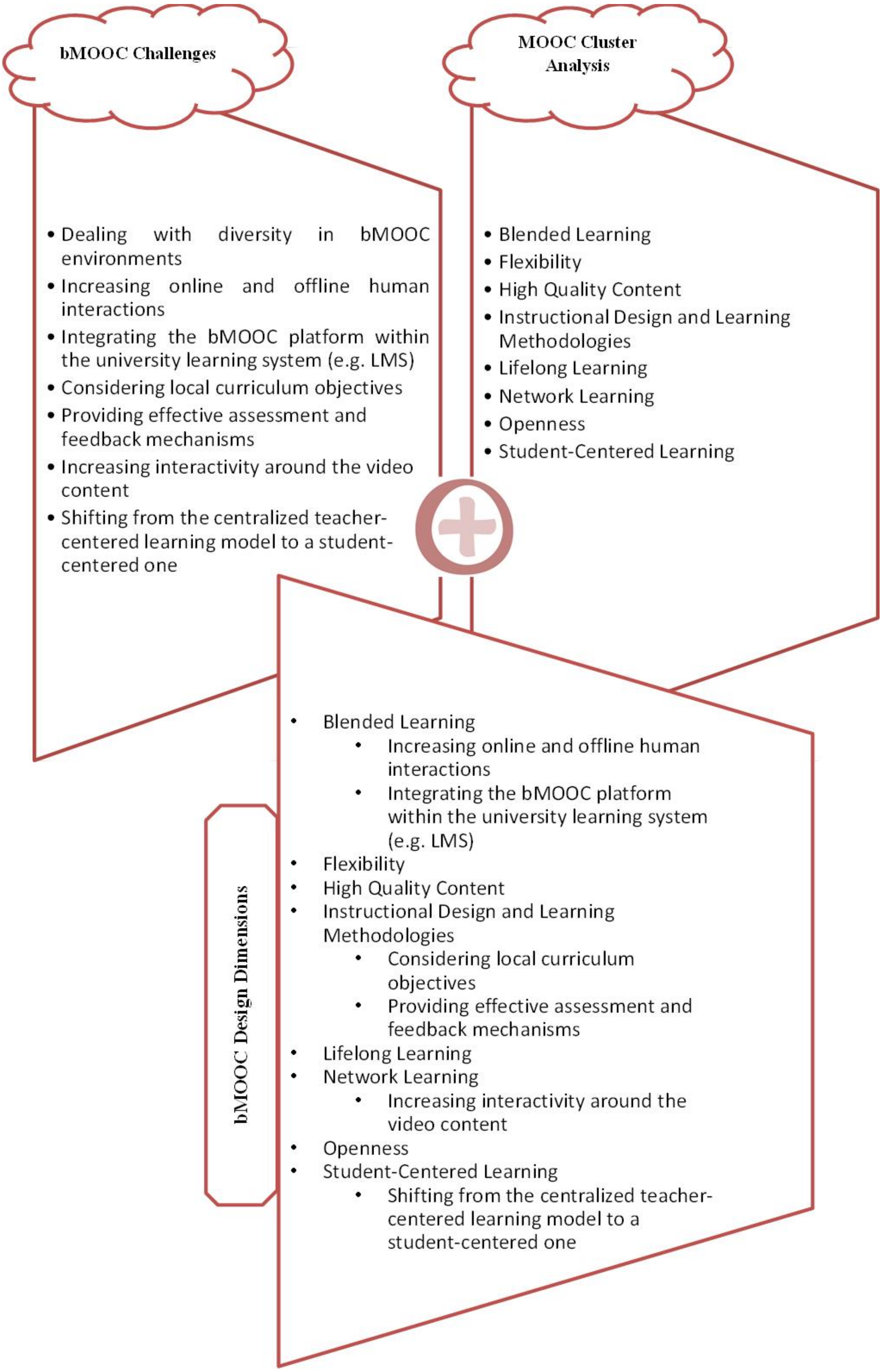

Figure 22: bMOOC Design Dimensions

However, none of the cMOOC, xMOOC and higher education learning models, provides a full support for all these design dimensions as discussed in section 3.2.2 (review Table 5). Indeed, cMOOCs support *flexibility* and *openness* and provide space for *self-organized* and *networked* learning where learners can define their own objectives, present their own view, and collaboratively create and share knowledge. xMOOCs focus on *high quality content* and follow *a clear instructional design approach*, where learning objectives are well-defined by teachers through short video lectures, often followed by e-assessment tasks. Higher education context provides a number of benefits including *blended learning, direct feedback, coaching, and scaffolding*, through better *integration with the local university LMS.*

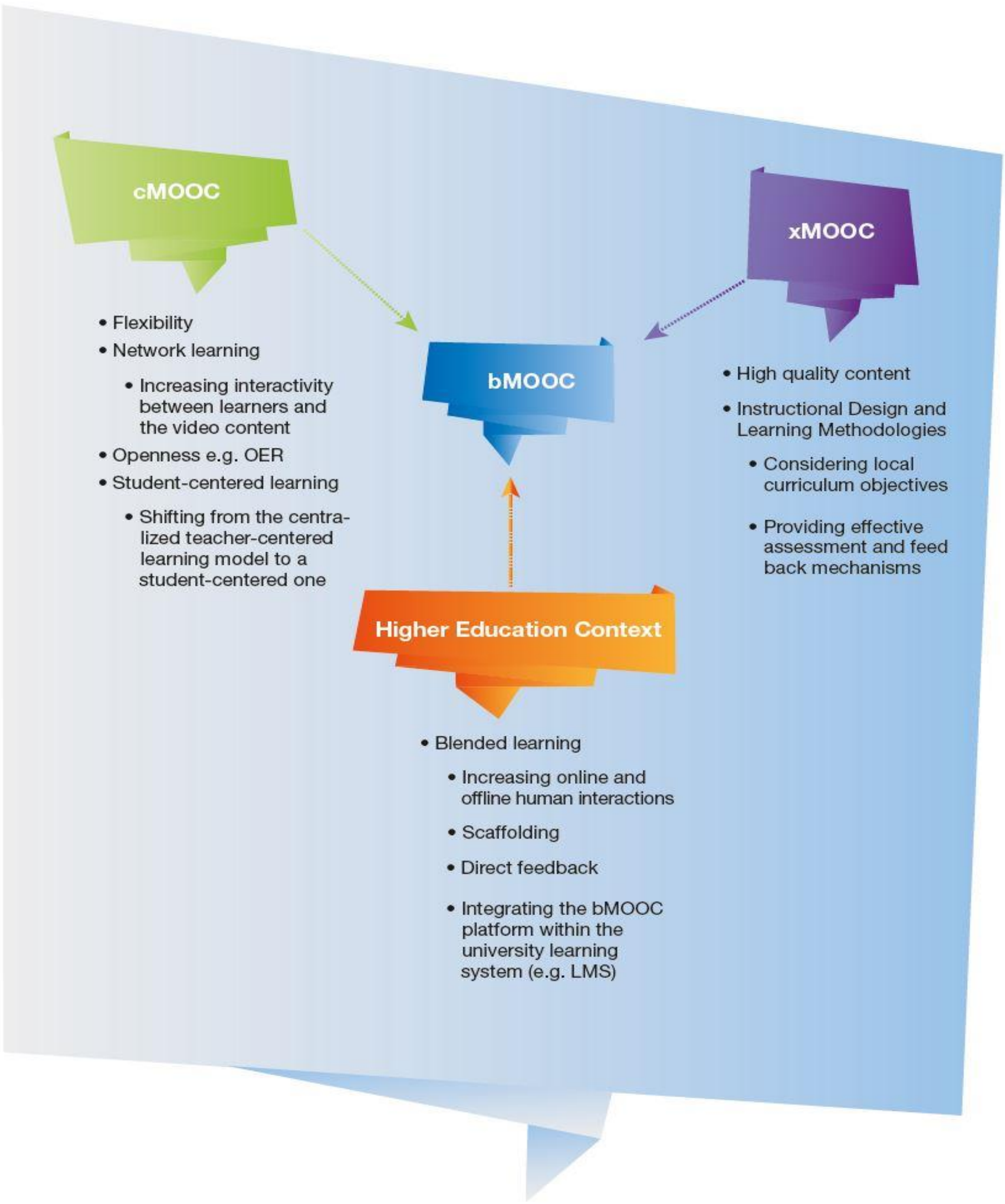

Figure 23: bMOOC as the convergence of cMOOC, xMOOC, and higher education context (Adapted from, Yousef et al., 2015d)

Thus, an effective bMOOC that has the potential to support all design dimensions can be viewed as the convergence of cMOOC, xMOOC, and higher education learning models, as depicted in Figure 23. The next step is to investigate a set of specific criteria related to each design dimension, which is presented in the next section. These criteria would help in designing effective bMOOCs.

3.4 bMOOC Design Criteria

Many researchers have been discussing the development of MOOCs in terms of concept, value, social, institutional, technological, importance, and marketing (Daniel, 2012). However, the quality design of MOOC environments has not yet been clearly defined, not to mention the technological and pedagogical approaches to engage passive participants to be active learners through learning activities (Morris, 2013). As a result, several studies have reported the lack of MOOC design (Hill, 2013; Waite, Mackness, Roberts, & Lovegrove, 2013). Thus, the quality of bMOOCs design becomes one of the main factors that determine their success. Different literature reviews provide a wide range of criteria addressing the design of effective TEL environments, such as content design, page layout, visual arrangements, use of illustrations, and colors. Nevertheless, not all of them can be used to design a successful bMOOC in higher education context. This section addresses the challenge of what drives an effective bMOOC. By highlighting the criteria that need to be considered when designing and implementing bMOOC environments.

3.4.1 Synopsis of Literature

Criteria and quality assurance are one of the core issues in the TEL field. Numerous studies have attempted to identify the quality dimensions of online courses. These are criteria and indicators that are supposed to assist TEL developers in designing online learning platforms, as they used by educators as guidelines in evaluating the effectiveness of their online courses. Wright (2003) provides a sum of quality and standards in the field of online learning, education, and training, based on the experiences of faculty staff in the Instructional Media and Design department at Grant MacEwan College. These criteria were classified into 10 categories with 121 specific indicators. These criteria are reviewed by 11 diverse groups of professionals in the TEL field.

The learner’s perspective is also the main focus of a study conducted by Ehlers (2004). The author acknowledges that successful TEL is not only related to high quality content delivered to learners by a TEL provider, but also requires co-operation from learners. This approach shows how learners’ feedback and experiences can be used to increase the quality of TEL experience. He presents an evaluation model reflecting learners’ predilection related to 30 evaluation dimensions and further categorized them into four preference profiles.

More recently, a study by Conole (2013) presents a specific quality approach, namely the 7Cs learning design framework, which can be used to design more pedagogically informed MOOCs. That aims to provide educators with the general guidance and support they need to design a MOOC. It contains 4 main categories namely, vision, activities, synthesis, and implementation.

As compared to these studies, the study at hand is a first step towards identifying specific criteria to design successful bMOOC. It analyzes a wide range of criteria that have been identified in MOOC studies. This early analysis took into consideration the challenges of bMOOCs, such as lack of human interaction, assessment issues, and pedagogical approaches. Therefore, a final set of 60 criteria is identified and classified into 8 main dimensions. Then these criteria are used as a basis for a large survey to be confirmed by learners who had taken one or more online courses as well as professors who had taught MOOCs. These criteria shall provide much of the foundation for researchers and instructional designers in improving the quality of bMOOCs.

3.4.2 Criteria Collection

The procedure was started through a literature review to collect a set of design criteria related to each design dimension of bMOOC. Thereby, it took into consideration the main challenges that have been identified in the MOOC literature (Yousef et al., 2014b). The initial list of criteria was collected included 102 indicators categorized into 8 main dimensions. This list of criteria was refined through a discussion with a small panel of learners (5 learners) as well as 5 professors who have taught MOOCs to get pre-tested feedback. Afterwards, an internal meeting has scheduled to discuss the feedback from both learners' and professors' perspectives resulting in a refinement of the initial list of criteria to include 60 indicators classified into 8 main dimensions, as depicted in Figure 24.

Furthermore, an empirical study has designed to collect feedback from different MOOC participants concerning the level of importance of the collected criteria for each design dimension (Yousef et al., 2014c). This part of the study investigates whether and how these quality standards can fulfill the needs and requirements of MOOCs stakeholder perspectives. The study employed an online survey instrument. Participants were asked to rate each item on a 5-point Likert scale from (1) not important to (5) very important. They could also comment and suggest modifications or additions. Of the study population, 205 subjects completed and returned the survey (98 professors and 107 learners). For more details about the demographic profile, refer to section 3.2.1. The overall response to this survey instrument was very positive and the respondents acknowledge the importance of considering these sets of criteria when designing the ingredients of bMOOC environments, as described in the following sections.

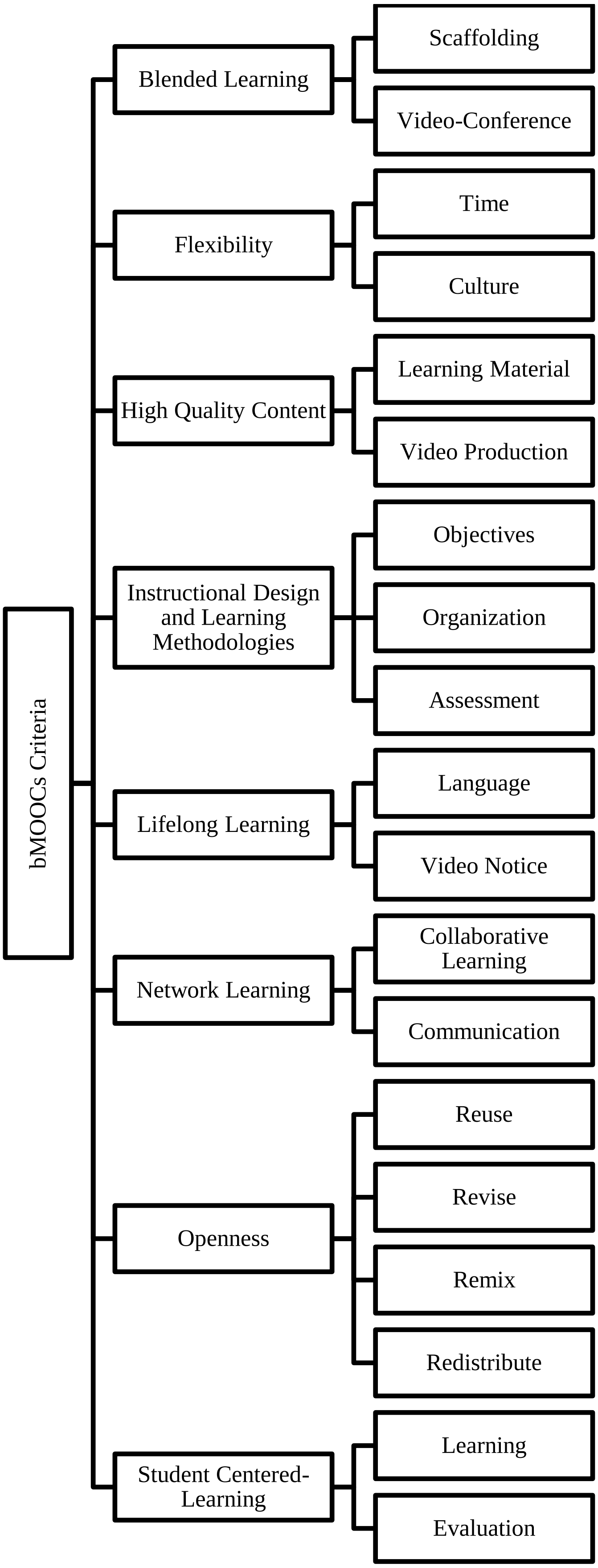

Figure 24: bMOOC Design Criteria

3.4.3 Data analysis

The initial intention was to split up the analysis of the survey results based on the learners' and MOOC providers' perspectives to figure out which criteria are more important for each target group. The statistical analysis is, however, showed no significant differences between the two groups, after computing the mean and standard deviation for each item. Thus, we decided to merge the two groups and analyze the whole set of data to highlight the criteria with the highest importance to both learners and MOOC providers. More details on this will be given in the next sections, and covers the criteria that need to be considered when designing and implementing a MOOC environment. The table below illustrates the 60 items categorized in eight clusters mentioned to measure stakeholders' perceptions of the bMOOCs design quality.

Table 6: bMOOCs: Design Criteria

Clusters	Criteria	$\bar{x}$	σ
Blended Learning			
Scaffolding	1. Provide coaching and scaffolding at critical times.	4.50	0.68
	2. Use of in-person class time for activities rather than traditional lectures.	4.10	0.95
Video-Conference	3. Using video-conference tools to allow learners from different locations to communicate with the teachers.	4.28	0.84
	4. On-line participants list should be available to help learners to do synchronous discussions.	4.13	0.93
Flexibility			
Time	5. Using the international time [UTC] for deadlines and calendar.	3.80	1.11
	6. Provide at least two different times for students to participate in the video-conference discussion.	4.06	0.95
Culture	7. Give learners examples that can be understood by everyone regardless of the cultural background.	4.08	0.87
	8. Video lecture should be into consideration of the cultural values: Notions of quality, normality, cleanliness, and proprietary vary according to culture.	3.86	0.98
	9. Provide links to videos encoded for different connection speed as much as possible.	4.30	0.84
	10. Help systems should be focused on reducing "user errors."	4.31	0.92
High Quality Content			
Learning Material	11. Provide a transcript of the video lecture.	4.24	0.94
	12. Synchronization of video and lecture note.	4.15	0.94
	13. Provide a summary of the video lecture.	4.31	0.86
	14. The level of detail provided about the subject should meet the level of audience for which the resource has been designed.	4.52	0.68
	15. Offer references for facts and information in the video-lecture.	4.39	0.81
	16. A different color can highlight pieces of information	4.01	1.00

Table 6: bMOOCs Design Criteria (Cont.)

	that are considered important.		
	17. Long sentences, which normally contain conditional clauses, are difficult to understand. So convert every long sentence into more short ones.	3.94	1.04
Video Production	18. Sound should be clear (even experienced presenters are prone to gabble when being recorded).	4.81	0.44
	19. Synchronization of video lecture and the transcript of the video.	4.09	1.00
	20. Starting videos with surprise information to attract the students.	3.73	1.03
	21. Use short video clips, no more than 20 minute clips.	4.29	0.95
	22. Framing: arrange objects/graphics to match screen ratio.	4.28	0.77
	23. Standard Video format be offered as a “HTML5-compatible video”.	4.09	0.86
	24. Keep videos small for easier transfer, e.g., to up to 10 M.B.	4.15	0.95
	25. Avoid videos that have rapid cuts or changes of scenery.	3.67	1.07
	26. The body of the text occupy from 25 to 40% of the total space of a video screen	3.46	0.99
	27. Minimum Video resolution (Pixels) 320* 240.	3.84	1.06
Instructional Design and Learning Methodologies			
Objectives	28. Objectives should be clearly defined at the beginning of each lecture.	4.63	0.69
	29. Each short video lecture should cover at most three objectives.	3.34	1.18
Organization	30. Offer course outline that contains objective, subject list and time schedule.	4.50	0.79
	31. Be careful entering expressions and symbols such as food, animals, and everyday objects.	3.48	1.08
Assessment	32. Provide integrated assessment within each task.	4.12	1.05
	33. Using of electronic assessment such as (E-test, short quizzes and surveys).	4.28	0.78
	34. Using different types of questions (e.g. short answers, essay, matching, Multiple Choice question and True/False question).	4.44	0.79
	35. Create the Question bank.	3.92	0.81
	36. Identify the 'default question grade' (i.e. the maximum number of marks for this question).	4.06	0.97
	37. Each assignment should have hints.	3.44	0.95
	38. Each quiz should give feedback and/or show the correct answers.	4.57	0.90
Lifelong Learning			
Language	39. Using English language for MOOCs to meet the wide range of students from different countries and cultures.	3.89	1.02
Video Notice	40. Videos should be displayed with a thumbnail and their (possibly truncated) title, as well as information about video date and ranking and how many times this view has been watched.	3.64	1.06
	41. Video lecture should be tagged / categorized to enable easier search.	4.45	0.72

Table 6: bMOOCs Design Criteria (Cont.)

Network Learning			
Collaborative Learning	42. Supporting the collaborative learning among students.	4.52	0.78
	43. Provide e-mail notification.	4.43	0.84
	44. Support participants for involving in Project-based learning.	4.50	0.64
Communication	45. Provide collaborative discussion tools.	4.50	0.69
	46. Provide video annotation tools.	3.93	0.92
	47. Link with the social networks tools such as “Facebook and Twitter”.	3.72	1.22
Openness			
Reuse	48. Student can download the video lecture in their own devices.	4.43	0.89
Revise	49. Provide related videos.	4.07	0.85
Remix	50. Write down the video keywords to help students search for related materials.	4.20	0.92
	51. Provide a search Box function to help Students to find different learning materials.	4.51	0.76
Redistribute	52. Use social networking tools to share learning material.	3.72	1.22
	53. Offer a subscribe feature to get videos and discussions updates.	4.14	0.88
Student Centered Learning			
Learning	54. Providing opportunities for students to become more self-organized.	4.31	0.81
	55. Let the students responsible for obtaining the objectives, have a voice in setting them.	3.13	1.15
	56. Student can switch between Slide and teacher view to full teacher or slide view.	3.88	1.02
	57. Control features for video clip where appropriate, for example, Play, repeat, full screen, slowdown, stop and pause.	4.70	0.53
Evaluation	58. Allow students to suggest new questions.	3.93	1.06
	59. Providing quiz-test report for students to know their performance.	4.49	0.91
	60. Video platform should provide ranking tools “Like & dislike”.	3.48	1.25
1. Not important … 5. Very important			

The next section discuss how these criteria are used to assure quality for very specific aspects, and confirm that highly ranked criteria related to each cluster are important in designing and developing of bMOOCs platforms in higher education.

3.4.4 Criteria Analysis Discussion

bMOOCs not only provide the opportunity to easily access learning resources, but also include several pedagogical and technology features that support different, important activities in the learning experience such as interaction, collaboration, evaluation, and self-reflection (Yousef et al., 2014c). The purpose of this discussion is to confirm that highly ranked criteria related to each cluster are important in designing and developing of bMOOCs platforms.

From the statistical results in Table 6, we can clearly observe that the scaffolding, collaboration, high quality content and self-organization learning appeared to be influential criteria that empower learners in bMOOCs. Although, literature reviews emphasize the need to involve learners to take voice in selecting their own objectives and learning strategies. The result of indicator 55 did not appear to be a critical factor in judging bMOOCs quality. The study also found that culture criteria had been identified as important in a bMOOC acceptance with a massive number of participants around the globe.

Evaluating a vast number of learners in bMOOCs is indeed a big challenge (Sandeen, 2013a). Thus, assessment is an important factor for the success of a bMOOC. In order to assure assessment tools to be relevant, accurate, and congruent with the objectives, content, and practical activities in a bMOOC environment. The statistical results of the assessment criteria indicate that both learners and teachers are aware that assessment is important to assure the quality of the learning outcome.

Assessment criteria obtained an overall average mean at above 4.12, with an acceptable standard deviation. Particularly noteworthy, indicators 34, 38 and 59 obtained high mean scores of 4.44, 4.57 and 4.49, respectively. These indicators stress the importance of feedback to help learners understand the topic of study and improve their learning outcome. Moreover, providing test report can improve learner’s self-awareness and self-confidence. In addition, learners and providers reported some comments on this category. They are considering opportunities to create an e-portfolios to collect all test reports, assignment tasks, and learners’ achievements in order to support self-reflection.

Does the bMOOC interface have an impact on the learning experience? In this study, participants consider the user interface criteria as important indicators of high quality bMOOCs. Indicator 57 obtained the highest mean score of 4.70. This indicator concentrates on the importance of control features of the lecture video that may influence the interaction and controlling of the lecture content. Moreover, a powerful search function is an important tool in bMOOCs to help learners easily find the required course materials. This is a crucial feature due to the open and distributed nature of bMOOCs. In sum, the most important interface features are the ones that are related to videos. This result is expected, since videos are the backbone of bMOOCs, which are obviously, inherently video-based learning environments.

The quality of the learning content was introduced in the literature as an important dimension in designing of bMOOCs platform. 17 indicators were present to observe the learners’ attention when they deal with the course content in bMOOCs. In general, it is important to ensure that the video content is accessible, appropriate, and accurate. Based on the survey results, recommendations for effective video content include good audio/video quality, providing a summary and a transcript of the video lecture, and using small chunks of videos of no more than 20 minutes. The participants of this study saw social communication tools as another powerful factor that may influence the effectiveness of a learning experience in bMOOCs. Discussion, notification, and video annotation tools were identified as the most important means to achieve collaboration in MOOCs.

3.5 Summary

Returning to the aims posed at the beginning of this chapter, this conceptual approach outlined the arising challenges in bMOOC in higher education. Driven by these challenges and based on a cluster analysis of MOOC stakeholder perspectives, the design dimensions for the effective integration of bMOOCs in a higher education context were proposed. These include blended learning, flexibility, high quality content, instructional design and learning methodologies, lifelong learning, network learning, openness, and student-centered learning. Furthermore, a set of design criteria were collected through literature review related to each design dimension. Furthermore, an empirical study was conducted to gather feedback from different MOOC stakeholders concerning the importance of the collected criteria for each dimension. Following this design criteria, the upcoming chapter presents the implementation and evaluation process of L^2P-bMOOC as a blended learning platform on top of L^2P learning system at RWTH Aachen University.

CHAPTER 4

L^2P-bMOOC

The design dimensions and criteria collected in chapter 3 have built the basis for the implementation of the L^2P-bMOOC platform. The primary aim of L^2P-bMOOC is to shift away from traditional MOOC environments where learners are limited to viewing video content passively towards a more dynamic and collaborative one. Learners are no longer limited to watching videos passively and are encouraged to share and create knowledge collaboratively. This chapter describes in-depth the implementation and evaluation process of L^2P-bMOOC. The user-centered design approach was chosen, which puts the user at the center of the development process (Karat, 1997; Gabbard, Hix, & Swan, 1999; Abras, Maloney-Krichmar, & Preece, 2004). It further presents the initial requirements, the main development strands, and the evaluation details of L^2P-bMOOC to gauge its usability and effectiveness[10].

4.1 Collaborative Video Annotations

Collaborative video annotation is widely researched in TEL with small groups of learners in which they can easily follow all changes that have been done with the video lecture (Hofmann, Boettcher, & Fellner, 2010). In MOOCs with massive number of learners, however, this set of annotations and comments might become very large. The requirements elicitation for an effective collaborative video annotation tool in a MOOC environment were collected through literature review, analyzed existing video annotations systems, conducted a survey, and interviewed potential users.

[10] Parts of this Chapter have been published in:

Yousef, A. M. F., Chatti, M. A., Danoyan, N., Thüs, H., & Schroeder, U. (2015b). Video-Mapper: A Video Annotation Tool to Support Collaborative Learning in MOOCs. Proceedings of the Third European MOOCs Stakeholders Summit EMOOCs 2015. pp. 131-140.

Yousef, A. M. F., Chatti, M. A., Schroeder, U., & Wosnitza, M. (2015d). A usability evaluation of a blended MOOC environment: An experimental case study. *The International Review of Research in Open and Distributed Learning*, 16(2).

Video annotation can have various forms of attaching a note, comment, explanations, and presentational mark-up attached to a video (Rich, & Hannafin, 2009). In a VBL context, annotation refers to the additional notes added to the video without modifying the resource itself, which aid in searching, highlighting, analyzing, retrieving, and providing feedback (Khurana, & Chandak, 2013). Moreover, a video annotation provides an easy way for discussion and reflection on the video content (Schroeter et al., 2003; Wang et al., 2007). Several attempts have been made to explore the potential of video annotation methods to increase the interactivity in VBL environments for various purposes. In this section, we analyze the existing video annotations tools and summarize their applicability and limitations and point out the main differences to our L^2P-bMOOC platform.

The following seven video annotation systems were selected for this study analysis due to their particular focus on the collaborative annotation of video content. VideoAnnEx MPEG-7 was implemented by IBM as a collaborative video annotation tool that allows users to semi-automatically annotate video content with semantic descriptions (Lin, Tseng, & Smith, 2003). The center for new media teaching and learning at Columbia University developed the Video Interaction for Teaching and Learning (VITAL) tool that enables learners to view, analyze, and communicate ideas by creating anchors or place holders as video hyperlink references. Then, teachers linked these hyperlinks within their video lectures (Preston, Campbell, Ginsburg, Sommer, & Moretti, 2005). Theodosiou, et al. (2009), developed MuLVAT as a multi-level video annotation tool based on XML dictionaries that allow users to attach semantic labels to the video segments. WaCTool is a collaborative synchronous video annotation for increasing the communication and sharing resources in a peer-to-peer-based learning environment (Motti, Fagá Jr, Catellan, Pimentel, & Teixeira, 2009). RMIT University developed a media annotation tool (MAT) that allows videos to be uploaded and annotated online. Each annotation is then marked with a specific color along the video timeline (Colasante, 2011). The Harvard University's Collaborative Annotation Tool (CATool) was developed and integrated with Harvard University's learning management system Course iSites that gives teachers as well as students the ability to highlight points of interest and enables discussions through text or media annotations (Harvard University, 2012). The Collaborative Lecture Annotation tool (CLAS) is a Web-based system for annotating video content that also includes a learning analytics component to support self-regulated learning (Mirriahi, & Dawson, 2013).

According to Döller and Lefin (2007), each system was analyzed according to the low-level features (e.g. color, shape, annotation panel, video controls, discussion panel) as well as the high-level features (e.g. object recognition, collaborative annotations, and structured organization of annotation). A summary of the analysis results and a comparison with the L^2P-bMOOC are presented in Table 7. This analysis shows that all of these tools support the basic features of video annotation, namely providing annotation panel, video controls, viewing area, custom annotation markers, and external discussion tools e.g. wiki, blog, chat. Only CATool and CLAS are providing more advanced features, such as social bookmarking and collaborative discussion panels. Additionally, the lack of integration between these tools and learning management systems or MOOCs makes their usage unpractical and out of context.

Table 7: Summary of the video annotation systems analysis

Functionality	System	**VideoAnnEx**	**VITAL**	**MuLVAT**	**WaCTool**	**MAT**	**CATool**	**CLAS**	**L²P-bMOOC**
Low-Level Features	Provide annotation panel, where learners can enter specific notes for the video lecture.	✓	✓	✓	✓	✓	✓	✓	✓
	Provide full video controls e.g. play, stop, loop, volume.	✓	✓	✓	✓	✓	✓	✓	✓
	Provide video viewing area.	✓	✓	✓	✓	✓	✓	✓	✓
	Allow learners to define custom annotation markers.	✓	✓	✓	✓	✓	✓	✓	✓
	Support safety and privacy by providing login identity.	✓	-	-	-	✓	✓	✓	✓
	Time line marker.	-	-	-	-	✓	✓	✓	✓
	Provide external discussion tools e.g. wiki, blog, chat.	✓	✓	✓	✓	✓	✓	-	✓
	Assign descriptive annotation list.	✓	-	✓	-	-	-	-	-
	Support automatic shot detection.	✓		✓	-	-	-	-	-
High-Level Features	Provide different ways for annotations filtering mechanism.	-	-	-	-	(✓)	-	-	✓
	Provide structured dictionaries for annotations.	-	-	✓	-	-	-	-	-
	Support collaborative annotations.	-	-	-	(✓)	✓	✓	✓	✓
	Support collaborative discussion panel.	-	-	-	-	-	✓	✓	✓
	Provide links to related data e.g. Pdf, PPT, lecture note.	-	-	-	✓	-	✓	✓	✓
	Provide video fragmenting tool e.g. cutting option.	-	-	-	-	-	-	-	✓
	Provide time line rang e.g. start and ending time for each annotation.	-	-	-	-	-	-	-	✓
	Provide social bookmarking.	-	-	-	-	-	✓	✓	✓
	Support search mechanism for annotations and comments.	-	-	-	-	-	-	-	✓
	Provide a rating system e.g. like and dislike, star rating.	-	-	-	-	-	-	-	✓
	Provide structured organizational annotation methods e.g. mind-maps.	-	-	-	-	-	-	-	✓
	Enable integratin in Learning Management Systems (LMS) or MOOCs.	-	-	-	-	-	✓	-	✓

Legend ✓ Completely supported (✓) Partly - Not supported

As compared to these tools, L²P-bMOOC is a new approach of representing and structuring video materials where videos are collaboratively annotated in a mind-map view. The social bookmarking, discussion threads, rating system, search engine, and ordering mechanisms for annotations were built into L²P-bMOOC to support a more effective self-organized and network learning experience in a bMOOC environment.

4.2 L²P-bMOOC Requirements

L²P-bMOOC design process was started by analyzed the existing collaborative video annotations systems to identifying which functionalities they have in common, which functionalities were most frequently used, and what are the additional functionalities that are still required to foster student-centered and collaborative bMOOCs as presented in the prior section.

In addition to that an Interactive Process Interviews (IPI) was conducted with target users to determine which functionalities they are expecting from a collaborative video annotation tool (Yin, 2003). These interviews involved three female and six male students who were between the ages of 21 and 28 years and all of them had prior experience with VBL. The most important point which stands out from this IPI is that learners focus more on specific sections of the video which contain concepts that they find interesting or difficult to understand, rather than the entire video.

In the second part of the interview session, respondents were asked to tell their opinion about using a mind-map as a structured method to view the video lecture augmented by collaborative annotations. They expressed a positive feedback and saw it as a useful addition for their learning that could help them to see quick overviews of the whole video-based lecture. Some of them also noted that the collaborative features of the tool would encourage them to share knowledge and learn from their peers, thus making the overall process more engaging. Afterwards, users were asked to suggest other possible features that they would need in such an environment. The proposed ideas and potential features were visualized as rough sketches which eventually evolved into a final paper prototype, as depicted in Figure 25.

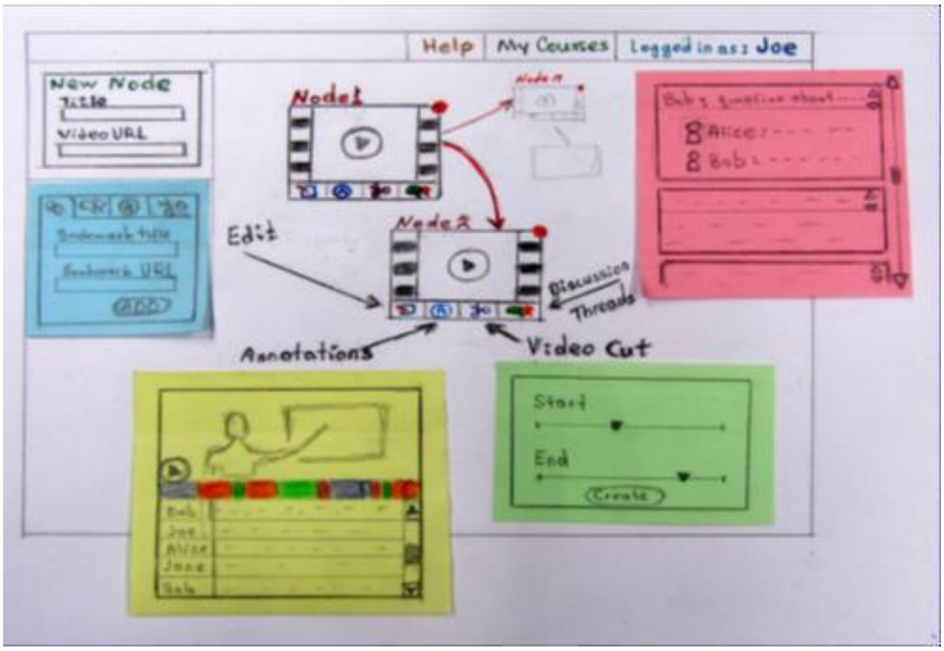

Figure 25: L²P-bMOOC Paper Prototype (Danoyan, 2013)

Based on the design criteria collected in Table 6 and the user interviews, whose results are derived a set of user requirements to support blended learning in MOOCs through collaborative video annotation, as summarized below:

- Support the creation of *video node maps* that correspond to the criteria "Providing opportunities for students to become more self-organized" in Table 6. The tool should let users organize subtopics of each lecture in a map-based form where each node contains a specific video corresponding to a lecture section or the whole lecture itself.
- Support *video fragmenting mechanism*: The tool should provide possibility to create new video nodes by clipping a certain section from the original video. This feature is aimed to facilitate learners' practice of viewing only specific sections of complete lectures. This requirement is related to the criteria "use short video clips".
- Provide *collaborative video annotation features*: In relation to the criteria "support collaborative learning among students", learners should be able to annotate sections of interest in the video and reply to each other's entry. The annotation mechanism should also incorporate an interactive timeline which visualizes all existing annotations with different colors, shapes or icons depending on the type of the annotation. Sample types could be question or related material suggestion that explains a specific concept in the video in more detail
- *Encourage active participation*, learner interaction and collaboration through collaboration features, such as social bookmarking, discussion threads, and voting/rating mechanisms
- Provide a *search function* as well as a filtering/sorting mechanism (based e.g. on adding date, rating, or number of replies each annotation received) for the video annotations. This would help particularly in cases when the videos have a large number of annotations, which is expected in a MOOC environment.
- Provide an *intuitive user interface*: One of the most important objectives of our project was to achieve interface simplicity and ease of use. This factor plays a crucial role for successful tool usage and user satisfaction. The design of our tool has thus to take usability principles into account and go through a participatory design process.

4.3 L²P-bMOOC Implementation

Driven by the wish to enhance bMOOCs environment with collaboration and interaction means, L²P-bMOOC provides the opportunity to better organize the course content and supports collaborative learning via several social interaction. In the ensuing sections, L²P-bMOOC is described with an eye on the implementation details. A presentation of the technologies used in the implementation of L²P-bMOOC will be followed by a detailed description of the different modules and their underlying functionalities.

4.3.1 Technologies

The software prototype uses multiple JavaScript frameworks and the *Node.js* platform for implementing the application's client-side and server-side logic. The main application design paradigm underlying our system is the Model View Presenter (MVP) pattern which has been realized using the *Backbone.js* framework. Backbone provides clear separation of application's data and its presentation organizing the code properly for flexibility and future reuse. In order to simplify client side scripting and to make the interface more appealing the popular *JQuery* and *JQuery UI* libraries were used for easy DOM element manipulations and common effects, animations and widgets (Yousef et al., 2015b).

The open source JsPlumb visualization library has been used for creation, deletion and manipulation of all map connections that are represented in SVG vector image format. For providing the interactive timeline feature that displays an overview of video annotations, our tool uses the open source Timeline component of CHAP Links Library that is developed as a Google Visualization Chart in JavaScript. In order to realize the cut functionality of our application we have utilized the W3C Media Fragments URI specification that addresses temporal and spatial media fragments in the Web using URIs (Troncy, Mannens, Pfeiffer, & Van Deursen, 2012; Danoyan, 2013).

The server-side technology *Node.js* was chosen for its event-driven, non-blocking I/O model that produces fast and scalable applications. The *Socket.IO* library provides real time editing features to the application based on WebSockets as main communication protocol. The authentication middleware *Passport.js* library establishes persistent login sessions for each client. MongoDB stores the map content as JSON-like documents which makes the application scalable, performant and highly available.

The application consists of a number of HTML pages. These pages communicate with the server using the Node.js platform. More precisely, the Node.js platform handles incoming user requests and communicates with a Mongo database using Mongoose modeling environment.

User interaction with the system begins at the login page (Login.html). This page authenticates users, and it communicates with the server via AJAX calls. Once a user is authenticated, a session-based Web Socket connection is established with the server. The user then is redirected to the main application page (Editor.js). An external JavaScript file (Editor.js) contains the client side scripts that define the application's Model, Views, Collections and a set of helper functions. All application views correspond to a template defined in the Editor.html file which is used to render the content of the view's model. Whenever the user interacts with the UI, corresponding events are triggered in respective views and a suitable response is generated by the listener functions which in turn re-render the DOM elements accordingly. The listener functions also handle the communication with server for all data manipulations. Apart from listening to events coming from DOM elements, Views also bind listeners on their models. This help to synchronize server content and to achieve real time collaborative editing. Figure 26 illustrates the operation at the client-side. To avoid clutter, the figure does not include all existing views and relationships. Instead, it displays only the main components. For instance, separate views and models exist for available courses and the hierarchical list of courses are displayed and managed using respective modules. In addition, all Views have their respective DOM elements, listen to their events, and manipulate the application behavior accordingly. However, some connections are omitted for the sake of readability (Danoyan, 2013).

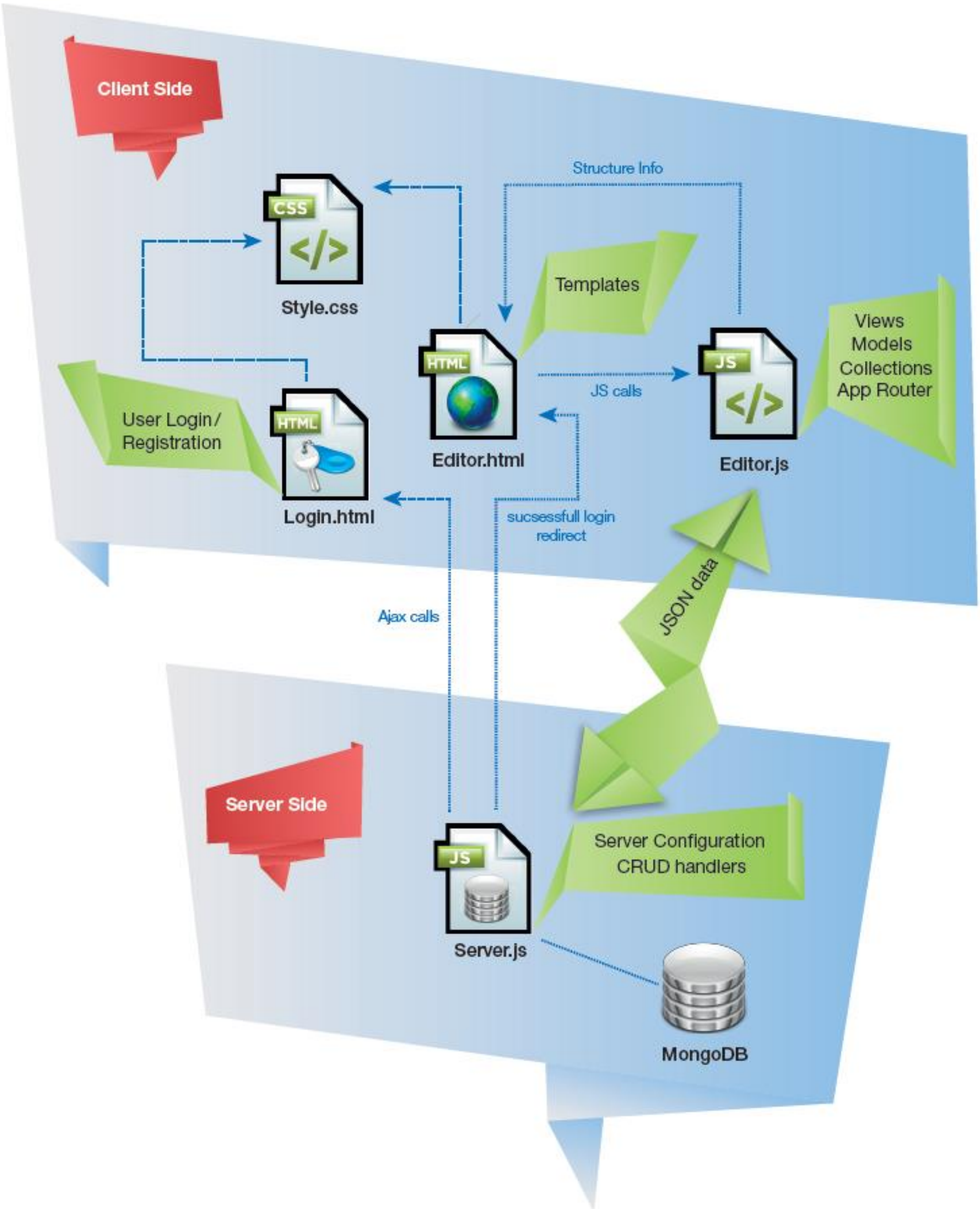

Figure 26: System component (adapted from Danoyan, 2013)

As soon as a user logs into the system, the Application router creates new instances of main Collections and binds them to their Views. As user selects a subject, the corresponding collection is fetched from the server and rendered on canvas. The latter is realized by creating a new Node View for each collection's node model and calling its render function. Node Views are used either when the user interacts with maps or when he/she makes changes to model's main attributes (title, connection, position change, etc.). The users are delegated to other Views if they select features that represent another module. Examples of such views, as shown in Figure 27, include: bookmarks, threads, video related actions or general editing mode that allows the user to change model properties from the sidebar (Danoyan, 2013).

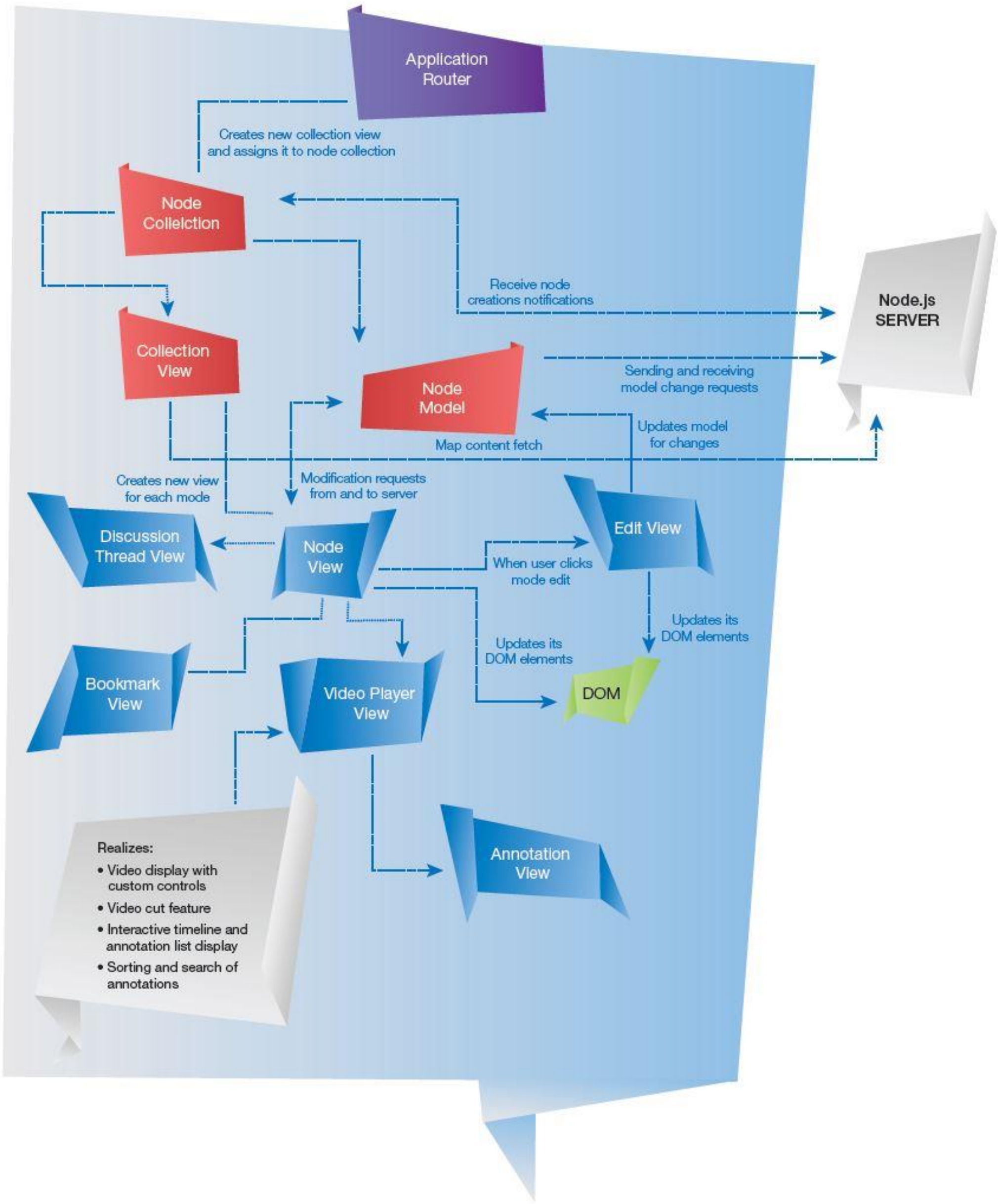

Figure 27: System Architecture: Simplified illustration of interaction flow of main client-side components (adapted from Danoyan, 2013)

4.3.2 Realization

Figure 28 illustrates simplified structure of Video Player views responsible for video related features. The main components of the L^2P-bMOOC will present in the next sections in more details.

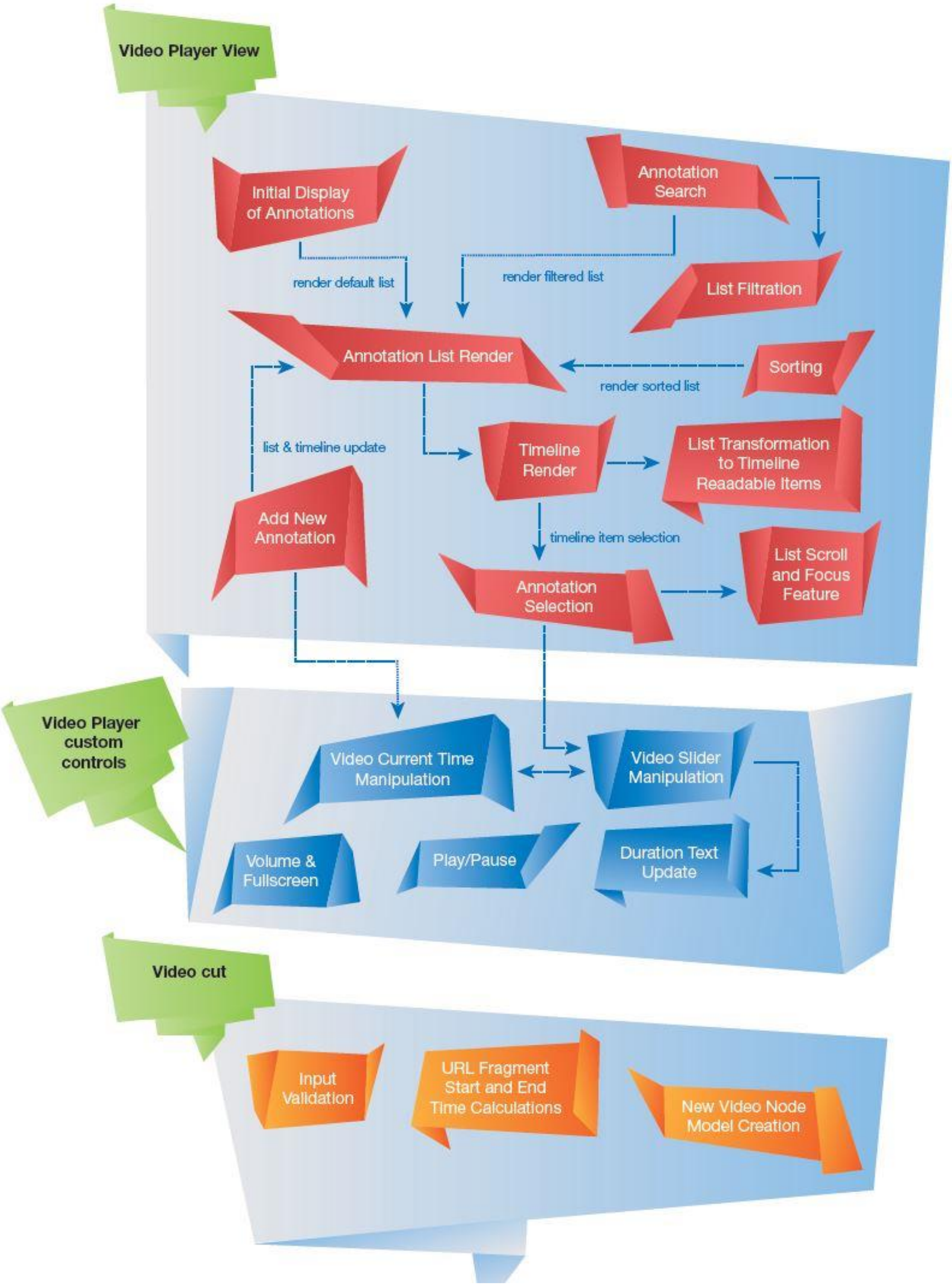

Figure 28: Realizing video related functionalities (adapted from Danoyan, 2013)

The workspace of L²P-bMOOC consists of an unbound canvas representing the video map structure of the lecture, a course selection section, and a sidebar for new video node addition and editing of video properties, as shown in Figure 29. The drop down list of courses shows available subjects and subtopics which correspond to course lectures. To establish connections between map nodes, the learners can simply drag the arrow icon of the source element and drop it on target nodes.

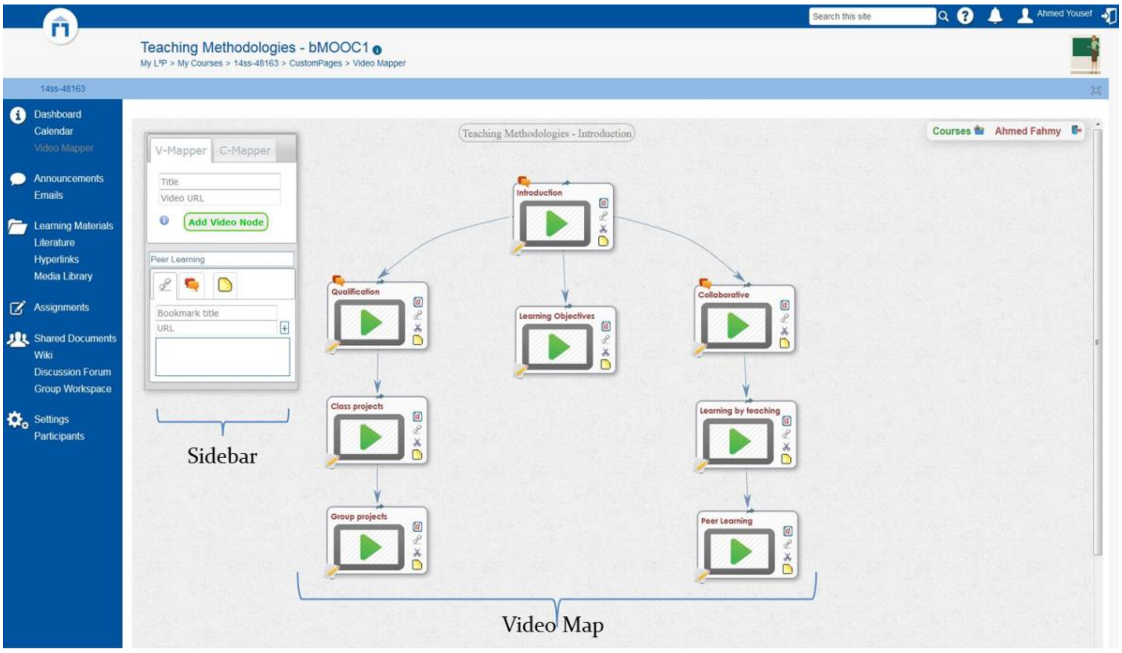

Figure 29: L²P-bMOOC Workspace (Yousef et al., 2015d)

Possible actions on a video node include video annotations, video clipping, social bookmarking, and discussion threads as illustrates in Figure 30.

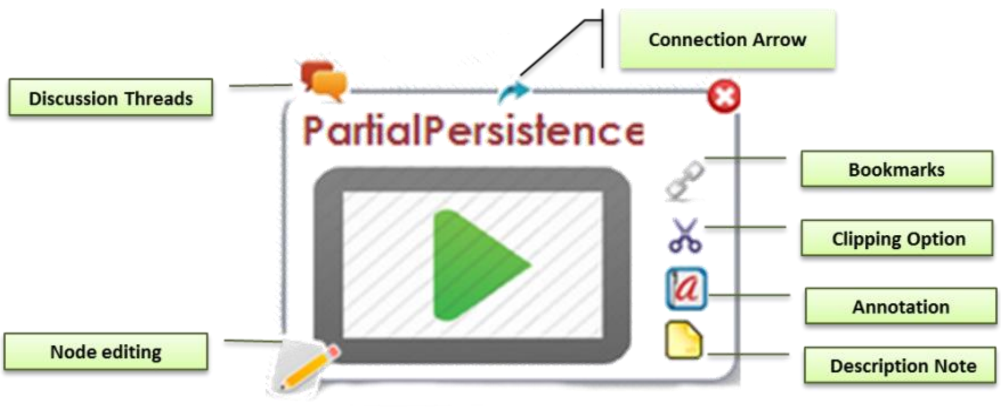

Figure 30: Actions on a Video Node in L²P-bMOOC (Yousef et al., 2015b).

Video Annotations

The annotation section of video nodes is displayed in a separate layer above the main page and can be opened by clicking the “Annotation icon @” attached to map nodes. It consists of three main blocks: Interactive timeline, list of existing annotations and creation form for new annotations (see Figure 31). The interactive timeline visualizing all annotations is located right under the video and is synchronized with the list of complete annotations. By selecting timeline items users can watch the video directly starting from the part to which the annotation points to. The timeline range corresponds to video duration and can be freely moved and zoomed into. Timeline items also include small icons that help to distinguish three annotation types: Suggestion, Question and Marked Important.

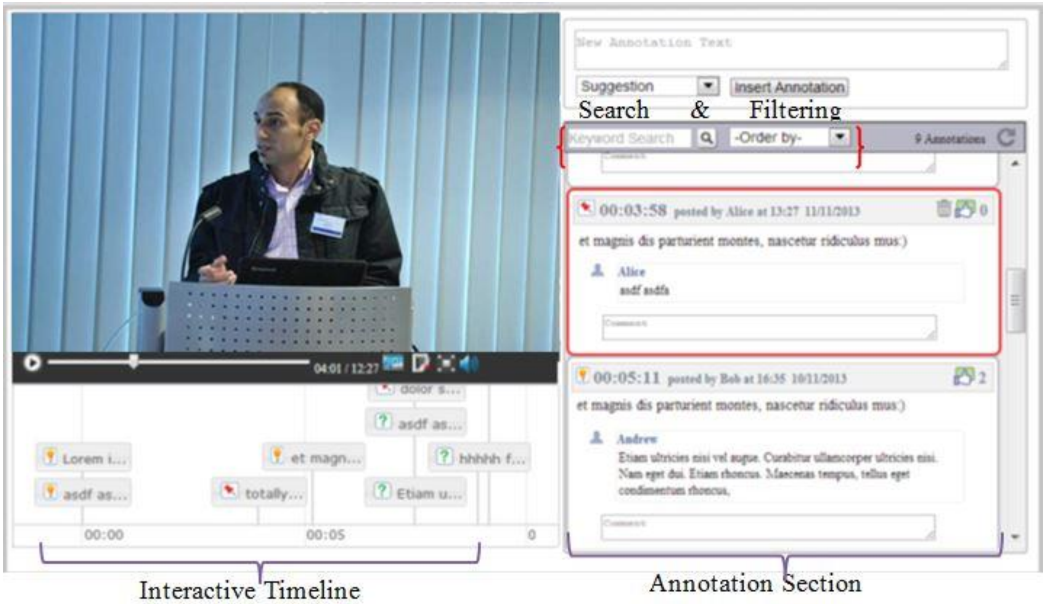

Figure 31: L²P-bMOOC Video Annotation Panel (Yousef et al., 2015d)

Moreover, learners can adjust their own learning processes according to their points of interest and discuss with text or attaching links of relevant materials and discussion threads. Learners also, can insert new annotations while the video is in play mode at the current playback position. Furthermore, if learners believe the annotation contains an interesting or important note they have the option to ”Like” it and later filtering items based on the number of likes. The “Trash” icon situated on top right corner of annotations is used to remove it. However, each item can be deleted only by its author.

Search and Sort Functionalities

Due to the long list of existing annotations in MOOC context, learners can perform searching and sorting actions. By entering a specific keyword, user name or annotation type, users can search for items in the list and a set of matching items will be drawn along with updated interactive timeline. Sorting can be done based on date, time on video, rating or number of replies each annotation received.

Video Clipping

In order to respond to the learners' interest in a specific section of the video lecture, L^2P-bMOOC provides a clipping option that creates a new node representing a specific segment of the video. Clipping videos is supported for both complete and already clipped videos as seen in Figure 32.

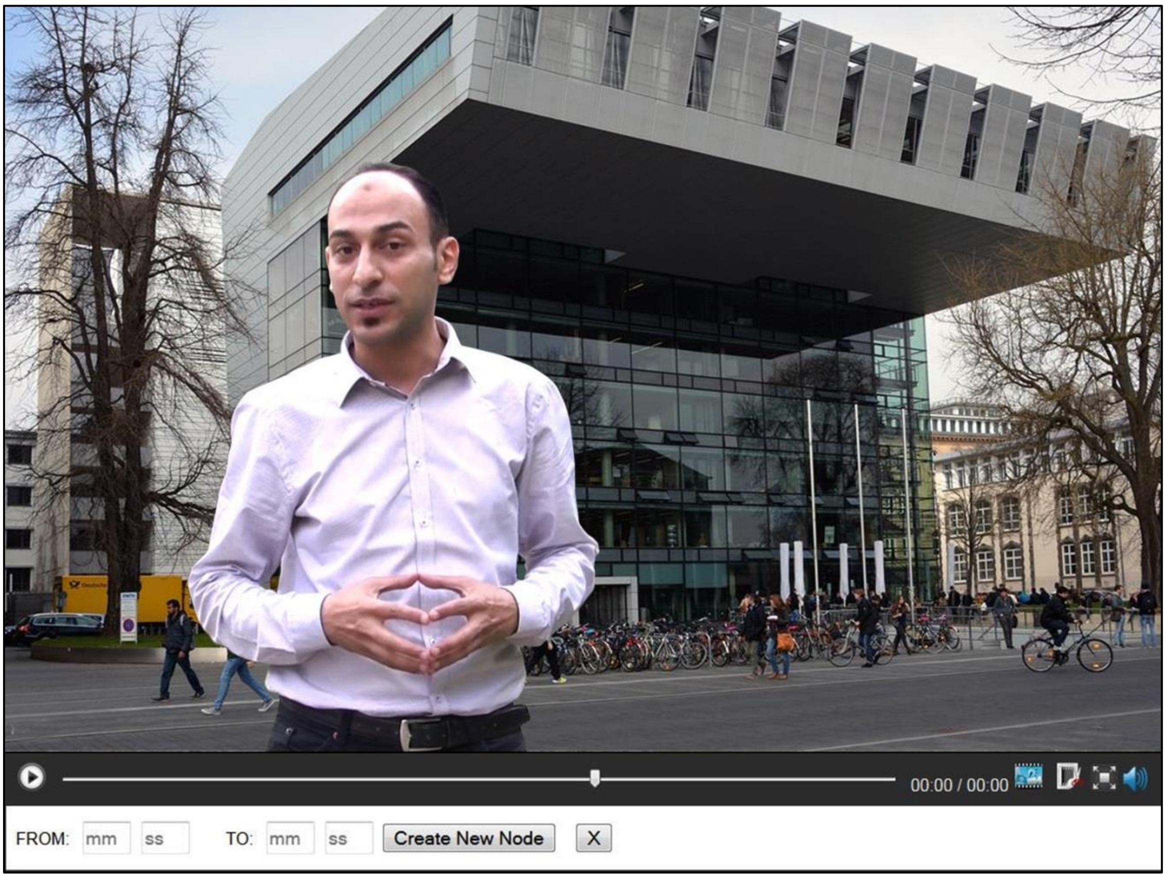

Figure 32: Creation of new nodes using particular portion of original video in L^2P-bMOOC

Bookmarks and Discussion Threads

The options of attaching links of relevant materials and discussion threads are applicable for the original video lecture as well as the video nodes. Bookmarks represent online resources that can be added by all course participants and ordered based on their rating. When a learner votes on an article attached in the bookmarks he does it for the benefit of his classmates. Therefore, voting on bookmarks serve as a quality indicator of the learning material that added by course participants. They can be displayed in a separate *JQuery Lightbox* appearing on top of the application page as can be seen in Figure 33.

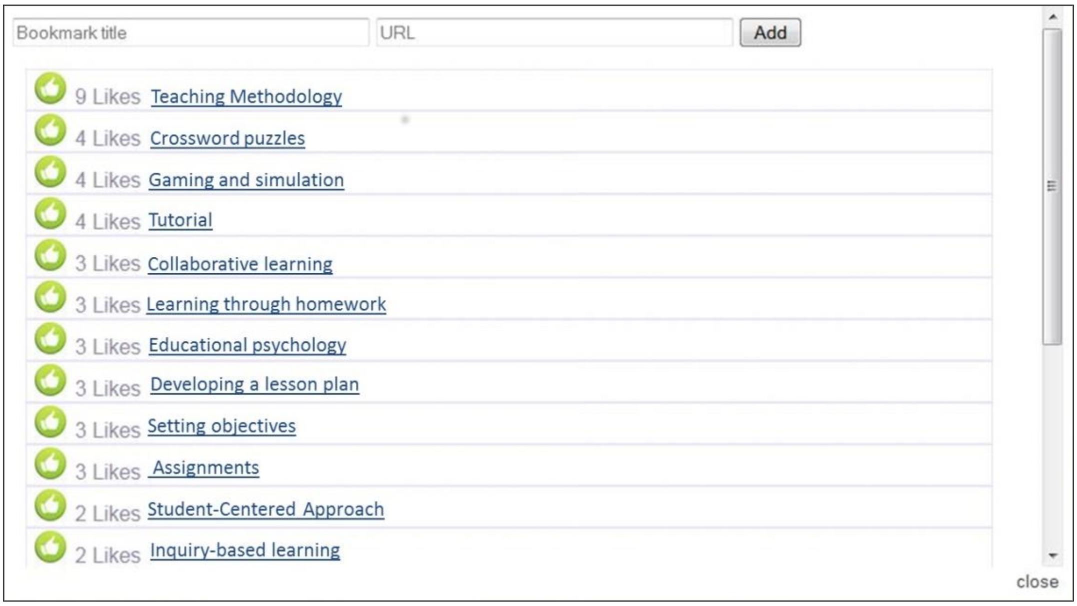

Figure 33: List of bookmarks

In contrast to annotations, discussion threads do not refer to any specific time in the video and may be used by course participants to discuss questions or suggestions relating to the general concept that the video node represents as shown in Figure 34.

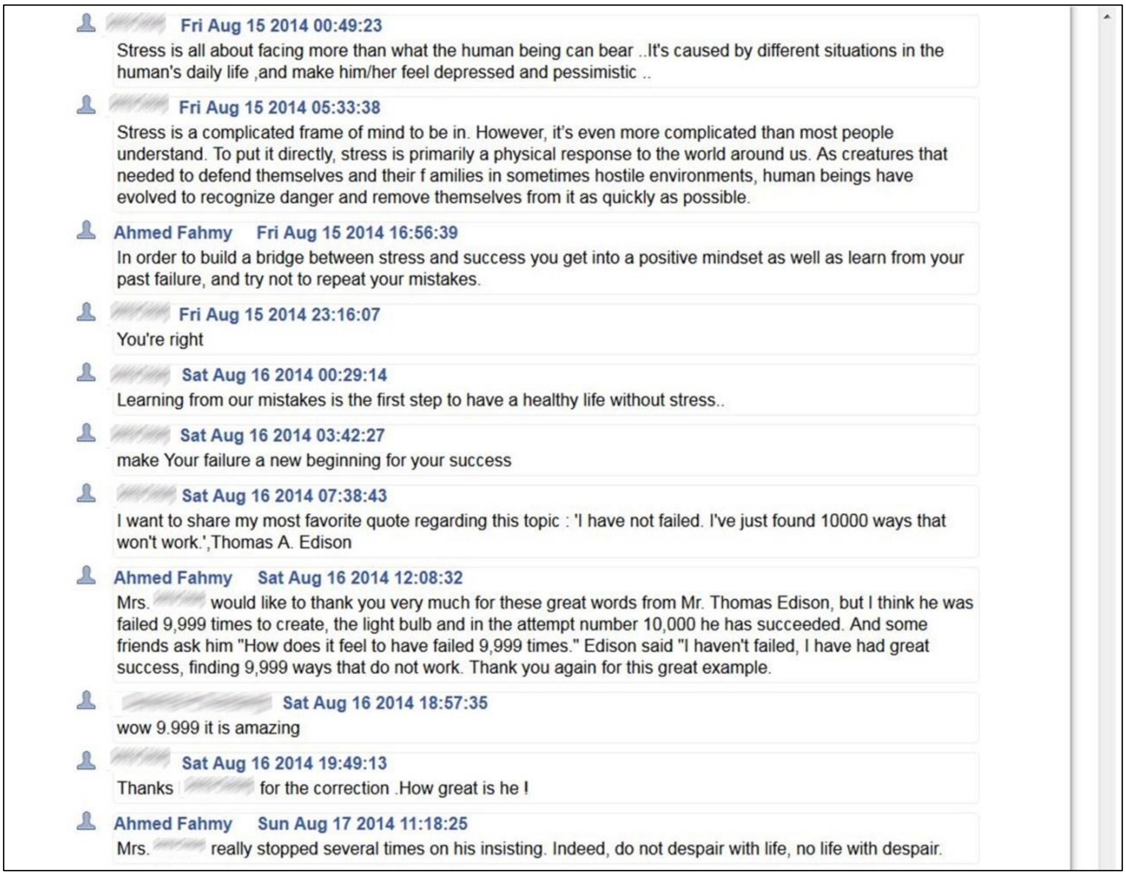

Figure 34: Discussion Thread view

Node Editing

L²P-bMOOC supports in-place editing of node components, such as title, bookmarks, discussion threads and description note. Users can simply use the edit icon appearing in lower-left corner of the node (review Figure 30). After clicking it, the toolbox in the sidebar gets filled with the components and some modifications can be done as presents in Figure 35. In order to add new connection between two nodes users have to drag from the small arrow icon and drop on target node. Removal of the connection is done by clicking on it and confirming the deletion in displayed pop-up.

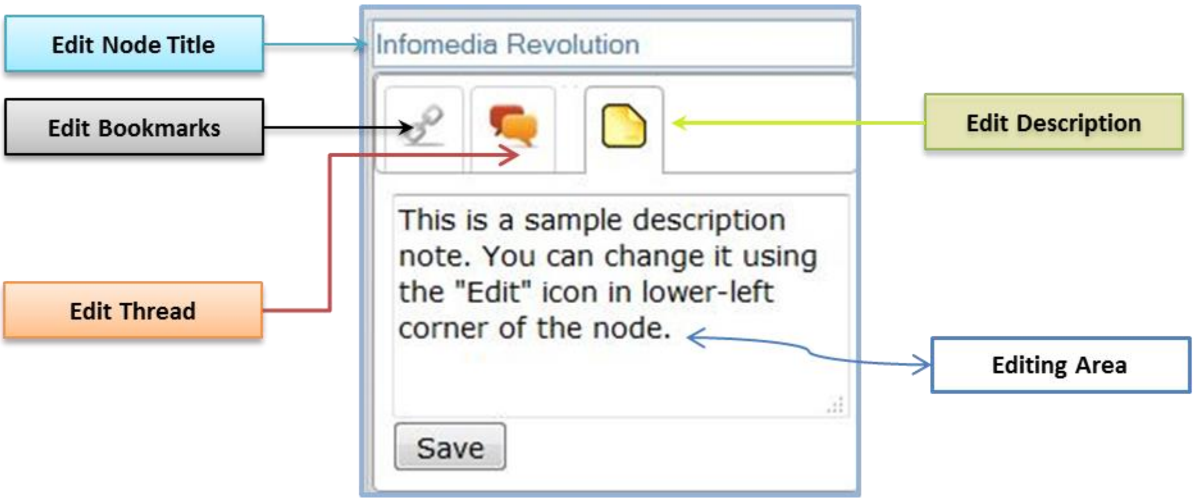

Figure 35: Node Editing in L²P-bMOOC

4.4 L²P-bMOOC Evaluation

In this dissertation, the L²P-bMOOC platform was used to offer a bMOOC on “Teaching Methodologies” at Fayoum University, Egypt in co-operation with RWTH Aachen University, Germany. This study conducted a thorough evaluation of this bMOOC to gauge its usability and effectiveness. To achieve this, a user study was performed with the aim to gather quantitative and qualitative data from participants’ experience in this course. This evaluation employed an evaluation approach based on Conole’s 12 dimensions rubrics, ISONORM 9241/110-S as a general usability evaluation, and a custom effectiveness questionnaire reflecting the various goals of bMOOC participants.

4.4.1 Conole’s 12 Dimensions Rubrics

Gráinne Conole developed a new classification for MOOCs as part of the EFQUEL MOOC Quality Project (Conole, 2013). Conole’s evaluation rubric consists of the 12 dimensions, namely, level of openness, degree of massiveness, the amount of use of multimedia, the use of communication tools, the degree of collaborative learning, the type of learner pathway (i.e. learner-centered learning against teacher-centered learning), quality assurance, amount of reflection, assessment strategies, learning model (i.e. formal and informal), autonomy, and diversity (Conole, 2013). We evaluated the bMOOC against these 12 dimensions by following a three levels scale (i.e. low, medium, high), as shown in Figure 36.

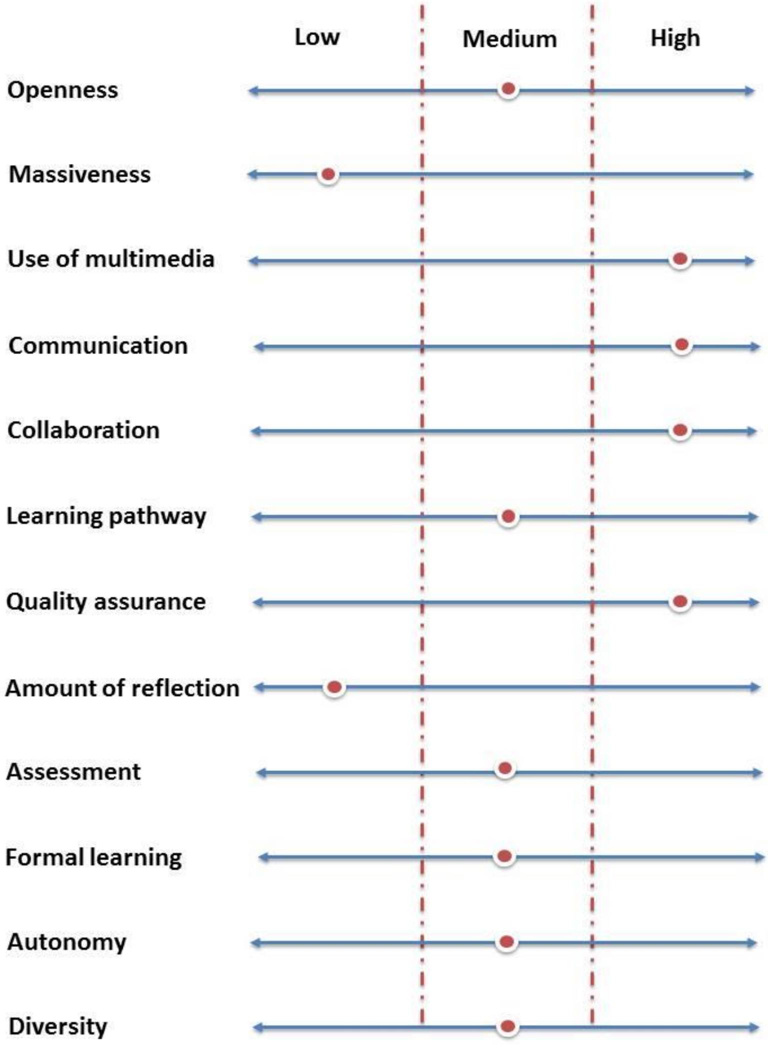

Figure 36: Evaluation of the bMOOC based on Conole's 12 Dimensions Rubrics (Yousef et al., 2015d)

The evaluation above shows the main characteristics of the "Teaching Methodologies" bMOOC. The course was offered through the L^2P-bMOOC platform hosted at RWTH Aachen University. It took place during the summer semester 2014 with duration of eight weeks. It was offered both formally to students from Fayoum University and informally with open enrollment to anybody who is interested in teaching methodologies. The teaching staff is composed of one professor and one assistant researcher from Fayoum University as well as one assistant researcher from RWTH Aachen University. A total of 128 participants completed this course. 93 are formal participants who took the course to earn credits from Fayoum University. These participants were required to complete the course and obtain positive grading of assignments. The rest were informal participants who didn't attend the face-to-face sessions. They have undertaken the learning activities at their own pace without receiving any credits. The teaching staff provided 6 video lectures and the course participants have added 27 related videos. This course was taught in English and participants were encouraged to self-organize their learning environments, present their own ideas, collaboratively create video maps of the lectures, and share knowledge through social bookmarking, annotations, forums, and discussion threads.

4.4.2 General Usability Evaluation (ISONORM 9241/110-S)

The ISONORM 9241/110-S questionnaire was designed based upon the International Standard ISO 9241, Part 110 (Prümper, 1997). We used this questionnaire as a general usability evaluation for the L^2P-bMOOC platform. It consists of 21 questions classified into seven main categories. Participants were asked to respond to each question scaling from (7) a positive exclamation and its mirroring negative counterpart (1). The questionnaire comes with an evaluation framework that computes several aspects of usability to a single score between 21 and 147. A total of 50 questionnaires were completed. The table below illustrates the summary of the ISONORM 9241/110-S usability evaluation.

Table 8: ISONORM 9241/110-S Evaluation Matrix (N= 50).

Factor	Aspect	$\bar{x}$	Σ
Suitability for tasks	Integrity	4.8	14.4
	Streamlining	5.1	
	Fitting	4.5	
Self- descriptiveness	Information content	4.9	14.5
	Potential support	4.8	
	Automatic support	4.8	
Conformity with user expectations	Layout conformity	5	14.5
	Transparency	4.8	
	Operation conformity	4.7	
Suitability for learning	Learnability	5.2	13.9
	Visibility	4.4	
	Deducibility	4.3	
Controllability	Flexibility	4.9	13.9
	Changeability	4.5	
	Continuity	4.5	
Error tolerance	Comprehensibility	2.4	7.4
	Correct ability	2.5	
	Correction support	2.5	
Suitability for individualization	Extensibility	4.8	14.7
	Personalization	5	
	Flexibility	4.9	
ISONORM score			**93.3**

The majority of respondents were in the 18-24 age range. Mostly are female (90%). Participants have a high level of educational attainment: 70% of participants are Bachelor students at Fayoum University and 30% have a Bachelor's degree or higher. They also have an experience with TEL courses. Nearly 75% reported that they attended more than two TEL courses.

The overall ISONORM 9241/110-S score from the questionnaires was 93.3, which translates to “Everything is all right! Currently there is no reason to make changes to the software in regards of usability” (Prümper, 1997). In particular, suitability for individualization category was rated the best. This indicates that the participants had no issues with the adaptation of the bMOOC environment to fit their needs and preferences. One unanticipated finding was that the error tolerance category was rated the worst with a sum of 7.4, which indicates that participants had some issues in handling the system errors.

In general, the ISONORM 9241/110-S evaluation results reflect a user satisfaction with the usability of the L^2P-bMOOC platform. There is, however, still room for further improvement, especially in the error tolerance category. A possible enhancement of L^2P-bMOOC would be to add a help guide (e.g. FAQs and system entry errors) as well as a video tutorial explaining the different features of the platform to ensure a better learning experience.

4.4.3 Effectiveness Evaluation

As stated above, learners have different goals when participating in MOOCs. The result of our study on diversity in MOOCs was a set of eight clusters of MOOC stakeholder perspectives. These include blended learning, flexibility, high quality content, instructional design & learning methodology, lifelong learning, network learning, openness, and student-centered learning. The effectiveness evaluation in this paper aims at assessing whether these goals have been met in the offered bMOOC.

There have been several attempts to evaluate the effectiveness of MOOCs. However, most of these studies only focus on a particular aspect of MOOCs. For instance, from a pedagogical perspective, Fini (2009) and Siemens (2013) focused on the effectiveness of cMOOCs for enhancing learning in the digital age. McAuley, Stewart, Siemens, & Cormier (2010) as well as Ostashewski and Reid (2012) focused on the effectiveness of the MOOC design, from a technical perspective. The study at hand aims at a comprehensive evaluation of MOOCs from different perspectives. A multi-level effectiveness evaluation of the bMOOC was applied that considers the different patterns of MOOC stakeholder perspectives. An online questionnaire was designed to gauge whether the different goals of the bMOOC participants have been achieved, as shown from Table 9 to Table 16. The content of this questionnaire is based on relevant literature (Shee & Wang, 2008; Chang, 1999; Tobin, 1998). A 5-point Likert scale was used from (1) strongly disagree to (5) strongly agree.

The questionnaire of this evaluation is concerned with a set of items regarding to each cluster. In order to ensure the relevance of these questions, this questionnaire was sent to a small panel of 5 learners as well as 5 learning technologies experts. They were asked for their opinions and suggestions for revising the questionnaire. Their feedback included a refinement of some questions and shifting questions to other clusters. The revised questionnaire was then given to the bMOOC participants. The following sections present the results of the effectiveness evaluation of the bMOOC.

Internal Course Diversity

First of all, participants were asked a general question about their purpose of participation in the Teaching Methodologies bMOOC, based on the eight clusters of MOOC stakeholder perspectives outlined above. The participants had the possibility to select more than one answer. Figure 37 shows the summary of their responses. The results reflect diversity in the participants' perspectives.

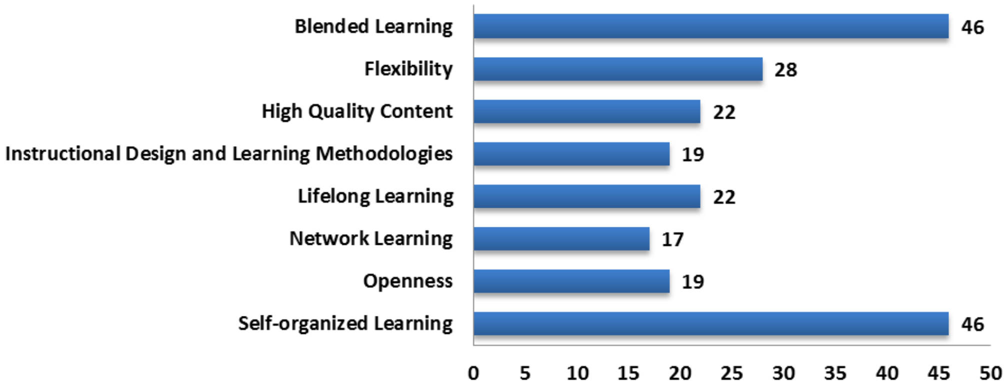

Figure 37: What is the Purpose of Your Participation in This Course? (N= 50) (Yousef et al., 2015d)

Blended Learning

The design of blended learning environments bringing together face-to-face and online learning can be a flexible and effective model to enhance classroom learning and to improve relationships with teachers and peers (Bruff et al., 2013). The course participants were asked to watch the lecture videos online and use the L^{2}P-bMOOC platform to collaboratively annotate and discuss the lecture content. The face-to-face sessions are then used to elaborate more on the concepts presented in the video lecture, discuss practical aspects of the course, and provide direct feedback to the group projects.

Table 9 lists the 5 evaluation items of the blended learning category. The agreeability mean of the respondents is quite high at 4.4. Item 2 "Bringing together face-to-face and online learning increases my motivation to share and discover new ideas" obtained the highest mean score of 4.5, which indicates that the bMOOC increased the course participants' motivation. The participants reported that the permanent coaching and scaffolding provided by the teachers, as well as the continuous direct feedback from other course participants had positive impact on their motivation in the course. Moreover, the face-to-face interactions with participants with diverse backgrounds and interests increased their engagement and trust. This reveals the importance of the human factor in bMOOCs.

Table 9: Descriptive Results of Blended Learning (N=50).

No	Blended Learning		
	Evaluation Item	$\bar{x}$	σ
1	Bringing together face-to-face and online learning helps me to improve my academic achievements outcome.	4.3	0.74
2	Bringing together face-to-face and online learning increases my motivation to share and discover new ideas.	4.5	0.76
3	Bringing together face-to-face and online learning enables me to accomplish tasks more quickly.	4.4	0.73
4	Blended learning approach can be used to supplement traditional classroom approach.	4.4	0.70
5	I felt a sense of satisfaction about this blended learning environment.	4.3	0.58
Blended Learning Average		**4.4**	**0.70**

This is consistent with the findings of Bruff et al. (2013) who pointed out that bMOOCs can improve the learning outcome, because participants in bMOOCs can benefit from the opportunities for independent learning, increased engagement and motivation, and flexibility of bMOOCs.

Flexibility

One of the successful factors in MOOCs is flexibility (Mackness et al., 2010).The 6 evaluation items in Table 10 aim at assessing the flexibility level of the bMOOC. Most participants reported a high satisfaction with the diversity of the provided learning materials as well as the ability to access the learning resources at any time and from anywhere.

Table 10: Descriptive Results of Flexibility Level (N=50).

No	Flexibility		
	Evaluation Item	$\bar{x}$	σ
1	I can access the learning activities at any time convenient to me.	4.4	0.63
2	I can access to lectures and learning activities from anywhere.	4.4	0.67
3	The learning environment provides me a wide range of materials that I can choose from.	4.3	0.85
4	I was able to access the learning materials without much difficulty.	4.6	0.70
5	The video mind-map content makes me want to explore the course further.	4.2	0.62
6	The learning environment allows me to focus on the learning activities suitable to me.	4.4	0.79
Flexibility Average		**4.4**	**0.71**

High Quality Content

One of the most important factors to empower and engage learners around the world to participate in MOOCs is the quality of course content (Yousef et al., 2014c). Shee and Wang (2008) pointed out that learners place great value on online courses where the content is well-organized, interactive, the presentation of the subject is clear, and in the right length. The 6 evaluation items in Table 11 aim at measuring the quality of the content in the provided bMOOC. The mean score in this category was 4.4.

Table 11: Descriptive Results of High Quality Content (N=50).

No	High Quality Content		
	Evaluation Item	$\bar{x}$	σ
1	The presentation of the subject content is clear.	4.4	0.74
2	The video-map helps to structure the learning content.	4.5	0.71
3	The interactive video annotations help to improve the quality of the learning content.	4.4	0.86
4	The information that has been presented in the discussions helps me to better understand this course.	4.4	0.86
5	The feedback on my annotations helps me to reflect on the course content.	4.3	0.93
6	Browsing the bookmarked articles on each video-node helps me to better understand the learning content.	4.5	0.73
High Quality Content Average		**4.4**	**0.81**

Most respondents agreed that the course materials and the user-generated content (e.g. mind maps, discussions, annotations, and bookmarks) were very helpful to better understand the course concepts. In particular, browsing highly rated bookmarked articles on each video node and receiving comments and suggestions on the annotations helped to improve the quality of the course content.

Instructional Design & Learning Methodology

Effective instructional design and learning methodology can make bMOOCs more attractive and motivating (Yousef et al., 2015a). Table 12 illustrates the evaluation of the effectiveness of the instructional design and learning methodology used in this bMOOC.

Table 12: Descriptive Results of Instructional Design & Learning Methodology (N=50).

No	Instructional Design & Learning Methodology		
	Evaluation Item	$\bar{x}$	σ
1	The learning objectives are clearly stated in each lecture.	4.2	0.89
2	The scope of the lecture is clearly stated.	4.4	0.84
3	The structure of this course keeps me focused on what is to be learned.	4.5	0.73
4	I always know where I am in the course.	4.4	0.83
5	The various tools in this learning environment are effective.	4.4	0.64
6	I have the possibility to ask my tutor what I do not understand.	4.4	0.83
7	The tutor responds promptly to my queries.	4.2	0.57
8	I can approach the teaching team in this course when needed.	4.6	0.54
9	The assessment in this course enhances my learning process.	4.3	0.53
10	The tutor sends me comprehensive feedback on my assignment.	4	0.95
11	The grading criteria were clearly communicated at the beginning of the course.	4.3	0.73
Instructional Design & Learning Methodology Average		**4.3**	**0.73**

Respondents were generally positive regarding the well-defined objectives, the clear structure, the effective tools, and the teaching assistance offered to support the learning activities in this course. One unanticipated finding was that the tutor feedback on the assignments obtained a relatively low mean score of 4. Possible reasons for this might be the limited time of the teaching team and using only one type of assessment, namely teacher assessment. Indeed, the ability to evaluate a large number of learners in MOOCs is a highly challenging task. It is necessary to go beyond traditional teacher assessment methods and apply open assessment methods that fit better to the bMOOC environments characterized by openness, networking, and self-organization. These include peer-assessment, self-assessment, and e-assessment methods (Yousef et al., 2015d).

Lifelong Learning

Learning is no longer restricted to the formal higher education context. MOOCs are providing a disorganized and unstructured learning model for informal participants. This kind of learning tends to be experimental, spontaneous and free from rigid curricula. There is a wide agreement among MOOC providers and researchers that MOOCs open doors for new opportunities for lifelong learning outside the boundaries of formal educational institutions (Milligan & Littlejohn, 2014; Kizilcec, Piech, & Schneider, 2013; Kop et al., 2011). Several studies on the profile of MOOC participants found that the majority has a Bachelor or a Master degree and in most of the cases the MOOC is used for job (re)training and lifelong learning purposes (Christensen, Steinmetz, Alcorn, Bennett, Woods, & Emanuel, 2013; Kizilcec et al., 2013; Kop et al., 2011). This is quite different in bMOOCs, as the majority of participants take the MOOCs as part of a university credit-bearing course. In our study, only 30% of the course participants are lifelong learners tending to learn through this bMOOC for their personal or professional interest rather than obtaining an official academic degree.

Table 13: Descriptive Results of Lifelong Learning (N=50).

No	**Lifelong Learning**		
	Evaluation Item	$\overline{x}$	σ
1	The course helps me to improve skills required for my (future) job.	4.6	0.69
2	The learning environment encourages me to invite participants from outside the university.	4.3	0.71
3	I will use this learning environment frequently for my continuous learning in the future.	4.6	0.70
4	Courses are delivered at suitable time for professional participants (workers).	4.3	0.80
5	The course content is also suitable for professional participants (workers).	4.5	0.50
6	This learning environment opens new opportunities to advance my knowledge and expertise.	4.4	0.73
Lifelong Learning Average		**4.5**	**0.69**

It can be seen from the data in Table 13, most of the respondents agreed that the course helps them improve skills required for their future job as school teachers and opens new opportunities to advance their knowledge and expertise. This confirms the potential of the bMOOC to support lifelong learning activities. The findings of the current study are consistent with those of Milligan and Littlejohn (2014) who emphasize the important role of MOOCs for opening up, supporting and enabling professional learning, allowing opportunities to link formal and informal learning.

Network Learning

Network learning is important in open and distributed learning environments like bMOOCs (Chatti et al., 2012a). A set of 7 items for the evaluation of the offered bMOOC in terms of collaborative and network learning are shown in Table 14.

Table 14: Descriptive Results of Network Learning (N=50).

No	Network Learning		
	Evaluation Item	$\bar{x}$	σ
1	I can interact with other students and the tutor synchronously and asynchronously.	4.4	0.54
2	I am allowed to create and manage my own group.	4.5	0.82
3	It is easy to work collaboratively with other students involved in a group project.	4.4	0.74
4	The communication tools enhance my interaction and collaboration with my course mates.	4.6	0.54
5	I was supported by positive attitude from my course mates.	4.4	0.86
6	I share what I have learned in this course with others outside of the learning environment.	4.4	0.73
7	The learning environment helps me receive support and feedback from other participants.	4.4	0.88
Network Learning Average		**4.4**	**0.73**

In this category, the high mean average of 4.4 indicates the effectiveness of the bMOOC in supporting network learning. In fact, the participants agreed that the collaboration and communication possibilities offered in L^2P-bMOOC (i.e. group workspaces, discussion forums, live chat, social bookmarking, and collaborative annotations) allowed them to share, discuss, exchange, and collaboratively construct knowledge as well as receiving feedback and support from peers.

Openness

Openness is one of the characteristics in MOOCs. It refers to providing a learning experience to a vast number of participants around the globe regardless of their location, age, income, ideology, and level of education, without any entry requirements, or course fees to access high quality education. Most of the MOOCs on the market are open for participants without any admission requirements and for free. They are, however, not open from a copyright perspective. For instance, Coursera does not permit users to reproduce, retransmit, distribute, or publish any material from its platform. The table below illustrates the high satisfaction of the respondents with the level of openness in the bMOOC. The offered bMOOC does not only enable participants to register for the course for free and without any academic requirements, but also enable them to reuse, revise, remix, and redistribute all course materials as seen fit.

Table 15: Descriptive Results of Openness (N=50).

No	Openness		
	Evaluation Item	$\bar{x}$	σ
1	I register for this course free of charge	4.7	0.47
2	There were no academic requirements for registration.	4.5	0.99
3	The learning material is available for free download.	4.6	0.48
4	This learning environment enables me to adapt the learning material to better meet my needs.	4.6	0.72
5	I can reuse the learning materials from this course to produce my final report assignment.	4.5	0.81
	Openness Average	**4.6**	**0.69**

Self-Organized Learning

One important goal of participation in MOOCs is self-organized learning. bMOOCs can provide a space for learners to be active participants in the learning process and to get mutual support (Chatti, 2010a). Table 16 shows the results of 10 evaluation items to examine how much the bMOOC supports self-organized learning.

Table 16: Descriptive Results of Self-Organized Learning (N=50).

No	Self-Organized Learning		
	Evaluation Item	$\bar{x}$	σ
1	I am allowed to create my own video mind-map.	4.3	0.81
2	I am allowed to work at my own pace to achieve my learning objectives.	4.4	0.60
3	I decide how much I want to learn in a given time period.	4.5	0.68
4	I decide when I want to learn.	4.2	0.78
5	I am aware of the activities of my peers in the course.	2.8	1.11
6	I have the possibility to ask other students what I do not understand.	4.1	0.73
7	I can organize my own learning activities.	4.4	0.64
8	I can learn independently from teachers.	4.3	0.69
9	I was in control of my progress as I moved through the material.	4.4	0.73
10	I can easily keep tracking of all activities (i.e. comments, likes, newly added nodes, etc.) in this course.	2.7	1.33
	Self-Organized Learning Average	**4**	**0.81**

The mean average was 4 which indicate that a majority agreed that the learning environment allowed them to be self-organized in their learning process. In particular, the participants reported that the representation of the lecture in a mind map view and the video clipping feature helped them to learn independently from teachers. The results further confirm that the learning environment encourages participants to work at their own pace to achieve their learning goals and keep them in control of their learning progress. Items 5 and 10 obtained the lowest mean score of 2.8 and 2.7, respectively. This shows that the participants had some difficulties in tracking and monitoring their learning activities and those of their peers. Further improvement should be done to address this important issue. This can be in the form of a learning analytics tool that enables to collect, visualize, and analyze the data from learning activities (e.g. comments, likes, newly added nodes) to support monitoring, awareness, self-reflection, and feedback (Chatti, Lukarov, Thüs, Muslim, Yousef, Wahid, Greven, Chakrabarti, & Schroeder, 2014).

4.5 Summary

The purpose of this chapter was to describe implementation and evaluation approaches to realize L^2P-bMOOC on the basis of the design dimensions, as outlined in chapter 3. The user-centered design method was chosen to develop L^2P-bMOOC, and puts the user at the center of the design process. The implementation started with an approach to annotating video lectures in order to increase the interactivity between learners and video content. Afterwards, the main modules of L^2P-bMOOC were presented, which included: group workspaces, discussion forums, live chat, social bookmarking, and collaborative annotations.

In March 2014 an exploratory case study was conducted, to evaluate the usability and effectiveness of L^2P-bMOOC. This case study used L^2P-bMOOC to offer a bMOOC on "Teaching Methodologies" at Fayoum University, Egypt in cooperation with RWTH Aachen University, Germany. The duration of this bMOOC was eight weeks. In order to gauge the usability and effectiveness of the course, an evaluation approach was employed based on Conole's 12 dimensions rubrics, ISONORM 9241/110-S as a general usability evaluation, and a custom effectiveness questionnaire reflecting the different MOOC stakeholder perspectives. The results of the study revealed a general satisfaction with L^2P-bMOOC in terms of usability and effectiveness.

There was a wide agreement among the participants that offered bMOOC can address the limitations of bMOOCs outlined in Section 3.1. In fact, the participants agreed that the collaboration and communication possibilities offered in L^2P-bMOOC (i.e. group workspaces, discussion forums, live chat, social bookmarking, and collaborative annotations) allowed them to share, discuss, exchange, and collaboratively construct knowledge as well as receive feedback and support from peers. The results further show that a majority agreed that L^2P-bMOOC allowed them to be self-organized in their learning process. In particular, the participants reported that L^2P-bMOOC helped them to learn independently from teachers and encouraged them to work at their own pace to achieve their learning goals.

The study, however, identified two problems concerning assessment and feedback. The participants had some difficulties in tracking and monitoring their learning activities and those of their peers. The second issue that pointed out was the limited ability to evaluate and give effective feedback for their open-ended exercises. Thus, there is abundant room for further progress in determining learning analytics techniques to foster monitoring, awareness, self-reflection, and feedback in bMOOC environments as well as to develop new assessment methods, such as peer-assessment, that reflect the open and massive nature of MOOCs. The upcoming chapters present the improvement that has been done to address these important issues.

CHAPTER 5

Learning Analytics in L^2P-bMOOC

The evaluation of the preliminary model of L^2P-bMOOC that was presented in the previous chapter showed that, the participants had some difficulties in tracking and monitoring their learning activities and those of their peers. Therefore, learning analytics can provide great support to learners in their bMOOC experience. This chapter presents the design process of developing application of learning analytics from a learner perspective to support bMOOC participants through personalization of the learning environment, monitoring of the learning process, awareness, self-reflection, and recommendation. This study also reviews the experience of a case study conducted with real course to evaluate the usability and effectiveness of the learning analytics module in L^2P-bMOOC[11].

5.1 Learning Analytics

Due to the massive nature of MOOCs, the amount of learning activities (e.g. forum posts, video comments, assessment) might become very large or too complex to be tracked by the course participants (Arnold, & Pistilli, 2012; Blikstein, 2011; McAuley et al., 2010). Moreover, in MOOCs it is difficult to provide personal feedback to a massive number of learners (Mackness et al., 2010; Yousef et al., 2015d). Therefore, there is a need for effective methods that enable to track learners' activities and extract conclusions about the learning process in order to improve learning among large groups of participants. This is where the emerging field of learning analytics can play a crucial role in supporting an effective MOOC experience. Learning analytics refers to "the use of intelligent data, learner-produced data, and analysis models to discover information and social connections, and to predict and advise on learning" (Siemens, & Long, 2011).

---

[11] Parts of this chapter have been published in:

Yousef, A. M. F., Chatti, M. A., Ahmad, I., Schroeder, U., & Wosnitza, M. (2015c). An Evaluation of Learning Analytics in a Blended MOOC Environment. Proceedings of the Third European MOOCs Stakeholders Summit EMOOCs 2015. pp. 122-130.

There are many objectives in learning analytics according to the particular point of view of the different stakeholders. Possible objectives of learning analytics include monitoring, analysis, prediction, intervention, tutoring/mentoring, assessment, feedback, adaptation, personalization, recommendation, awareness, and reflection (Charleer, Odriozola, Luis, Klerkx, & Duval, 2014; Chatti, Dyckhoff, Schroeder, & Thüs, 2012a; Leony, Pardo, de la Fuente Valentín, de Castro, & Kloos, 2012; Mattingly, Rice, & Berge, 2012; Slade & Prinsloo, 2013; Yousef, et al., 2014c). Despite the wide agreement that learning analytics can provide value to different MOOC stakeholders, the application of learning analytics on MOOCs is rather limited until now. Most of the learning analytics implementations in MOOCs so far are focused on an administrative level and meet the needs of the course providers. Current studies have primarily focused on addressing low completion rates, investigating learning patterns, and supporting intervention (Chatti et al., 2014). Thus, this chapter focuses on the application of learning analytics from a learner perspective to support bMOOC participants through personalization of the learning environment, monitoring of the learning process, awareness, self-reflection, and recommendation. The following sections discuss the implementation, and evaluation of the new learning analytics module in L^2P-bMOOC.

5.1.1 Requirements

Driven by the wish to enhance L^2P-bMOOC with a learning analytics module, a set of requirements was collected from recent learning analytics and MOOCs literature (Chatti et al., 2012a; Yousef et al., 2014b). Further Interactive Process Interviews (IPI) were conducted with students to determine which functionalities they are expecting from a learning analytics tool in L^2P-bMOOC. Following that a survey was carried out to collect feedback from different MOOC stakeholders concerning the importance of the collected requirements. A summary of the survey analysis results are presented in Table 17.

Table 17: L^2P-bMOOC Learning Analytics Requirements (N=205)

	L^2P-bMOOC Learning Analytics Requirements	$\bar{x}$	σ
1	Provide recommendations and feedback for learners to improve their performance.	4.6	0.67
2	Provide performance report to learners.	4.5	0.77
3	Provide learners with analytics tools for awareness and self-reflection.	4.4	0.82
4	Provide statistics on the course activities.	4.4	0.78
5	Predict student performance.	4.4	0.85
6	Analysis and visualization of learning activities.	4.3	0.79
7	Apply Social Network Analysis (SNA) techniques to identify/visualize relationships between learners.	3.8	1.12
8	Provide the options for reporting to the teacher.	3.5	1.20
	Learning Analytics Average	4.3	0.87
	1. Strongly disagree … 5. Strongly agree		

This analysis concluded a set of user requirements to support learning analytics in L^2P-bMOOC, as summarized below:

- *Intuitive User Interface*: An important factor for user satisfaction is a simple and easy to use learning analytics interface. The design of the module has thus to take usability principles into account and go through a participatory design process.
- *User Recommendation*: due to the large number of courses on a MOOC platform, there is a need for a recommendation mechanism that enables learners to discover courses based on their interests and activities on the platform.
- *User Analytics*: Provide statistics on the user activities on the platform. This feature would allow users to track their activities across all courses that they are participating in and quickly navigate to their performed activities such as their annotations, likes, threads, and videos.
- *Course Analytics*: Provide users with a complete picture of all course activities. This feature would allow students to reflect on their activities in the course and teachers to monitor the activities in their courses.
- *Course Activity Stream*: In order to increase awareness, there is a need for a notification feature that can support users in tracking recent activities (i.e. likes, thread discussions, annotations, comments, new videos) in their courses.
- *User Courses*: Provide users with a personalized view of the courses and video nodes where they had a contribution. This would allow users to get a quicker access to the videos that they are interested in.

5.1.2 Implementation

The design requirements collected above have built the basis for the implementation of the learning analytics module in L^{2}P-bMOOC.

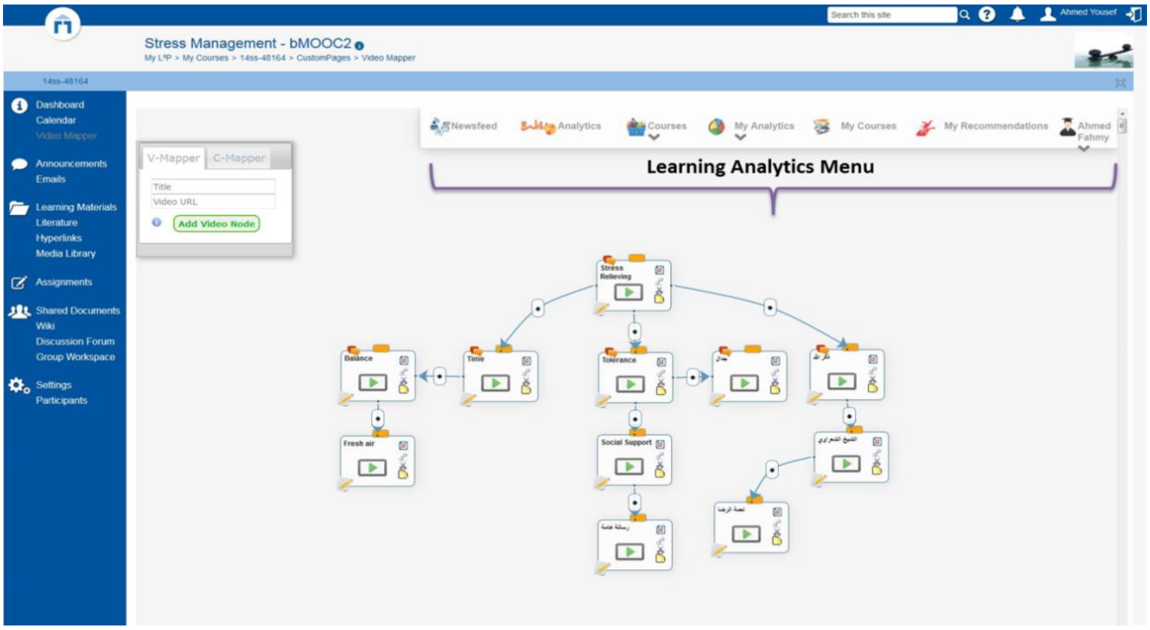

Figure 38: Learning Analytics Dashboard in L^{2}P-bMOOC (Yousef et al., 2015c).

The learning analytic dashboard in L²P-bMOOC consists of a navigation menu bar displayed on the top corner inside the main workspace, as shown in Figure 38. Possible actions on the learning analytics dashboard include course activity stream, course analytics, user analytics, user courses, and user recommendation as described in the following sections.

Newsfeed

In order to keep track of what's new in the learning environment, L²P-bMOOC provides a course activity stream feature called newsfeed, as presented in Figure 39. Learners can use the newsfeed to get notifications on recent activities (e.g. likes, thread discussions, annotations, comments, new videos) in the courses they are enrolled in. By clicking on a specific notification item, the learner can get a direct access to the related activity in its context. The newsfeed page is the first interface displayed to a learner when he or she logs into the system. The notifications can further be filtered by course (Ahmad, 2014; Yousef et al., 2015c).

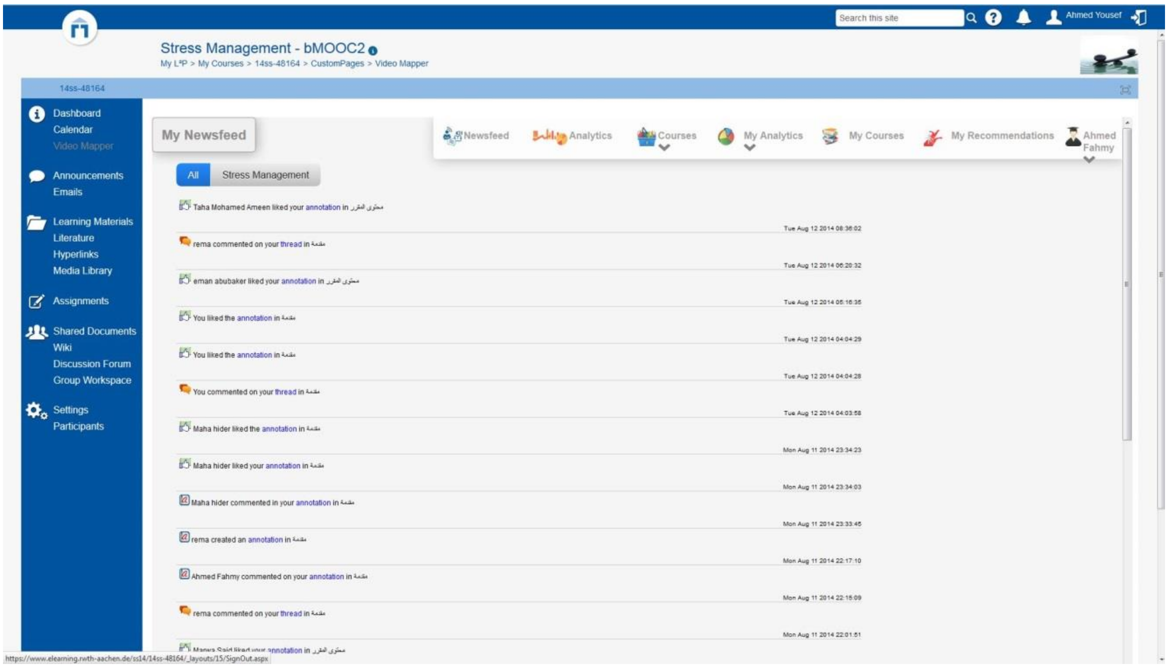

Figure 39: Newsfeed View in L²P –bMOOC (Yousef et al., 2015c)

Course Analytics

This feature provides an overview on the course statistics in all courses in L²P-bMOOC ranked by popularity. The statistics are represented as a pie chart with four different fields, namely the numbers of annotations, likes, discussions threads, and added videos, as illustrated in Figure 40. Clicking the pie chart enables the learners to get a direct access to the lectures in the course and their related video maps. This visualization can support the learners' awareness of the courses with high interactivity. It can also help teachers in the monitoring of the activities in their courses (Ahmad, 2014; Yousef et al., 2015c).

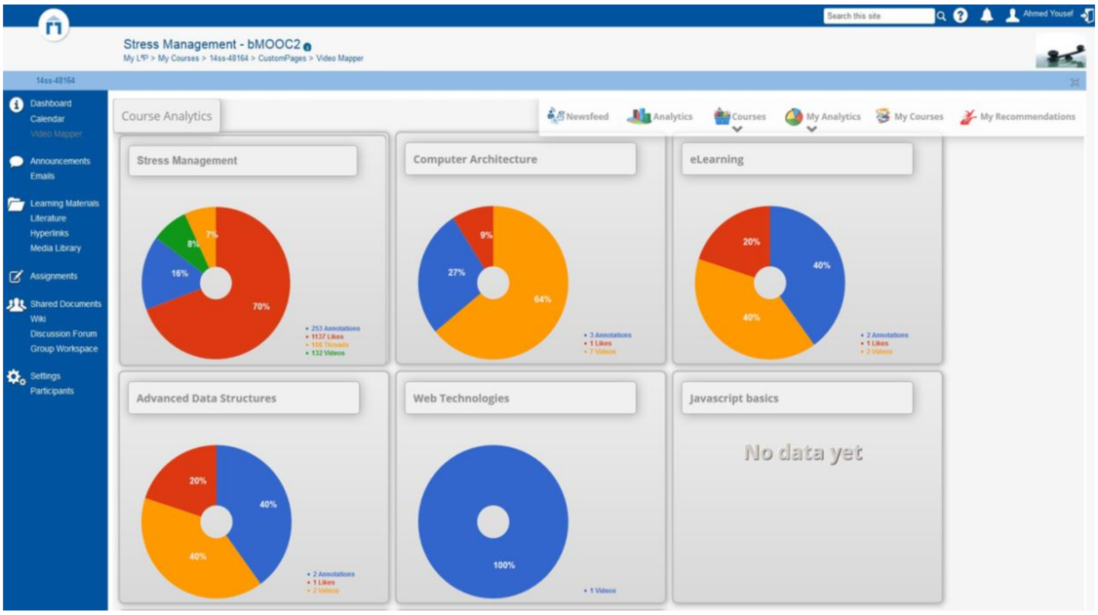

Figure 40: Course Analytics View in L²P –bMOOC (Yousef et al., 2015c)

My Analytics

Learners can use this feature to get statistics on their activities (i.e. annotations, likes, discussions threads, and added videos) throughout all courses they are participating in. By clicking on e.g. the annotation field in the pie chart, learners can get a direct access to all video nodes where they had annotations, as shown in Figure 41. This feature can support learners in the monitoring of their distributed activities as well as self-reflection on their performance in the learning environment (Ahmad, 2014; Yousef et al., 2015c).

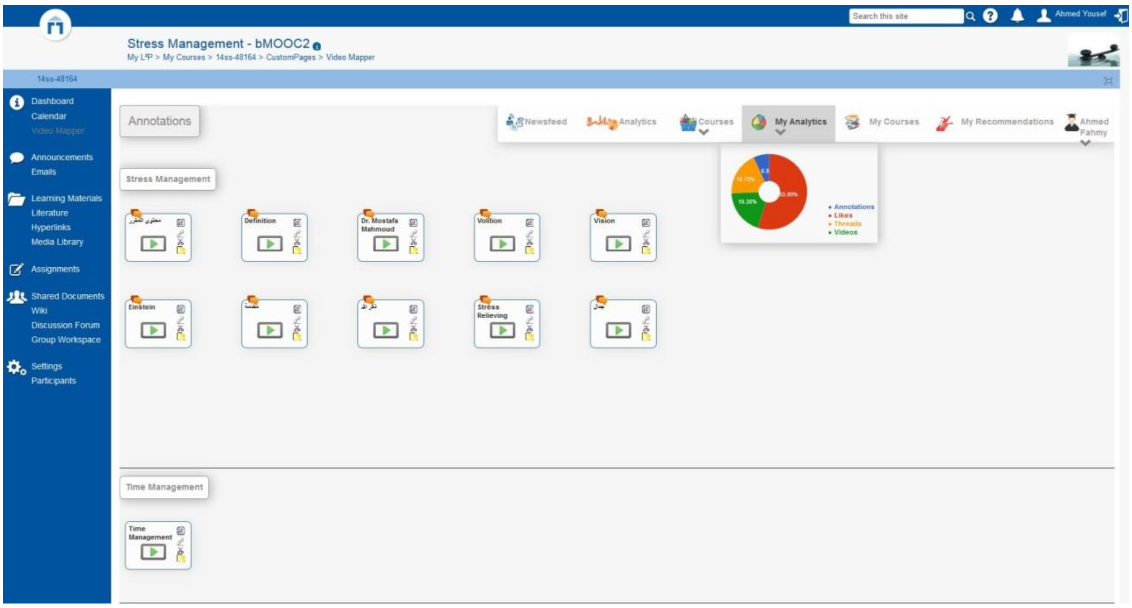

Figure 41: My Analytics View in L²P –bMOOC (Yousef et al., 2015c)

My Courses

This feature enables learners to focus on their courses of interest. As shown in Figure 42, learners can get an overview on their courses and the particular video nodes that they are active in (e.g. posted an annotation, added a bookmark, contributed to a discussion). This feature acts as a filtering mechanism for the video nodes of interest, thus enabling a personalized view of the learning environment (Ahmad, 2014; Yousef et al., 2015c).

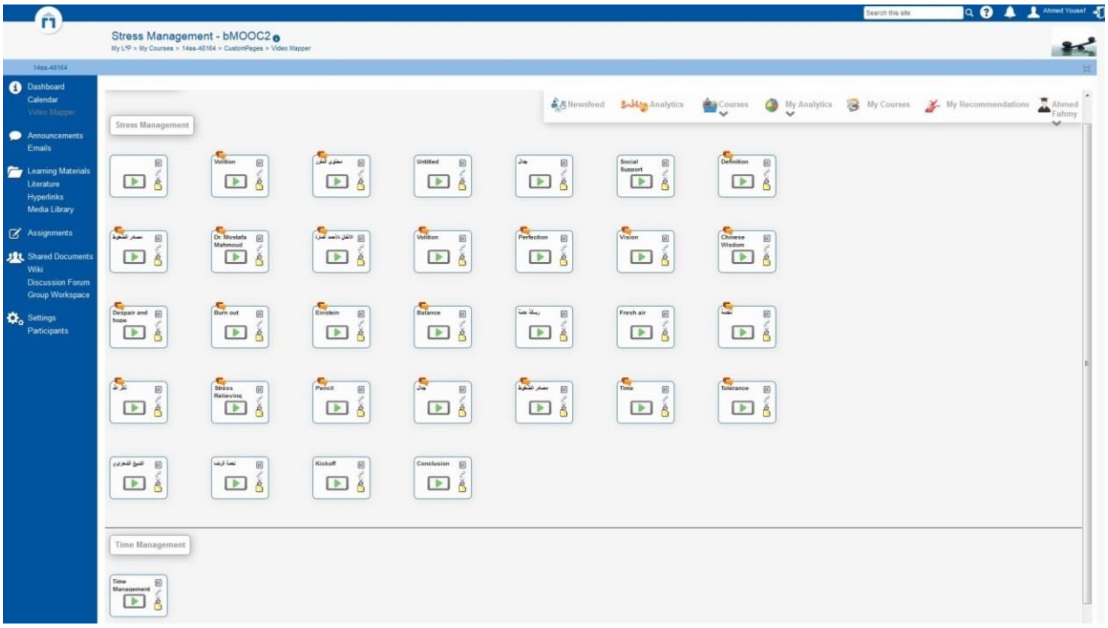

Figure 42: My Courses View in L^2P–bMOOC (Yousef et al., 2015c)

My Recommendations

The aim of this feature is to recommend courses and learning materials based on the learner's interests and activities. L^2P-bMOOC follows a collaborative tag-based recommendation approach. L^2P-bMOOC allows users to tag the different courses on the platform (Ahmad, 2014). These tags are used to generate recommendations of courses having the same tags, as shown in Figure 43.

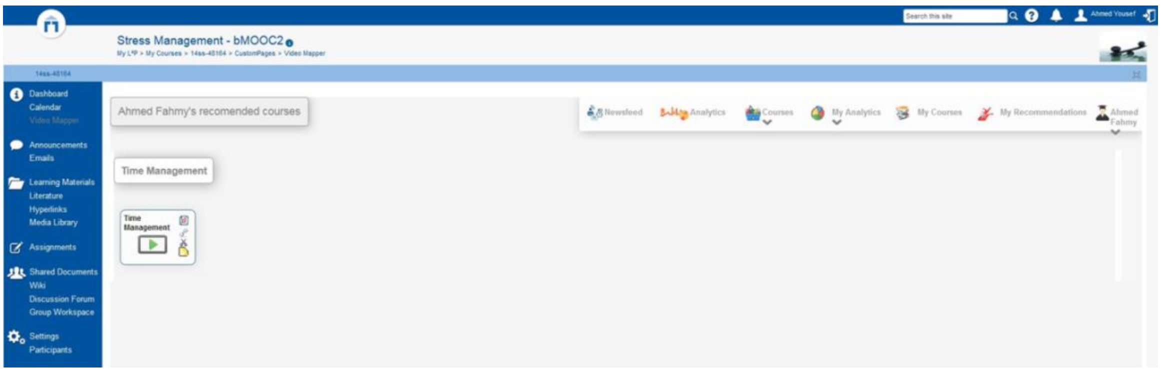

Figure 43. My Recommendations View in L^2P-bMOOC (Yousef et al., 2015c)

5.2 Case Study

In August 2014, a second case study was conducted to evaluate the usability and effectiveness of the learning analytics module. The enhanced version of L²P-bMOOC was used to offer a bMOOC on "Stress Management" at Cairo University, Egypt in cooperation with RWTH Aachen University, Germany. This course was offered informally with a duration of four weeks. A total of 103 participants completed this course. They have undertaken the learning activities at their own pace without receiving any type of academic credits. The teaching staff provided 27 short video lectures and the course participants added another 105 related videos. Participants in the course were encouraged to use video maps to organize their lectures, and collaboratively create and share knowledge through annotations, comments, discussion threads, and bookmarks. The participants further used the learning analytics module to support their activities in the course.

5.3 Evaluation of Learning Analytics in L²P-bMOOC

The following sections give more concrete details on the evaluation of the learning analytics module in L²P-bMOOC in terms of usability and effectiveness. The procedure for evaluating are based on the ISONORM 9241/110-S as a general usability evaluation and a custom effectiveness questionnaire to measure the added value of using learning analytics in L²P-bMOOC.

5.3.1 General Usability Evaluation (ISONORM 9241/110-S)

The usability evaluation was conducted according to ISONORM 9241/110-S as a general usability questionnaire for the L²P-bMOOC environment (Prümper, 1997). It consists of 21 questions classified into seven main categories. Participants were asked to respond to each question scaling from (7) a positive exclamation and its mirroring negative counterpart (1). The questionnaire comes with an evaluation framework that computes several aspects of usability to a single score between 21 and 147. A total of 43 out of 103 participants completed the questionnaire. The evaluators showed diversity in age (Figure 44), gender (Figure 45), level of education (Figure 46), and experience with TEL courses (Figure 47). The results obtained from the ISONORM 9241/110-S usability evaluation are summarized in Table 18.

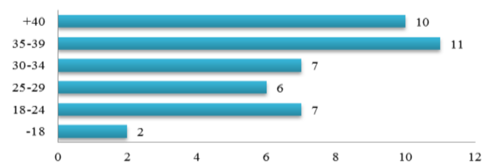

Figure 44: What is your age group? (N = 43)

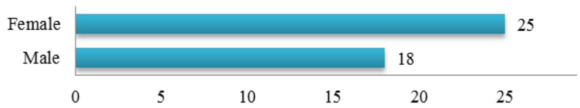

Figure 45: What is your gender?" (N = 43)

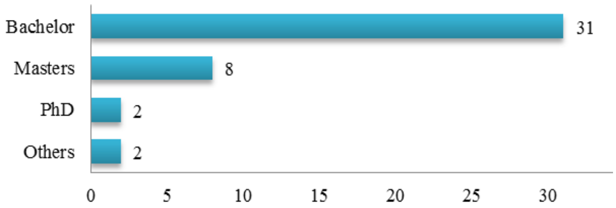

Figure 46: What is your education level? (N = 43)

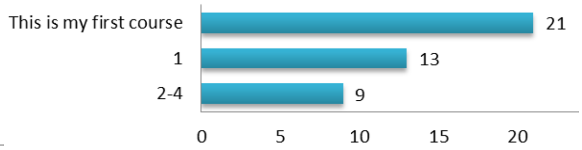

Figure 47: How many TEL courses you are enrolled in? (N = 43)

The overall score from the second case study was 123.8 which translate to “Congratulations! Your software is perfectly matched to their users!” (Prümper, 1997). This result reflects a high level of user satisfaction with the usability of L^2P-bMOOC.

Table 18: ISONORM 9241/110-S Evaluation Matrix (N= 43).

Factor	Aspect	$\bar{x}$	Σ
Suitability for tasks	Integrity	6.0	17.9
	Streamlining	6.1	
	Fitting	5.8	
Self- descriptiveness	Information content	5.7	17.2
	Potential support	5.2	
	Automatic support	6.0	
Conformity with user expectations	Layout conformity	5.7	18.4
	Transparency	6.5	
	Operation conformity	6.2	
Suitability for learning	Learnability	5.8	17.8
	Visibility	5.8	
	Deducibility	6.2	
Controllability	Flexibility	6.4	17.0
	Changeability	6.1	
	Continuity	4.5	
Error tolerance	Comprehensibility	5.6	17.1
	Correct ability	5.5	
	Correction support	6.0	
Suitability for individualization	Extensibility	5.8	18.4
	Personalization	6.2	
	Flexibility	6.4	
ISONORM score			**123.8**

The higher ISONORM score achieved in the second case study as compared to the first one could be attributed to the several improvements of L^2P-bMOOC by adding a help guide (e.g. FAQs and system entry errors) as well as a video tutorial explaining the different features of the environment to ensure a better learning experience. Figure 48 compares the results obtained from the preliminary usability evaluation of the first case study and the statistics achieved in the second case study.

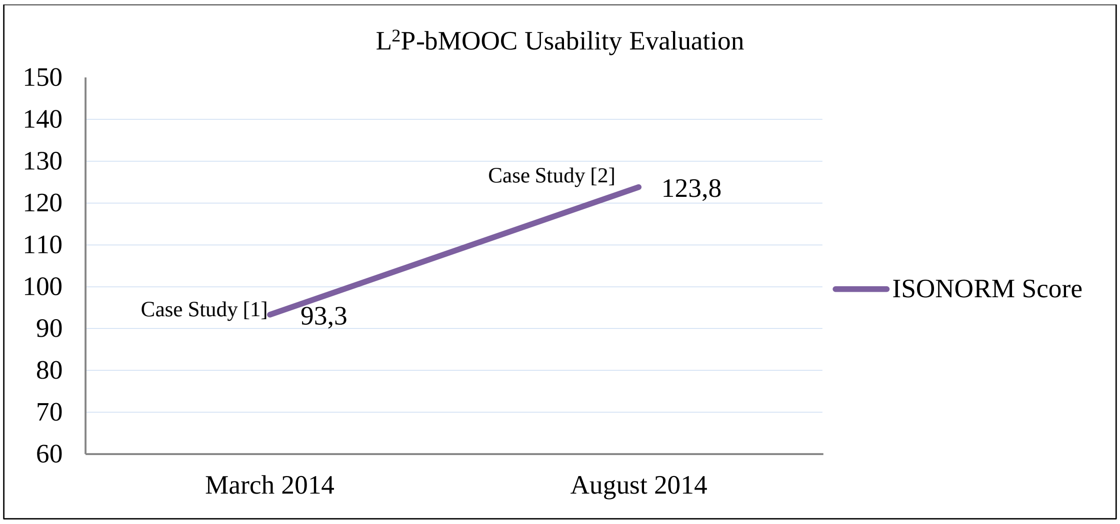

Figure 48: Comparison of L^{2}P-bMOOC Usability Evaluations

5.3.2 Effectiveness Evaluation

The research reported here focused on learning analytics from a learner perspective to support self-organized and networked learning through (a) personalization of the learning environment, (b) monitoring of the learning process, (c) awareness, (d) self-reflection, and (e) recommendation. The effectiveness evaluation aims at assessing whether these goals have been met in L^{2}P-bMOOC.The effectiveness questionnaire aimed at collecting feedback from the course participants on the different learning analytics objectives outlined above, as shown in Table 19. A 5-point Likert scale was used from (1) strongly disagree to (5) strongly agree.

Table 19: The Effectiveness Evaluation of Learning Analytics in L^{2}P-bMOOC (N=43).

No	**Learning Analytics**		
	Evaluation Items	$\bar{x}$	σ
1	My courses help me to personalize my learning environment.	4.5	0.76
2	The course analytics helps me to monitor the course activities.	4.7	1.12
3	My analytics helps me to monitor my own activities in the learning environment.	4.7	1.00
4	The newsfeed helps me to keep tracking of all activities (i.e. likes, thread discussions, annotations, comments, new videos) in the learning environment.	4.6	1.30
5	The newsfeed helps me to improve collaboration with peers.	4.5	1.23
6	The course analytics helps me to compare my activities with that of others in the course.	4.6	1.19
7	My analytics helps me to reflect on my own performance.	4.6	0.91
8	The rating system (Likes) helps me to find valuable learning resources.	4.8	0.57
9	The recommended resources in the bookmarks help me to better understand the course.	4.5	0.64
10	I find the recommended courses useful.	4.7	0.61
Learning Analytics Average		4.6	0.93

In addition to ensure the relevance of these questions, this questionnaire was sent to a small panel of 5 learners as well as 5 learning technologies experts. They were asked for their opinions and suggestions for revising the questionnaire. Their feedback included a refinement of some questions and replacing some others. The revised questionnaire was then given to the L^2P-bMOOC participants. The mean average of the effectiveness evaluation was 4.6, which indicates a general satisfaction with the learning analytics module in L^2P-bMOOC. The evaluation items of the questionnaire aimed at gauging the effectiveness of the following aspects:

Personalization of the Learning Environment

In relation to the personalization of the learning environment, item 1 achieved a mean score of 4.5 which reveals that the evaluators found “My courses” to be useful for the personalization of their learning environment, as they can get a personalized view on their courses and the particular video nodes that they are active in.

Monitoring of the Learning Process

The aspect of monitoring of the learning process is shown in Table 19 Item 2 and 3. The agreeability mean of the respondents for both items is quite high at 4.7, which indicates that the different statistics on annotations, likes, discussions threads, and added videos offered in “Course Analytics” and “My Analytics” supported learners in the efficient monitoring of the course activities as well as their distributed activities in all courses.

Awareness

Items 4 and 5 concern the aspect of awareness. These items achieved high mean scores of 4.6 and 4.5, respectively. The participants reported that the “Newsfeed” helped them to receive regular updates on the various activities in the learning environment, without the need to access each course. Moreover, they noted that the “Newsfeed” fostered effective interaction and collaboration, as they were able to get notifications and promptly react to the discussions of their peers.

Self-Reflection

In terms of self-reflection (items 6 and 7), a mean score of 4.6 was achieved. Most participants reported a high satisfaction with the support provided in “Course Analytics” and “My Analytics” to compare their activities with their peers and reflect on their own performance.

Recommendation

As for the questions regarding the recommendation possibilities in L^2P-bMOOC (items 8, 9, and 10), most participants agreed that the rating system (Likes), social bookmarking, and the tag-based recommendation of courses were helpful for them to locate valuable learning resources in an efficient manner, thus dealing with the information overload problem that characterizes self-organized and open learning environments.

5.4 Summary

Because of massive enrollments in MOOCs, learners are often overwhelmed with the flow of information in MOOCs (Chatti et al., 2014). This challenge matches the results that have been observed in the first bMOOC case study conducted in March 2014, (review chapter 4). The participants of the first bMOOC had some difficulties in tracking and monitoring their learning activities and those of their peers. This chapter therefore focuses on an application of learning analytics from a learner perspective to support bMOOCs participants through personalization of the learning environment, monitoring of the learning process, awareness, self-reflection, and recommendation. In August 2014, the second case study was conducted to evaluate the usability and effectiveness of the learning analytics module. The evaluation revealed a general satisfaction with the usability and the effectiveness of the learning analytics module in terms of personalization, monitoring, awareness, self-reflection, and recommendation.

CHAPTER 6

Peer Assessment in L^2P-bMOOC

One of the biggest challenges facing bMOOC is how to assess the learners' performance in a massive learning environment beyond traditional automated assessment methods. To address this challenge, peer assessment has been proposed as an effective assessment method in MOOCs. The problem is, however, how to ensure the quality of the peer assessment in terms of validity and reliability. Moreover, assessment in bMOOCs introduces unique challenges regarding the best peer assessment model in a in a learning environment that brings together face-to-face interactions and online activities. This chapter presents the details of a study conducted to investigate peer assessment in L^2P-bMOOCs[12].

6.1 Peer Assessment in MOOCs

Assessment and feedback are essential part of the learning process in MOOCs. Collecting valid and reliable data to grade learners' assignments; identifying learning difficulties and taking action accordingly; and using these results, are just a portion of the measures to improve the academic experience (Kulkarni et al., 2013). However, the ability to evaluate a large scale of participants in MOOCs is obviously a big challenge (Yin and Kawachi, 2013). The most widely used evaluation technique in MOOCs is regular automated assessment, which restricted to closed question formats, e.g. quizzes with multiple choice questions, and electronic essay assignment (Díez, Luaces, Alonso-Betanzos, Troncoso & Bahamonde, 2013; Kaplan & Bornet, 2014). Which are strongly focused on the cognitive aspects of learning. The key challenge of automated grading in MOOCs is inability to capture the semantic meaning of learners' answers; in particular on open-ended questions (Kulkarni et al., 2013). In fact, it is difficult to apply this assessment method in practical courses (e.g. mathematics proof and computer programming) or humanities curricula, mainly due the nature of these courses, which are based on the creativity and imagination

[12] Parts of this chapter have been published in:

Yousef, A. M. F., Wahid, U., Chatti, M. A., Schroeder, U., & Wosnitza, M. (2015e). The Effect of Peer Assessment Rubrics on Learners' Satisfaction and Performance within a Blended MOOC Environment. *In Proc. CSEDU 2015 conference Vol. 2, pp. 148-159.* INSTICC, 2015.

of the learners (Kulkarni et al., 2013; Sandeen, 2013b). This provides strong ground for alternative assessment methods that provide effective and constructive feedback to MOOCs participants about their open-ended exercises, or essays.

The generic aim of most assessment methods is to provide such kind of feedback usually involve teaching staff correcting and grading the assignments. In the MOOCs scenarios, this requires substantial resources in terms of time, money, and manpower. To alleviate this problem, this study argues that the most suitable way is to look for assessment methods that employ the wisdom of the crowd. Such assessment methods include portfolios, wrappers, self-assessment, group feedback, and peer assessment (Chatti et al., 2014; Davis, Dikens, Leon-Urrutia, Sanchéz-Vera, & White, 2014).

Learner's portfolio is an approach to authentic assessment that potentially enables large classes to reflect on their work (McMullan, Endacott, Gray, Jasper, Miller, Scholes, & Webb, 2003); wrapping assessment techniques use a set of reflective questions to engage participants in self-assessment and self-directed learning (Yorke, 2007); self-assessment can be used to prompt learners' reflection on their own learning outcomes; and peer assessment refers crowdsourcing grading activities where learners can take responsibility for rating, evaluating, and providing feedback on each other's work (Topping, 1998).

These different assessment activities were considered collectively, and concluded that the most suitable assessment method in our bMOOC scenario is to involve the learners themselves under supervision and guidance from the teachers. This study at hand, demonstrate that peer assessment activities that involve learners themselves in the assessment process can play a crucial role in supporting an effective MOOC experience. This method of assessment is suitable for activities, like exercises, assignments, or exams which do not have clear right or wrong answers (O'Toole, 2013). Several studies have been conducted to investigate the impact of using peer assessment in traditional classroom instruction, and acknowledged a number of distinct advantages. These include: increase in learners' responsibility and autonomy, new learning opportunities for both sides (i.e. givers and receivers of work review), enhanced collaborative learning experience, and strive for a deeper understanding of the learning content (Topping, 1998; Van Zundert, Sluijsmans, & Van Merriënboer, 2010). Furthermore, Learners who involved in peer assessment process may promote a sense of ownership, personal responsibility, and motivation as well as develop teamwork skills (Topping, 1998).

Unfortunately, to date there has been little discussion about using peer assessment in MOOC environments. The following section discusses specifically how MOOCs providers are utilizing peer assessment in their courses, namely Coursera and edX. Furthermore, illustrates some of the key issues that MOOCs providers are facing when they dealing with peer assessment tools. This aims to secure evidence about the effects design of peer assessment in bMOOCs context.

6.1.1 Coursera

Coursera has integrated a peer assessment system in its learning platform to evaluate and provide feedback for at least 3 to 4 assignments. Coursera provides learners with an optional evaluation matrix to improve peer assessment results. In addition, learners have the opportunity to self-evaluate themselves (Piech et al., 2013; Luo, Robinson, & Park, 2014). The peer assessment system in Coursera involves three main phases: 1) submission phase, 2) evaluation phase, and 3) publishing results as shown in Figure 49 (Coursera, 2015). Until recently, there has been no reliable evidence on how peer assessment affects the learning experience in Coursera.

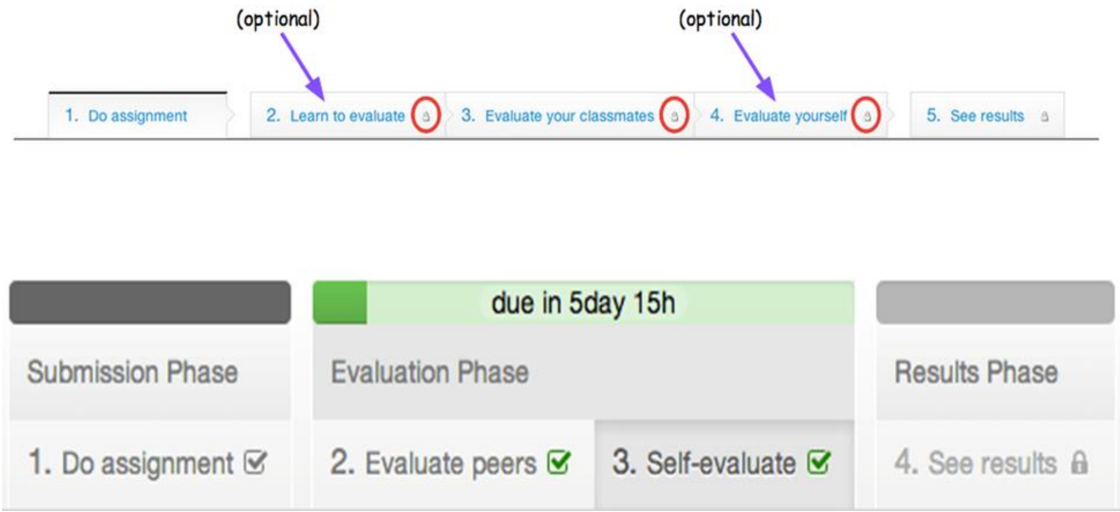

Figure 49: Peer assessment in Coursera (Source: help.coursera.org)

In several MOOCs offered by the Pennsylvania State University and hosted online by Coursera, learners reported that, they mistrusted the peer assessment results. Moreover, they outlined some of the issues of peer assessment, such as the lack of peers' feedback, accuracy, and credibility (Suen, 2014).

6.1.2 edX

Peer assessment in edX, exists in a very similar fashion like in Coursera. In the case of edX peer assessments, learners are required to review a few assignments samples that have already been graded by the professor before evaluating their peers in order to ensure their ability and knowledge in grading the assignments work. After learners proved that they can assign grades similar to those given by the professor, they are permitted to evaluate each other's work and provide feedback, using the same rubric (edX, 2015).

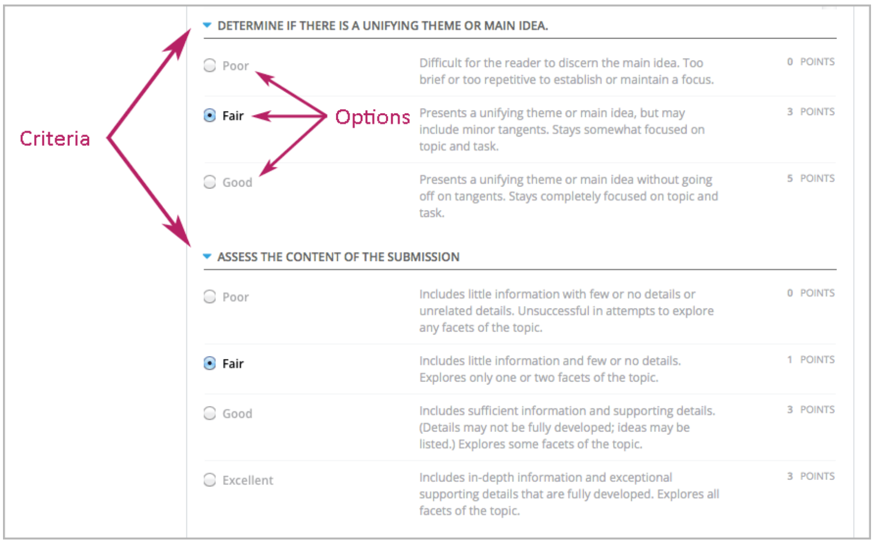

Figure 50: Peer assessment rubrics in edX (Source: edx-guide-for-students.readthedocs.org)

6.1.3 Peer Assessment Issues in MOOCs

Peer assessment is valuable evaluation method used to facilitate learners for receiving deeper feedback on their assignments but it is not always as effective as expected in MOOCs scenarios (Suen, 2014). Jordan (2013) shows that MOOCs which used peer assessments tend to have lower course completion rates compared to the ones that used automated assessment. In general, there are several possible factors that can explain the lack of effectiveness of peer assessment in MOOCs:

- The issue of scale (Suen, 2014).
- The diversity of reviewers' background and prior experience (Yousef et al., 2015c).
- The lack of accuracy and credibility of peer feedback (Suen, 2014).
- The lack of transparency of the review process.
- MOOCs participants do not trust the validity and reliability of peer assessment results due to the absence of a clear evaluation authority (e.g. teacher)
- The low perceived expertise (McGarr & Clifford, 2013).
- Peer assessment in MOOCs employs fixed grading rubrics. Obviously, different exercise types require different assessment rubrics (Sánchez-Vera & Prendes-Espinosa, 2015).

6.2 Peer Assessment Module in L²P-bMOOC

So far, little research has been carried out to investigate the effectiveness of using peer assessment in a bMOOC context (Chatti et al., 2014; Suen, 2014). Therefore, in this case study focus will be placed on an application of peer assessment from a learner perspective in bMOOCs. It aims to address the following research questions:

- Does the peer assessment module improve learning outcomes?
- Does the peer assessment module provide a reliable and valid feedback for participants?
- Which peer assessment model fits best in a bMOOC context?

6.2.1 Requirements

In order to enhance L^2P-bMOOC with a peer assessment module, a set of design requirements were crafted from recent peer assessment and MOOCs literature (Gielen, Dochy, Onghena, Struyven, & Smeets, 2011; Suen, 2014; Yousef et al., 2014b). Then, an online survey was designed to gather feedback from different targeted groups concerning the importance of the collected requirements (Yousef et al., 2014c). The table below illustrates a summary of the survey analysis results.

Table 20: L^2P-bMOOC Peer Assessment Requirements (N=205).

No	L^2P-bMOOC Peer Assessment Requirements		
	Items	$\bar{x}$	σ
1	Students should receive feedback and/or correct answers to each assignment task.	4.57	0.90
2	Provide formative assessment and feedback within the learning process.	4.12	1.05
3	Design flexible guidelines and rubrics for each task.	4.53	0.84
4	Give clear directions and time limits for in-class peer review sessions (i.e., face-to-face interaction) and set defined deadlines for out-of-class peer review assignments.	4.36	1.06
5	Each student doing the peer review should explain his or her evaluation.	4.32	0.79
	Peer Assessment Average	**4.38**	**0.92**

1. Strongly disagree … 5. Strongly agree

The agreeability means of peer assessment requirements is quite high at above 4. In particular, indicators 3 and 5 call for specific, albeit flexible guidelines and rubrics. This is important to avoid grading without reading the work, or not following a clear grading scheme, which negatively impacts the quality of the given feedback (Yousef et al., 2014c). Based on the peer assessment literature review and the survey results, a set of requirements were derived to support peer assessment in L^2P-bMOOC, as summarized below:

- *User Interface*: The interface should be simple, understandable, and easy to use while requiring minimal user input. The interface design of the module should take usability principles into account, and go through a participatory design process (Nielsen, 1994).

- *Rubrics*: Provide learners with flexible task-specific rubrics that include descriptions of each assessment item to achieve fair and consistent feedback for all course participants.
- *Management*: Peer assessment should be easy to manage. The module ought to be integrated into the platform with features for activation and deactivation.
- *Scalability*: The fundamental difference between MOOCs and traditional classroom is the scale of learners. Consequently, scalability should be considered in the implementations of peer assessment module in L2P-bMOOC.
- *Collaborative Review*: Provide mechanisms for a collaborative review process which involves the input of more than one individual participant.
- *Double Blind Process*: Peer assessment module should support the double blind review process. Neither the assignment authors know the reviewers identities, nor the reviewers know the assignment authors identities.
- *Deadlines*: Peer assessment module should provide two deadlines for each task: the submission deadline for learners to submit their work, and the other for the peer grading phase.

6.2.2 Implementation

The peer assessment module in L^2P-bMOOC consists of the six components as shown in Figure 51.

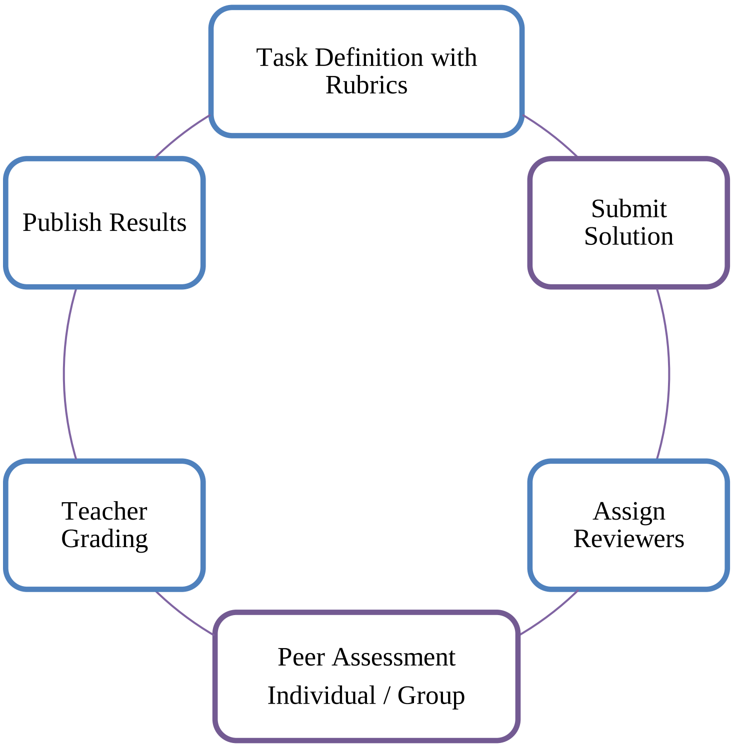

Figure 51: Peer assessment workflow (Yousef et al., 2015e)

These peer assessment components are classified according to the following methods:

- Teachers need methods to define assignment tasks and manage the review process.
- Learners need methods to see assignment tasks and submit solutions, as well as, to provide and receive peer reviews.

Microsoft SharePoint 2013 has been used as the underlying technology of the L²P platform. SharePoint offers a solid base for MOOCs development, while offering a wide range of other advantages. These include scalability, security, customization and collaboration. The internal list structure of SharePoint makes it easy to implement fine grained rights on individual list items, which allow for easy to use rights management in L^{2}P-bMOOCs peer assessment module. Basically, it is easy to configure who can see what on a given point in time. Also, workflows can be used to organize submission and evaluation processes.

Teacher Perspective

The peer assessment module in L^{2}P-bMOOC consists of a centralized place of actions (navigation ribbon) to help teachers to define, manage, and navigate the assignment tasks, as shown in Figure 52.

Figure 52: Teacher Navigation Ribbon

The ribbon actions provide a complete set of tools to define peer assessment tasks, manage task-specific rubrics, assign reviewers, give final grades, and publish the results.

Task Definition with Rubrics

The task definition begins with defining some basic attributes of the assignments. These attributes include the name and description, the deadlines, and the associated materials and resources. Additionally, there are a number of specific settings to be configured, which are related to the peer assessment itself. These specific settings are concerning the start and end of the review, the review impact on the final grade, and the task-specific rubrics (see Figure 53).

There are well researched and documented methods to enhance the effectiveness of peer assessment by asking direct questions for the peer to answer, in order to assess the quality of work by the author (Gielen, Peeters, Dochy, Onghena, & Struyven, 2010). This way, the reviewer can easily reflect on the quality of work in a goal-oriented manner. Therefore, a rubric system was implemented in order to enable tutors identify specific questions related to each task, and also reuse pre-defined rubrics. The process for defining rubrics is included in the task definition itself.

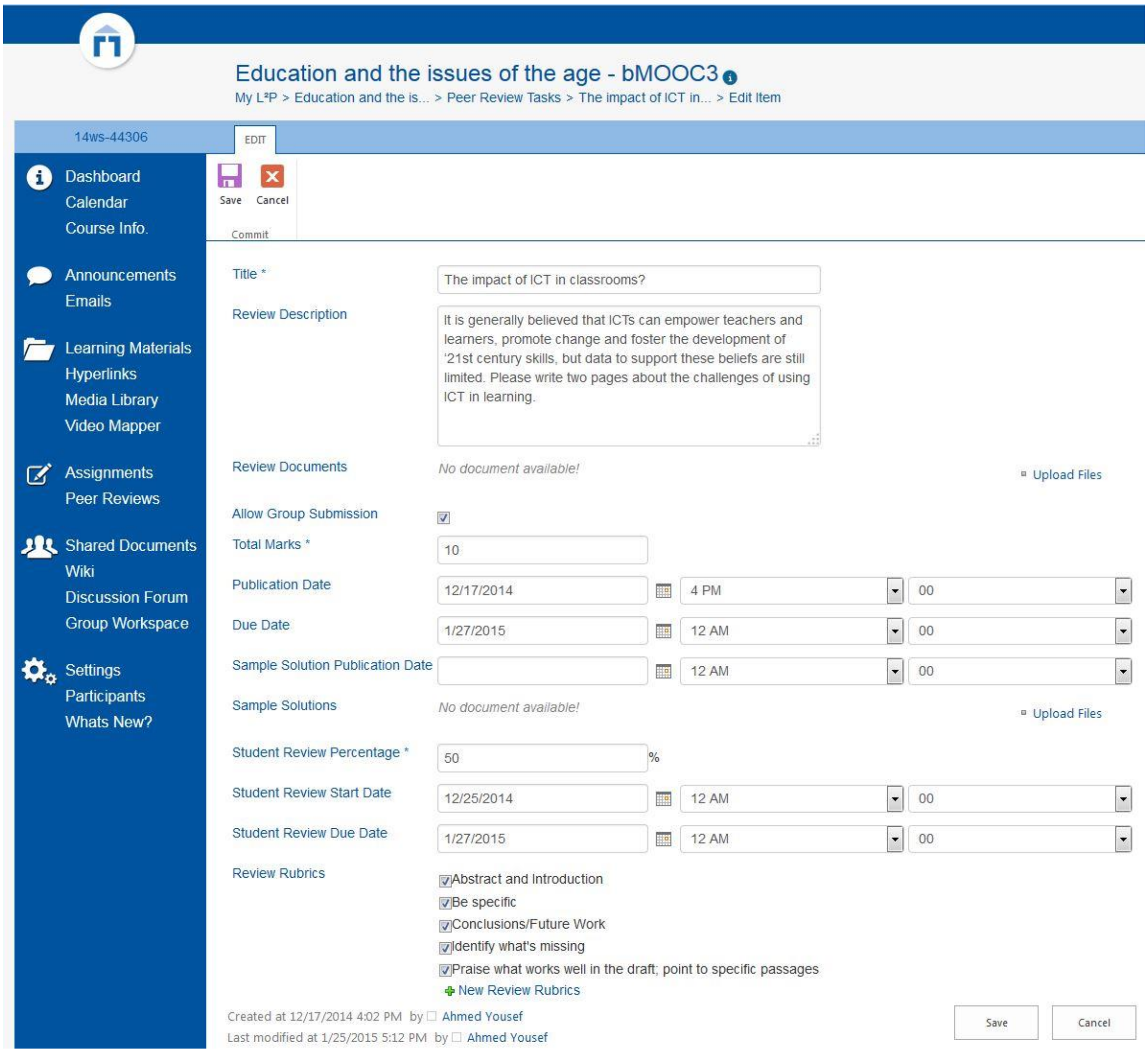

Figure 53: Task Definition with Rubrics

A typical rubric has two attributes: name and the actual rubric question. Further, it contains descriptions that define the learning outcome and performance levels to provide enough information to guide learners in doing the peer assessment review. Teachers can select multiple rubrics to associate with an assignment definition, as shown in Figure 54.

Once the assignment task has been defined, an automated workflow takes care of publishing the assignment at the specified time along with submission deadline. Meanwhile, another workflow takes care of the review submission after the review start date.

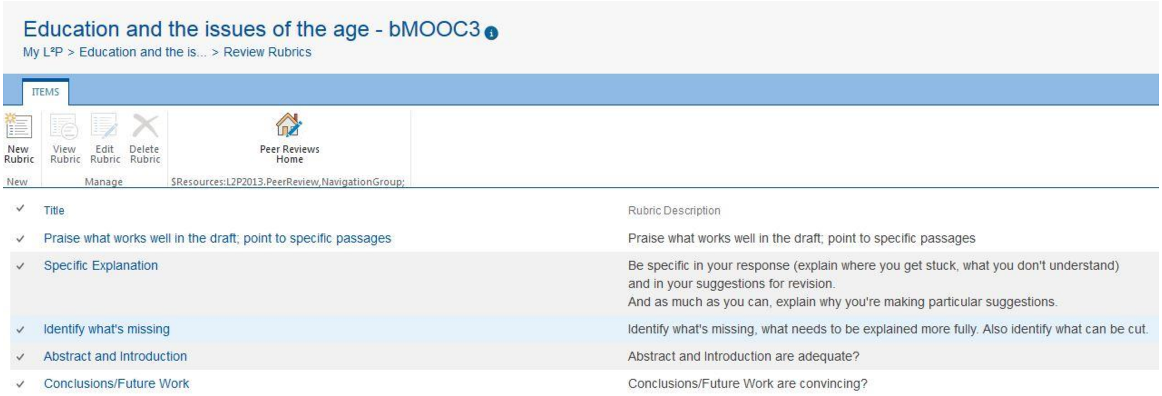

Figure 54: Managing Rubrics

Assigning Reviewers

Course teachers can assign solutions submitted by learners to different peers for reviewing by selecting from a list (see figure 55).

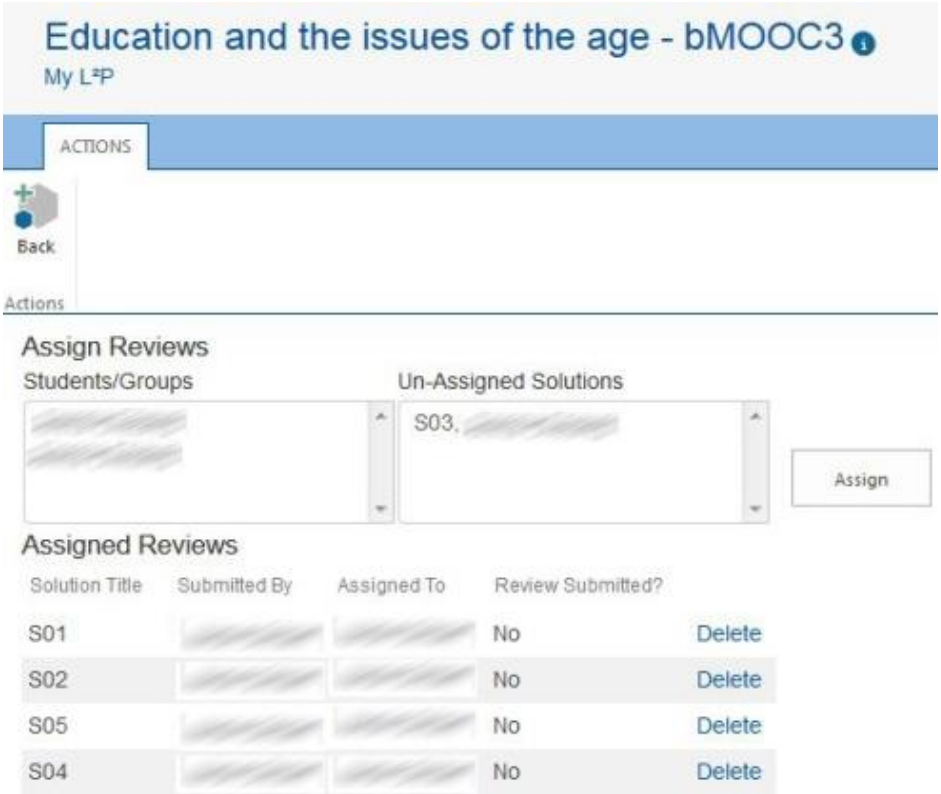

Figure 55: Assigning Reviewers

Future versions of the system should automate the distribution process. There are mechanisms to reverse the process, if there is a problem or a mistake. After this, the assigned reviews are visible to the learners according to the specified dates, and if any review assignment is made after the review start date, it would be shown to the learners directly.

Teacher Grading

Teachers have the option to grade the submitted solutions, but this is not mandatory. They could only assign a grade to learners taking the peer reviews into account, as shown in Figure 56.

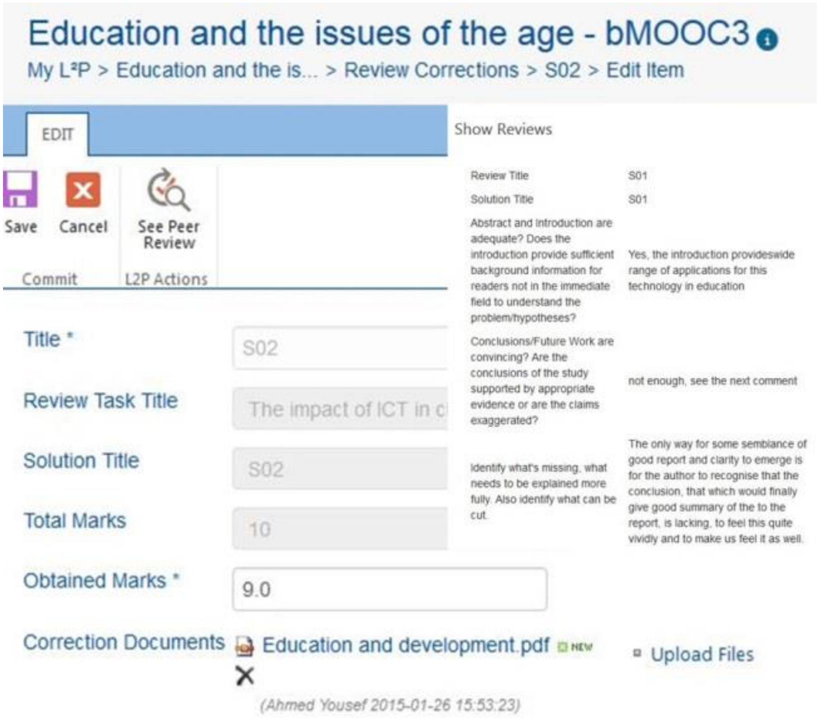

Figure 56: Teacher Grading

Publishing Grades

After grading all the solutions, teachers can publish the results to the learners at once using an action from the ribbon. As a result, the learners are able to see the correction from the teachers as well as the reviews submitted by their peers.

Learner Perspective

The navigation ribbon encompasses actions to help learners to submit solutions and perform the peer assessment task.

Submitting Solutions

Once the assignment has been published, the learners can see the details of the assignment and work on their solutions until the proposed deadline. Learners can add a solution by adding a description and uploading their documents and resources relevant to the solution. Learners can work individually, or in groups, depending on the assignment's requirements as illustrates in Figure 57.

Peer Assessment

There are a number of peer assessment methodologies dealing with the anonymity of author and reviewer, e.g. Single Blind Review (reviewer is anonymous, author is known), Double Blind Review (both reviewer and author are anonymous) and lastly the Open Review (No anonymity). For the purpose of this implementation we decided to use the Double Blind Review, as it reduces the chances of biased marking (Sitthiworachart & Joy, 2004). Once the peer review phase starts, the learners can see a list of reviews assigned to them by the teachers. The interface for adding a review can be seen in Figure 58. It contains two sections, the submitted solution on the top and the review section with rubrics at the bottom. The reviewers can see the documents and resources attached to the solution and any comments given by the authors. They can add their comments against the rubric questions in the review section along with an option to upload any files and grade the review as well.

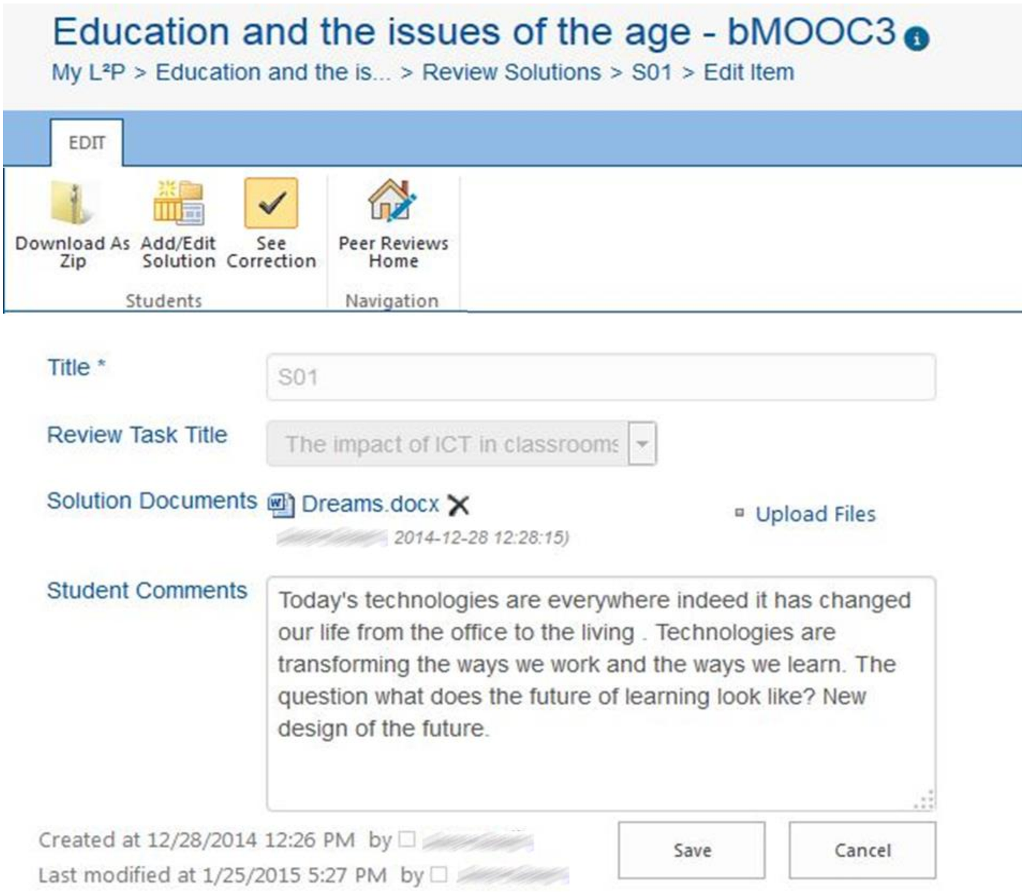

Figure 57: Submitting Solutions

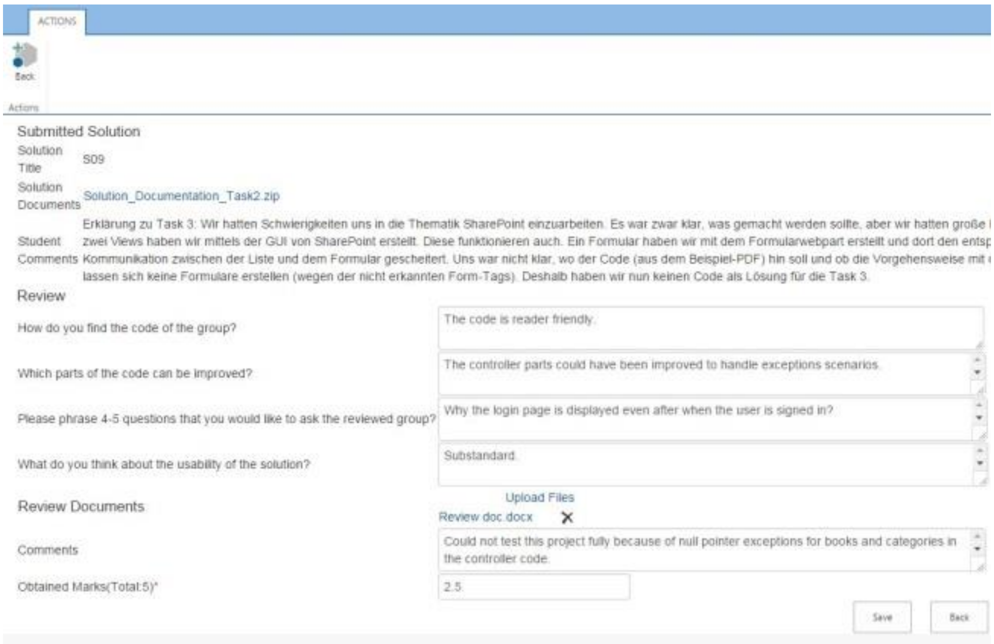

Figure 58: Peer Assessment Interface

6.3 Case Study

In October 2014, the third case study was conducted to investigate the effectiveness of the peer assessment module. The enhanced edition of L^{2}P-bMOOC was used to offer a bMOOC on “Education and the Issues of the Age” at Fayoum University, Egypt in cooperation with RWTH Aachen University. Again, the course was offered both formally to students from Fayoum University and informally with open enrollment to anyone who is interested in teaching and educations issues.

The teaching staff is composed of one professor and one assistant researcher from Fayoum University as well as one assistant researcher from RWTH Aachen University. A total of 133 participants completed this course. 92 formal participants took the course to earn credits from Fayoum University. These participants were required to complete the course and obtain positive grading of assignments. The remaining 41 were informal participants who didn’t attend the face-to-face sessions. They have undertaken the learning activities at their own pace without receiving any type of academic credits.

The teaching staff provided nine short video lectures and the course participants added another 25 related videos. Participants in the course were encouraged to use video maps to organize their lectures, and collaboratively create and share knowledge through annotations, comments, discussion threads, and bookmarks. Participants used the peer assessment module for the submission of a team project report. After the submission, every team reviewed other’s work and provided their feedback based on the rubric questions provided by the teaching staff. These reviews were then taken into consideration by the teaching staff while compiling their own feedback of the team projects. Once the teacher reviews were completed the final corrections were made public to the students who could see both reviews for their own project namely, the review from peer and the review from the teacher.

6.4 Evaluation

The result of usability evaluation in the second case study (c.f. Figure 48) reflects a high level of user satisfaction with the usability of L^2P-bMOOC platform. This case study, therefore, conducted a thorough evaluation of the peer assessment module in L^2P-bMOOC in order to answer the main question in this work. The aim was to evaluate the effectiveness of the module, including the impact on learning outcome and the quality of feedback. Our endeavor was also to explore which peer assessment model fits best in a bMOOC context. The employed evaluation approach is based on a custom questionnaire to measure the effectiveness of peer assessment in L^2P-bMOOC.

6.4.1 Effectiveness Evaluation

This study has focused on peer assessment to support groups or individuals to review, grade and provide in-depth feedback for their peers, based on flexible rubrics. The effectiveness evaluation aims at investigating the impact on learning outcomes and the quality of feedback. This study included the design of a questionnaire adapted from (Brindley & Scoffield, 1998; Andrade, 2000; Sadler & Good, 2006; Wolf & Stevens, 2007; Puegphrom & Chiramanee, 2011; Kulkarni, 2013). The questionnaire consisted of two main parts. The first part containing 21 items in the two categories mentioned above as illustrated in Table 21. The second part aimed at exploring the most effective peer assessment model in a bMOOC setting, as presented in Table 22. To ensure the relevance of these questions, a pre-test was conducted with 5 learners and 5 learning technologies experts. Their feedback included a refinement of some questions and replacing some others. The revised questionnaire was then given to the “Education and the Issues of the Age” course participants.

Table 21: The Effectiveness Evaluation of Peer Assessment in L^2P-bMOOC (N= 57)

No	Peer Assessment Evaluation Items	$\bar{x}$	σ
	Impact on learning outcome		
1	The peer feedback helped me to see errors in my own work.	4.5	0.50
2	Reviewing others' work helped me to reflect on my own work.	4.4	0.53
3	The received feedback helped me to reflect on my own work.	4.2	0.51
4	The peer assessment helped me to learn how to give constructive feedback to peers.	4.2	0.62
5	The peer feedback helped me to come up with new ideas.	4.4	0.53
6	The comments I received from peer feedback helped to improve the quality of my work.	4.3	0.48
7	The received feedback helped me to get more information about the learning topic.	4.4	0.53
8	Reviewing others' work helped me to expand knowledge about the learning topic.	4.3	0.51
9	The peer assessment increased my ability in organizing ideas and contents in my work.	4.1	0.50
	Impact on learning outcome average	**4.3**	**0.52**

Table 21: The Effectiveness Evaluation of Peer Assessment in L^2P-bMOOC (N= 57) (Cont.).

Quality of feedback			
10	The scoring grade I received from peer feedback was valid.	4.2	0.51
11	The peer feedback I received is accurate and credible.	4.2	0.50
12	I am confident that my peers have enough ability to assess my work.	4.2	0.53
13	I am confident that I have the ability to assess peers' work.	4.3	0.71
14	I put sufficient effort into grading peers' work.	4.5	0.56
15	The peer assessment rubrics and their descriptions were sufficiently clear.	4.3	0.57
16	The peer assessment rubrics supported in providing peers with detailed feedback on their assignment work.	4.4	0.62
17	The peer assessment rubrics assisted me in focusing on particular details in the peers work.	4.4	0.53
18	The description of the rubrics helped me understand what teachers expected in the evaluation report.	4.4	0.54
19	The peer assessment rubrics made the review task clearer.	4.4	0.56
20	The peer assessment rubrics made the review process more transparent.	4.3	0.54
21	The peer assessment rubrics were necessary to complete my review task.	4.4	0.53
Quality of feedback average		**4.3**	**0.55**
1. Strongly disagree … 5. Strongly agree			

Of the study population, a total of 57 out of 133 participants completed the questionnaire. Diversity in learner's age was exhibited by the evaluators, their ages ranging from 18 to 40+ years with almost 65% of the evaluators being between the ages of 18 and 24. Around 70% of the evaluators were Bachelors students, 17% from Masters courses and the remaining 12% pursuing a PhD. The participants on the whole demonstrated that they had taken at least one online course.

Impact on Learning Outcome

Respondents were asked to indicate whether the peer assessment has affected their learning outcome. As can be seen from Table 21, the overall response to the evaluation items 1-9 was very positive at 4.3 with acceptable standard deviation at 0.52. This indicates that peer assessment is a powerful evaluation method to detect and correct errors, reflect, and criticize which are key elements in double-loop learning.

The concept of double-loop learning was introduced by Argyris and Schön (1978) within an organizational learning context. According to the authors, learning is the process of detecting and correcting errors. Error correction happens through a continuous process of inquiry, reflection, and (self-) criticism, which enables learners to test, challenge, and eventually update their knowledge, and in so doing improving their learning outcome (Chatti, Jarke, & Schroeder, 2012b).

Peer assessment further fosters continuous knowledge creation, which is a prerequisite for effective learning (Nonaka and Takeuchi, 1995). This can be attributed to the fact that in the peer assessment process, learners can learn from either negative or positive aspects of peer's work and make use of them to get in-depth understanding and had advanced information about the learning topic, and improve their knowledge, which leads to an enhancement of their learning performance.

Quality of Feedback

Key challenges in peer assessment include the diversity of reviewers' background and prior experience (Yousef et al., 2015c), the lack of accuracy and credibility of peer feedback (Suen, 2014) as well as the lack of transparency of the review process. Moreover, MOOC participants do not trust the validity and reliability of peer assessment results due to the absence of a clear evaluation authority (e.g. teacher) and the low perceived expertise of students (McGarr & Clifford, 2013).

Rubrics provide a possible solution to overcome these issues by offering clear guidelines when assessing peer's work. Items 10 to 21 in Table 21 are concerned with the quality of the rubric-based peer feedback approach employed in L^2P-bMOOC. In general, the respondents agreed that harnessing rubrics had a positive impact on the quality of the peer assessment task, in terms of the accuracy and credibility of peer feedback (item 11), transparency of the review process (item 20), as well as validity and reliability of peer assessment results (item 10 and 12). Moreover, the study revealed that participants became more confident in their ability to assess peers' work. They confirmed that following clear rubrics helped them understand the evaluation criteria and supported them in providing peers with detailed feedback.

6.4.2 Peer Assessment Models

An important goal in our study was also to explore which peer assessment model fits best in a bMOOC context, as presented in Table 22. This study draws a certain conclusions about the most effective peer assessment practices in bMOOCs as follows:

Time: Optimal feedback should be provided early in the assessment process in order to give learners the opportunity to react and improve their work.

Anonymity: An important aspect of peer assessment is to ensure the anonymity of the feedback. This way, reviewers can provide critical feedback and grading without considering interpersonal factors e.g. friendship bias or personal dislikes.

Delivery: Indirect feedback ensures more effective assessment results as learners feel more comfortable to give honest feedback without any influence from peers.

Peer Grading: Peer grading should only be a part of the final grade in order to ensure the validity of the assessment results.

Channel: Assessment results can be more accurate and credible when learners receive feedback from multiple reviewers rather than from a single one. This way, learners have the chance to receive a multifaceted feedback on their work.

Review Loop: Having multiple feedback iteration achieve a better learning outcome as learners can reflect on the assignment work multiple times.

Teacher role: The teachers should still take an active role in the peer assessment process, by defining evaluation rubrics, providing sample solutions, and checking the peer review results. They can also help in developing review skills.

Table 22: Peer Assessment Models in bMOOCs (N= 57)

Peer Assessment Models	$\bar{x}$	σ
Time		
Early feedback	**4.6**	**0.50**
Delayed feedback	1.7	0.44
Anonymity		
Double blind review	**4.6**	**0.48**
Single blind review	2.3	0.61
Open review	1.7	0.88
Delivery		
Indirect feedback (i.e., written)	**4.6**	**0.72**
Direct feedback (i.e., face-to-face)	2.2	0.68
Peer Grading		
Review with grading	3.1	0.86
Review with partly grading	**4.4**	**0.79**
Review without grading	1.9	0.41
Peer Grading Weight		
Contributing to the final official grade	3.8	0.93
Not contributing to the final official grade	2.9	1.20
Channel		
Single channel feedback (1:1)	2	0.52
Multiple channel feedback (m:n)	**4.8**	**0.34**
Review Loop		
Single loop	2	0.73
Multiple loop	**4.8**	**0.34**
Teacher Role		
Substitution	2.1	0.57
Supplementary	**4.3**	**0.58**
Monitoring	2.9	0.87

1. Strongly disagree … 5. Strongly agree

6.5 Summary

The main goal of this chapter was to determine how to assess the learners' performance in larger class sizes beyond traditional automated assessment methods. Peer assessment has been proposed as an effective assessment method in MOOCs to address this challenge. Consequently, this chapter presents the details of a study conducted to investigate peer assessment in L^{2}P-bMOOCs. The study results show that flexible rubrics have the potential to make the feedback process more accurate, credible, transparent, valid, and reliable, thus ensuring the quality of the peer assessment task. Furthermore, early feedback, anonymity, indirect feedback, peer grading as only a part of the final grade, multiple channel feedback, multiple feedback loops, as well as a supplementary teacher role are the most effective assessment methods in bMOOCs.

CHAPTER 7

Conclusion and Future Research Directions

The changes in pedagogy in combination with new technologies can be a powerful environment for learning and contribute to change society. Massive Open Online Courses (MOOCs) have a remarkable ability to expand access to a large scale of participants worldwide, beyond the formality of the higher education systems. MOOCs support participants to be actively involved in collaborative learning and construct their own learning experience in a variety of domains, without any entry requirements or tuition fees, regardless of their location, age, income, ideology, and education background (Yousef et al., 2014b). Furthermore, MOOCs support a movement toward a vision of lifelong and on-demand learning for those who are working full time or have taken a break from formal education (Kop et al., 2011).

Different types of MOOCs have been introduced in the MOOC literature. Daniel (2012) and Siemens (2013) classified MOOCs into connectivist MOOCs (cMOOCs) and extension MOOCs (xMOOCs). The vision behind cMOOC is based on the theory of connectivism, which fosters connections, collaborations, and knowledge sharing among course participants. The second type, xMOOCs is following virtue of behaviorism and cognitivist theories with some social constructivism aspects. xMOOC platforms were developed by different elite universities and usually distributed through a third party provider such as Coursera, edX, and Udacity. Recently, new forms of MOOCs have emerged. These include smOOCs as open online courses with a relatively small number of participants and blended MOOCs (bMOOCs) as hybrid MOOCs including in-class and online learning activities.

Despite their popularity and the large scale participation, a variety of concerns and criticism in the use of MOOCs have been raised. Chapter 2 provided an extensive review of the MOOC literature and stressed that the initial vision of MOOCs that aims at breaking down obstacles to education for anyone, anywhere and at any time is stand away from the actuality (Yousef et al., 2014b). In fact, most MOOC environments so far still focus on conventional education models (i.e. centralized learning, traditional teacher-centered). Efforts to provide a less rigorous learner-centered model, really open, and distributed forms of MOOCs are more often the exception rather than the reality. Other limitations of MOOCs include pedagogical problems concerning assessment and feedback (Hill, 2013), the lack of interactivity around the video content (Grünewald et al, 2013), as well as the complexity and diversity of MOOC participants. This diversity is not only related to the cultural and demographic attributes, but it also considers the diverse motives and perspectives when enrolled in MOOCs. Furthermore, a major problem with MOOCs is the ignorance of the importance and benefits of face-to-face communication (Hollands & Tirthali, 2014; Schulmeister, 2014).

In order to address these limitations, a new design paradigm emerges, called blended MOOCs (bMOOCs). This paradigm aims to bring together in-class (i.e. face-to-face) interactions and online learning components as a blended environment. This blended model can resolve some of the hurdles facing standalone MOOCs (Ostashewski & Reid, 2012; Bruff, et al., 2013; Ghadiri et al., 2013). The bMOOCs model has the potential to bring human interactions into the MOOC environment, foster student-centered learning, support the interactive design of the video lectures, provide effective assessment and feedback, as well as contemplate the diverse perspectives of the MOOC participants. There is also a growing body of literature which considered several approaches to integrate bMOOC in higher education (Loviscach, 2013; Griffiths et al., 2014; Sandeen, 2013b). However, relatively little research has been conducted so far in order to address the effective design of bMOOC environments in higher education.

The primary aim of this dissertation was to investigate the effective design of L^2P-bMOOC in higher education context. This final chapter summarizes the main findings of this dissertation in a systematic way, revisits the main contributions related to the research questions in this work, and finally proposes recommendations for future research directions.

7.1 Conclusion

This dissertation extends our knowledge of the design patterns for effective bMOOC environments. The following sections summarize the main findings and contributions of this dissertation according to each research question with a critical eye for its problems and limitations.

7.1.1 bMOOC Design Dimensions

The major research question in this dissertation was how to effectively design and integrate bMOOCs in a higher education context? This leads to a number of challenges that need to be addressed, namely: a) dealing with diversity in bMOOC environments, b) increasing online and offline human interactions, c) integrating the bMOOC platform within the university learning system (e.g. LMS), d) considering local curriculum objectives, e) providing effective assessment and feedback mechanisms, f) increasing interactivity between learners and the video content, g) shifting from the centralized teacher-centered learning model to a student-centered one.

In order to address the second research question, which broached the diversity issue in MOOCs, an empirical analysis of interest patterns of MOOCs participants was conducted to create a meaningful picture of the MOOC community. This analysis has demonstrated a set of eight clusters of MOOC stakeholder perspectives namely, blended learning, flexibility, high quality content, instructional design & learning methodologies, lifelong learning, network learning, openness, and student-centered learning. The analysis of the collected dataset provides a major step forward in the understanding of MOOC stakeholder perspectives. Within the bounds of this enormous diversity of MOOC perspectives, the conceptual approach in chapter 3 tackled the research question concerning the design dimensions of bMOOC environments in a higher education context. It provides a mapping between bMOOC challenges and the different clusters of the MOOC stakeholder perspectives analysis, in order to derive possible bMOOC design dimensions (c.f. Figure 22).

7.1.2 bMOOC Design Criteria

In dealing with the research question of what are the criteria and requirements to best ensure the quality of learning in a bMOOC environment, a set of design criteria related to each bMOOC dimension was collected thorough literature review (c.f. Figure 24). Furthermore, an empirical study was conducted to collect feedback from different MOOC participants concerning the importance of the collected criteria for each dimension. The results of this study are based on a large survey including 107 learners who had taken one or more online courses as well as 98 professors who had taught MOOCs. The statistics results of this survey showed that, usability, course content, collaboration, and instructional design play a major role in achieving effective bMOOCs.

This survey analysis may not be generalizable due to the limited number of participants who responded to this survey. Despite the low response rate, the heterogeneous profiles and goals of the respondents makes our sample valid in this field.

Moreover, we extended this study to identify specific criteria regarding assessment and learning analytics. For this purpose, additional 13 criteria were added (i.e., eight criteria for learning analytics and five for peer assessment). Driven by the results of this study, it can therefore be argued that peer assessment and learning analytics have obtained the highest average mean scores of 4.38 and 4.25 respectively, which reflects the importance of peer assessment and learning analytics as key features in bMOOCs.

7.1.3 L^2P-bMOOC Platform

The research question on how to effectively integrate bMOOC environments in a higher education context was answered by implementing L^2P-bMOOC. The design dimensions and criteria identified in chapter 3 have built the basis for the implementation of the L^2P-bMOOC platform on top of the L^2P learning management system of RWTH Aachen

University, Germany. In L^{2}P-bMOOC, video materials are represented, structured, and collaboratively annotated in a mind-map format. L^{2}P-bMOOC supports learner-centered bMOOCs by providing a bMOOC environment where learners can take an active role in the management of their learning activities, thus harnessing the potential of bMOOCs to support self-organized learning. Moreover, L^{2}P-bMOOC fosters human interaction through face to face communication and scaffolding, driven by blended learning approach. Furthermore, the platform includes a video annotation tool that enables learners' collaboration and interaction around a video lecture to engage the learners and increase interaction between them and the video content. Thus, L^{2}P-bMOOC changes the traditional MOOC concept, where learners are limited to viewing video content towards a collaborative and dynamic one. Learners are encouraged to organize their learning, collaborate with each other, create and share their knowledge with others (Yousef et al., 2015b).

Does the L^{2}P-bMOOC meet the various goals of bMOOC participants? In what ways are learners satisfied with the usability of L^{2}P-bMOOC? The answer to these research questions was given based on a quantitative and qualitative analysis of three case studies conducted as summarized below.

Case Study [1]

As pilot test for this platform the course "Teaching Methodologies" was delivered as bMOOC by the Fayoum University, Egypt in cooperation with RWTH Aachen University. It started in March 2014 and ran for eight weeks. This course was offered both formally to students from Fayoum University and informally with open enrollment to anybody who was interested in teaching and learning methodologies. At the end of the course, there were 128 active participants. 93 were formal participants who took the course to earn credits from Fayoum University (Yousef et al., 2015d).

Results were derived and conclusions were reported based on the 50 participants who completed and submitted the questionnaire by the end of the survey period. The most interesting findings are summarized in the following points:

- The collaboration and communication tools (i.e. group workspaces, discussion forums, live chat, social bookmarking, and collaborative annotations) allowed the course participants to discuss, share, exchange, and collaborate on knowledge construction, as well as, receive feedback and support from peers.
- The results further show that the majority agreed that L^{2}P-bMOOC allowed them to be self-organized in their learning process. In particular, the participants reported that it helped them to learn independently from teachers and encouraged them to work at their own pace to achieve their learning goals.
- The study, however, identified two problems concerning assessment and feedback. The participants had some difficulties in tracking and monitoring their learning activities and those of their peers. The second issue pointed out was the

limited ability to evaluate and give effective feedback for their open-ended exercises (Yousef et al., 2015d).

A possible solution for the first problem was the introduction of learning analytics features. These features can improve the participants' learning experience through e.g. the monitoring of their progress and supporting (self)-reflection on their learning activities. Peer assessment was proposed to alleviate the second problem.

7.1.4 Learning Analytics in L^{2}P-bMOOC

In bMOOCs the amount of learning activities might become very large or too complex to be tracked by the course participants. Learning analytics can provide great support to learners in their MOOC experience. For this purpose, the second case study focused on the application of learning analytics from a learner perspective to support bMOOCs participants through personalization of the learning environment, monitoring of the learning process, awareness, self-reflection, and recommendation.

Case Study [2]

In August 2014, a second case study was conducted to evaluate the usability and effectiveness of the learning analytics module. The enhanced version of L^{2}P-bMOOC was used to offer a bMOOC on "Stress Management" at Cairo University, Egypt in cooperation with RWTH Aachen University, Germany. This course was offered informally with a duration of four weeks. A total of 103 participants completed this course. The evaluation of learning analytics module in L^{2}P-bMOOC revealed a high level of user satisfaction with the usability and the effectiveness of this module in terms of personalization, monitoring, awareness, self-reflection, and recommendation (Yousef et al., 2015c).

7.1.5 Peer assessment in L^{2}P-bMOOC

In MOOCs, assessment and feedback are essential part of the learning process. In order to enhance L^{2}P-bMOOC with a peer assessment module, the third case study focused on the application of peer assessment from a learner's perspective to provide a reliable and valid feedback for bMOOC participants through peer assessment rubrics.

Case Study [3]

In October 2014, a third case study was conducted to investigate the effectiveness of the peer assessment module. L^{2}P-bMOOC, extended with a peer assessment module, was used to offer a bMOOC on "Education and the Issues of the Age" at Fayoum University, Egypt in cooperation with RWTH Aachen University. Again, the course was offered both formally to students from Fayoum University and informally with open enrollment to anyone who is interested in teaching and educations issues. A total of 133 participants completed this course. 92 formal participants took the course to earn credits from Fayoum University.

The study results show that flexible rubrics have the potential to make the feedback process more accurate, credible, transparent, valid, and reliable, thus ensuring the quality of the peer assessment task. Furthermore, early feedback, anonymity, indirect feedback, peer grading as only a part of the final grade, multiple channel feedback, multiple feedback loops, as well as a supplementary teacher role are the most effective assessment methods in bMOOCs.

7.2 Future Research Directions

Each of the research directions followed in this dissertation yields immediate, open research gaps that still exist, which should be considered for future work, especially in the fields of design, learning analytics, and assessment.

7.2.1 bMOOC Design

It is necessary to conduct research on how to improve the MOOC environments by investigating new learning models such as recommender systems and mobile bMOOCs.

Intelligent Recommendations System

The outcomes of this dissertation show how important it is to consider the complexity and diversity of MOOC participants. Parts of this research focused on clustering the different patterns of MOOC stakeholders in order to build a deeper and better understanding of their behaviors as presented in chapter 3. However, it is a challenge to design different learning materials that are suitable for the varied needs of MOOCs participants. On the one hand, professors who taught MOOCs have troublesome in recommending learners to select suitable learning materials due to the wide range of educational material and knowledge shared in MOOCs platforms. On the other hand, MOOCs participants feel lost and dispersing to select the educational resources and the learning style that meet their characteristics the best (McLoughlin, 2013; Knox, Ross, Sinclair, Macleod, & Bayne, 2014; Wilkowski, Deutsch, & Russell, 2014; Yousef et al., 2015a).

Subsequently, this has thrown up many questions in need of further research for instance, how to identify learners' needs and how to provide an adapted learning experience to better serve the MOOCs participants' needs? Research on learning analytics and personalized learning targets these critical questions through tracking participants' behaviors and extract conclusions about the learning process in order to improve learning among large groups of participants and to support individual learners to achieve success in their MOOCs.

Recommendations in L²P-bMOOCs so far aim at providing users with new interesting items based on their tagging behavior. A major problem of this approach is that tag-based recommendation does not occur at the semantic level. Thus, research is needed to investigate different approaches of user recommendation in bMOOCs, especially collaborative filtering algorithms (Sarwar, Karypis, Konstan, & Riedl, 2001) in conjunction with content-based filtering (Balabanović & Shoham, 1997; Pazzani & Billsus, 2007). The integration of both approaches has the potential to improve the learning experience in bMOOCs and to provide more accurate recommendations for learners.

Mobile bMOOC (M-bMOOC)

Recently, the capabilities of mobile technologies are undergoing rapid evolution, from the early generations tended to a communication device, toward being gradual integration into learning and teaching processes (Huber, 2012). Mobile technologies allow learners to access a variety of learning resources while being on the move (Kukulska-Hulme & Shield, 2008). However, the most important limitation in our study lies in the fact that L²P-bMOOC was not designed for mobile devices. Future research should therefore concentrate on the designing of a mobile learning architecture for providing M-bMOOC in order to expand the opportunities to enter into such interactions scenarios that make learning more accessible, equitable and flexible for M-bMOOC participants, and thus they are able to switch between devices at their own preference (de Waard, 2013).

7.2.2 Learning Analytics in bMOOC

The presented application of learning analytics, as discussed in chapter 5, is a significant and powerful resource used in L²P-bMOOC for supporting personalization of the learning environment, monitoring of the learning process, awareness, self-reflection, and recommendation. However, this application is still in the early stages of implementation. Chatti et al. (2012a) identify the challenge in:

> "How to aggregate and integrate raw data from multiple, heterogeneous sources, often available in different formats, to create useful educational data sets that reflects the distributed activities of the learning; thus leading to more precise and solid learning analytics results"

bMOOCs provide an exciting opportunity for learning analytics research. They capture and store large data sets from learners' activities that can provide insight into the learning processes. Thus, one promising avenue to improve bMOOCs experience is to strive for an open learning analytics approach that enables to provide understanding into how learners learn in open and networked learning environments such as bMOOCs and how educators, institutions, and researchers can best support this process (Chatti et al., 2014).

7.2.3 Open Assessment in bMOOC

One of the more significant outcomes that emerged from this dissertation is that flexible peer assessment rubrics have the potential to make the feedback process more accurate, credible, transparent, valid, and reliable. However, to increase the potential impact of peer assessment on learning, it is crucial to a) improve grading accuracy and b) understand which peer assessment scenarios affect learning outcomes in bMOOCs and how these scenarios can be supported (Gielen et al., 2010). Recent evidence suggests inter-rater reliability to measure the extent of agreement among raters as a possible solution for improving grading accuracy (Gwet, 2014). In order to develop a full version of peer assessment, additional studies are needed that consider several promising scenarios such as a) variation in the peer assessment loops b) variation in the review channels e.g. peer assessment could take place in pairs or groups, c) variation in the peer feedback e.g. written vs. oral feedback, d) variation in the pedagogical anatomy e.g. anonymous vs. open, and e) variation in assessment tasks e.g. formative assessment vs. summative assessment.

References

Abras, C., Maloney-Krichmar, D., & Preece, J. (2004). User-centered design. *Bainbridge, W. Encyclopedia of Human-Computer Interaction. Thousand Oaks: Sage Publications*, *37*(4), 445-456.

Agarwal, A. (2013). Why massive open online courses (still) matter. A TED presentation http://www.ted.com/talks/anant_agarwal_why_massively_open_online_courses_still_matter.

Ahmad, I. (2014). Learning Analytics tool for Video-Based Learning in L²P. Master thesis, RWTH Aachen, Aachen, Germany.

Allen, I. E. and Seaman, J. (2013). Changing Course: ten years of tracking online education in the United States. *Babson Survey Research Group and Quahog Research Group, LLC*, annual report, Retrieved from http://www.onlinelearningsurvey.com/reports/changingcourse.pdf

Andrade, H. G. (2000). Using rubrics to promote thinking and learning. *Educational Leadership*, *57*(5), 13-19.

Anderson, T., and Dron, J. (2011). Three generations of distance education pedagogy. *International Review of Research in Open and Distance Learning*, 12(3), pp. 80-97.

Anderson, T., and McGreal, R. (2012). Disruptive pedagogies and technologies in universities. *Education Technology and Society*, 15(4), pp. 380-389.

Antioch University (2014). Antioch Univeristy becomes first US institution to offer credit for MOOC learning through Coursera. Retrieved from, http://www.antioch.edu/antiochannouncement/antioch-university-becomes-first-us-institution-to-offer-credit-for-mooclearning-through-coursera/.

Argyris, C., & Schon, D. (1978). Organizational learning: A theory of action approach. Reading, MA: Addision Wesley.

Arnold, K. E., & Pistilli, M. D. (2012, April). Course Signals at Purdue: Using learning analytics to increase student success. In Proceedings of the 2nd International Conference on Learning Analytics and Knowledge (pp. 267-270). ACM.

Arnold, P., Kumar, S., Thillosen, A., & Ebner, M. (2014). Offering cMOOCs collaboratively: The COER13 experience from the convenors' perspective. eLeanrning Papers, 37, 63-68.

Balabanović, M., & Shoham, Y. (1997). Fab: content-based, collaborative recommendation. Communications of the ACM, 40(3), 66-72.

Balslev, T., De Grave, W. S., Muijtjens, A. M., & Scherpbier, A. J. J. A. (2005). Comparison of text and video cases in a postgraduate problem-based learning format. *Medical education*, *39*(11), 1086-1092.

Bazeley, P., & Jackson, K. (Eds.). (2013). *Qualitative data analysis with NVivo*. Sage Publications Limited.

Bell, F. (2010). Network theories for technology-enabled learning and social change: Connectivism and actor network theory. *Proceedings of the Seventh International Conference on Networked Learning 2010*, pp. 526-533.

Bell, F. (2011). Connectivism: Its place in theory-informed research and innovation in technology-enabled learning. *The International Review of Research in Open and Distance Learning*, 12(3), pp. 98-118.

Bernstein, R. (2013). Education Evolving: Teaching Biology Online. Cell, 155(7), 1443-1445.

Bishop, J. L., & Verleger, M. A. (2013, June). The flipped classroom: A survey of the research. In ASEE National Conference Proceedings, Atlanta, GA.

Blikstein, P. (2011). Using learning analytics to assess students' behavior in open-ended programming tasks. In *Proceedings of the 1st international conference on learning analytics and knowledge* (pp. 110-116). ACM.

Blom, J., Verma, H., Li, N., Skevi, A., and Dillenbourg, P. (2013). MOOCs are more social than you believe. *eLearning Papers, ISSN: 1887-1542, Issue 33*.

Blomberg, G., Sherin, M. G., Renkl, A., Glogger, I., & Seidel, T. (2014). Understanding video as a tool for teacher education: investigating instructional strategies to promote reflection. Instructional Science, 42(3), 443-463.

Borko, H., Jacobs, J., Seago, N., & Mangram, C. (2014). Facilitating video-based professional development: Planning and orchestrating productive discussions. In Transforming Mathematics Instruction (pp. 259-281). Springer International Publishing.

Boud, D., & Falchikov, N. (1989). Quantitative studies of student self-assessment in higher education: A critical analysis of findings. *Higher education*, *18*(5), 529-549.

Boven, D. T. (2013). The next game changer: the historical antecedents of the MOOC movement in education. *eLearning Papers, ISSN: 1887-1542*, Issue 33.

Brantley-Dias, L., Dias, M., Frisch, J. K., & Rushton, G. (2008, March). The role of digital video and critical incident analysis in learning to teach science. In *Proceedings of the American Educational Research Association Annual Meeting*.

Brindley, C., & Scoffield, S. (1998). Peer assessment in undergraduate programmes. Teaching in higher education, 3(1), 79-90.

Brown, S. (2013). Back to the future with MOOCs?. *ICICTE 2013 Proceedings,* pp. 237-246.

Bruff, D. O., Fisher, D. H., McEwen, K. E., & Smith, B. E. (2013). Wrapping a MOOC: Student perceptions of an experiment in blended learning. *MERLOT Journal of Online Learning and Teaching*, *9*(2), 187-199.

Cabiria, J. (2012). Connectivist learning environments: Massive open online courses. *The 2012 World Congress in Computer Science Computer Engineering and Applied Computing,* Las Vagas.

Calandra, B., Brantley-Dias, L., & Dias, M. (2006). Using digital video for professional development in urban schools: A preservice teacher's experience with reflection. *Journal of Computing in Teacher Education*, *22*(4), 137-145.

Calandra, B., Brantley-Dias, L., Lee, J. K., & Fox, D. L. (2009). Using video editing to cultivate novice teachers' practice. Journal of research on technology in education, 42(1), 73-94.

Calandra, B., Gurvitch, R., & Lund, J. (2008). An exploratory study of digital video editing as a tool for teacher preparation. Journal of Technology and Teacher Education, 16(2), 137-153.

Calter, M. (2013). MOOCs and the library: Engaging with evolving pedagogy. *IFLA World Library and Information Congress (IFLA WLIC 2013)*, Singapore.

Chamberlin, L., and Parish, T. (2011). MOOCs: Massive Open Online Courses or Massive and Often Obtuse Courses?. eLearn, 2011(8), 1.

Chang, V. (1999). Evaluating the effectiveness of online learning using a new web based learning instrument. In Proceedings Western Australian Institute for Educational Research Forum.

Chang, W. H., Wu, Y. C., & Yang, J. C. (2011a). Webpage-based and video summarization-based learning platform for online multimedia learning. In *Edutainment Technologies. Educational Games and Virtual Reality/Augmented Reality Applications* (pp. 355-362). Springer Berlin Heidelberg.

Chang, W. H., Yang, J. C., & Wu, Y. C. (2011b, July). A Keyword-based Video Summarization Learning Platform with Multimodal Surrogates. In *Advanced Learning Technologies (ICALT), 2011 11th IEEE International Conference on* (pp. 37-41). IEEE.

Charleer, S., Odriozola, S., Luis, J., Klerkx, J., & Duval, E. (2014, September). LARAe: Learning analytics reflection & awareness environment. In *ARTEL14: Proceedings of the 4th Workshop on Awareness and Reflection in Technology-Enhanced Learning*.

Chatti, M. A. (2010a). *Personalization in Technology Enhanced Learning: A Social Software Perspective* (Doctoral Dissertation), RWTH Aachen University, Shaker Verlag.

Chatti, M. A. (2010b). The LaaN Theory. In: Personalization in Technology Enhanced Learning: A Social Software Perspective. Aachen, Germany: Shaker Verlag, pp. 19-42.

Chatti, M. A., Dyckhoff, A. L., Schroeder, U., & Thüs, H. (2012a). A reference model for learning analytics. *International Journal of Technology Enhanced Learning*, 4(5), 318-331.

Chatti, M. A., Jarke, M., & Schroeder, U. (2012b). Double-loop learning. Encyclopedia of the sciences of learning, 1035-1037.

Chatti, M. A., Lukarov, V., Thüs, H., Muslim, A., Yousef, A. M. F., Wahid, U., Greven, C., Chakrabarti, A., Schroeder, U. (2014). Learning Analytics: Challenges and Future Research Directions. eleed, Iss. 10. (urn:nbn:de:0009-5-40350).

Chatti, M. A., Schroeder, U., & Jarke, M. (2012c). LaaN: convergence of knowledge management and technology-enhanced learning. *Learning Technologies, IEEE Transactions on*, *5*(2), 177-189.

Chenail, R. J. (2011). YouTube as a Qualitative Research Asset: Reviewing User Generated Videos as Learning Resources. *Qualitative Report*, *16*(1), 229-235.

Cho, Y. H., & Huang, Y. (2014). Exploring the links between pre-service teachers' beliefs and video-based reflection in wikis. Computers in Human Behavior, 35, 39-53.

Choi, H. J., & Johnson, S. D. (2005). The effect of context-based video instruction on learning and motivation in online courses. *The American Journal of Distance Education*, *19*(4), 215-227.

Christensen, G., Steinmetz, A., Alcorn, B., Bennett, A., Woods, D., & Emanuel, E. J. (2013). The MOOC phenomenon: who takes massive open online courses and why?. *University of Pennsylvania, nd Web*, *6*.

Chuang, H. H., & Rosenbusch, M. H. (2005). Use of digital video technology in an elementary school foreign language methods course. *British Journal of Educational Technology*, *36*(5), 869-880.

Chunwijitra, S., Berena, A. J., Okada, H., & Ueno, H. (2012, May). Authoring tool for video-based content on WebELS learning system to support higher education. In *Computer Science and Software Engineering (JCSSE), 2012 International Joint Conference on* (pp. 317-322). IEEE.

Clow, D. (2013). MOOCs and the funnel of participation. In *Proceedings of the Third International Conference on Learning Analytics and Knowledge* (pp. 185-189). ACM.

Coates, K. (2013). The Re-invention of the Academy: How Technologically Mediated Learning Will–And Will Not–Transform Advanced Education. In *Hybrid Learning and Continuing Education* (pp. 1-9). Springer Berlin Heidelberg.

Colasante, M. (2011). Using video annotation to reflect on and evaluate physical education pre-service teaching practice. *Australasian Journal of Educational Technology, 27*(1), 66-88.

Comeaux, K. R. (2005). *Cognitive Memory Effects on Non-Linear Video-Based Learning* (Master Thesis, Faculty of the Louisiana State University, Retrieved from http://www.interruptions.net/literature/Comeaux-Thesis.pdf

Conole, G. (2013). MOOCs as disruptive technologies: strategies for enhancing the learner experience and quality of MOOCs. Revista de Educación a Distancia, 39, 1-17.

Conrad, D. (2013). Assessment challenges in open learning: Way-finding, fork in the road, or end of the line?. *Open Praxis*, 5 (1), pp. 41-47.

Cooper, S., and Sahami, M. (2013). Reflections on Stanford's MOOCs :New possibilities in online education create new challenges. Comm. ACM 56(2), pp. 28–30.

Coursera. (2015) *How will my grade be determined?* Retrieved on 20th of January, 2015 from, http://help.coursera.org/customer/portal/articles/1163304-how-will-my-grade-be-determined-

Cretchley, J., Gallois, C., Chenery, H., & Smith, A. (2010). Conversations between carers and people with Schizophrenia: a qualitative analysis using Leximancer. *Qualitative Health Research, 20*(12), 1611-1628.

Cusumano, M. A. (2013). Technology strategy and management: Are the costs of 'free' too high in online education? *Comm. ACM* 56(4), pp. 26–29.

Dale, E. (1969). Audiovisual methods in teaching. NY: Dryden Press.

Dalgarno, B., Kennedy, G., & Merritt, A. (2014). Connecting student learning at university with professional practice using rich media in practice-based curricula. In Curriculum models for the 21st century (pp. 213-233). Springer New York.

Daniel, J. (2012). Making sense of MOOCs: Musings in a maze of myth, paradox and possibility. *Journal of Interactive Media in Education, 3*. Retrieved from http://www.jime.open.ac.uk/jime/article/viewArticle/2012-18/html.

Danoyan, N. (2013). Video Annotation Tool to Support Collaborative Learning in L²P. Master thesis, RWTH Aachen, Aachen, Germany.

Davis, H., Dikens, K., Leon-Urrutia, M., Sanchéz-Vera, M. M., & White, S. (2014). MOOCs for Universities and Learners an analysis of motivating factors. In *Proc.* CSEDU 2014 conference, pp. 105-116. INSTICC, 2014.

de Waard, I. (2013). Impact of mobile access on learner interactions in a MOOC. Master Thesis, Retrieved from Athabasca DThesis database http://hdl.handle.net/10791/23

de Waard, I., Abajian, S., Gallagher, M. S., Hogue, R., Keskin, N., Koutropoulos, A., and Rodriguez, O. C. (2011b). Using mLearning and MOOCs to understand chaos, emergence, and complexity in education. *International Review of Research in Open and Distance Learning*, 12(7), pp. 94-115.

de Waard, I., Koutropoulos, A., Keskin, N. Ö., Abajian, S. C., Hogue, R., Rodriguez, C. O., and Gallagher, M. S. (2011a). Exploring the MOOC format as a pedagogical approach for mLearning. *10th World Conference on Mobile and Contextual Learning (mLearn2011)*. Beijing, China.

DeLoache, J. S., & Korac, N. (2003). Special Section: Children and television video-based learning by very young children. *Developmental Science*, *3*, 245-246.

Derek Bok Center (2014). Blended Learning in Harvard College: A Pilot Study of Four Courses Executive Summary, Results, Recommendations and Surveys. Retrieved from http://bokcenter.harvard.edu/files/bokcenter/files/blended_learning_report_web_version_new_0.pdf

Díez, J., Luaces, O., Alonso-Betanzos, A., Troncoso, A., & Bahamonde, A. (2013, December). Peer assessment in MOOCs using preference learning via matrix factorization. In *NIPS Workshop on Data Driven Education*.

Dikeogu, G. C. and Clark, C. (2013). Are you MOOC-ing yet? A review for academic libraries. *College & University Libraries Section Proceedings (CULS)*, 3, pp. 9-13.

Döller, M., & Lefin, N. (2007). Evaluation of available MPEG-7 annotation tools. *Proceedings of IMEDIA*, *7*, 25-32.

Donkor, F. (2010). The comparative instructional effectiveness of print-based and video-based instructional materials for teaching practical skills at a distance. *The International Review of Research in Open and Distance Learning*, *11*(1), 96-116.

Donkor, F. (2011). Assessment of learner acceptance and satisfaction with video-based instructional materials for teaching practical skills at a distance. *The International Review of Research in Open and Distance Learning*, *12*(5), 74-92.

Du, X., & Taylor, S. (2013). Flipped classroom in first year management accounting unit–a case study. In H. Carter, M. Gosper and J. Hedberg (Eds.), Electric Dreams. Proceedings 30th ascilite 2013 Sydney, pp.252-256.

edX. (2014). Terms of Service. Retrieved on 20th of January, 2015 from, https://www.edx.org/edx-terms-service

edX. (2015). Open Response Assessments. Retrieved on 20th of January, 2015 from, http://edx-guide-for-students.readthedocs.org/en/latest/SFD_ORA.html

Ehlers, U. D. (2004). Quality in e-learning from a learner's perspective. European Journal for Distance and Open Learning, 1, 73-90.

El-Hmoudova, D. (2014). MOOCs motivation and communication in the cyber learning environment. Procedia-Social and Behavioral Sciences, 131, 29-34.

Esposito, A. (2012). Research ethics in emerging forms of online learning: issues arising from a hypothetical study on a MOOC. The Electronic Journal of e-Learning, 10(3) pp. 315-325.

Fabris, C. (2015). One Reason to Offer Free Online Courses: Alumni Engagement. In the Chronicle of Higher Education. Retrieved from, http://chronicle.com/article/One-Reason-to-Offer-Free/151163

Fearing, N., Bachman, S., Holzman, M., Scott, D., & Brunt, M. (2010). Evaluation of a video-based curriculum for laparoscopic biliary surgery: a pilot study from the SAGES MIS Web Learning Center. *Surgical endoscopy*, *24*(12), 3141-3143.

Fernández, J. T. (2013). Professionalisation of teaching in universities: Implications from a training perspective. *RUSC. Universities and Knowledge Society Journal, 10*(1), 170-184.

Fini, A. (2009). The technological dimension of a massive open online course: The Case of the CCK08 course tools. *The International Review of Research in Open and Distance Learning*, 10(5).

Fink, A. (2005). Conducting research literature reviews: from the internet to paper (2nd ed.). *Thousand Oaks, California:* Sage Publications.

Finlay, J., Soosay, M., Thomson, S., Chawawa, M., Moore, D., Renshaw, T., Gorra, A., & Ross, J. S., (2008, August). Video-based learning objects for teaching human-computer interaction at different levels. In *Proceedings of the 9th Annual Conference of the HEA Information and Computer Sciences Subject Centre, ed. H. White* (pp. 194-198).

Fournier, H., Kop, R., & Durand, G. (2014). Challenges to research in MOOCs. Journal of Online Learning & Teaching, 10(1).

Fournier, H., Kop, R., and Sitlia, H. (2011). The value of learning analytics to networked learning on a personal learning environment. *LAK '11 Proceedings of the 1st International Conference on Learning Analytics and Knowledge*, pp. 104-109.

Freeman, M., and Hancock, P. (2013). Milking MOOCs: Towards the right blend in accounting education. In *The Virtual University: Impact on Australian Accounting and Business Education, part B*, pp. 86-100.

Friesen, N. (2012). Report: Defining Blended Learning. Retrieved from http://learningspaces.org/papers/Defining_Blended_Learning_NF.pdf

Fu, C. H., Wang, K. T., Cheng, S. C., & Hou, T. W. (2008). Building Video Concordancer Supported English Online Learning Exemplification. In *Advances in Multimedia Information Processing-PCM 2008* (pp. 731-737). Springer Berlin Heidelberg.

Gabbard, J. L., Hix, D., & Swan, J. E. (1999). User-centered design and evaluation of virtual environments. *Computer Graphics and Applications, IEEE*, *19*(6), 51-59.

Gaebel, M. (2013). MOOCs Massive Open Online Courses. *EUA Occasional papers*, Retrieved from http://www.eua.be/Home.aspx

Gainsburg, J. (2009). Creating effective video to promote student-centered teaching. *Teacher Education Quarterly*, 163-178.

Gallagher, S. and LaBrie, J. (2012). Online learning 2.0: strategies for a mature market. *Continuing Higher Education Review*, 76, pp. 65-73.

Ghadiri, K., Qayoumi, M. H., Junn, E., Hsu, P., & Sujitparapitaya, S. (2013). The transformative potential of blended learning using MIT edX's 6.002 x online MOOC content combined with student team-based learning in class. environment, 8, 14.

Giannakos, M., Chorianopoulos, K., Ronchetti, M., Szegedi, P., & Teasley, S. (2014). Video-Based Learning and Open Online Courses. *International Journal of Emerging Technologies in Learning (iJET)*, *9*(1), pp-4.

Gielen, S., Dochy, F., Onghena, P., Struyven, K., & Smeets, S. (2011). Goals of peer assessment and their associated quality concepts. *Studies in Higher Education*, *36*(6), 719-735.

Gielen, S., Peeters, E., Dochy, F., Onghena, P., & Struyven, K. (2010). Improving the effectiveness of peer feedback for learning. *Learning and Instruction*, *20*(4), 304-315.

Goulah, J. (2007). Village voices, global visions: Digital video as a transformative foreign language learning tool. *Foreign Language Annals*, *40*(1), 62-78.

Graham, C. R. (2006). Blended learning systems. CJ Bonk & CR Graham, The handbook of blended learning: Global perspectives, local designs. Pfeiffer.

Green, K. (2013). Mission, MOOCs & money. *AGB, Trusteeship Magazine*, 21(1), pp. 9-15.

Greenberg, A. D., & Zanetis, J. (2012). The impact of broadcast and streaming video in education. *Cisco: Wainhouse Research*.

Griffiths, R., Chingos, M., Mulhern, C. & Spies, R (2014). Interactive Online Learning on Campus Testing MOOCs and Other Platforms in Hybrid Formats in the University System of Maryland. In Ithaka S+R report Retrieved from http://sr.ithaka.org/research-publications/interactive-online-learning-on-campus

Grünewald, F., Meinel, C., Totschnig, M., & Willems, C. (2013). Designing MOOCs for the Support of Multiple Learning Styles. In Scaling up Learning for Sustained Impact (pp. 371-382). Springer Berlin Heidelberg.

Guàrdia, L., Maina, M., and Sangrà, A. (2013). MOOC Design Principles. A Pedagogical Approach from the Learner's Perspective. eLearning Papers, ISSN: 1887-1542, Issue 33.

Guthrie, J., Burritt, R., and Evans, E. (2013). Challenges for accounting and business education: blending online and traditional universities in a MOOC environment. In *The Virtual University: Impact on Australian Accounting and Business Education*, part one pp.9-22.

Gwet, K. L. (2014). *Handbook of inter-rater reliability: The definitive guide to measuring the extent of agreement among raters*. Advanced Analytics, LLC.

Hakkarainen, P., & Vapalahti, K. (2011). Meaningful Learning through Video-Supported Forum-Theater. *International Journal of Teaching and Learning in Higher Education*, *23*(3), 314-328.

Halter, C. P. (2006). The reflective lens: The effects of video analysis on preservice teacher development. Dissertation Abstracts International, 67, 03, 2006, (UMI No. 3211280).

Hames, M. (2015). Online course Advent of the Atomic bomb featured in Chronicle. *Colgate News*, Retrieved from, http://news.colgate.edu/2015/01/online-course-advent-of-the-atomic-bomb-featured-in-chronicle.html/

Harvard University (2012). Open Sourcing Harvard University's Collaborative Annotation Tool. retrieved from http://blogs.law.harvard.edu/acts/files/2012/06/handout.pdf

Heller, F. (2004). Action research and research action: a family of methods. Essential guide to qualitative methods in organizational research, 349-360.

Herreid, C. F., & Schiller, N. A. (2013). Case studies and the flipped classroom. Journal of College Science Teaching, 42(5), 62-66.

Hew, K. F., & Cheung, W. S. (2014). Students' and instructors' use of massive open online courses (MOOCs): Motivations and challenges. Educational Research Review, 12, 45-58.

Hilger, C. (2014). Learning with MOOCs: Examples of Blended Learning. Retrieved from, http://extensionengine.com/learning-with-moocs-examples-of-blended-learning/#.VOr2jC6YGqE

Hill, P. (2013). Some validation of MOOC student patterns graphic. Retrieved from http://mfeldstein.com/validation-mooc-student-patterns-graphic/

Hofmann, C., Boettcher, U., & Fellner, D. W. (2010). Change Awareness for Collaborative Video Annotation. *Proceedings of the 9th International Conference on the Design of Cooperative Systems*, pp. 101-118.

Hollands, F. M. & Tirthali, D. (2014). MOOCs: Expectations and reality. Full report. Center for Benefit-Cost Studies of Education, Teachers College Columbia University.

Hovland, C. I., Lumsdaine, A. A., & Sheffield, F. D. (1949). Experiments on mass communication. (Studies in social psychology in World War II, Vol. 3.).

Hoy, M. B. (2014). MOOCs 101: an introduction to massive open online courses. Medical reference services quarterly, 33(1), 85-91.

Hoyos, C. A., Sanagustín, M. P., Kloos, C. D., Parada G., H. A., Organero, M. M., and Heras, A. R. (2013). Analysing the Impact of Built-In and External Social Tools in a MOOC on Educational Technologies. *8th European Conference on Technology Enhanced Learning, EC-TEL2013*, Paphos, Cyprus, Springer, pp. 5-18.

Hsu, C. K., Hwang, G. J., Chang, Y. T., & Chang, C. K. (2013). Effects of Video Caption Modes on English Listening Comprehension and Vocabulary Acquisition Using Handheld Devices. *Educational Technology & Society*, *16*(1), 403-414.

Huang, H. T. D., & Hung, S. T. A. (2013). Exploring the utility of a video-based online EFL discussion forum. British Journal of Educational Technology, 44(3), E90-E94.

Huber, J. (2012). Mobile Interaction with Large Multimedia Information Spaces. Dissertation, Technische Universität Darmstadt, Germany. Retrieved from http://tuprints.ulb.tu-darmstadt.de/3197/7/DissertationJochenHuber.pdf

Hung, D., Tan, S. C., Cheung, W. S., & Hu, C. (2004). Supporting problem solving with case-stories learning scenario and video-based collaborative learning technology. *JOURNAL OF EDUCATIONAL TECHNOLOGYAND SOCIETY*, *7*, 120-128.

Irvine, V., Code, J., and Richards, L. (2013). Realigning higher education for the 21st-century learner through multi-access learning. *Journal of Online Learning and Teaching*, 9(2), pp. 172-186.

Jona, K., & Naidu, S. (2014). MOOCs: emerging research. Distance Education, 35(2), 141-144.

Jordan, K. (2013). *MOOC completion rates: The data*. Retrieved on 20.01.2015, from http://www.katyjordan.com/MOOCproject

Kaplan, F., & Bornet, C. A. M. (2014). A Preparatory Analysis of Peer-Grading for a Digital Humanities MOOC. In *Digital Humanities 2014: Book of Abstracts* (No. EPFL-CONF-200911, pp. 227-229).

Karat, J. (1997). Evolving the scope of user-centered design. *Communications of the ACM*, *40*(7), 33-38.

Karlsen, G. (2005). From Thumbs to Fingertips: Introducing Networked Digital Video to Online Learning. *Journal of Distance Education*, *20*(2), 85-87.

Kay, R. & Edward, J. (2012). Examining the Use of Worked Example Video Podcasts in Middle School Mathematics Classrooms: A Formative Analysis. *Canadian Journal of Learning and Technology*, 38 (2).

Kellogg, S. (2013). How to make a MOOC. *Nature, international weekly journal of science*, Macmillan Publishers Limited, 499, pp. 369-371.

Kersting, N. B., Givvin, K. B., Thompson, B. J., Santagata, R., & Stigler, J. W. (2012). Measuring usable knowledge teachers' analyses of mathematics classroom videos predict teaching quality and student learning. *American Educational Research Journal*, *49*(3), 568-589.

Khurana, K., & Chandak, M. B. (2013). Study of Various Video Annotation Techniques. *International Journal of Advanced Research in Computer and Communication Engineering*, *2*(1).

King, N. (2004) Using Templates in the Thematic Analysis of Text. In *C.Cassell and G.Symon (Eds.), Essential Guide to Qualitative Methods in Organizational Research,* Sage Publications: 256–270.

Kirkgöz, Y. (2011). A Blended Learning Study on Implementing Video Recorded Speaking Tasks in Task-Based Classroom Instruction. *Turkish Online Journal of Educational Technology-TOJET*, *10*(4), 1-13.

Kizilcec, R. F., Piech, C., & Schneider, E. (2013). Deconstructing disengagement: analyzing learner subpopulations in massive open online courses. In *Proceedings of the third international conference on learning analytics and knowledge* (pp. 170-179). ACM.

Knox, J., Ross, J., Sinclair, C., Macleod, H., & Bayne, S. (2014). MOOC Feedback: Pleasing All the People? In Krause, S. Lowe, C. Invasion of the MOOCs: The Promise and Perils of Massive Open Online Courses, pp. 98.

Kolowich, S. (2013). In deals with 10 public universities, Coursera bids for role in credit courses. Chronicle of Higher Education, 30.

Kong, S. C., Shroff, R. H., & Hung, H. K. (2009). A web enabled video system for self-reflection by student teachers using a guiding framework. Australasian Journal of Educational Technology, 25(4).

Kop, R. (2011). The challenges to connectivist learning on open online networks: Learning experiences during a massive open online course. *The International Review of Research in Open and Distance Learning, Special Issue-Connectivism: Design and Delivery of Social Networked Learning*, 12(3), pp. 19-38.

Kop, R., and Hill, A. (2008). Connectivism: Learning theory of the future or vestige of the past?. *International Review of Research in Open and Distance Learning*, 9(3).

Kop, R., Fournier, H., & Mak, J. S. F. (2011). A pedagogy of abundance or a pedagogy to support human beings? Participant support on massive open online courses. *The International Review of Research in Open and Distance Learning*, *12*(7), 74-93.

Koutropoulos, A., Gallagher, M. S., Abajian, S. C., de Waard, I., Hogue, R. J., Keskin, N. Ö., and Rodriguez, C. O. (2012). Emotive vocabulary in MOOCs: Context & participant retention. *European Journal of Open, Distance and E-Learning*.

Kruiderink, N. (2013). Open buffet of higher education. *In Trend report: open educational resources 2013,* pp. 54-58.

Kukulska-Hulme, A., & Shield, L. (2008). An overview of mobile assisted language learning: From content delivery to supported collaboration and interaction. *ReCALL*, *20*(03), 271-289.

Kulkarni, C., Wei, K. P., Le, H., Chia, D., Papadopoulos, K., Cheng, J., Koller, D., & Klemmer, S. R. (2013). Peer and self-assessment in massive online classes. *ACM Transactions on Computer-Human Interaction (TOCHI)*, *20*(6), 33.

Kuter, S., Gazi, Z. A., & Aksal, F. A. (2012). Examination of Co-construction of Knowledge in Videotaped Simulated Instruction. *Educational Technology & Society*, *15*(1), 174-184.

L^2P (2013). L^2P Lehr- und Lernplattform der RWTH Aachen University. Retrieved from, https://www3.elearning.rwth-aachen.de/SitePages/Start.aspx

Lambert, S., and Carter, A. (2013). Business Models for the Virtual University. In *The Virtual University: Impact on Australian Accounting and Business Education, Part B,* pp.77-85.

Laws, R. D., Howell, S. L., and Lindsay, N. K. (2003). Scalability in Distance Education: Can We Have Our Cake and Eat it Too?. *Online Journal of Distance Learning Administration*, 6(4).

Leony, D., Pardo, A., de la Fuente Valentín, L., de Castro, D. S., & Kloos, C. D. (2012, April). GLASS: a learning analytics visualization tool. *In Proceedings of the 2nd International Conference on Learning Analytics and Knowledge* (pp. 162-163). ACM.

Leximancer (2013). From Words to Meaning to Insight. Retrieved from https://www.leximancer.com/

Lim, S., Coetzee, D., Hartmann, B., Fox, A., & Hearst, M. A. (2014, March). Initial experiences with small group discussions in moocs. In Proceedings of the first ACM conference on Learning@ scale conference (pp. 151-152). ACM.

Lin, C. C., & Tseng, Y. F. (2012). Videos and Animations for Vocabulary Learning: A Study on Difficult Words. *Turkish Online Journal of Educational Technology-TOJET*, *11*(4), 346-355.

Lin, C. Y., Tseng, B. L., & Smith, J. R. (2003). VideoAnnEx: IBM MPEG-7 annotation tool for multimedia indexing and concept learning. In *IEEE International Conference on Multimedia and Expo* (pp. 1-2).

Lindgren, R., Pea, R., Lewis, S., & Rosen, J. (2007). Learning from digital video: An exploration of how interactions affect outcome. CSCL, 2007, pp. 447-449.

Liyanagunawardena, T. R., Adams, A. A., & Williams, S. A. (2013). MOOCs: A systematic study of the published literature 2008-2012. *The International Review of Research in Open and Distance Learning*, 14(3), 202-227.

Loo, J. L., Ngo, L. T., Hennesy, C. K., Quigley, B. D., & McKenzie, J. (2014, April). Embedding Video-based Learning Modules for Library Research Methods in an

Online Graduate Engineering Degree Program. In 121st ASEE Annual Conference & Exposition Proceedings.

Loviscach, J. (2013). MOOCs und Blended Learning–Breiterer Zugang oder Industrialisierung der Bildung. In R. Schulmeister (Hrsg.), MOOCs–Massive Open Online Courses. Offene Bildung oder Geschäftsmodell, 239-256.

Luo, H., Robinson, A. C., & Park, J. Y. (2014). Peer grading in a mooc: Reliability, validity, and perceived effects. *Online Learning: Official Journal of the Online Learning Consortium*, *18*(2).

Maas, A., Heather, C., Do, C. T., Brandman, R., Koller, D., & Ng, A. (2014). Offering Verified Credentials in Massive Open Online Courses: MOOCs and technology to advance learning and learning research (Ubiquity symposium).

Machun, P. A., Trau, C., Zaid, N., Wang, M., and Ng, J. W. (2012). MOOCs: Is there an app for that?: expanding Mobilegogy through an analysis of MOOCs and iTunes university. *International Conferences on Web Intelligence and Intelligent Agent Technology*, IEEE/WIC/ACM, pp. 321-325.

Mackness, J., Mak, S., & Williams, R. (2010). The ideals and reality of participating in a MOOC. *7th International Conference on Networked Learning 2010 Proceedings*, pp. 266-274.

Mak, S. F. J., Williams, R. and Mackness, J. (2010). Blogs and forums as communication and learning tools in a MOOC. In *L. Dirckinck–Holmfeld, V. Hodgson, C. Jones, M. de Laat, D. McConnell, & T. Ryberg (Eds.), Proceedings of the Seventh International Conference on Networked Learning 2010*, pp. 275-284.

Malan, D. J. (2013). Implementing a Massive Open Online Course (MOOC). *Journal of Computing Sciences in Colleges*, 28(6), pp. 136-137.

Maclellan, E. (2001). Assessment for learning: the differing perceptions of tutors and students. *Assessment & Evaluation in Higher Education*, *26*(4), 307-318.

Majchrzak, T. A., & Usener, C. A. (2012, January). Evaluating e-Assessment for exercises that require higher-order cognitive skills. In *System Science (HICSS), 2012 45th Hawaii International Conference on* (pp. 48-57). IEEE.

Marshall, S. (2014). Exploring the ethical implications of MOOCs. *Distance Education*, *35*(2), 250-262.

Martin, F. (2013). Will Massive Open Online Courses change how we teach?: sharing recent experiences with an online course. *Comm. ACM* 55(8), pp. 26–28.

MassBay (2013). New Course: Practical Python Programming. Retrieved from, http://www.massbay.edu/Academics/New-Course--Practical-Python-Programming.aspx

Mattingly, K. D., Rice, M. C., & Berge, Z. L. (2012). Learning analytics as a tool for closing the assessment loop in higher education. Knowledge Management & E-Learning: *An International Journal (KM&EL)*, 4(3), 236-247.

Mayring, P. (2000). Qualitative content analysis. *Qualitative Social Research, 1(2)*, Art. 20. Retrieved from: http://www.qualitative-research.net/index.php/fqs/article/view/1089/2385

Mayring, P. (2003). *Qualitative Inhaltsanalyse, Grundlagen und Techniken* (8th ed.). Weinheim: Beltz, UTB.

McAndrew, P. (2013). Learning from open design: running a learning design MOOC. *eLearning Papers, ISSN: 1887-1542, Issue 33*.

McAuley, A., Stewart, B., Siemens, G., & Cormier, D. (2010). The MOOC model for digital practice. Technical Report, Retrieved October 2014 from http://www.elearnspace.org/Articles/MOOC_Final.pdf.

McCallum, C. M., Thomas, S. and Libarkin, J. (2013). The AlphaMOOC: Building a Massive Open Online Course one graduate student at a time. *eLearning Papers, ISSN: 1887-1542, Issue 33*.

McCarthy, J. (2010). Blended learning environments: Using social networking sites to enhance the first year experience. *Australasian Journal of Educational Technology*, *26*(6), 729-740.

McDonald, S., Daniels, K., & Harris, C. (2004). Using templates in the thematic analysis of texts. *Essential guide to qualitative methods in organizational research*, 73–85.

McGarr, O., & Clifford, A. M. (2013). 'Just enough to make you take it seriously': exploring students' attitudes towards peer assessment. *Higher Education*, *65*(6), 677-693.

McLoughlin, C. E. (2013, June). The pedagogy of personalised learning: exemplars, MOOCS and related learning theories. In World Conference on Educational Multimedia, Hypermedia and Telecommunications (Vol. 2013, No. 1, pp. 266-270).

McMullan, M., Endacott, R., Gray, M. A., Jasper, M., Miller, C. M., Scholes, J., & Webb, C. (2003). Portfolios and assessment of competence: a review of the literature. *Journal of advanced nursing*, *41*(3), 283-294.

Merkt, M., Weigand, S., Heier, A., & Schwan, S. (2011). Learning with videos vs. learning with print: The role of interactive features. *Learning and Instruction*, *21*(6), 687-704.

Milligan, C., & Littlejohn, A. (2014). Supporting professional learning in a massive open online course. *The International Review of Research in Open and Distance Learning*, *15*(5).

Milligan, C., Littlejohn, A., and Margaryan, A. (2013). Patterns of engagement in connectivist MOOCs. *Journal of Online Learning and Teaching*, 9(2), pp. 149-159.

Milrad, M., Rossmanith, P., & Scholz, M. (2005). Implementing an Educational Digital Video Library Using MPEG-4, SMIL and Web Technologies. *Educational Technology & Society*, *8*(4), 120-127.

Mirriahi, N., & Dawson, S. (2013). The pairing of lecture recording data with assessment scores: a method of discovering pedagogical impact. In *Proceedings of the Third International Conference on Learning Analytics and Knowledge* (pp. 180-184). ACM.

Montazemi, A. R. (2006). The effect of video presentation in a CBT environment. *Educational Technology & Society*, *9*(4), 123-138.

Morris, L. V. (2013) MOOCs, emerging technologies, and quality. *Innovative Higher Education,* Springer, 38, pp. 251-252.

Motti, V. G., Fagá Jr, R., Catellan, R. G., Pimentel, M. D. G. C., & Teixeira, C. A. (2009, June). Collaborative synchronous video annotation via the watch-and-comment paradigm. In *Proceedings of the seventh european conference on European interactive television conference* (pp. 67-76). ACM.

Muhirwa, J. M. (2009). Teaching and learning against all odds: A video-based study of learner-to-instructor interaction in international distance education. *The International Review of Research in Open and Distance Learning*, *10*(4).

Nielsen, J. (1994). Usability inspection methods. In *Conference companion on Human factors in computing systems* (pp. 413-414). ACM.

Nielsen, Jakob (2002). Top Ten Guidelines for Homepage Usability. *Available on line at http://www.useit.com/alertbox/20020512.html*.

Nikopoulou-Smyrni, P., & Nikopoulos, C. (2010). Evaluating the impact of video-based versus traditional lectures on student learning. *Educational Research*, *1*(8), 304-311.

Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company: How Japanese companies create the dynamics of innovation*. Oxford university press.

Odhabi, H., & Nicks-McCaleb, L. (2011). Video recording lectures: Student and professor perspectives. British Journal of Educational Technology, 42(2), 327-336.

Osguthorpe, R. T., & Graham, C. R. (2003). Blended Learning Environments: Definitions and Directions. *Quarterly Review of Distance Education*, *4*(3), 227-33.

Ostashewski, N., & Reid, D. (2012). Delivering a MOOC using a social networking site: the SMOOC Design model. In Proc. *IADIS International Conference on Internet Technologies & Society*, (2012), 217-220.

O'Toole, R. (2013) Pedagogical strategies and technologies for peer assessment in Massively Open Online Courses (MOOCs). *Discussion Paper. University of Warwick, Coventry, UK: University of Warwick*. Retrieved from http://wrap.warwick.ac.uk/54602/

Ovaska, S. (2013). User experience and learning experience in online HCI courses. In *P. Kotzé et al. (Eds.): INTERACT 2013, Part IV, LNCS 8120*,pp. 447-454.

Pang, Y. (2010). Improving hybrid learning of physical education by video review. In *Advances in Web-Based Learning–ICWL 2010* (pp. 230-239). Springer Berlin Heidelberg.

Pardos, Z. A. and Schneider, E. (2013). First annual workshop on Massive Open Online Courses (moocshop). *In K. Yacef et al. (Eds.): AIED, LNAI.* Springer *7926*, P. 950.

Pazzani, M. J., & Billsus, D. (2007). Content-based recommendation systems. In The adaptive web (pp. 325-341). Springer Berlin Heidelberg.

Pea, R., & Lindgren, R. (2008). Video collaboratories for research and education: An analysis of collaboration design patterns. *Learning Technologies, IEEE Transactions on*, *1*(4), 235-247.

Peter, S. and Deimann, M. (2013). On the role of openness in education: A historical reconstruction. *Open Praxis*, 5(1), pp. 7-14.

Petko, D., Reusser, K., Noetzli, C., Krammer, K., & Hugener, I. (2003, August). Collaborative video based teacher training in a virtual learning environment. In *10th European Conference for Research on Learning and Instruction (EARLI), Padova/Italy*.

Piech, C., Huang, J., Chen, Z., Do, C., Ng, A., & Koller, D. (2013). Tuned models of peer assessment in MOOCs. *arXiv preprint arXiv:1307.2579*.

Portmess, L. (2013). Mobile Knowledge, karma points and digital Peers: The tacit epistemology and linguistic representation of MOOCs. *Canadian Journal of Learning and Technology*, 39(2).

Preston, M., Campbell, G., Ginsburg, H., Sommer, P., & Moretti, F. (2005, June). Developing new tools for video analysis and communication to promote critical thinking. In *World Conference on Educational Multimedia, Hypermedia and Telecommunications* (Vol. 2005, No. 1, pp. 4357-4364).

Prümper, J. (1997). Der Benutzungsfragebogen ISONORM 9241/10: Ergebnisse zur Reliabilität und Validität. In *Software-Ergonomie'97* (pp. 253-262). Vieweg+ Teubner Verlag.

Puegphrom, P., & Chiramanee, T (2011). The Effectiveness of Implementing Peer Assessment on Students' Writing Proficiency, The 3rd International Conference on Humanities and Social Sciences (pp. 1-17). Prince of Songkla University.

Purser, E., Towndrow, A., and Aranguiz, A. (2013). Realising the potential of peer-to-peer learning: taming a MOOC with social media. *eLearning Papers, ISSN: 1887-1542, Issue 33*.

Qiao, Q., & Beling, P. A. (2011, January). Classroom video assessment and retrieval via multiple instance learning. In *Artificial Intelligence in Education* (pp. 272-279). Springer Berlin Heidelberg.

Rhoads, R. A., Berdan, J. and Lindsey, B. T. (2013). The open courseware movement in higher education: unmasking power and raising questions about the movement's democratic potential. *Educational Theory*, 63(1), pp. 87-110.

Rich, P. J., & Hannafin, M. (2009). Video annotation tools technologies to scaffold, structure, and transform teacher reflection. *Journal of Teacher Education*, *60*(1), 52-67.

Richards, L. (1999). *Using NVivo in qualitative research*. Sage.

Rodriguez, C. O. (2012). MOOCs and the AI-Stanford like courses: Two successful and distinct course formats for massive open online courses. *European Journal of Open, Distance and E-Learning*.

Rodriguez, O. (2013). The concept of openness behind c and x-MOOCs (Massive Open Online Courses*). Open Praxis, Special theme: Openness in higher education*, 5(1), pp. 67-73.

Romero, M. (2013). Game based learning MOOC. promoting entrepreneurship education. *eLearning Papers, ISSN: 1887-1542*, Issue 33.

Russell, D. M., Klemmer, S., Fox, A., Latulipe, C., Duneier, M., & Losh, E. (2013, April). Will massive online open courses (moocs) change education?. *In CHI'13 Extended Abstracts on Human Factors in Computing Systems* (pp. 2395-2398). ACM..

Ruth, S. (2012). Can MOOC's and existing e-learning paradigms help reduce college costs? *International Journal of Technology in Teaching and Learning*, 8(1), pp. 21-32.

Sánchez-Vera, M. M., & Prendes-Espinosa, M. P. (2015). Beyond objective testing and peer assessment: alternative ways of assessment in MOOCs. *RUSC. Universities and Knowledge Society Journal*, *12*(1). pp. 119-130. doi http://dx.doi.org/10.7238/rusc.v12i1.2262

Sadler, P. M., & Good, E. (2006). The impact of self-and peer-grading on student learning. *Educational assessment*, *11*(1), 1-31.

Sandeen, C. (2013a). Assessment's place in the new MOOC world. *Research & Practice in Assessment Journal*, 8 (summer 2013), pp. 5-13.

Sandeen, C. (2013b). Integrating MOOCS into traditional higher education: the emerging "MOOC 3.0" Era. Change: The Magazine of Higher Learning, 45(6), 34-39.

Sanou, B. (2013). The World in 2013: ICT Facts and Figures. *International Telecommunications Union*.

Santagata, R. (2009). Designing video-based professional development for mathematics teachers in low-performing schools. *Journal of Teacher Education*, *60*(1), 38-51.

Santagata, R., & Angelici, G. (2010). Studying the impact of the lesson analysis framework on preservice teachers' abilities to reflect on videos of classroom teaching. Journal of Teacher Education, 61(4), 339-349.

Santagata, R., & Guarino, J. (2011). Using video to teach future teachers to learn from teaching. Zdm, 43(1), 133-145.

Santos, J. L., Klerkx, J., Duval, E., Gago, D., & Rodríguez, L. (2014, March). Success, activity and drop-outs in MOOCs an exploratory study on the UNED COMA courses. In Proceedins of the Fourth International Conference on Learning Analytics And Knowledge (pp. 98-102). ACM.

Sarwar, B., Karypis, G., Konstan, J., & Riedl, J. (2001, April). Item-based collaborative filtering recommendation algorithms. In *Proceedings of the 10th international conference on World Wide Web* (pp. 285-295). ACM.

Schroeder, U. (2009). Web-based learning–yes we can!. In *Advances in Web Based Learning–ICWL 2009* (pp. 25-33). Springer Berlin Heidelberg.

Schroeter, R., Hunter, J., & Kosovic, D. (2003). Vannotea: A collaborative video indexing, annotation and discussion system for broadband networks. In *Knowledge capture* (pp. 1-8). ACM Press (Association for Computing Machinery).

Schulmeister, R. (2014). The Position of xMOOCs in Educational Systems. eleed, Iss. 10. (urn:nbn:de:0009-5-40743)

Schuwer, R. and Janssen, B. (2013). Trends in business models for open educational resources and open education. In *Trend report: open educational resources 2013*, pp. 60-66.

Schuwer, R., Janssen, B. and Valkenburg, W. V. (2013). MOOCs: trends and opportunities for higher education. In *Trend report: open educational resources 2013*, pp. 22-27.

Schworm, P. (2012). Community colleges to try blended studies: Add in-person help for online education. http://www.bostonglobe.com/metro/2012/11/18/edx-expands-offerings-mass-community-colleges/IurtCNtV5UrXwWh08g48KN/story.html

Seidel, T., Blomberg, G., & Renkl, A. (2013). Instructional strategies for using video in teacher education. *Teaching and Teacher Education*, *34*, 56-65.

Shee, D. Y., & Wang, Y. S. (2008). Multi-criteria evaluation of the web-based e-learning system: A methodology based on learner satisfaction and its applications. Computers & Education, 50(3), 894-905.

Shen, W. (2014). Using Video Recording System to Improve Student Performance in High-Fidelity Simulation. In *Frontier and Future Development of Information Technology in Medicine and Education* (pp. 1753-1757). Springer Netherlands.

Sherin, M. G., & van Es, E. A. (2009). Effects of video club participation on teachers' professional vision. *Journal of Teacher Education*, *60*(1), 20-37.

Shih, R. C. (2010). Blended learning using video-based blogs: Public speaking for English as a second language students. *Australasian Journal of Educational Technology*, *26*(6), 883-897.

Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning*, *2*(1), 3-10.

Siemens, G. (2013). Massive Open Online Courses: Innovation in Education?.*Open Educational Resources: Innovation, Research and Practice*, 5.

Siemens, G., & Long, P. (2011). Penetrating the Fog: Analytics in Learning and Education. *EDUCAUSE review*, *46*(5), 30.

Sitthiworachart, J., & Joy, M. (2004). Effective peer assessment for learning computer programming. In *ACM SIGCSE Bulletin* (Vol. 36, No. 3, pp. 122-126). ACM.

Slade, S., & Prinsloo, P. (2013). Learning Analytics Ethical Issues and Dilemmas. *American Behavioral Scientist*, *57*(10), 1510-1529.

Smith, A. E., & Humphreys, M. S. (2006). Evaluation of unsupervised semantic mapping of natural language with Leximancer concept mapping. *Behavior Research Methods*, *38*(2), 262-279.

Smith, B. and Eng, M. (2013). MOOCs: A learning journey two continuing education practitioners investigate and compare cMOOC and xMOOC learning models and experiences. 6th International Conference, ICHL 2013 Toronto, ON, Canada. Springer, pp.244-255.

Smyth, R. (2011). Enhancing learner–learner interaction using video communications in higher education: Implications from theorising about a new model. *British Journal of Educational Technology*, *42*(1), 113-127.

Snelson, C., Rice, K., & Wyzard, C. (2012). Research priorities for YouTube and video-sharing technologies: A Delphi study. *British Journal of Educational Technology*, *43*(1), 119-129.

So, H. J., Lossman, H., Lim, W. Y., & Jacobson, M. J. (2009). Designing an online video based platform for teacher learning in Singapore. Australasian Journal of Educational Technology, 25(3).

Spector, J. M. (2013). Trends and research issues in educational technology. *The Malaysian Online Journal of Educational Technology*, 1 (3), pp. 1-9.

Stewart, B. (2013). Massiveness + Openness = new literacies of participation?. *Journal of Online Learning and Teaching*, 9(2), pp. 228-238.

Stine, J. K. (2013). MOOCs and executive education. *UNICON*, *research report*. Retrieved from http://uniconexed.org/2013/research/UNICON-Stine-Research-06-2013-final.pdf

Stödberg, U. (2012). A research review of e-assessment. *Assessment & Evaluation in Higher Education*, *37*(5), 591-604.

Subbian, V. (2013). Role of MOOCs in integrated STEM education: A Learning perspective. *3rd IEEE Integrated STEM Education Conference*.

Suen, H. K. (2014). Peer assessment for massive open online courses (MOOCs). *The International Review of Research in Open and Distance Learning*, *15*(3).

Szafir, D. and Mutlu, B. (2013). ARTFuL: Adaptive review technology for flipped learning. In *CHI 2013 conference: Changing Perspectives*, Paris, France, pp. 1001-1010.

Teplechuk, E. (2013). Emergent models of Massive Open Online Courses: an exploration of sustainable practices for MOOC institutions in the context of the launch of MOOCs at the University of Edinburgh. *MBA Dissertation*, University of Edinburgh.

Theodosiou, Z., Kounoudes, A., Tsapatsoulis, N., & Milis, M. (2009). Mulvat: A video annotation tool based on xml-dictionaries and shot clustering. In *Artificial Neural Networks–ICANN 2009* (pp. 913-922). Springer Berlin Heidelberg.

Tobin, K. (1998). Qualitative perceptions of learning environments on the world wide web. Learning Environments Research, 1(2), 139-162.

Topping, K. (1998). Peer assessment between students in colleges and universities. *Review of Educational Research*, *68*(3), 249-276.

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British journal of management*, *14*(3), 207-222.

Tripp, T., & Rich, P. (2012). Using video to analyze one's own teaching. *British Journal of Educational Technology*, *43*(4), 678-704.

Troncy, R., Mannens, E., Pfeiffer, S., & Van Deursen, D. (2012). Media fragments URI 1.0 (basic). W3C proposed recommendation. *World Wide Web Consortium*.

Tschofen, C., Mackness, J. (2012). Connectivism and dimensions of individual experience. *The International Review of Research in Open and Distance Learning*, 13 (1), pp. 124-143.

Tse, ShekKam; Yuen, Allan Hoi Kau; Loh, Elizabeth Ka Yee; Lam, Joseph WaiIp& Ng, Rex Hung Wai (2010). The impact of blogging on Hong Kong primary school students' bilingual reading literacy. *Australian Journal of Teacher Education*, 26(2), 164-179.

Tucker, B. (2012). The flipped classroom. Education Next, 12(1), 82-83.

van Es, E. A., & Sherin, M. G. (2006). How different video club designs support teachers in "learning to notice". Journal of computing in teacher education, 22(4), 125-135.

van Zee, E. H., & Roberts, D. (2006). Making science teaching and learning visible through web-based "snapshots of practice". *Journal of Science Teacher Education*, *17*(4), 367-388.

Van Zundert, M., Sluijsmans, D., & Van Merriënboer, J. (2010). Effective peer assessment processes: Research findings and future directions. *Learning and Instruction*, *20*(4), 270-279.

Verleur, R., Heuvelman, A., & Verhagen, P. W. (2011). Trigger videos on the Web: Impact of audiovisual design. *British Journal of Educational Technology*, *42*(4), 573-582.

Vihavainen, A., Luukkainen, M. and Kurhila, J. (2012). Multi-faceted support for MOOC in programming. *SIGITE'12, Proceedings of the ACM Special Interest Group for Information Technology Education Conference*, Calgary, Alberta, Canada, pp. 171-176.

Viswanathan, R. (2013). Teaching and learning through MOOC. *Frontiers of Language and Teaching*, 3, pp. 32-40.

Voss, B. D. (2013). Massive Open Online Courses (MOOCs): A primer for university and College Board members. *AGB Association of Governing Boards of Universities and Colleges*.

Waite, M., Mackness, J., Roberts, G., and Lovegrove, E. (2013). Liminal participants and skilled orienteers: Learner participation in a MOOC for new lecturers. *Journal of Online Learning and Teaching*, 9(2), pp. 200-215.

Waldrop, M. M. (2013). Online learning: Campus 2.0. *Nature, international weekly journal of science*, Macmillan Publishers Limited, 495, pp. 160-163.

Wallace, A. (2013, September). Social learning platforms and the flipped classroom. In *e-Learning and e-Technologies in Education (ICEEE), 2013 Second International Conference on* (pp. 198-200). IEEE.

Wang, M., Hua, X. S., Song, Y., Hong, R., & Dai, L. R. (2007, July). Lazy Learning Based Efficient Video Annotation. In *Multimedia and Expo, 2007 IEEE International Conference on* (pp. 607-610). IEEE.

Watson, M., Smith, A., & Watter, S. (2005, January). Leximancer concept mapping of patient case studies. In *Knowledge-based intelligent information and engineering systems* (pp. 1232-1238). Springer Berlin Heidelberg.

WEO. (2012). International energy agency. Retrieved from http://www.worldenergyoutlook.org/

Whitehead, C. C. (2006). Evaluating web page and web site usability. *ACM SE'06*, Melbourne, Florida, USA March, 10-12, 788-789.

Wiecha, J. M., Gramling, R., Joachim, P., & Vanderschmidt, H. (2003). Collaborative e-learning using streaming video and asynchronous discussion boards to teach the cognitive foundation of medical interviewing: a case study. *Journal of medical Internet research*, *5*(2).

Wilkowski, J., Deutsch, A., & Russell, D. M. (2014, March). Student skill and goal achievement in the mapping with Google MOOC. In *Proceedings of the first ACM conference on Learning@ scale conference* (pp. 3-10). ACM.

Wilson, S. G. (2013). The Flipped Class A Method to Address the Challenges of an Undergraduate Statistics Course. Teaching of Psychology, 40, 193-199.

Wolf, K., & Stevens, E. (2007). The role of rubrics in advancing and assessing student learning. *The Journal of Effective Teaching*, *7*(1), 3-14.

Woodruff, A. W. (2014). Using video based instruction to teach art to students with autism spectrum disorder. Theses and Dissertations, Art & Visual Studies. Paper 5, 2014, http://uknowledge.uky.edu/art_etds/5

Wouters, P., Tabbers, H. K., & Paas, F. (2007). Interactivity in video-based models. *Educational Psychology Review*, *19*(3), 327-342.

Wright, C. R. (2003). Criteria for evaluating the quality of online courses. Alberta Distance Education and Training Association.

Wu, C. C., & Kao, H. C. (2008). Streaming Videos in Peer Assessment to Support Training Pre-service Teachers. Educational Technology & Society, 11(1), 45-55.

Yang, J. C., Huang, Y. T., Tsai, C. C., Chung, C. I., & Wu, Y. C. (2009). An Automatic Multimedia Content Summarization System for Video Recommendation. *Educational Technology & Society*, *12*(1), 49-61.

Yin, R. (2003). *Case study research: Design and methods* (3rd ed.). California: SAGE Publications.

Yin, S., & Kawachi, P. (2013). Improving open access through prior learning assessment. *Open Praxis*, *5*(1), 59-65.

Yorke, M. (2007). Assessment, especially in the first year of higher education: Old principles in new wrapping. In *REAP International Online Conference on Assessment Design for Learner Responsibility*.

Young, J. R. (2012). A conversation with Bill Gates about the future of higher education. The Chronicle of Higher Education, 25.

Yousef, A. M. F., Chatti, M. A., & Schroeder, U. (2014a). Video-Based Learning: A Critical Analysis of The Research Published in 2003-2013 and Future Visions. In *eLmL 2014, The Sixth International Conference on Mobile, Hybrid, and On-line Learning* (pp. 112-119).

Yousef, A. M. F., Chatti, M. A., Schroeder, U., Wosnitza, M., Jakobs, H. (2014b). MOOCs - A Review of the State-of-the-Art. *In Proc. CSEDU 2014 conference*, Vol. 3, pp. 9-20. INSTICC, 2014.

Yousef, A. M. F., Chatti, M. A., Schroeder, U., & Wosnitza, M. (2014c). What Drives a Successful MOOC? An Empirical Examination of Criteria to Assure Design Quality of MOOCs. In *Advanced Learning Technologies (ICALT), 2014 IEEE 14th International Conference on* (pp. 44-48). IEEE.

Yousef, A. M. F., Chatti, M. A., & Schroeder, U. (2014d). The State of Video-Based Learning: A Review and Future Perspectives. *International Journal On Advances in Life Sciences*, *6* (3 and 4), 122-135.

Yousef, A. M. F., Chatti, M. A., Wosnitza, M., & Schroeder, U. (2015a). A Cluster Analysis of MOOC Stakeholder Perspectives. RUSC. Universities and Knowledge Society Journal, 12(1), 74-90.

Yousef, A. M. F., Chatti, M. A., Danoyan, N., Thüs, H., & Schroeder, U. (2015). Video-Mapper: A Video Annotation Tool to Support Collaborative Learning in MOOCs. Proceedings of the Third European MOOCs Stakeholders Summit EMOOCs 2015. pp. 131-140.

Yousef, A. M. F., Chatti, M. A., Ahmad, I., Schroeder, U., & Wosnitza, M. (2015c). An Evaluation of Learning Analytics in a Blended MOOC Environment. The European MOOC Stakeholder Summit 2015.

Yousef, A. M. F., Chatti, M. A., Schroeder, U., & Wosnitza, M. (2015d). A usability evaluation of a blended MOOC environment: An experimental case study. The International Review of Research in Open and Distributed Learning, 16(2).

Yousef, A. M. F., Wahid, U., Chatti, M. A., Schroeder, U., & Wosnitza, M. (2015e). The Effect of Peer Assessment Rubrics on Learners' Satisfaction and Performance within a Blended MOOC Environment. *In Proc. CSEDU 2015 conference.* INSTICC, 2015.

Yuan, L. and Powell, S. (2013a). MOOCs and open education: Implications for higher education. *JISC CETIS*, Retrieved from http://jisc.cetis.ac.uk/

Yuan, L., and Powell, S. (2013b). MOOCs and disruptive innovation: Implications for higher education, *eLearning Papers, ISSN: 1887-1542*, Issue 33.

Zahn, C., Hesse, F., Finke, M., Pea, R., Mills, M., & Rosen, J. (2005, May). Advanced digital video technologies to support collaborative learning in school education and beyond. In *Proceedings of th 2005 conference on Computer support for collaborative learning: learning 2005: the next 10 years!* (pp. 737-742). International Society of the Learning Sciences.

Zahn, C., Krauskopf, K., Kiener, J., & Hesse, F. W. (2014). Designing Video for Massive Open Online-Education: Conceptual Challenges from a Learner-Centered Perspective. Proceedings of the European MOOC Stakeholder Summit 2014, 160.

Zhang, D., Zhou, L., Briggs, R. O., & Nunamaker Jr, J. F. (2006). Instructional video in e-learning: Assessing the impact of interactive video on learning effectiveness. *Information & Management*, *43*(1), 15-27.

Statement of Originality

This dissertation would not have been possible without the close collaboration within the Learning Technologies Research Group (LuFG Informatik 9), headed by Prof. Dr. Ulrik Schroeder. Many of the presented ideas and techniques evolved from the fruitful discussion in the group and also with the students.

Parts of this thesis are published in international journals of computer science and educational technology such as The International Review of Research in Open and Distributed Learning (*IRRODL*), Universities and Knowledge Society Journal (*RUSC*), International Journal on Advances in Life Sciences (*LifSci*) and Communications in Computer and Information Science (*CCIS* Series Book) Springer.

In addition to the proceedings of international conferences such as the The 14th IEEE International Conference on Advanced Learning Technologies (*ICALT* 2014) International Conference on Computer Supported Education (*CSEDU* 2013, 2014, 2015), the 6th International Conference on Mobile, Hybrid, and On-line Learning (*eLmL* 2014), and the Third European MOOCs Stakeholders Summit (*EMOOCs* 2015).

Some approaches dealing with video annotations in chapters 4 and learning analytics in chapter 5 were initially implemented in Master's thesis of Narek Danoyan (2013) and Imran Ahmad (2014), respectively.

The publications, where the chapters or parts of them appeared, are footnoted at the beginning of the corresponding chapter. A complete list of my previous publications is given separately in the following for convenience.

List of Publications

2015

Yousef, A. M. F., Chatti, M. A., Wosnitza, M., & Schroeder, U. (2015a). A Cluster Analysis of MOOC Stakeholder Perspectives. RUSC. Universities and Knowledge Society Journal, 12(1), 74-90.

Yousef, A. M. F., Chatti, M. A., Danoyan, N., Thüs, H., & Schroeder, U. (2015b). Video-Mapper: A Video Annotation Tool to Support Collaborative Learning in MOOCs. Proceedings of the Third European MOOCs Stakeholders Summit EMOOCs 2015. pp. 131-140.

Yousef, A. M. F., Chatti, M. A., Ahmad, I., Schroeder, U., & Wosnitza, M. (2015c). An Evaluation of Learning Analytics in a Blended MOOC Environment. Proceedings of the Third European MOOCs Stakeholders Summit EMOOCs 2015. pp. 122-130.

Yousef, A. M. F., Chatti, M. A., Schroeder, U., & Wosnitza, M. (2015d). A usability evaluation of a blended MOOC environment: An experimental case study. The International Review of Research in Open and Distributed Learning, 16(2).

Yousef, A. M. F., Wahid, U., Chatti, M. A., Schroeder, U., & Wosnitza, M. (2015e). The Effect of Peer Assessment Rubrics on Learners' Satisfaction and Performance within a Blended MOOC Environment. *In Proc. CSEDU 2015 conference Vol. 2, pp. 148-159.* INSTICC, 2015.

Yousef, A. M. F., Chatti, M. A., Schroeder, U., Wosnitza, M., Jakobs, H. (In press). The State of MOOCs from 2008 to 2014: A Critical Analysis and Future Visions. Communications in Computer and Information Science (CCIS Series book). Springer.

Yousef, A. M. F., Chatti, M. A., Wosnitza, M., & Schroeder, U. (2015a Spanish version). Análisis de clúster de perspectivas de participantes en MOOC. Monográfico: Los MOOC:¿ una transformación radical o una moda pasajera?, 12(1), 74.

2014

Yousef, A. M. F., Chatti, M. A., & Schroeder, U. (2014a). Video-Based Learning: A Critical Analysis of The Research Published in 2003-2013 and Future Visions. In *eLmL 2014, The Sixth International Conference on Mobile, Hybrid, and On-line Learning* (pp. 112-119).

Yousef, A. M. F., Chatti, M. A., Schroeder, U., Wosnitza, M., Jakobs, H. (2014b). MOOCs-A Review of the State-of-the-Art. *In Proc. CSEDU 2014 conference*, Vol. 3, pp. 9-20. INSTICC, 2014.

Yousef, A. M. F., Chatti, M. A., Schroeder, U., & Wosnitza, M. (2014c). What Drives a Successful MOOC? An Empirical Examination of Criteria to Assure Design Quality of MOOCs. In *Advanced Learning Technologies (ICALT), 2014 IEEE 14th International Conference on* (pp. 44-48). IEEE.

Yousef, A. M. F., Chatti, M. A., & Schroeder, U. (2014d). The State of Video-Based Learning: A Review and Future Perspectives. *International Journal On Advances in Life Sciences, 6* (3 and 4), 122-135.

Chatti, M. A., Lukarov, V., Thüs, H., Muslim, A., Yousef, A. M. F., Wahid, U., Greven, C., Chakrabarti, A., Schroeder, U. (2014). Learning Analytics: Challenges and Future Research Directions. eleed, Iss. 10. (urn:nbn:de:0009-5-40350).

2013

Yousef, A. M. F., Rößling, G. (2013). How to Design Good Educational Blogs in LMS?. In Proc. CSEDU 2013 conference, pp. 70-75. INSTICC, 2013.

Supervised Master's Thesis

Finished Thesis

Danoyan, N. (2013). Video Annotation Tool to Support Collaborative Learning in L²P. Master thesis, RWTH Aachen, Aachen, Germany.

Ahmad, I. (2014). Learning Analytics tool for Video-Based Learning in L²P. Master thesis, RWTH Aachen, Aachen, Germany.

Running Thesis

Bhattacharyya, R. (running). A Mobile Collaborative Video Annotation Tool. Master thesis, at Learning Technologies Research Group (LuFG Informatik 9), RWTH Aachen.

Petro, T. (running). Integrating Embedded Video Files into Learning Management Systems. Master thesis, at Learning Technologies Research Group (LuFG Informatik 9), RWTH Aachen.

Sofyan, Z. (running). Visual Analytics in Video-Mapper. Master thesis, at Learning Technologies Research Group (LuFG Informatik 9), RWTH Aachen.

Laksono, R. (running). Usability, Modularity, and Extensibility Improvement on Video-Mapper. Master thesis, at Learning Technologies Research Group (LuFG Informatik 9), RWTH Aachen.