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Knowledge Communities in Online Education and (Visual) Knowledge Management

19. Workshop GeNeMe‘16
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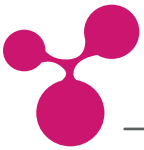

GeNeMe '16

Gemeinschaften in Neuen Medien

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Prof. Dr. Eric Schoop
Prof. Dr. Nina Kahnwald
(Hrsg.)

mit Unterstützung von:

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Preface

Thomas Köhler [1], Sander Münster [1], *Eric Schoop [1], Nina Kahnwald [2]*
[1] Technische Universität Dresden
[2] Hochschule der Deutschen Gesetzlichen Unfallversicherung (HGU)

Dear Readers of the OAP Version of the Proceedings on the 19th GeNeMe 2016,
Dear Colleagues of the GeNeMe Community,

Traditionally, the conference „Communities in New Media (GeNeMe)“ examines organisational and information technology perspectives in the context of virtual enterprises, online communities, and social networks. As organisers of the „Knowledge Communities 2016“ conference at the Technische Universität Dresden, Nina Kahnwald, Thomas Köhler, Eric Schoop, and Stefan Ehrlich are committed to the scientific and multidisciplinary exchange on the topic, which also builds a bridge between research and entrepreneurial practice.
In the meantime, the cooperation of the 19th GeNeMe 2016 with the 11th IFKAD 2016 for the GeNeMe 2016 in Dresden is now behind us and we were able to present the three tracks „Knowledge Communities I“ & „Knowledge Communities II“ as well as „Visual Knowledge Management“ in front of an international English-speaking audience at this multicultural conference!
With the publication, you have the OAP (Open Access Publication) version of the Proceedings in hand or can read it in digital form after the contributions have first appeared in the framework of the Proceedings of the 11th IFKAD 2016 (International Forum on Knowledge Asset Dynamics), not only with the publication of the OAPs (see Spender, Noennig & Schiuma, 2016).

The 19th GeNeMe 2016 was organised as a sub-conference of the 11th IFKAD from 15 to 18 June 2016 at TU Dresden. The three GeNeMe tracks „Knowledge Communities I“ and „Knowledge Communities II“ as well as „Visual Knowledge Management“ found an ideal framework under the motto „Towards a New Architecture of Knowledge: Big Data, Culture and Creativity“. Stronger than in previous years, the stakeholders dealt with questions of the visualisation of knowledge management and online knowledge communities, as well as digitisation in business and science, while in 2015 the 18th GeNeMe had established a strong link to knowledge management. To this extent, the GeNeMe 2016 was again able to take up the joint umbrella of a multicultural conference as a starting point for thematic innovations.
Content and organisational support came from the Knowledge Research Center KRC Dresden e.V., the Society for Media in Science GMW e.V., the Society for Computer Science GI e.V., as well as the Leibniz Research Group Science 2.0. As a result, two

conferences with mutually complementary thematic focus areas could be brought together with several networks, which negotiate learning and knowledge processes in the area of conflict between science, organisation, technology, and (corporate) culture.

New to the implementation of 2016 were the international orientation and the further expansion of the offer with a „Knowledge Week“. The IFKAD context (11th International Forum on Knowledge Asset Dynamics) ensures a very good international visibility to a high-quality publication (both in book form and online). The basis for the selection of the contributions was a peer review of the individual submissions, this time on the basis of abstracts, whereupon the complete texts were to be produced.

Thematic focus of GeNeMe 2016

Communities in New Media started in 1998 as a workshop series at TU Dresden, and since then has annually dealt with online communities at the interface between several disciplines such as education and economics, computer science, social and communication sciences, and more. (See Köhler, Kahnwald & Schoop, 2015). The workshop is traditionally a forum for interdisciplinary dialogue between science and business and serves to share experiences and knowledge among participants from different disciplines, organisations, and institutions.

In addition to the core themes of knowledge management and communities (in the chapters of the same name), the main focus of the conference is also on the support of knowledge and learning processes in the field of (media-assisted) higher education. This is complemented by an informational perspective when it comes to more functional and methodological approaches - use cases, workflows, and automation in knowledge management. In addition, systems and approaches for feedback, exchange, and ideas are presented. With the focus of knowledge media design and visual research as well as creative processes, this time there is also a highlight on visual aspects of knowledge management and mediation.

For IFKAD 2016, three GeNeMe tracks were accepted which focus on the interface of knowledge communities and knowledge management as well as knowledge media design in science, business, or education. In this conference volume you will find detailed information about these three tracks:

- Knowledge Communities I: Knowledge Management
- Knowledge Communities II: Online Education
- Visual Knowledge Management

The first track, „Knowledge Communities I: Knowledge Management“, was chaired by Eric Schoop, Thomas Köhler, Nina Kahnwald, Sander Münster, and Stefan Ehrlich and investigates two main areas:

- Economic activity and knowledge organisation and processes in online communities
- Technologies and methods for online communities and the analysis of the respective KM processes

The second track, „Knowledge Communities II: Online Education“, headed by Nina Kahnwald Thomas Köhler, Eric Schoop, Lars Schlenker, and Stefan Ehrlich, is concerned with two main areas:

- Concepts of knowledge communities (KC) in online education / knowledge work
- Learning, teaching, and researching in online communities

The third track, „Visual Knowledge Management“, presented by Sander Münster, Anja Jannack, Jörg-Rainer Nönnig, Jan Wojdziak, and Florian Niebling, covers two main areas:

- Concepts, methods, and approaches to the design of knowledge media
- Investigation of visual research and creative processes

Digital conference documentation

As the framework programme of 2016 was much more extensive than in the previous years and the GeNeMe was even part of a Knowledge Week in Dresden, which also included training courses for young academics and a knowledge camp for our company partners, there are, in addition to these proceedings, other materials of these conference modules to document the programme for the GeNeMe community. In addition to the open access publication „Knowledge Communities“ (available at www.qucosa.de), it is recommended to visit the websites www.ifkad.org (documentation of the IFKAD partner conference), www.geneme.de (the conference archive since 1998), and www.wissensgemeinschaften.org (with videostreams of selected sessions).

Quality Assurance

With almost 50 submitted proposals, this year‘s conference enjoyed significant high-quality demand. Thus, 40 contributions could be accepted after assessments and sometimes extensive revisions, including 14 as comprehensive scientific contributions. In the sense of a trend barometer, it is interesting to look at the topics of these full papers in detail. Arranged according to six thematic priorities, they deal with the following:

- Focus on knowledge management;
- Focus on technologies, methods, and systems;
- Focus on feedback, exchange, and process;
- Focus on higher education and online education;
- Focus on media design;
- Focus on visual research and creative processes.

It is noteworthy that in 2016 all contributions published here will be presented in English, most of which will be published by international groups of authors. In this respect, the trend towards the internationalisation of the conference community has continued significantly. The event is now gaining more international visibility!

Each submission was assessed by two to three experts from the participating disciplines, in a number of rework phases, in a double-blind procedure. Therefore, we would like to thank the almost 40 experts from science and industry. It was only through their highly professional work as members of the programme committee that it was possible to make a good selection and to provide constructive, detailed feedback to the authors of rejected articles.

For this reason, our thanks go to the reviewers, as well as the chairs of the sessions and the colleagues involved in the conference organisation and the production of the proceedings!

Dresden, in December 2016

Thomas Köhler, Sander Münster, Eric Schoop, and Nina Kahnwald

on behalf of the conference organizers

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Köhler, T., Kahnwald, N. & Schoop, E. (2015). Knowledge Communities in Business and Science. Proceedings of the GeNeMe 2015; Dresden, TUDPress.

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Vorwort

Thomas Köhler [1], Sander Münster [1], *Eric Schoop [1], Nina Kahnwald [2]*
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Sehr geehrte Leserinnen und Leser der OAP Fassung der Proceedings zur 19. GeNeMe 2016,
Liebe Kolleginnen und Kollegen der GeNeMe-Community,

Traditionell untersucht die Konferenz „Gemeinschaften in neuen Medien (GeNeMe)“ organisationale und informationstechnische Perspektiven im Kontext von Virtuellen Unternehmen, Online-Gemeinschaften und sozialen Netzwerken. Als Organisatoren der Konferenz „Knowledge Communities 2016“ an der TU Dresden liegt Nina Kahnwald, Thomas Köhler Eric Schoop und Stefan Ehrlich der wissenschaftliche und dabei multidisziplinär begründete Austausch zum Themenfeld am Herzen, der zugleich eine Brücke zwischen Forschung und unternehmerischer Praxis baut.
Inzwischen liegt die Kooperation der 19. GeNeMe 2016 mit der 11. IFKAD 2016 für die Ausrichtung der GeNeMe 2016 in Dresden hinter uns und wir haben die drei Tracks „Knowledge Communities I“ & „Knowledge Communities II“ sowie „Visual Knowledge Management“ in Rahmen dieser Multikonferenz vor einem internationalen englischsprachigen Publikum erfolgreich präsentieren können!
Mit der Publikation halten Sie die OAP-Fassung der Proceedings (Open Access Publikation) in der Hand bzw. lesen diese in digitaler Form nachdem die Beiträge zuerst im Rahmen der Proceedings der 11. IFKAD 2016 (International Forum on Knowledge Asset Dynamics) erschienen sind, nicht jedoch als OAP publiziert wurden (vgl. Spender, Noennig & Schiuma, 2016).

Die 19. GeNeMe 2016 wurde als Teilkonferenz der 11. IFKAD vom 15. bis 18. Juni 2016 an der TU Dresden ausgerichtet. Unter dem Tagungsmotto „Towards a New Architecture of Knowledge: Big Data, Culture and Creativity“ fanden die drei GeNeMe-Tracks „Knowledge Communities I“ & „Knowledge Communities II“ sowie „Visual Knowledge Management“ einen idealen Rahmen. Stärker als in den Vorjahren befassten sich die Akteure mit Fragen der Visualisierung von Wissensmanagement und online-Wissensgemeinschaften sowie der Digitalisierung in Wirtschaft und Wissenschaft, während in 2015 die 18. GeNeMe einen starken Bezug zum Wissensmanagement hergestellt hatte. Insofern konnte die GeNeMe 2016 wiederum das gemeinsame Dach einer Multikonferenz als Ausgangspunkt für thematische Innovationen aufgreifen.

Inhaltliche und auch organisationale Unterstützung kam in gewohnter Weise vom Knowledge Research Center KRC Dresden e.V., der Gesellschaft für Medien in der Wissenschaft GMW e.V., der Gesellschaft für Informatik GI e.V. und auch dem Leibniz Forschungsverbund Science 2.0. Im Ergebnis konnten zwei Tagungen mit sich gegenseitig ergänzenden thematischen Schwerpunkten mit mehreren Netzwerken zusammengebracht werden, die Lern- und Wissensprozesse im Spannungsfeld zwischen Wissenschaft, Organisation, Technologie und (Unternehmens-)Kultur verhandeln.

In der Umsetzung neuartig waren 2016 die vornehmlich internationale Orientierung und die nochmalige Erweiterung des Angebotes jetzt zu einer „Knowledge Week". Durch den IFKAD-Kontext (11th International Forum on Knowledge Asset Dynamics) ist eine sehr gute internationale Sichtbarkeit bis hin zu einer hochwertigen Publikation (sowohl in Buchform als auch Online) gesichert. Grundlage für die Auswahl der Beiträge war wiederum eine Peer Review der einzelnen Einreichungen, diesmal auf Basis von Abstracts, woraufhin die vollständigen Texte zu erstellen waren.

Inhaltliche Schwerpunkte der GeNeMe 2016

Gemeinschaften in Neuen Medien hat 1998 als Workshop-Reihe an der TU Dresden begonnen und seither jährlich das Thema Online-Communities an der Schnittstelle mehrerer Disziplinen wie Informatik, Bildungs- und Wirtschaftswissenschaften, Informatik sowie Sozial-und Kommunikationswissenschaft u.a.m. thematisiert (vgl. Köhler, Kahnwald & Schoop, 2015). Der Workshop ist traditionell ein Forum für den interdisziplinären Dialog zwischen Wissenschaft und Wirtschaft und dient dazu, Erfahrungen und Wissen unter den Teilnehmern aus verschiedenen Disziplinen, Organisationen und Institutionen zu teilen.

Die inhaltlichen Schwerpunkte der Konferenz widmen sich neben den Kernthemen Wissensmanagement und Communities (in den gleichnamigen Kapiteln) auch der Unterstützung von Wissens- und Lernprozessen im Bereich der (mediengestützten) Hochschullehre. Ergänzt wird diese eher organisationswissenschaftliche durch eine informatorische Perspektive, wenn es um stärker funktionale bzw. auch methodische Ansätze geht – Use Cases, Workflows und Automatisierung im Wissensmanagement. Darüber hinaus werden Systeme und Ansätze für Feedback, Austausch und Ideenfindung vorgestellt. Mit den Schwerpunkten der Wissensmediengestaltung und visuellen Forschungs- sowie Kreativprozessen wird diesmal auch ein Schlaglicht auf visuelle Aspekte von Wissensmanagement und -vermittlung geworfen.

Für die IFKAD 2016 wurden drei GeNeMe-Tracks angenommen, die sich auf das Interface von Wissensgemeinschaften und Wissensmanagement sowie die Wissensmediengestaltung in Wissenschaft, Wirtschaft oder Bildung konzentrieren.

Im vorliegenden Tagungsband finden Sie detaillierte Informationen zu diesen drei Tracks:

- Knowledge Communities I: Knowledge Management
- Knowledge Communities II: Online Education
- Visual Knowledge Management

Der erste Track „Knowledge Communities I: Wissensmanagement“ unter Leitung von Eric Schoop, Thomas Köhler, Nina Kahnwald, Sander Münster und Stefan Ehrlich beschäftigt sich mit zwei Hauptfeldern:

- Wirtschaftstätigkeit und Wissensorganisation und -prozesse in Online-Communities
- Technologien und Methoden für Online-Communities und die Analyse der jeweiligen KM-Prozesse

Der zweite Track „Knowledge Communities II „Online Education“ unter Leitung von Nina Kahnwald Thomas Köhler, Eric Schoop, Lars Schlenker und Stefan Ehrlich beschäftigt sich mit zwei Hauptfeldern:

- Konzepte von Wissensgemeinschaften (KC) in Online-Bildung / Wissensarbeit
- Lernen, Lehren und Forschen in Online-Communities

Der dritte Track „Visual Knowledge Management“ unter Leitung von Sander Münster, Anja Jannack, Jörg-Rainer Nönnig, Jan Wojdziak sowie Florian Niebling beschäftigt sich mit zwei Hauptfeldern:

- Konzepte, Methoden und Ansätze zur Gestaltung von Wissensmedien
- Untersuchung visueller Forschungs- und Kreativprozesse

Digitale Tagungsdokumentation

Da das Rahmenprogramm 2016 deutlich umfangreicher als in den Vorjahren ausgefallen ist und die GeNeMe Bestandteil einer Knowledge Week in Dresden war, die auch Trainingsangebote für den wissenschaftlichen Nachwuchs und ein Knowledge Camp für unsere Unternehmenspartner umfasste, gibt es neben diesen Proceedings auch weitere Materialien dieser Konferenzbausteine, um diese für die GeNeMe-Community nachhaltig zu dokumentieren. Neben der hier vorgelegten Open Access Publikation „Knowledge Communities“ (abrufbar unter www.qucosa.de) empfiehlt sich daher auch der Blick auf die Websites www.ifkad.org (Dokumentation zur Partnerkonferenz IFKAD), www.geneme.de (hier findet sich das Konferenzarchiv seit 1998) und www.wissensgemeinschaften.org (mit Videostreams ausgewählter Sitzungen).

Qualitätssicherung

Mit fast 50 eingereichten Vorschlägen erfreute sich die diesjährige Konferenz einer sehr guten und auch hochwertigen Nachfrage. So konnten 40 Beiträge nach Begutachtungen und mitunter umfangreichen Überarbeitungen angenommen

werden, darunter 14 als umfassende wissenschaftliche Beiträge. Im Sinne eines Trendbarometers ist es interessant, die Themen dieser Vollbeiträge detailliert zu betrachten. Nach sechs Themenschwerpunkten geordnet, behandeln sie:

- Schwerpunkt Wissensmanagement;
- Schwerpunkt Technologien, Methoden und Systeme;
- Schwerpunkt Feedback, Austausch und Prozess;
- Schwerpunkt Hochschuldidaktik und Online Education.
- Schwerpunkt Wissensmediengestaltung
- Schwerpunkt Visuelle Forschungs- und Kreativprozesse

Bemerkenswert ist, dass 2016 alle hier publizierten Beiträgen in englischer Sprache präsentiert werden, diese zumeist auch von internationalen Autorenteams kommen. Insofern hat sich der Trend zur Internationalisierung der Konferenz-Community deutlich fortgesetzt. Die Veranstaltungen werden jetzt auch international sichtbarer!

Jede Einreichung wurde von zwei bis drei Experten der beteiligten Disziplinen in teilweise mehreren Überarbeitungsphasen in einem double-blind-Verfahren begutachtet. Daher gilt unser Dank auch den fast 40 Gutachterinnen und Gutachern aus Wissenschaft und Wirtschaft. Nur durch ihre fachlich hoch kompetente Arbeit als Mitglieder des Programmkomitees ist es bei der Fokussierung des Themenfeldes und der Vielzahl der Beiträge möglich gewesen, eine gute Auswahl zu treffen und auch den Autoren abgelehnter Beiträge konstruktives, detailliertes Feedback geben zu können.

Für das Zustandekommen des vorliegenden Bandes gilt unser Dank daher in erster Linie den Gutachterinnen und Gutachtern, ebenso wie den Chairs der Sessions und den an der Tagungsorganisation sowie der Herstellung der Proceedings beteiligten Kolleginnen und Kollegen!

Dresden, im Dezember 2016

Thomas Köhler, Sander Münster, Eric Schoop und Nina Kahnwald

für die Konferenzorganisatoren

Literaturangaben

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Knowledge Communities I: Knowledge Management

Process Learning Environments

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Structured Abstract

Purpose – Due to faster innovation cycles and competitive markets, current methods for implementing and adapting business processes can not keep pace with changing requirements and cause BPM solutions to falls short of business needs. The purpose of this paper is to propose a new approach for implementing an agile BPM methodology by substituting the plan-build-run approach with an incremental prototype-based model, removing intermediaries from the time critical path of business process evolution, and empowering end users to change business processes at runtime by manipulating process artefacts.

Design/methodology/approach – Based on interviews with customers and stakeholders and our experience in implementing complex BPM solutions in SMEs, we propose key concepts for an agile BPM approach and derive basic requirements for implementing a BPM system that allows users to redefine business processes during their execution. This analysis is supplemented by a brief overview of current research trends in modelling and implementing agile BPM.

Originality/value – All existing solutions examined by our team imply a separate modelling step by users or process managers. The designed key concepts enable users to implicitly model processes without interrupting day to day operations. Our approach enables organisations to introduce business process management in areas where agility is very important (e.g. product development) or to increase operational agility in areas with established BPM. Practical implications – An agile BPM solution can give organisations the flexibility they need to react quickly to changing markets and customer needs. We want to help them to introduce standardization and efficiency without losing agility. In areas where classical BPM is in place, our approach can increase the adaptation rate of process changes. In the areas of knowledge workers with a high level of agility, our approach can increase efficiency by supporting knowledge sharing.

Keywords – process learning; agile business process; process knowledge; business process management

Paper type – Practical Paper

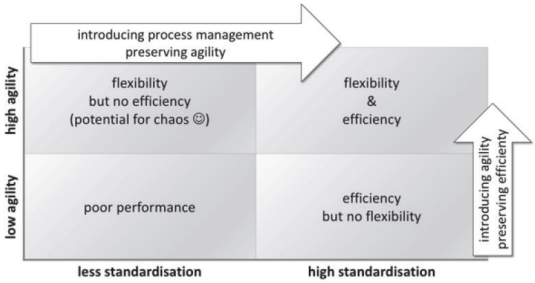

Figure 1: Introducing agile BPM

1 Introduction: The Debt of Accelerated Change

As software professionals in companies that develop customer specific process and document management solutions we have watched many of our customers struggling - and sometimes almost failing - to cope with the organisational demands of business processes changing faster than their supporting infrastructure can be updated. The reasons for these accelerated changes in business processes of organisations and enterprises are manifold: Faster innovation cycles, customisation and individualisation of products, dynamic changes in competitive markets, more flexible supply and value chains, changes in legislation, and structural changes in business units are only some of them. Failure to support factual changes in daily operations with the appropriate adaptations of the accompanying business processes leads to missed business opportunities and higher operational overhead.

On the other hand, changing established procedures and evolving business process management software infrastructure imposes a heavy burden on the organisation as a whole and on individual employees who "just want to get work done". Even if your staff really embraces change, few things cause less enthusiasm than introducing new BPM software. More often than not, the term "BPM software migration" is used as a pejorative for unfulfilled expectations, extended periods of extra work, decreased productivity, and widespread frustration over features delivered to late, not fit for the desired task or cumbersome to use.

An essential fraction of the risks for changing or introducing BPM software infrastructure originates from requirement analysis and business process modelling. Some customers face stern difficulties in formalizing and externalizing knowledge about their business processes, resulting in over-simplified uses cases with insufficient

coverage of non-trivial exceptions to the ‘easy path’. On top of this, different business units might have evolved subtle different notions about the handling of processes and naming of artefacts, which do not matter on the operational level but are tremendously difficult to implement in working software. The other end of the spectrum are customers who spend large sums on professional process consultants that come up with extensive and intricate process landscapes, describing even rare and simple processes in great detail – sometimes on a scale and level that makes this valuable knowledge too difficult or unwieldy to use, not only for software developers but also for users who are expected to think and operate within this framework.

In addition to this, most organisations include units, where the value of introducing BPM is widely recognized, but implementing BPM is difficult due to the very nature of their processes. This is especially true for e.g. research and development departments where knowledge intensive, emergent processes prevail. The processes of knowledge workers are semi-structured at most. Usually they can not be defined ex-ante and have to be designed at runtime.

Either way, understanding (and sometimes shaping) the process landscape of a customer to the point where it can be casted into useful and useable BPM software is time consuming and error prone. As processes keep on changing during requirement analysis, some of the results inevitably will be outdated on delivery. Agile software development methods have helped to mitigate these risks but are not applicable to all customers and do not solve the fundamental problem of business process models and BPM software failing to deliver on expectations due to a fast changing and complex reality that can not be modelled in a way that is both exhaustive and useable.

2 Key Concept: Agile BPM and Disintermediation for a faster BPM Cycle

Existing methods for BPM and for developing BPM software often incorporate the Plan-Build-Run-approach or apply the popular PDCA (Plan-Do-Check-Act) cycle. Both are recognised and well established methods for implementing a continuous improvement process. However, their application to BPM software infrastructure does not necessarily lead to the intended results. Especially in fast changing organisations, the planning stage consumes too much time and feedback from the check or run phase is integrated too late.

Employees who are required to use BPM software based on non-optimal process models develop strategies and shortcuts to mitigate the insufficient fit between the model and existing reality. When using conventional BPM software, this might actually amplify problems in the long run: increasing portions of the actual business process become decoupled from the model or are performed in ways that violate basic assumptions of the model. As control and coverage of processes will no longer

be provided by the existing BPM software and employees might try to obfuscate the derivation from company regulations, assessing and re-modelling theses processes for the next iteration cycle will become even more difficult.

By introducing agile concepts, methods, and tools to BPM, as described in section 5, empowering employees to adapt existing processes becomes part of the solution instead of causing additional problems. Our approach removes the intermediaries (e.g. process consultants, supervisors, and software developers) from the time critical path of business process transformations. Their role will change from gatekeepers to "gardeners", who will support employees by evaluating, structuring, regulating and streamlining the manifold process variations that will arise.

3 Requirements: Freedom of Choice vs. Normative Frameworks

With the power to change operational procedures of an organisation comes the responsibility to ensure, that these changes are beneficial to the organisation as a whole. A new or adapted process must operate within the boundaries given by strategic goals and legal requirements - and it must sustain interoperability with other processes or coworkers. One major challenge is to avoid, what can be called "the entropic death" of the BPM system, caused by e.g. a large number of fairly similar processes that have accumulated over time due to minute changes, that resulted in yet-another-workflow for a certain task and a multiplicity of ambiguous denominations for artefacts.

Among other things, guidelines have to be in place for deciding, whether an entirely new process should be established or if a given process should be adapted, with these adaptation being mandatory in a global scope. Also, a self-sustaining process must be established that consolidates the naming of concepts and artefacts or at least creates awareness for existing ambiguities and duplicate naming schemes . Such normative processes have to be backed by a common set of rules, comparable to the values and principle of the 'Manifesto for Agile Software Development'[1] and they have to be supported, and sometimes to be enforced, by appropriate software tools.

Therefore, our approach will focus on the following core requirements for a methodology and a supplementing technology stack for agile BPM.:

- Provide best practise guidelines for the application of process templates or fragments and related artefacts. Support the selection process with context specific recommendations.
- Externalize knowledge about changes in business processes. Make this knowledge accessible to all stakeholders, but prevent information overload.
- Avoid fragmentation of the process landscape by creating duplicate or very similar processes instead of extending or adapting existing ones.

1 http://agilemanifesto.org/

- Avoid the god-object-antipattern by creating processes that have too many variations for doing “everything”.
- Offer a small, manageable set of generic and adaptable building blocks representing process fragments that can be composed into a wide variety of workflows and business processes.
- Provide software tools that adhere to high usability standards and offer an easyto- use, intuitive, and self-describing UI for creating and adapting processes and artefacts.
- Integrate analysis tools for semantic analysis and identification of recurring workflow patterns.
- Implement a central control instance to define mandatory templates, constraints and compliance rules.
- Integrate existing BPM and workflow solutions or define migration paths for their replacement.
- Support the transformation of running process instances and ontology evolution.
  - Create and maintain a common and unambiguous ontology/nomenclature for concepts, artefacts and processes. Establish migration paths or bridging solutions for existing differences in naming, for ambiguous entities, and for deviations in the perception of actual business processes.

4 Research Approaches and Existing Software Solutions

Hajiheydari and Dabaghkashani (Hajiheydari 2011) identify strategic alignment, top management support, management of people, and change management as critical success factors for BPM implementations. A wide variety of business process modelling methods (Giaglis 2001) has evolved to facilitate the transformation of domain knowledge into models, that can further be used to support the implementation of BPM software. With an increased demand for restructuring business processes and for stakeholder participation, approaches like Subject Oriented BPM (S-BPM, see e.g. Fleischmann 2012) gained popularity. S-BPM enables stakeholders to express and communicate their knowledge from an actor-driven perspective using natural language and simplified diagrams. Another way to support ad-hoc process specifications by end users is provided by Adaptive Case Management (ACM, see Swenson 2010). However, S-BPM and ACM work with a static process model that can not be adapted during execution. To overcome these limitations, Gottanka and Meyer (Gottanka 2012) propose with ModelAsYouGo a concept to collaboratively redesign S-BPM while executing a process. Kurz and Lederer (Kurz 2014) extend an ACM approach by using S-BPM for modelling case behavior.

Forbrig (Forbrig 2016) proposes to combine Continuous Software Engineering (CSE) methods, agile software development (e.g. SCRUM), Human Centered Design (HCD) and concepts of Continuous Business Process Improvement (CPI) to address the challenges of fast changing business processes. However, this approach can change processes only between at least two development sprints, as the analysts' sprint runs at least one cycle ahead of software developer sprints. On the other hand it provides greater control and professional oversight for changes and integrates well with the traditional role of analysts. Schiffner et al. (Schiffner 2014) present a conceptual design and a prototype for S-BPM-driven evolutionary business information systems (EBIS, see Neumann 2014), where process changes by stakeholders take effect immediately. They recognize process agility as the basis for organizational agility and highlight the necessity to support model management, communication/ collaboration management, and continuous process improvement. From their work it becomes evident, that further research into the handling of model inconsistencies and concepts for offloading modelling task to the end user is required.

The BPM software market responds to the challenges identified in section 3 by offering software solutions that adhere to a "low code"-paradigm by integrating visual BPM modelling capabilities into their software products. A number of providers distribute tool stacks for easily designing process models with graphical tools and for simulating, deploying and running those models. These solution are used by end users to create and run processes and workflows in a web browser or on a mobile device. Some common products are:

- Appian BPM Software includes preconfigured industry solutions for e.g. financial services, energy, healthcare, etc.[2]
- K2 Business Applications provide preconfigured domain solutions for e.g. human resource management, purchasing, marketing, and many more.[3]
- Nintex also includes workflow automation and offers standard integration with MS Office and MS SharePoint.[4]
- The Comindware Business Application Platform comes with preconfigured domain solutions for e.g. collaboration, order management, claims management, etc.[5]
- Some solutions are offered only as cloud based SaS products like Run my process[6] and Effectif.[7]

2 http://www.appian.com

3 http://www.k2.com

4 http://www.nintex.com

5 https://www.comindware.com

6 https://www.runmyprocess.com/en/

7 http://www.effektif.com

5 New Concepts for an Agile BPM Methodology

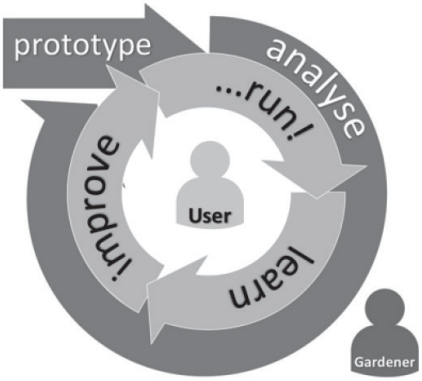

Figure 2: Agile BPM cycle

5.1 Paradigms of the Proposed Agile BPM Methodology

Our proposed agile BPM methodology is build around two core principles or values. The first one can be paraphrased with "empower and trust your users": Users are empowered to drive change based on his or her expert knowledge of the business domain. The organisation trusts them to apply this privilege wisely and responsibly.

A second core principle, "the path is made by walking", targets the emergent nature of business processes. Instead of using a Plan-Build-Run approach, we start by setting up a prototype system with an initial configuration for selected workflows. While the system is being used, users adapt and configure generic standard processes and artefacts to their needs. Domain experts ("gardeners") analyze the resulting processes and the modelling process itself (PPM - Process of Process Modelling) to identify recurring patterns and possible constraint violations to derive new, organisation

specific process templates and rules governing their application. This approach to modelling is inspired by the Oregon Experiment (Alexander 75): By the end of 1970, the campus community of the University of Oregon sought more control over their lives and their environment. After several attempts to quiet the student community, UO administration hired the Berkeley Center for Environmental Structure and its chief architect Christopher Alexander. Alexander developed radical new concepts for integrating the campus community into designing an ideal institution. One of the concepts was, to plan no paths between buildings, but let the students leave footprints on the campus. The emerging trails became the blueprint for paved roads and walkways.

Another analogy for our approach to agile BPM are modern connected navigation system, currently marketed by e.g. Tesla, Falk, or Becker. When driver deviates from the computed route because he or she knows some shortcuts or a faster routes, the system logs the alternative route along with context conditions (e.g. traffic situation, time of day, day of week, etc.). Future route calculations will consider such potential optimisations if applicable. In this way, a global model (the navigation systems' route map) will be optimised, based on local knowledge of experts (the drivers). As the navigation system collects and analyses the optimisation variants of all connected drivers, all participants will profit from the accumulated knowledge. The challenges of transferring this approach to agile BPM lie in providing a similar, near effortless way of knowledge sharing, appropriate methods for analysing collected data, and last but not least in convincing users to try unfamiliar, but potentially beneficial routes.

5.2 Stages of an Agile BPM Process

For implementing an agile BPM process we propose the following stages depicted in Figure 2:

[prototype] During an initial setup process, a generic and coarse draft for a domain specific data model and a basic set of simple workflow steps are defined. Both are based on templates and will be assembled from off-the-shelfcomponents. If necessary, adapters for integrating legacy data are provided. This results in a prototype containing data models and process models that already support simplified versions of common domain processes or workflows. This step is similar to the established BPM cycle but significantly less complex and extensive. To jump-start the learning process, key performance indicators are defined during prototype setup. These indicators comprise e.g. the lifetime of a process instance or the number of steps for reaching a given target state.

[run!] With the prototype established, users will instantly perform at least some of their work using the new system. As in other BPM systems, they will interact with process artefacts using form based user interfaces. Active process instances can be modified and extended by adding data fields the forms. Those interventions extend the data model for a single process instance. Another way to enrich the process model consists of adding arbitrary pre-defined process steps as consecutive actions to the process instance and assigning the co-worker best fitting to the implied task. That way, each users can delegate work items to others and define what needs to be done. This will result in a number of implicitly derived data and process models and can be done without explicit modelling task our support from intermediaries like analysts or process managers.

[learn] During the live cycle of each process instance the software monitors changes to data and process models. A basic recommender system supports users by suggesting frequently added data fields and process steps. At first, selection and ranking of recommendations will be based on similarities between process instances and the monitoring of the defined key performance indicators. After this cold start phase, the input of process gardeners will be used to refine the recommendation process. The result of the learning stage is a continuously improving statistical model of the usage and the performance of different process instances.

[analyse] Process mining is the key for understanding actual processes and changes in the process landscape over time. By integrating process mining as an ongoing and parallel activity, process gardeners receive continuous updates on all process models and can intervene if necessary. They can figure out under which circumstances additional data fields or workflow steps were added, why and when paths of work items changed and which model variant might be most appropriate for efficiently managing a given process. These insights are used to optimise the recommender system and to restrict user choices where necessary(e.g. to enforce compliance rules).

[improve] Backed by statistical data and knowledge, users can continuously improve their way of performing or changing processes and organizing their work. They are guided by the same software they use for performing their actual tasks, not by a separate tool or an external process documentation. And they remain free to create exceptions for selected process instances whenever necessary. Process gardeners resemble the necessary counterweight to keep the BPM system in balance by maintaining a global view on the process landscape. Their actions are based on process mining and they decide and define:

- Which data fields of process artefacts become mandatory under specific conditions.
- Which roles and users are allowed to perform certain process steps.
- Which process steps become mandatory and are exempt from possible exceptions.
- Which areas of the process landscape are designated to receive a higher or lower degree of freedom and agility.
- Which process flow becomes “best practice” will rank higher in recommendations to users.

5.3 Mitigating Expected Risks of Agile BPM

Besides the benefits of agile BPM, like an optimised fit between process models and actual processes and faster adoption of process changes, we anticipate a number of risks where mitigation strategies will have to be implemented:

- Creating or adapting local process fragments is done by users who do not necessarily consider implications for the whole process chain and act on local knowledge and context. This can cause inefficiencies or even deadlocks when process instances traverse department boundaries as local optimisations might conflict with a better global solution. Especially the implementation of complex and extensive processes contradict our approach of using local design optimisations and can lead to byzantine process landscapes that are difficult to use and to maintain.
- Even if users do not explicitly model business processes, empowering users to adapt and shape IT solutions requires an elevated degree of expertise. This extends to knowledge about processes and their dependencies and a deeper understanding of the business domain, as well as to general proficiency in working with IT systems. As the re-assignment of process responsibility to end users is a core paradigm of agile BPM, our proposed method might not be suitable for every user.
- Special attention has to be given to the integration of legacy systems, as a suboptimal design of bridging and adapter layers might lead to additional risk for keeping the adaptations in line with continuously evolving processes.

5.4 From Process Managers to Process Gardeners

The conventional BPM cycle assigns a central role to process managers and hold them responsible for aligning business processes to the strategic and operational requirements of the business model. Particular tasks of this role are:

- Maintain an overview perspective in relation to the general context of an organisation.
- Orchestrate the interaction of particular stakeholders.
- Ensure efficiency, effectiveness and compliance.
- Specification and operation of IT applications to support relevant business processes.

One essential drawback of this centralized approach is the inherent risk of process managers becoming a bottleneck for changes and potential dissociation from operational requirements. As a result, the BPM process slows down and processes do not reflect business needs in an appropriate manner.

Agile BPM relocates process managers and introduces a perspective shift. A process manager is no longer a gatekeeper but becomes a process gardener. Instead of designing and selecting processes, he or she has to supervise and guide others. Their changes mostly originate from operational requirements. By analyzing and continuously monitoring the evolving process landscape, a process manager can gain insights into those changing requirements and has to derive methods for keeping processes streamlined and aligned to strategic goals and compliance requirements. To fulfill his/her responsibilities different instruments for shaping and taming the growth of the process landscape are available:

- Restrict a users' capabilities for modifying data models and process steps.
- Modifying parts of the data and process model.
- Define and enforce model constraints.
- Modification and configuration of the integration layer for legacy applications or external services.
- Definition and communication of process metrics.
- Configuration of the recommender system.

The process gardener uses the same software tools as a regular user, that is the BPM application itself, supplemented by analytic and visualisation tools for process mining.

6 Conclusions

The fact that BPM concepts addressing the agile transformation of business processes (e.g. S-BPM and "low code BPM") are transformed into maturing products that currently move into the market shows the demand for more flexible BPM solutions. Also the desire for structural guidance of knowledge workers that preservers freedom and agility underlines the need for an agile end-user driven BPM approach. We described and discussed key features of a BPM methodology that empowers end users to create and modify running processes by manipulating process artefacts without explicit modelling and derived requirements and concepts for implementing this approach. Essential parts of these concepts are currently evaluated with one of our customers and show high potential for supporting more agile business processes. However, further research issues comprise:

- How can legacy integration be encapsulated by an agile BPM solution?
- What are the most effective methods for a process gardener to intervene while users work within a self learning process environment?
- Where are the conceptual boundaries of agile BPM?
- In which business areas (industries, domains) agile BPM can deliver the expected benefits.
- How can the benefit of agile BPM be evaluated and proven?
- Which additional risks do arise from implementing an agile BPM approach?

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Two Steps to IT Transparency: A Practitioner's Approach for a Knowledge Based Analysis of Existing IT Landscapes in SME

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Structured Abstract

Purpose – The purpose of this paper is to show how knowledge intensive information technology (IT) applications within an organisation can be identified and analysed to achieve two corporate goals: First, an optimisation of the corporate IT landscape that avoids inefficiencies or redundancies. Second the implementation of a knowledge management (KM) system that is aligned with the corporate IT infrastructure.

Design/methodology/approach – Methodically, the approach can be described as a practical two-step procedure. In the first step the knowledge intensive IT systems are identified through a questionnaire that is performed in the IT department of the organisation. Based on the expertise of the IT management adequate information concerning benefits and utilization of the applications and the description of technical conditions can be determined. On the basis of the work of the first step, selected user groups (key-user, admin-user, heads of departments, etc.) are surveyed on a broader base through semi-structured interviews. The focus here is to determine the application within its processes and to identify the importance in the fulfilment of the daily tasks as well as the capabilities in knowledge management. Therefore the survey covers the main questions regarding the classification of KM and provides a solid foundation for optimisations regarding the IT infrastructure. The two-step approach also provides the flexibility to identify future processes concerning an appropriate KM system and to identify practical adaptions of the existing IT landscape.

Originality/value – The suggestion of a newly developed method to identify and assess knowledge intensive IT systems – what includes hard- and software – within an organisation. The results of the method can be used to develop recommendations to improve the conceivably of already existing KM or to originate an organisational KM as well as to enhance the existing IT landscape. This includes in particular the consideration of the processes in which knowledge is generated, stored, used and shared.

Practical implications – The identification, utilization and harmonization of KM intensive systems can be a substantial advantage during the implementation or enhancement process of KM for two reasons: First, the important and implicitly for KM purposes used systems are identified and evaluated before the inception of the organisational KM. Second, the knowledge management orientation of the approach allows reducing both, the complexity and the variety of IT applications within an organisation.

Keywords – Knowledge Management implementation, Identification of IT applications, Assessment of IT applications , IT optimisation, IT analysis

Paper type – Practical Paper

1 Introduction

„Now that total information is possible, it requires management discipline not to ask for information. The effort of limiting information will be greater than the effort to generate information.“ (Zuboff 1988, p. 357)

The identification of IT systems as well as the individual roles of these systems within KM are an essential part of KM implementation. Furthermore, the identification and evaluation as well as the deduction of recommendations for the optimization of KM and IT are prerequisite to deal with the advanced requirements of knowledge workers professional life. Through the increasing information dynamics in the context of organisations the management of knowledge has become a business key task (Aier & Schönherr, 2007). Especially Web 2.0 applications play a decisive role. They enable the users to simultaneously share their knowledge through formal and informal channels. Therefore users face an increased importance of software systems, an increased amount of 1506 knowledge as well as an increased demand for the handling of knowledge. Consequently intuitive systems that are easy to operate as well as trainings and mentoring for complex systems are fundamental essentials to establish acceptance in users minds and hence in corporate culture. The approach in this paper shows how to identify and assess IT systems with respect to their KM-potential what contributes indirectly also to manage IT.

After more than a quarter of a century of increasing attention in KM, the state of research can be regarded as advanced (Jasimuddin, 2006). However the links between KM and IT are recognized by academia since the inception of KM-science and from practitioners' point of view regarded as a fundamental requirement (Hislop, 2002).

Hardware and IT infrastructure are not considered in detail within the following consideration of IT landscape. These are just considered as a framework for existing software solutions, but not taken into a closer consideration. Hence, the following practical approach is limited primarily to IT applications and therefore covers only a part within an implementation process of KM.

In the first chapter, the underlying theory will be described in detail. The second part will be the presentation of the developed two-steps approach, containing an evaluation of the first and the second layer of the model. The consequent procedure for the deduction measures including specific recommendations for actions as well as a prototypical practical implementation will be discussed in the following chapter. The last chapter will be a conclusion including possibilities for future improvement as well as limitations of the concept.

2 Theoretical background

In consideration of interdisciplinary and department-spanning cooperation, in particular for knowledge transfer, an approach to identify and assess the IT systems and applications is mandatory. The technical classification of IT systems forms the basis of the research approach.

The theoretical foundation of the practical analysis is based on several science areas: business administration, computer science and sociology (Broßmann & Mödinger, 2011). In the following different models concerning KM and classification of IT systems will be introduced and summarized. These are the Fraunhofer KM reference model (Heisig, 2005), the framework of Bredehorst (Bredehorst, et al., 2013), the architecture for integrated knowledge management according to Riempp (Riempp, 2005) and the criteria to evaluate KM suggested by Buder and Städler (2006).

Fraunhofer reference model for Knowledge Management

The figure 1 shows a model that is based on the Fraunhofer KM model. It was developed in 2005 and forms the basis for KM implementation (Heisig, 2005).

The considered KM core activities are to generate knowledge, to apply knowledge, to store knowledge and to distribute knowledge along the business processes and the domains of knowledge. The domains of knowledge are prerequisites and have to be defined within the implementation of KM. The main domains are the following: Knowledge about customers, knowledge about markets, knowledge of products, technical knowledge and knowledge about methods, knowledge about the organisation, knowledge about partners, knowledge about laws and standards and knowledge about patents (Mertins & Orth, 2009).

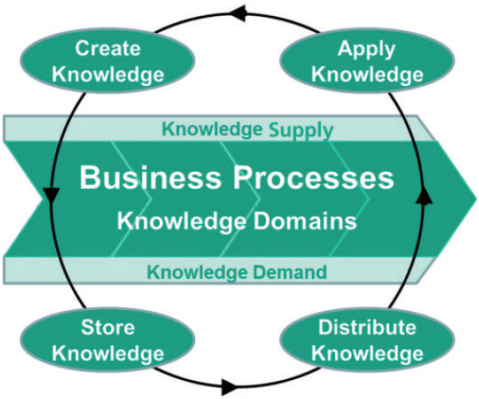

Figure 1: KM implementation model based on the Fraunhofer reference model for Knowledge Management of the KM (Heisig, 2005).

Architecture for integrated Knowledge Management

Riempp presented in 2005 his approach of the „architecture for integrated knowledge management", which considers the importance of IT applications.

The integrated information system is organized in five key areas (or pillars). The first key area (1) **transaction** summarizes the completion of tasks such as reservations, payments, inventory changes, orders, confirmations of orders, etc. within the business and support processes. Today, they are usually provided by ERP, SCM and CRM systems. Such functions are not part of KM in the strict sense, but they should be considered in an integrated view, as for the preparation and implementation of the transactions of knowledge is necessary and may result from the execution of new knowledge. The pillar (2) **content** includes all functions for management of digital information objects and their descriptive context (e.g. creating, sharing, publishing, revising, archiving). The third key area named (3) **competence**. The individuals with their competences use content and competence profiles to detect in virtual and / or physical spaces their mutual knowledge to prepare, execute and evaluate tasks, furthermore to exchange, develop and apply knowledge. The associated functions are located in the (4) **collaboration** pillar.

Finally, the area (5) **orientation** comprises all those functions that are alike required in all other pillars, such as search, navigation and administration (e.g. maintenance of user profiles and permissions, authentication, personalization, access protection).

In the case of many users, peripheral content and numerous spaces for collaboration, a system is needed to obtain clarity and comfort of usage. Therefore a regulatory framework is required that ideally uses a consistent taxonomy or ontology.

Finally, the culture of an organisation is determining the elements of software architecture, purpose and framework conditions. If in an organisation, the direct exchange of knowledge is prerequisite, the pillar collaboration is the most important one and can be carried out by correspondingly powerful community management systems (Riempp, 2005).

Type of organisation and appropriate IT applications

Figure 2 shows the different types of organisations and their allocation to different IT systems. Accordingly, hierarchical organized companies should prefer to use ERPsystems for the management of structured information. For companies that are organized as a network, rather collaborative IT systems, for example Wikis or blogs are more effectively for an optimal support of all important work flows.

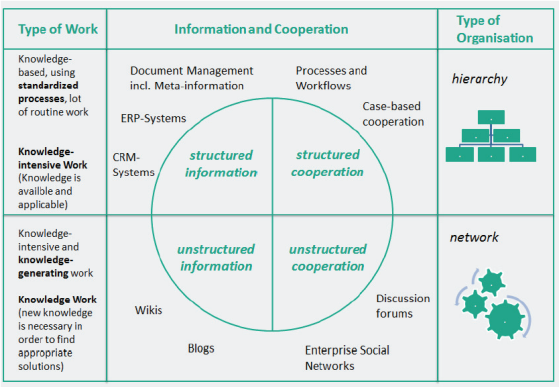

Figure 2: Type of Work and Software-Solutions based on Bredehorst, et al. 2013.

Assessment of Knowledge Management and IT applications

Buder and Städler (2006) suggested assessing KM and IT applications with the following appropriate criteria:

1) **appropriate functionality:** Role configuration, easy to use selection mechanisms (important from unimportant information), supporting the crossdivisional communication, functionality should be appropriate to the handling.

2) **simple and intuitive handling:** Permanent use is achieved by simple and intuitive handling, supporting usage habits (push- vs. pull- approaches), identification of different types of knowledge.

3) **high system availability:** Permanent availability and rapid relief to system failures, simple configuration and hence to provide trainings to have many experts is useful.

4) **appropriate degree of integration:** Isolated application brings only short-term benefits and long-term lead to a uncontrolled growth of diverse and parallel used IT solutions.

5) **trainings:** Non-usage can also be attributed to a lack of knowledge in handling; optimal use can only be achieved by sufficient knowledge of the software and its logic (Buder & Städler, 2006).

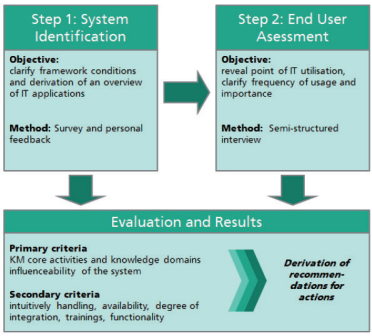

Figure 3: Two-step approach

3 Two steps to IT transparency: A practitioner's approach for a knowledge analysis of existing IT landscapes in SME

The suggested two steps approach focuses the practitioners. Hence, it tries to combine the above-mentioned theoretical foundations and enables to draw qualitative and quantitative results and subsequently allow to get an overview and an assessment of used IT and KM. The procedure itself is a two-step approach, which makes it possible to involve the opinion of all participants in process of identification and assessment of KM and the IT systems. This led to a high level of recognition with the outcomes of the assessment by most of the participating staff. The reminder of this chapter describes the two step approach in detail. The above presented models show the variety of possible methods, which can be used. The following practical approach is based on the Fraunhofer KM reference model with the focused elements to generate knowledge, to

apply knowledge, to store knowledge and to distribute knowledge along the business processes and the domains of knowledge. The „Architecture for integrated knowledge management“ as well as the classification of types of organisations in connection with allocation of IT applications are considered to be the theoretical framework and are the basis for the general structure of IT systems. The criteria (1) appropriate functionality, (2) simple and intuitive handling, (3) high system availability, (4) appropriate degree of integration and (5) trainings, are part of the subsequent evaluation process. Figure 3 shows the methodology of the used two-step-approach:

Step 1: The IT Department survey

The first phase starts with a survey carried out in the IT department, more precisely the IT responsible person of the organisation. This means a questionnaire carried to reflects the IT infrastructure, the systematic in the networks and the handling of soft- and hardware to get a comprehensive overview of the organisational IT landscape. The focus is on the framework and the borders of the total infrastructure of the IT landscape. Besides on overview over the used and potentially available software is attained by this first questionnaire. It is not possible to reveal all soft- and hardware that is used in this first step; however fundamental questions regarding structures within the IT become clear, for instance:

- How are the administration rights distributed within the organisation?
- How is the software-order-process structured?
- What software is available and what was the acquired purpose?
- What are the standard software packages in the organisation?
- How is the supply of hardware-components structured?

The first phase allows a classification of the IT systems, for instance exchange platforms, general communication software, process management related software or software that is used for project management. Furthermore, the possibilities of influence reveal: Which systems can be altered and which are prescribed from forces outside of the organisation, like hierarchically superior corporate parents?

This first phase is prerequisite and covers all functions in order to get a first impression for each of the systems, the interaction between soft- and hardware structure and the IT landscape as a whole.

Step 2: The IT end user survey

In the second phase the users are surveyed. The applied method is a semi-structured guided interview with maximum two people per interview. The users get questions to the following thematic topics: (1) collection of relevant IT systems (2) evaluation of the usage of specific IT systems (3) evaluation of the content of the IT systems (4) personal evaluation and additional notes.

The selection of users can be made in different ways. First, the users are picked along the value generating processes. A second option is to choose the users according to organisational units like departments. A third alternative would be to pick a group of users that are representative for the whole organisation (Doppler, et al., 1998). When regarding large organisations that employ a large number of people it is not possible to survey every employee in an appropriate timeframe. The semi-structured interviews are conducted for each department or process. Overall, there is some evidence that the involvement of the employees increases the acceptance for newly implemented management instruments (Pawlowsky & Gözalan, 2012).

All picked users get the prepared list from the first phase. They were asked to add relevant systems that are not already on the list but are used in their day to day business as well as to delete systems that are not used. Afterwards, the users are asked specific questions to every system. The questions concern the frequency of usage, the user group within the department or unit, the general usage of the system, core task of the software and main usage.

Because the interviews are semi-structured, the approach leaves open space for additional issues regarding the general proceeding in the processes. This information can be used for further assessment in the evaluation process which subsequently takes place after finalization of the second step. The questions of the survey in detail are:

- Collection of relevant IT systems: add or delete software systems from the prepared list of the first step.
- Evaluation of the usage of specific IT systems: Who is using the software within the department or within the process? How often is the system used? Are you or your department knowledge provider or knowledge recipient (related to single modules within the software)?
- Evaluation of the content: What is the purpose of the system? For which purpose are you using the system? Which kinds of domains of knowledge are covered from the system? How up-to-date are the knowledge contents?
- Personal evaluation and additional notes: Any suggestion for improvement (content- and technical-related)? How the system should (not) be used ?

The query should enable to obtain the users point, unbiased by the framework and potential influence. To figure out the knowledge relevant processes a special focus of the query is on the criteria of the KM reference model. Therefore the crucial core questions are: Where and when is the knowledge generated, where and when is it stored, where and when is it distributed and where and when is it applied?

4 Evaluation and Results

The assessment is based on the two steps model. Initially a general overview of the IT systems is prepared. This overview contains the modules and functions of the systems as well as their detailed descriptions. The descriptions contain the key task of the system, the task within the respective organisation as well as the purchase reason for the system.

In general the second step digs deeper in detail and includes the representation of users per process or organisational unit. Therefore also the frequency of usage within different processes or organisational units reveals. This allows an assessment of the relevance of the IT system in different user groups. The evaluation is splitted in qualitative and quantitative criteria. The quantitative assessment is archived through the statements of the users. These are sub summarized for each unit as well as for the whole organisation, which enables to get an overview of the relevant systems and their meaning in an overall context.

The quantitative assessment required more attention and a closer consideration. A classification of the IT systems is made according to the KM core activities and knowledge domains (Heisig, 2005). Therefore all IT systems are classified as either knowledge supplying or knowledge demanding. Besides, the influence of the organisation on the IT system is clarified. Questions like: “Has our organisation an influence on the content or the technical configuration of the system?” or “How are the administration rights distributed within the organisation?”, are treated by first stage results. The systems that are classified as “externally administrated” or even “no influence on content or configuration” are not immediately excluded from the evaluation, however they are not in the focus for the deduction of specific measures. This due to the fact that suggested measures cannot be implemented.

After that, the assignment of organisation specific knowledge domains to each system is made. This allows by implication also the identification of uncovered knowledge domains. Also the personal opinion of the staff regarding each system will be considered in detail. This item is evaluated on the IT system level, no restriction regarding the group of users or the department has been made. Therefore the results are aggregated for each evaluated system. This led to an overview of suggestions of each system without regarding a functional assignment.

After summarization and analysis of the two stages, the relevance and importance of IT systems can be identified. The analysis shows the usage of the IT systems and furthermore the usage of the IT systems within single process steps. Furthermore, the approach allows considering the IT landscape within an organisation, hence the consideration of the factor of influence in content or technical configuration is

important for deriving recommendations. Besides a pure review of IT systems, the assessment of the content and their factors of importance will be considered. The knowledge domains within an organisation as well as the generation, application, storage, distribution and usage of knowledge are covered by the evaluation. The detection of uncovered knowledge domains can show a lack of possibilities to manage knowledge that is relevant for organisational success.

The following questions are the basis to assess the IT systems with high relevance and frequency of use:

- Which contents are used? And for what purpose?
- How important is the content in regard to the usage of the users?
- Which domains of knowledge are covered? Which are uncovered?

Depending on the importance and relevance of the contents within the system, the following criteria are under consideration: (1) adequate functionality, (2) simple and intuitive handling, (3) high system availability (4) adequate level of integration, (5) training. The following questions are the basis to assess the IT systems with high relevance and frequency of use:

- What contents are taught in trainings? Are there enough training sessions? (or not at all)
- Is a contact person in case of technology and/or content related issues available?
- Are there interfaces available to avoid redundancies?
- How vulnerable is the system for failures? How is the rapidity to correct failures?
- Does the system allow an intuitive usage/handling? And why (not)?

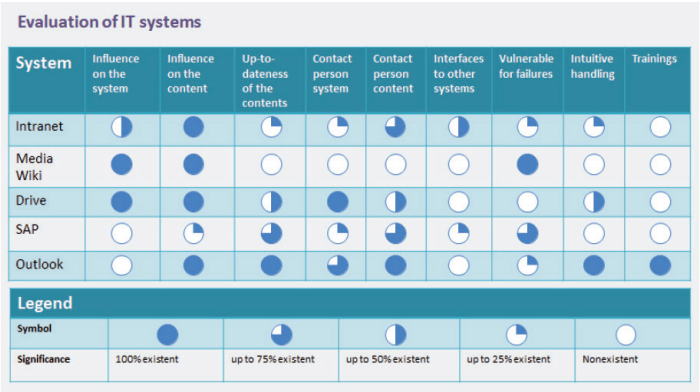

Figure 4: Evaluation of IT systems

The following figure 4 shows the used evaluation and assessment method. Consequently recommendations are derived from the evaluation above, which should lead to an improvement for the user. Findings may be the need for trainings, redundancies in various systems, contact persons do not exist. Derived recommendations are therefrom: to offer sufficient training to the employees, to provide interfaces to avoid redundancies, to train experts.

5 Practical implementation and experiences

The procedure described above has already been tested in a research organisation. It has taken place in combination with the implementetion of KM. The organisation is strongly embedded in predetermined conditions, which is characterized by rigid structures within the IT landscape. Therefore, the technical scope-of-action was limited to a minimum; content-related redesigning was also rather not possible in most of the systems.

Initially, the framework of the IT infrastructure was clarified with the IT manager. Subsequently individual employees of each department were interviewed to the IT systems which were identified by the first phase. The evaluation of the results has led to identification of weaknesses in the intuitive handling of the systems, which could be solved by concrete derived recommendations. This was particularly the improvement of the intranet as the general organisation internal information platform. Other recommendations were made on systems that were under the influence and structured by single users, rather than by organisational requirements.

6 Conclusion and Limitations

The method of data collection with integration of end users leads to a high level of identification with the forthcoming changes and the companies` aim to integrate a KM system in their businesses (Czichos, 2014). Besides, the interview oriented and explicitly end-user-integrating procedure is able to broaden the acceptance for existing and new integrated IT systems that are used in KM. Therefore the whole process of KM implementation is more efficient and resource-saving compared to other approaches. The IT landscape within an organisation or – more general all institutions that demand for a generalized IT department – can be often described as various and complex (Aier & Schönherr, 2007). Furthermore, the average user could be assumed to be rarely capable to keep an overview over the wide span of existing systems which are often also very demanding in usage. Besides IT transparency, the approach also leads to an optimization of the handling of IT systems and software structures – given that there is possibility of influence on the evaluated systems.

The practical application has shown that the procedure depends on the size of the company as well as on clear structures within an institution. Although the detection and recording of IT systems by the first and second step leads to the desired results, but is too superficial for a complete transparency of IT infrastructure, therefore more likely to be used for KM. Another limitation is that the method has only been implemented in research institutions in SME size. In another context, regarding for instance size or branch the method could be possibly not applicable without adjustments.

Nevertheless, the procedure in addition to a general inventory of all IT systems provides optimization potentials and possibilities of their subsequent implementation.

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Social Media and Sustainable Communication. Rethinking the Role of Research and Innovation Networks.

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Structured Abstract

Purpose – Recent studies demonstrate the serious influence of social media on scholarly communication. However, scientists from academia seem to be rather carful in trying new technologies (Kaiser, Köhler, Weith 2016), with most preferring private channels first (Pscheida et al., 2013). Nevertheless, science and innovation are a public issue of wide interest. Communication is a fundamental prerequisite for transfer of information and creation of knowledge, but not sufficient to sustainably implement knowledge in society (Johnson & Chang 2000). Any innovative development from R&D needs to be published and distributed by means of communication and learning. Only if processes of learning are added relevant knowledge can be converted into actions and become effective (Larsen-Freeman 2013).

Design/methodology/approach – New media technologies open up a variety of technological tools and innovative individual and organizational collaboration patterns. Does science consider such opportunities? What kind of data can be used to investigate the ICT / social media usage from a functional perspective? The authors decided to build their argumentation on two cases studies, describing the structural design of research networks, which are indeed quite similar. Therefore, the funding measure „Sustainable Land Management" as well as the research network „eScience Saxony" were considered. Both combine a series of smaller R&D projects within the context of a wider network. The data shows, however, differences in structure and scope (some projects follow a transdisciplinary approach while others do not) as well as further similarities in relation to the usage of social media.

Originality/value – As a research question it is examined how actors of network projects design processes of transfer and implementation of knowledge in their project networks. For the empirical investigation, qualitative data of the two cases is obtained and evaluated systematically. The findings emphasize (1) the equality of knowledge communication and organization of joint learning experiences and,

moreover, (2) similar conceptual understanding of transfer across projects. Moreover, they (3) consider similar media scenarios as appropriate. Marginally, also (4) processes of communication and learning receive attention – which are used as the operationalization of transfer and implementation in the studied networks.

Practical implications – The aim of the research presented is to investigate the various effects of the research networks as a specific form of organizational intervention (Härtel et al, 2015). The authors thereby give attention to the transfer and implementation strategies from the perspective of knowledge communication, in respect of knowledge management, and use theoretical approaches from different disciplines including developmental and social sciences (Stützer et al., 2013) as well as education and organizational studies to elaborate the meaning of research and innovation networks.

Keywords – Social media, sustainable communication, research and innovation networks, case study.

Paper type – Academic Research Paper

1 Introduction

Recent studies demonstrate the serious influence of social media on scholarly communication. However, scientist from academia seem to be rather careful in trying new technologies (Kaiser, Köhler, Weith 2016); moreover, they prefer usage in a private, nonprofessional context first (Pscheida et al., 2016). Nevertheless, science and innovation are a public issue of wide interest. Communication is a fundamental prerequisite for the transfer of information and creation of knowledge, but not sufficient to sustainably implement knowledge in society (Johnson & Chang 2000). Any innovative development from Research and Development (R&D) needs to be published and distributed by means of communication and learning. Only if processes of learning are added relevant knowledge can be converted into actions and become effective (Larsen-Freeman 2013).

2 Social Media in scholarly communication

Universities are genuine places for the creation, dissemination and transfer of knowledge. But E-Learning activities of universities often have a one-sided orientation where the focus is mostly on the technological support of courses by learning management systems, in particular the use of lecture recordings and authoring tools for creating E-Learning content compliance (Lattemann & Köhler 2005, 2006). Although learning always takes place in social communities, only recently a stronger focus of scientific discourses on the use of media according to this

social dimension has been observed (Köhler & Neumann 2011). These activities are undoubtedly necessary and important and aim generally to support higher education and university teachers. However, the students are more often indirectly a target group, as, approaches to directly support student learning are rare. The aim of Köhler & Neumann (2011) was to consider the learning experience and the different phases of the studies from the perspective of students and identify potential support options for these phases by the universities. From a technological point of view, a specific social software was in question. This included web-based applications which are characterized by the fact that they encourage interaction and sharing among users instead of providing services to single users in an individualized way only.

Kahnwald et al. (2016) state that higher education has the potential of using social software especially in supporting informal learning and in universities do exploit this potential in different ways. But so far, social media are hardly implemented in a systematic or even constant manner. Starting from the assumption that the students (in the sense of a community of practice) pursue a common goal (the completion of their studies), Kahnwald et al. (2016) explain that students of Saxon universities were interviewed in focus group interviews about the challenges they face in each study phase. To get an insight into how universities already support informal learning processes with social software, case studies were developed around good practices. Against the background of this empirically gathered evidence, different implementation scenarios for social software have been developed in the field of higher education and a number of strategic recommendations for the use of social software derived to promote informal learning of students at university (Kahnwald et al., 2016).

The social science theories and models of communication and diffusion of research results show that communication and social diffusion are closely interlinked. Not the media alone, but the social relations of actors have an influence on whether and how information and knowledge flow function in a media society. Opinion and information distribution is based on social synergies, in particular resulting from interaction processes of actors. These are often pursued as social capital in the context of social research (Henning 2006, Breiger 1990). In particular, the web-based access to information can diffuse the process of the social component of interpersonal communication. Therefore, in this age of media coverage of social networks, a unidirectional theory, as Lasswell (1948) and Shannon and Weaver (1949) described, can be considered no longer (Rogers 2003).

Katz and Lazarsfeld (1955) transferred in their approach the phenomenon of the influence of social relationships to a model, whereby the idea of the omnipotence of the media was shifted toward an influence of the social dimension. Although this

simplified model of the two-step flow of communication seems obsolete in social science today, it is still regarded as a basis for the further development of many existing communication and diffusion theories (Stützer et al. 2013). Today the priority starts from a multi-stage flow that considers particularly the reciprocity of interpersonal relationships at the centre of investigations. Interpersonal communication therefore forms the basis for all forms of social diffusion processes. The study of social media as a media meeting point therefore plays a significant role in modern social science. Socially oriented online platforms thus provide participants with the instrument to become influential actors in web-based information and knowledge transfer and ensure the networking potential in knowledge networks.

3 Communication and transfer in research and innovation networks

3.1 Research and innovation networks

Not only in scholarly collaboration professionals face new challenges in the age of eresearch- oriented „digital research". In particular, challenges such as dealing with digital material and resources, information management systems, personal working and learning environments, social networks, and further collaboration in research and innovation networks are typical patterns of organizational behaviour (Endruweit 2004, Scott & Davis 2007).

Nowadays professional networks are predominantly based upon social media tools – as the 15 million members in XING or the focused user groups in networks like the SIFAcommunity with its appr. 5,000 users demonstrate (Köhler et al. 2015). At the same moment, communication is an important prerequisite for the development and implementation of research and innovation networks. During the last decade various research activities have recognized and reflected these issues in practice, shown for example in the German funding measure 'Learning regions' or various funding measures about 'Innovation networks'.

The usage of social media can facilitate exchange of scientists from different organisations located worldwide and, thus, enhance information flows notably in complex networks reducing communication costs at once. It is to be kept in mind, that Walsh & Maloney (2007: 725) assumed in their study of collaboration problems in research networks that "asynchronous communication — which easily allows both one-to-one or one-to-many transmission, and which allows easy transmission of longer, text-based messages — may be critical for keeping collaborations on track. In contrast, synchronous communication, although richer in back-channel information, may be neither necessary nor effective, perhaps due to the coordination costs required to set up the conversation (…).".

However, how does recent literature define communication, and in particular social media? What do we understand by collaboration as well as by research and innovation networks? “Science communication, as one part of all general sender – receiver activities, aims to enhance public scientific awareness, understanding, literacy, and culture by building AEIOU [Awareness, Enjoyment, Interest, Opinion-forming, and Understanding of science] responses in its participants. (…) Science communication also provides skills, media, activities, and dialogue to enable the general public, mediators, and science practitioners to interact with each other more effectively.” (Burns et al. 2003: 198f.).

Our understanding of collaboration refer the definition of Thomson (2006: 23): “Collaboration is a process in which autonomous actors interact through formal and informal negotiation, jointly creating rules and structures governing their relationships and ways to act or decide on the issues that brought them together; it is a process involving shared norms and mutually beneficial interactions.” Liyanage points out in her definition the strategic aspect of collaborations that are “forms of strategic alliance between firms and other organizations which are developed for strategic purposes” (1995: 554). Collaborative R&D and research collaboration are specific types of collaboration. They “provide unique opportunities for different parties to succeed in research and its commercialization” (Liyanage 1995: 554). Rampersad et al. (2010: 794) define innovation networks “as a relatively loosely tied group of organizations that may comprise of members from government, university and industry continuously collaborating to achieve common innovation goals.”.

If one follows the largest funding institution in Europe, the European Union’s research framework program, one may find the „Network of Excellence (NoE)”, which typically is a medium-sized research project co-funded by the European Commission in the programs FP6 and FP7 between 1998 and 2006. These projects are „designed to strengthen scientific and technological excellence on a particular research topic through the durable integration of the research capacities of the participants” (EC, 2006). NoE usually combine several independent institutions who partner for the duration of appr. 3 years around a single thematic domain. More recently, the German Leibniz society started to launch research alliances (2014), whereas the Fraunhofer Society, another German research corporation, uses the idea of research composites. When addressing this macrosocial form one may link the research collaboration with organizational theory where networks occurred as a key concept in the 1990s (cf. Lattemann & Köhler 2005, who summarize previous research and discuss governance concepts for virtual organizations).

3.2 Research design, methodology, and sample

New media technologies open up a variety of technological tools and innovative individual and organizational collaboration patterns. Does science consider such opportunities? What kind of data can be used to investigate the Information and Communication Technology (ICT) / social media usage in a functional perspective? The authors decided to build their argumentation on two cases studies describing the structural design of research networks, which are indeed quite similar. More specifically, we focused on the funding measure „Sustainable Land Management" as well as the research network „eScience Saxony", both of which combine a series of smaller R&D projects within the context of a wider network. The data shows, however, differences in structure and scope (some projects follow a transdisciplinary approach while others do not) as well as further similarities in relation to the usage of social media.

The chosen methodology focused on surveys in order to detect the usage of social media in relation to the structural development of the respective networks. To do so, interviews were conducted with typical representatives of actor groups in the networks, chosen due to its central position in each network or subsequent project. The data was processed as a qualitative content analysis. The interview technique used was of a rather semi-structured character. Additional results from the study include documents describing the configuration and the findings of both networks.

4 Data from two sample cases

Case 1: Sustainable Land Management

The Germany Federal Ministry of Education and Research (BMBF 2013) financially supported funding measure „Sustainable Land Management" (NLM) with its currently 25 project networks is here a typical example (Kaiser et al. 2012). With the aim of pioneering the design of the research landscape between the applied research and system design, conscious network structures in the form of project networks from research and practice are addressed (inter- und transdisciplinary focus) by the BMBF.

A new feature of this approach is the sense that, in addition to the interest in the subject-specific knowledge gained in the area of land use research, the question of knowledge transfer is also analysed.

Figure 1: Website of the funding measure „Sustainable Land Management“ (cf.http://nachhaltiges-landmanagement.de/en/)

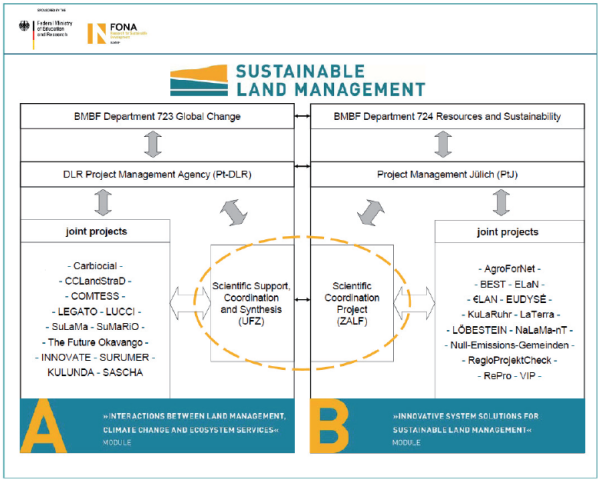

Figure 2: Structure of the funding measure „Sustainable Land Management“ (figure by the authors, the acronyms stand for single collaborative projects)

This is done in particular by the professional competence regarding spatial development, environmental and planning sciences, and landscape research (cf. Zscheischler et al. 2014, Salet 2014), also taking into account expertise from neighbouring areas such as climate research (cf. Knieling & Müller 2015; Knieling & Roßnagel 2015) or forestry science (cf. Janse 2007).

Case 2: research network eScience Saxony

Figure 3: Organizational structure of the eScience – Research Network (cf. https://escience.htwk-leipzig.de/)

The situation is similar in the case of the research network eScience Saxony. The project eScience – Forschungsnetzwerk Sachsen (http://www.esciencesachsen.de), which is a joint project, with funding by the European Social Fund, of all the 12 state universities in Saxony, coordinated by the TU Dresden, the TU Bergakademie Freiberg, and the HTWK Leipzig.

Through the coordinated actions of the Saxon State Ministry of Science and Art and the European Commission, but as well the national German Federal Ministry of Education and Research over the last years, the field of „computational sciences" has been advanced to an excellent level regionally, which includes the introduction of certain E-Learning support systems (Hener & Buch 2006). There was, however, still a strong need, especially in relation to research regarding cooperative, media-supported actions of scientists as well as the tools, technologies and methods employed, to overcome substantial deficits. This is where the network started in order to assist scientists in developing appropriate usage of digital online technologies as research tools.

With the specific organizational structure of the eScience – Research Network Saxony it became possible to address 3 thematic areas with a series of highly specified projects under the joint umbrella of the research network. The selection procedure and the quality assurance where granted with the Scientific Supervision by the E-Learning Task Force which belongs itself to the State Rectors' Conference and acts as interface to the ministry and all rectorates (Köhler et al. 2010). Overall this structure interlinks a network with a classis hierarchic organization and a project structure, i.e. combines three different types of organization.

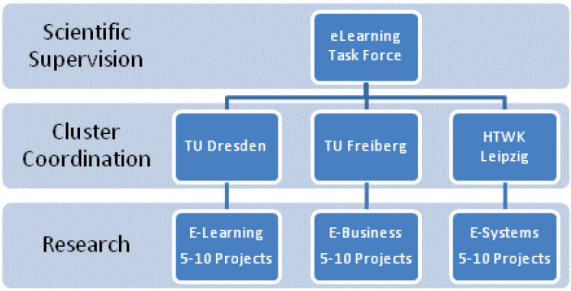

Figure 4: Organizational structure of the eScience – Research Network (own figure)

5 Conclusions

Concerning the idea of interlinking concepts of social media, efficient collaboration, and effective communication, both networks are completely different. Already this observation leads to the necessity of rethinking of the role of research and innovation networks on social media usage. In future, the social embedding and social interlinkages of network actors should attract more attention in research and practice while considering a mix of different organizational patterns.

Another aspect is the domain of the networks which may have some influence, whereas as e-science by nature deals with ICT and social media as a tool, sustainable land use is a large scale endeavour in the applied natural sciences with strong linkages to a variety of sectors outside academia, such as public administration, farming, and others. In addition, it needs to be taken into account that some of the subsequent projects have reached the end of their life cycles, i.e. the core focus of their communication strategies was directed towards transfer and implementation. These are by nature, activities of intense communication, additionally driven by institutional settings like funding regulations concerning the communication of results. All those findings call for different means and patterns of collaboration – from a simple website via an online database until social media communities – whereas undoubtedly communication is one of the core activities of the networks even though those are foremost perceived and thought as thematic task form in- and outside.

Instruments of communication of various means could be worked out which are used strategically for transfer and implementation. Indeed the projects used their grants toward communication rather wide, i.e. there was no single focus detected on (social/online) media use. Especially digital media such as websites, newsletters, or locations explicitly for internal deployment such as Dropbox were used. In contrast to this use of so-called new media, there is a sceptical attitude of the respondents to these transfer

agents. They do, however, name the advantages of digital instruments such as time savings, location independence, and financial savings. Nevertheless, they do not see the need to introduce a technology-based exchange platform, also to reduce additional time consumption and costs (cf. Härtel et al. 2015).

As well authors observed a stronger awareness of the concepts and potentials of social media in the e-science core community. However when it comes to external transfer, respondents rely mainly on informal exchange processes with the project partners in both cases. In particular with respect to practice partners, this is a proven strategic approach. With informal approaches, preferably already existing working relationships are involved. In common discourse, existing stocks of knowledge of partners are exchanged, used, and supplemented, carrying the newly created knowledge.

This perspective recognises that the knowledge and skills needed for innovation cannot be simply transferred through networks by linking these multiple groups – there also needs to be what Kogut and Zander (1992, p. 389) termed a "common stock of knowledge", to facilitate such processes. That is, the communication of knowledge is only possible between people who, to some extent at least, share a system of meaning (Trompenaars 1995). Knowledge then is not transferred but must be continuously created and recreated through networking as individuals come to share a common understanding or a common frame of reference. From this perspective then networking is seen not as a case of linear information transfer but as a process of interrelating and sense making (Weick 1990; Swan et al. 1999: 263). For future research a more comprehensive reflection of results from transdisciplinary (td) research projects for this case will be helpful. In td research communication between different actor groups is one of the key issues. Additionally the analysis and conceptual framing of processes are important aspects (c.f. Zscheischler & Rogga 2015).

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Consolidating eLearning in a Higher Education Institution: An Organisational Issue integrating Didactics, Technology, and People by the Means of an eLearning Strategy

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Structured Abstract

Purpose – Back in the year 2000, the European Council (2000) declared in its Lisbon Agenda that the European Union should become "[…] the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion." This vision encompassed far more than just societal and economic growth in a global world; it also included educational strategies and an e-learning action plan. For example, in 2011, the European Commission mentioned the following as a key policy issue (Communication 2011): to "better exploit the potential of ICTs to enable more effective and personalised learning experiences, teaching and research methods (e.g. [sic] eLearning and blended learning) and increase the use of virtual learning platforms." In accordance with this roadmap, higher education institutions are called on to reflect and re-engineer their educational systems, adapt them to current and future technological and didactical demands and address new generations of teachers and students. New concepts like connectivism (Siemens 2004) and the recognition of non-formal and informal learning (OECD 2016) enhance traditional formal learning settings and lead far beyond the provision of mere learning content management systems. New e-learning and blended learning arrangements like MOOCs (Cormier & Siemens 2010), collaborative learning in the virtual classroom (Tawileh, Bukvova & Schoop 2013) and flipped classroom approaches (Hussey, Fleck & Richmond 2014) are evolving and must be explored, evaluated and then strategically implemented into everyday teaching and learning processes. A comprehensive e-learning strategy should therefore address four fields: didactics, technology, organisation and economy and culture (Seufert & Euler 2004). Besides orientation on the actual trends, the strategy development should also recognise and integrate practical local experiences of early adopters and actors of e-learning in the field. Therefore, a community of knowledge experts in e-learning application has been involved in the strategy development.

Design/methodology/approach – Best practice report of a comprehensive quality initiative for the sustainable improvement of everyday teaching and learning processes at a large university. The challenges of current and future trends in formal and informal learning, collaboration in virtual classrooms and internationalisation of research and teaching processes are analysed and addressed by the strategy implementation plan and a regular evaluation and improvement concept is presented and discussed.

Originality/value – The e-learning strategy presented was developed, discussed and adopted in 2015. Its implementation plan is currently at the final discussion stage, having been due for adoption in January 2016. Practical implications – The e-learning strategy's implementation plan lists targets and sub-targets, underlined by concrete measures, tools and methods, responsible institutions and persons and financial sources. Regular evaluations and improvements will give elearning providers a set of proven instruments to further improve their activities and provide the broad range of students and teachers with a set of best practices to follow, enabling them to discover the benefits of e-learning for their everyday processes.

Keywords – Strategy, higher education, e-learning, dissemination, implementation

Paper type – Practical Paper

1 Background

Back in the year 2000, the European Council (2000) declared in its Lisbon Agenda that the European Union should become "[…] the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion." This vision encompassed far more than just societal and economical growth in a global world. It also included educational strategies and an e-learning action plan. For example, in 2011, the European Commission mentioned the following as a key policy issue (Communication 2011): to "better exploit the potential of ICTs to enable more effective and personalised learning experiences, teaching and research methods (e.g. [sic] eLearning and blended learning) and increase the use of virtual learning platforms."

In accordance with the Bologna Roadmap, in the last decade the German state of Saxony initiated the transition from four to five-year single-track diploma study programmes to the new European standard – bachelor's and master's programmes. This process was accompanied by a state-wide digitisation initiative to improve both productivity and quality in higher education. So, on behalf of the state's Ministry for Science and the Arts, the State Rectors' Conference determined an infrastructure consisting of both a strategy outline for e-learning in Saxony up to 2020 (AK E-Learning 2014), and a standardised learning content management system, which

is currently used by 14 universities in Saxony (OPAL 2016). With regard to this infrastructure, regularly state-wide projects for the development and the roll-out of practical e-learning solutions are announced and funded (Bildungsportal Sachsen 2016).

Embedded into this context, TU Dresden[1] additionally runs the Multimediafonds (Multimedia Fund 2016) programme already since 2005, funding small local initiatives to document and roll out evaluated best practice examples of e-learning from early adopters and researchers in the field of e-learning to a broader audience at the university. During this process, the faculties denominated e-learning deputies. They were asked to develop faculty-oriented e-learning strategies and hand in their faculty's proposals for funding based on these strategies. In 2015, a task force headed by TU Dresden's Vice Rector for Education and International Affairs condensed these de-centralised, bottom-up initiatives and developed the central e-learning strategy for the whole university as usual top-down approach. By this dual perspective, which is based on the fundamental directives of TU Dresden's Institutional Strategy (The Synergetic University 2013), already existing practical expertise should be included into the strategic change process.

2 Theoretical foundations: the planning and realisation of a strategic change process

Within universities, strategies have a clearly defined field of action, which is restricted by a meta-system and organisational policy on the one hand and the tactical methods of the change agents charged with implementation on the other.

Different criteria based on existing data are used for the initial analysis in order to obtain the legitimacy and acceptance vital to implementing the strategy. In accordance with different process and implementation models for the higher education sector (e.g. Keller 1983, Dickeson 2010, Rowley et al. 1997), a range of criteria for developing the e-learning strategy was included. Innovation, demand and quality aspects are decisive in terms of content and viability and resource and cost issues when it comes to implementation. Available skills and staff resources in particular should prove to be a decisive factor in implementation planning. The media centre at TU Dresden is an appropriate centre for digitising learning and teaching, but it was also important to allow all departments, faculties and staff to contribute to achieving objectives. Here, online education is considered to be an organisational development process that links with other stakeholders both within and outside the university (Köhler & Neumann 2011).

1 Dresden is the capital of Saxony. With more than 36.000 students in 14 Faculties, TU Dresden is one of the largest German Technical Universities and, since 2012, one of the 11 German Universities of Excellence (https://tu-dresden.de/tu-dresden/profil#page-intro-1)

The strategy should be adopted by the entire university, not seen as merely a top-down instrument in the context of developing higher education. This is why departmental and/or faculty experts were dispatched to the work group for the Vice Rector for Education and International Affairs1. The aim was that they would harmonise their practical expertise in integration of e-learning into their every-day teaching and learning processes, and the specific needs of their fields (e.g. mechanical engineering, medicine or business management) with the possibilities offered by digitisation that were presented by the media centre's e-learning experts, in order to ultimately ensure the widespread acceptance and achievement of targets.

Specifically, the following multi-stage model (Dolence 1997) was used during the strategy development:

- Developing key performance indicators
- Assessing the internal environment
- Analysing strengths, weaknesses, opportunities and threats
- Generating and discussing ideas
- Formulating strategies, goals and objectives
- Formulating the implementation plan.

Implementing the digitisation strategy was not wholly determined by the experts involved in the planning or the vice rector. The responsibility was rather divided between a number of parties. On the one hand, the media centre plays a central, advisory role. It supports lecturers, departments, faculties and university administration when it comes to media education, media rights and media technology issues, acting as a hub where information is collected so that it is available to all of the relevant parties. On the other hand, however, all of these parties work independently towards achieving targets in their respective departments, where regular evaluation and feedback provided to the change agents (generally e-learning representatives from the faculty or department) should ensure quality and sustainability. The final evaluation will take place after five years, on the basis of which TU Dresden's digitisation strategy will be updated as necessary.

3 TU Dresden: a case study

3.1 A framework for e-learning usage

In order to develop initial criteria and ideas, comprehensive guiding principles and foundations for e-learning usage at TU Dresden were drafted as a mission statement (for further discussion compare: E-Learning Strategie der TU Dresden 2015):

- TU Dresden aims to develop a new teaching and learning culture, which addresses a meaningful crossover between technical implementation options, didactics and designing the virtual and/or physical teaching and learning environment.
- TU Dresden's diversity – both in terms of its range of disciplines and its students – requires continuous adjustment of the relationship between conventionally and digitally supported teaching concepts in order to offer attractive conditions for students and young scientists in the future.
- In order to improve and ensure the quality and economic viability of digital teaching, TU Dresden is working towards further standardisation in terms of digitally mapped teaching and research processes and methods. The university is committed to a statewide e-learning infrastructure for Saxony and is proactive in developing it further and promoting its widespread usage.
- It is particularly important for TU Dresden to offer students and lecturers alike opportunities for individuality and interaction, while achieving a higher degree of effectiveness in so-called 'mass study' situations.
- The expansion of research into digital teaching in higher education is vital issue for TU Dresden. The results lead to a continuous development of the e-learning strategy and its implementation.

3.2 Fields of action regarding the e-learning strategy and measures to achieve objectives

Based on the principles and fundamental concepts set out for e-learning usage, the objectives of fostering individuality and interaction, supporting teaching processes and expanding and opening up teaching, which are linked to TU Dresden's e-learning strategy, were determined and further refined using sub-objectives (see Figure 1).

These objectives and sub-objectives are set out below, along with the respective measures needed to achieve them. The sub-objectives focus on wide-ranging effectiveness and build on the current situation and TU Dresden's previous actions and structures.

<table>
<tr><td colspan="3">Integrate innovation</td></tr>
<tr><td>Foster individuality and interaction</td><td>Support teaching processes</td><td>Expand and open up teaching</td></tr>
<tr><td colspan="3">Develop structures and ensure sustainability</td></tr>
</table>

Figure 1: The e-learning strategy's long-term objectives

Foster individuality and interaction

In the introductory phase, courses will be offered to an increasing number of students. In this regard, the university is addressing an extremely diverse student population and, as such, measures are required, which give students access to flexible learning environments both in terms of time and location and enable them to acquire and deepen their knowledge and skills both alone and in a group and replay or catch up via different digital learning resources. This is how individual, interactive learning processes can be implemented and academic success can be increased with perspective, even in mass study situations. The following sub-objectives and measures are taken into account in the context of fostering individuality and interaction:

Online-based teaching/learning scenarios: The aim here is to systematically increase the prevalence of digital teaching/learning scenarios in individual faculties in order to offer students the option of individuality through flexible courses and content. In order to meet these requirements, self-learning offerings should be made available to students, strengthening self-managed, informal learning. Furthermore, the integration of webinars into courses should be promoted and a range of taster and bridging courses should be offered to new 1551 students. Meeting these objectives will require the long-term preparation of an elearning infrastructure, support offerings for lecturers and the provision of an appropriate reward system.

Online-based examination types: The aim here is to increase the prevalence of self-assessments and e-examinations in order to make examination processes and practice options more flexible. E-examinations should therefore be structured and have a central infrastructure (i.e. dedicated examination rooms and equipment) to ensure legally sound online assessments. Furthermore, selfassessment options suited to the target group(s) should be made available and developed. In addition to the above mentioned e-learning infrastructure, support offerings and reward system, adaptations of examination rules and processes and the establishment of an e-assessment centre to ensure the quality of the examination processes are essential (e.g. selectivity, validity, reliability and understandability of the test items).

Virtual collaboration, cooperation and communication: The aim here is to support team work and collaborative learning between students and lecturers in the virtual classroom in order to enable interactive learning processes (even for large events). Specifically, lecturers should enable virtual group work and expand the scope of virtual support for students. Achieving this requires the long-term provision of an e-learning infrastructure, support offerings for lecturers and an appropriate reward system.

Technology-based teaching in the real classroom: The aim here is to provide and use suitable technology to enhance traditional teaching in order to foster interactive learning processes (even for large audiences). The regular integration of audience response into teaching and learning activities should be boosted and the technical use of an audience response system ensured. Increasing lecturers' use of audience response requires appropriate incentives and the provision of support offerings, e.g. in the form of training, consultation and information. Furthermore, a central provision of technology and user support are essential.

Support teaching processes

In order to allow a balance between research and teaching, lecturers must be better supported in their delivery of high-quality teaching and economical use of innovative 1552 technology. Both lecturers' educational media competence and students' media skills must be promoted here in order to successfully plan and implement digital teaching and learning scenarios. The aim is to support lecturers in order to effectively prepare excellent teaching (which enables individual, interactive learning). This enables them at the same time to actively research to a sufficient extent and to give their teaching a research focus. The following sub-objectives and measures are taken into account in the context of supporting teaching processes:

Training opportunities and materials: Lecturers and students should be supported with a needs-based offering of training and development, with the aim of developing a new teaching and learning culture in all departments. Specifically, lecturers' educational media competence and media skills should be promoted and special requirements should be considered in training offerings. Furthermore, students' media skills should also be promoted. In order to achieve this, user training and educational media development should be regularly offered to lecturers and further developed, options for individual requirements (e.g. different disciplines demanding different didactics and e-learning support) should be created and also training offerings for students should be developed.

Support and consultation: The aim here is to support lecturers by individual educational media and application-specific consultation and support, in addition to the networking and provision of e-tutors. Furthermore, the dialogue between lecturers in appropriate formats should also be promoted (community building – e.g. E-Teaching Day at TU Dresden 2015). In addition to the adoption of media technology and didactic consultation for lecturers (e-learning support), a standardised training offering for e-tutors should also be established and the development of a community should be promoted.

Reward system: With the Multimedia Fund, TU Dresden has an intra-university incentive for both lecturers and students. The aim here is to increase the usage of e-learning in teaching and therefore promote the development of contemporary, attractive teaching and learning offerings. Continuous provision and development of the Multimedia Fund is required in order to maintain the incentive.

Expand and open up teaching

The trend towards life-long learning means that TU Dresden is opening up its courses to more target groups (e.g. promoting a family-friendly university). Furthermore, location-independent teaching and learning now mean that international students can already access courses online, even before they decide to study at a German university. TU Dresden should meet this challenge with new, digitally supported teaching and learning offerings, which can also integrate current development in the field of open education resources. The following sub-objectives and measures are taken into account in the context of expanding and opening up teaching:

Opening up courses: The aim here is to offer established, flexible, on-the-job, family-friendly and continuing education courses, as well as strong support for new students and interested parties via an appropriate proportion of onlinesupported teaching. Specifically, (massive) open online courses should be established as an element of digital teaching, on-site teaching should be expanded to distance teaching and learning, on-the-job and continuing education courses should be created and tailored offerings for specific target groups should be available in preparation for university admission. In addition to the provision of an e-learning infrastructure and appropriate user support, increased didactic flexibility of existing courses through e-learning elements and central access is required.

Internationalisation: The aim here is to internationalise study programs and teaching. Primary support should be given to teaching across different sites, students' collaboration and international courses should be strengthened through digitisation. Achieving this requires the long-term provision of an e-learning infrastructure, support offerings for lecturers and an appropriate reward system.

Teaching and learning materials as open educational resources (OER): The aim here is to exploit the potential of unrestricted educational resources. The integration of OER in practice and the provision of an open pool for the use and exchange of learning materials are desirable. In order to achieve this, an integration strategy for OER is required first of all, in addition to establishing technical requirements for the open pool of learning resources.

Integrate innovation, develop structures and ensure sustainability

TU Dresden sees collaboration between all parties, including students, in the context of integrated innovation management as a significant task for the future. Innovations should be explored, discussed and integrated into the existing process. In terms of sustainability, it must be ensured that the financing of new processes and methods is viable beyond start-up funding. It must be taken into account that this does not always require the consolidation of resources; resource-saving, more efficient standard operations can also result in sustainability. In accordance with the synergetic university's motto, networking and transparency enable links to be created, which allow the integration of new elements into existing structures. The following sub-objectives and measures are taken into account in the context of integrating innovation, developing structures and ensuring sustainability:

Integrate innovation: The intention here is the integration and communication of e-learning innovations in order to support the development of a new teaching and learning culture. This requires the continuous investigation, testing and evaluation of innovations while establishing a university-wide innovation forum.

Develop structures: The aim here is to develop the digital structures and support processes that foster teaching under the umbrella of a consistent quality management. Specifically, networking structures have to be expanded, communication about and the visibility of e-learning should increase and the standardisation, planning and implementation of the required equipment in classrooms have to be pushed. This requires creating appropriate interfaces between the systems (e.g. student lifecycle and learning management systems), building transparent structures to support communication, creating a reward system for e-learning representatives and providing in-depth training and consultation. To improve teaching quality through e-learning, quality criteria must be defined and digitisation measures integrated into the university's quality management system. In order to achieve a stronger link between virtual and physical teaching and learning environments, didactic criteria must be defined, tested and afterwards integrated into the university's didactic training program.

Ensure sustainability: The intention here is to ensure a sustainable implementation of the e-learning strategy. This includes the long-term availability, regular updates and maintenance of an e-learning infrastructure designed to cover diverse teaching needs, consolidating services and centralising infrastructures. In order to ensure sustainability, a comprehensive sustainability concept must be developed and continuously checked, adapted and further developed. This also applies to the bottom-up e-learning strategies of the faculties. Finally, the long-term sustainability of an e-learning infrastructure should be ensured, along with appropriate consultation and service.

4 Conclusions

This paper presented the e-learning strategy of TU Dresden, one of Germany's largest Technical Universities and, since 2012, one of the 11 German Universities of Excellence. Its implementation plan follows the fundamental directives of TU Dresden's Institutional Strategy (The Synergetic University 2013) and combines two perspectives: (1) decentralised bottom-up strategies by the faculties and their e-learning actors and (2) central top-down approach by a task force headed by TU Dresden's Vice Rector for Education and International Affairs. Against the backdrop of the challenges of current societal and educational policies, and taking into account the vast diversity of its subjects, TU Dresden's e-learning strategy addresses three main objectives: (1) Foster individuality and interaction, (2) support teaching processes and (3) Expand and open up teaching. These objectives are framed by integrative innovation management and sustainable, multi-step expansion, which takes into account existing structures and (financial) limitations, exploits synergetic usage of new resources and opens up free spaces through standardisation and more efficient organisational and technical processes.

Considering the combination of different stakeholders in a bottom-up and a top-down approach, this conscious strategic process differs from what can be found in literature on the typical (sometimes even unintentional) development of e-learning in German universities (Köhler, Neumann & Saupe, 2010). The active participation of e-learning experts from different fields of TU Dresden, a strategy process taking into regard already existing, competing de-centralised strategies focusing upon faculties' specialities and cultural contexts, the local university's reward system, and the recognition of the value of e-learning as an integral, strategic part both in the internationalisation and in the quality management roadmap of TU Dresden are very encouraging. This gives hope that the developed strategy will provide a long-term orientation and framework for diverse initiatives to sustainably change and improve the teaching and learning processes.

Thus, the development process can be seen as an intentional knowledge management approach, fostering communication between and collaboration of diverse e-learning experts and institutions at TU Dresden. Due to the early stage of the initiative, the proof of the long-term success of the strategy depends on its fast official implementation and communication by the University Management and its acceptance by the majority of currently often still observant teachers and tutors.

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How to treat the troll? An empirical analysis of counterproductive online behavior, personality traits and organizational behavior

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Structured Abstract

Purpose – Online environments, such as social networks and online forums, offer new possibilities and a wide variety of identity and social relationship management for the users. However, besides functional contributions like mutual support and easy ways of establishing contacts there are critical perspectives on computer-mediated communication (CMC) regarding detrimental behavior like provoking, overbearing, attacking and insulting other users, especially when anonymity is high. Recent research has shown that these kinds of online behavior are associated with personality traits like sadism, machiavellianism, narcissism, and psychopathy (Buckels, Trapnell & Paulhus, 2014) and can lead to severe trouble, negative affect and dysfunction in online communities (Cheng, Danescu-Niculescu-Mitzil & Leskovec, 2015). As such, in the public perception "trolls" have become a synonym for counterproductive and dysfunctional behavior (Bishop, 2014a, 2014b). Our research aim was to shed more light on trolling and counterproductive online behavior theoretically as well as empirically. In other words: We wanted to know who is behind the troll? How can he or she be characterized in terms of personality traits and what can be expected from trolls when it comes to the organizational context and job performance?

Design/methodology/approach – In a first step, we formulated a theoretical framework on counterproductive online behavior. On that ground, two online surveys (N = 122; N = 133) were conducted. The first study's goal was to develop and validate a questionnaire on counterproductive online behavior. The second study analyzed counterproductive online behavior and tested for possible interrelations to personality traits and work-related outcomes.

Originality/value – Using explanatory factor analyses we developed a 40-item questionnaire with two higher dimensions: Constructiveness and destructiveness. 15 subscales focus on different communication styles and trolling strategies. The second study tested the two dimensions of counterproductive online behavior on work-related outcomes such as work engagement, task-related performance and interpersonal

facilitation. As was expected, destructiveness revealed significant negative correlations with all work-related outcomes as well as deviant work behavior. Constructiveness, in contrast, showed positive associations with interpersonal facilitation.

Practical implications – So far, research on trolling and counterproductive online behavior has been limited to theoretical or anecdotal approaches in most cases (cf. Bishop, 2013a, 2013b). Our study aimed at a more systematic examination of this CMCspecific phenomenon. However, our study design, acquisition of the samples and the formulation of the questionnaire suggest that the results are valid indeed. On that note, our research is a first step for a deeper understanding on people showing counterproductive online behavior.

Keywords – trolling, counterproductive online behavior, dark triad, job deviance, work engagement

Paper type – Academic Research Paper

1 Introduction

The Internet offers many different opportunities for group development and fosters communication beyond national borders. Older generations perceived the Internet as innovative and future-oriented but for the younger generations the Internet is a fundamental part of everyday life and it´s not possible to imagine one without the other (Schulmeister, 2009). Actually, online interaction comprises very different audio-visual possibilities and characterizes the leisure-behavior of the current generations. The aims of these interactions are to preserve friendships and to communicate with friends. This corresponds with regular socialization processes of children and juveniles, who use online communication for more effective identity and relationship management (Schmidt, Paus-Hasenbrink & Hasenbrink, 2009). As implied by the notion of ‚Digital Natives', everyday usage of interactive online media has a significant influence on society as a whole, but also on personality development (Schulmeister, 2009).

However, there are also critical aspects of online communication. Especially possibilities of largely anonymous usage are seen to be responsible for the rising account of personal assaults and hostility in communities and social networks (Buckels, Trapnell & Paulhus, 2014). These counterproductive online behaviors are mostly known as trolling, flaming, or hating and they are just common synonyms for the variety of negative behavior present throughout the Internet, which are responsible for substantial disruption in the online community (Cheng, Danescu-Niculescu-Mitzil & Leskovec, 2015).

Online communication enables many opportunities to indulge in antisocial behaviors anonymously which cannot be shown in real-life without getting into trouble. Therefore, it is necessary to analyze the negative as well as possible positive impacts of such behaviors, because online behavior affects real life and vice versa. Especially regarding the workplace, further research is required to investigate not only the risks but also potential benefits and resources of counterproductive online-behavior, e.g., in terms of a 'social corrective'. Thus our research aims at the development of a suitable instrument to survey counterproductive online-behavior to assess the potentials, risks and resources of these behaviors concerning everyday life in general and the workplace in particular.

2 Computer-mediated communication

Computer-mediated communication (CMC) or online communication allows for social exchange with other persons, without being obliged to reveal one's own identity. The interacting partners enjoy a relative amount of anonymity, depending on the choice of medium, nickname, profile picture or the mode of expression. This perceived anonymity might foster deindividuation and depersonalization of the interacting persons. Deindividuation effects the reduction of self-awareness, which provides the base for antisocial behavior, whereas depersonalization describes the loss of identity and reality caused by anonymity (Postmes, Spears & Lea, 2002). On that note, Spears, Postmes, Lea and Wolbert (2002) point out that even distinctly antisocial behaviors like insulting other users might be accepted as socially adequate and in conformance with group norms. What might seem aggressive and antisocial for the out-group may be absolutely acceptable for the in-group and may be interpreted as ironic or playful (Spears et al., 2002).

3 Counterproductive online behavior – A definition

In scientific research the term trolling has been adopted as a synonym for antisocial behavior. Generally trolling is described as posting provocative and inflammatory comments, messages, pictures or videos (Baker, 2001; Brandel, 2007; Phillips, 2013). However, this common view does not account for the multifaceted nature of counterproductive behavior, which includes not only antisocial behaviors like provocations or insults, but also passive and prosocial expressions in different contexts.

At a behavioral level Hardaker (2013) describes trolling as intentional use of impoliteness, aggression, deception and/or manipulation in CMC to foster an atmosphere beneficial for conflicts just for the purpose to entertain the troll. The recipient may perceive the behavior of the transmitter as covert or overt trolling. Covert strategies often include manipulating or flattering tactics to adopt an identity, which

hides the real intentions of the transmitter. Therefore, the transmitter uses specific strategies which allow more defensive interpretations. Nevertheless, the transmitter may use overt strategies and adopt an identity clearly showing his intention to troll the interaction by aggressive and provocative behavior. More specific, Hardaker (2013) distinguishes between six different strategies including disgressing, (hypo) criticizing, antipathizing, endangering, shocking and aggressing, whereby disgressing can be rated as a covert strategy and aggressing as the most overt.

More detailed, Bishop (2014a, 2014b) focusses on 12 typical behavioral categories aimed at preventing or disturbing constructive interaction in online communities. These categories can be separated into four groups: haters (destroying and escalating behavior without expecting a serious advantage for themselves), lolcows (seeking for attention by continuous provocation), bzzzzters (being motivated by the desire of social interaction independent of a deeper sense or a specific topic) and eyeballs (taking an observant position in online communities and waiting for the right moment to post provocative content). Follwing Bishop, these different types of online behaviors may have counterproductive as well as productive effects on online communities. Partly, presented online behaviors represent extreme and rare forms, so that they are not easily assessed at all. Whether behavior is rated constructive or destructive also depends on the culture within the online community. Therefore, we suggest the following definition as a basis for standardized assessment of counterproductive online behavior: Counterproductive online behaviors within CMC include all behaviors that do not serve the primary goal of the online community and/or have a detrimental effect on the community. However, this might include behaviors which are not outright hostile and have a well-meaning intention.

4 Destructive and constructive effects

The majority of scientific research on counterproductive online behavior focuses solely on theoretical derivations or anecdotal approaches (c.f. Bishop, 2013a, 2013b).

Buckels, Trapnell & Paulhus (2014) developed the Global Assessment of Internet Trolling (GAIT) and were the first to test counterproductive online behavior quantitatively. However, the GAIT encompasses only a part of counterproductive behaviors. Their results show that these kinds of online behavior are associated with personality traits like sadism, machiavellism, narcissism, and psychopathy. In addition, negative correlations with conscientiousness and agreeableness where identified. Thus, users showing counterproductive online behavior tend to be unreliable, negligent and less disciplined. They do not care about the wellbeing of other users and focus primarily on their own wellbeing and entertainment.

Moreover, regarding the three characteristics of the Dark Triad, Buckels, Jones and Paulhus (2013) underpin the connection between sadism and a lower level of empathy. They point out that people who tend to bear sadistic tendencies enjoy hurting other individuals even without any provocation. For the workplace context this means that employees who show destructive counterproductive online behaviors might act unpredictable and harass their colleagues for example by irrational sanctions or bullying. For online user with narcissistic tendencies, this might lead to less loyalty regarding supervisors and colleagues as well as a sense of superiority. Furthermore, machiavellians ignore social norms and are unable to build up stable relationships. They manipulate their work environment and tend to show deviant and unethical behavior. People with psychopathic traits also tend to show deviant or anti-social behaviors and also a low performance at work (O'Boyle, Forsyth, Banks & McDaniel, 2012).

Nevertheless, there also constructive effects of counterproductive online behaviors like entertainment and enhancing group-cohesion by out-group discrimination. These types of behaviors don´t serve the main topic of the community but also reduce the negative effects of destructive behavior like insults, flames and harassments. Independent of its constructive or destructive orientation, counterproductive online behavior may have positive influences on self-esteem and self-efficacy. For example, counterproductive online-behaviors help to cope with mental stress emotionally in the short term (Chiu, Huang, Cheng & Sun, 2015). Also, variation of identities offers an opportunity to test different role models and types of behavior. Mikal, Rice, Abeyta and Devilbiss (2013) argue that in times of personal or family distress it helps to adopt different role models so that changes and critical situation can be encountered in a flexible manner. People who are able to adopt different role models are more satisfied than individuals with less identity-defining role models (McKenna & Seidman, 2005). Thus, CMC provides an environment that might help to develop stable identity (Wettstein, 2012).

Counterproductive online behaviors enable developing a feeling of group cohesion and belonging because they strengthen existing in-groups but also the development of new alliances (Hopkinson, 2013). Bannon, McGlynn, McKenzie and Quayle (2015) point out that conflicts between in-groups and out-groups are in some way accepted and playful so teasing each other is accepted behavior and might raise the attraction of one's own ingroup. Furthermore, feelings of group cohesion and belonging foster social support (Hopkinson, 2013).

So far, research on counterproductive online behaviors is scarce, especially regarding the standardized assessment of such behaviors. Therefore, we aim to develop an instrument to assess counterproductive online behaviors and to examine their effects in a standardized and reproducible way.

5 Method

5.1 Procedure and results of the preliminary study

On the ground of the formulated theoretical framework we developed the Questionnaire on Counterproductive Online Behavior (QOCB). To validate the questionnaire, we first conducted an online survey (N = 122). The sample consisted of 55 women and 67 men with an average age of 29.09 years (SD = 8.40) who spend an average of 5.63 hours (SD = 3.43) daily in the internet. The whole sample was acquired via online forums. A number of questions ('fake scales') were placed at the beginning of the questionnaire to test for truthful response.

Using explanatory factor analyses we developed a 40-item questionnaire with two higher dimensions: Destructiveness (α = .95) consisting of 27 items, and constructiveness (α = .82) consisting of 13 items. Both dimensions, destructiveness and constructiveness explain a total variance of 57.31%. The 40 items in total can be devided into 15 subscales focused on different communication styles and trolling strategies which are presented in Table 1. The 15 subscales of the QOCB consist of at least two to four items.

5.2 Procedure and measurement of the main study

For further research we verified the criterion validity of the QOCB with another online sample of N = 133 participants consisting of 75 women and 58 men. The mean age of the participants was 25.85 years (SD = 7.23) and the average time spent by participants on the internet was 4.86 hours (SD = 2.90) daily. The majority of the sample pursuited an academic education (36.1%).

The QOCB was used to assess the two dimensions of counterproductive online behavior. Destructiveness and constructiveness were rated on a 5-point Likert-Scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). The dimension destructiveness included the subscales creativity (e.g., "If I want to make fun of someone, I create my own content and post them on the Internet"), spoofing (e.g., "Stupid and pointless comments are 'my thing'"), criticism (e.g., "There is nothing better than to destroy the worldviews of other users"), provocation (e.g., "I like to provoke other Internet users in online communities"), shocking (e.g., "Shocking other internet users entertains me"), hostility (e.g., "I insult other users just for fun"),

territoriality (e.g., “Newbies have to earn my respect hardly”), revenge (e.g., “Internet users who insult me must expect my vengeance”), deception (e.g., “I like to adopt different identities on the internet”) and exploitation (e.g., “Exploiting other Internet users is perfectly legitimate”). The dimensions constructiveness included the subscales defence (e.g., “I defend other Internet users when they are attacked”), reporting (e.g., “I frequently report inappropriate content on the Internet to the admins”), trust (e.g., “Earning the trust of other Internet users is easy for me”), support (e.g., “I share my life experience with other users”) and attention (e.g., “If I feel bad I post my feelings on the Internet”). The internal consistency of each subscale is listed in Table 1.

Table 1. Scales of the QOCB: Number of items, means (M), standard deviation (SD), internal consistency (α) and discriminatory power (rit)

Scales	Items	M	SD	α	rit
Creativity	2	1.44	.84	.88	.78
Spoofing	4	2.02	1.06	.85	.66–.74
Criticism	4	1.82	.78	.71	.44–.55
Provocation	2	1.72	.103	.82	.70
Shocking	3	1.65	.86	.82	.65–.69
Hostility	3	1.66	.96	.84	.69–.74
Territoriality	3	1.76	.96	.81	.63–.72
Revenge	2	2.23	.95	.75	.60
Deception	2	1.77	1.05	.69	.53
Exploitation	2	1.50	.82	.67	.51
Defence	2	2.94	1.07	.81	.67
Reporting	2	2.31	1.06	.71	.55
Trust	2	2.70	1.18	.80	.61
Support	4	2.77	.94	.80	.57–.67
Attention	3	1.67	.70	.68	.46–.57

Notes. N = 122.
Scales are rated on a 5-point Likert-Scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Beside the QOCB we included a number of other personality-focused and job-related scales to test for possible interrelations. To assess the Dark Triad of negative personality traits, we used a scale developed by Küfner and colleagues (2015) consisting of 12 items divided into the three scales psychopathy (α = .72), machiavellianism (α = .78) an narcissism (α = .85). To represent the five dimensions of personality we used the 10 Item Big Five Inventory (Rammstedt, Kemper, Klein, Beierlein & Kovalea, 2013). We also included the German version of the Interpersonal Reactivity Index (Paulus,

2009a) to assess perspective taking (α = .71), fantasy (α = .74), empathic concern (α = .71) and personal distress (α = .66). To measure job-performance we included the three 5-item scales: Task-related performance (α = .90), work-engagement (α = .84) and interpersonal relief (α = .89) developed by Ferris, Witt and Hochwarter (2001). For the assessment of deviance we used the 19-item Workplace Deviance Scale (Bennent & Robinson, 2000) comprising of the subscales interpersonal workplace deviance (α = .78) and organizational workplace deviance (α = .81).

To illustrate the frequency of internet activity we included several questions to assess the daily number of comments, the time spent on the internet as well as the number of self-created and shared content.

6 Results

Regarding the frequency of internet activities, we found significant correlations between both, destructiveness (r = .28**) and constructiveness (r = .37***) and the number of daily comments. Furthermore, only significant correlations between constructiveness and the time (r = .29**), spent on the internet, the number self-created (r = .28**) and shared (r = .34***) content were identified.

To underpin the postulated relations and to control the criterion validity of the QOCB a multiple regression analysis was conducted, revealing significant predictor functions for the two dimensions destructiveness and constructiveness. Controlling the predicting value of destructiveness and constructiveness for the Dark Triad, we identified destructiveness to be a unique predictor for narcissism (β = .25; p = .008), machiavellianism (β = .63***) and psychopathy (β = .57***).

Destructiveness was also identified to be a significant predictor for conscientiousness (β = -.26**) and agreeableness (β = -.31**).

Controlling the different facets of empathy for destructiveness and constructiveness, we identified destructiveness to be a unique predictor for perspective taking (β = -.19*). Constructiveness was identified to be a unique predictor for fantasy (β = .25*).

The results of the multiple regressions analysis pointed out, that destructiveness significantly predicted task-related performance (β = -.31***). Furthermore, destructiveness was identified to be a unique predictor for work engagement (β = -.38***). Concerning interpersonal relief, both predictors destructiveness (β = -.38***) and constructiveness (β = .20*) revealed significant results. Finally, destructiveness was identified to predict workplace deviance on a .001-level (β = .43***).

7 Discussion

Our research supports the postulated relations and underpins the bivariate dimensional structure of counterproductive online behavior. The significant relation between the different types of the frequencies of different internet activity showed that user who preferred counterproductive online behavior with constructive effects on the online community aimed at long-term and mutual interaction. In contrast, those users who preferred destructive effects on the online community since destructiveness revealed significant correlations with the daily number of comments only. Users who showed counterproductive online behaviors with destructive effects on online communities posted content that was not aimed at positive exchange but at provocation, insults or harassment. The further investigation pointed out that regarding the characteristics of the Dark Triad, only destructiveness predicted narcissism, machiavellianism and psychopathy. Positive expressions of destructiveness therefore indicated increased expressions of the Dark Triad, so these findings extend the results of Buckels et al. (2014) and confirm the assumption that the GAIT is not a sufficient instrument to capture the diversity of counterproductive behaviors. In addition, the results concerning the relation between our instrument and the Big Five point out that the relations postulated by Buckels et al. (2014) are only transferable on destructiveness. In contrast, constructiveness did explain additional variance. These results argue for the postulated multidimensionality of counterproductive online behavior. Regarding the relations between QOCB and empathy, the differences between destructiveness and constructiveness are highlighted again. The negative contribution of destructiveness concerning perspective taking and the positive relations between constructiveness and fantasy point out that these two scales are distinct indeed. Moreover, regarding empathic concern, the results show that users who prefer counterproductive behavior with destructive effects on the online community exhibit less

empathic concern than those users, who tend to aim at constructive effects. These results support the postulated theoretical foundation and allow to assume serious effects for real life and especially working life: For example, higher scores on destructiveness led to less task-related performance, work-engagement, interpersonal relief and more workplace deviance. From a statistical perspective, the QOCB's scales and the included subscales exhibit sufficient to good internal consistencies, construct validity. The presented results verified the postulated relations so that also criterion validity was approved. As such, the QOCB serves as a proper base for further research, which is necessary to underpin the proposed assumptions like possible effects on identity development or long-term effects. A far more important finding, however, is the fact that counterproductive online behaviors does not occur isolated and independent but rather shows a broad variation, even between the two dimensions

constructiveness and destructiveness. It would be way to early to assume that different types of users exist, which show definable expressions of counterproductive online behavior but the relevance for further research is remarkable.

The QOCB does not claim completeness and requires further development but it fulfills the role of a valid and reliable instrument that includes and subsumes the state of the art of counterproductive online behavior. Furthermore, it is the first and actual only instrument that allows a differentiated consideration of the variety of constructive and destructive online behaviors.

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Knowledge Communities II: Online Education

Sifa-Portfolio – a Continuing Education Concept for Specialists on Industrial Safety Combining Formal and Informal Learning

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Structured Abstract

Purpose – Specialists on industrial safety (Sifas) are appointed by companies due to German occupational safety act (ASiG) as safety advisors, to analyse the work environments and the work procedures. Their principal task is to inspect workplaces for adherence to regulations on health, safety and environment, and design actions to prevent from disease or injury of workers and environmental damages. Due to variety of settings in which work safety specialists are involved, they are obliged to continuous further education and permanent adoption to changing circumstances of occupational context. To do so, Sifa's need access to tools which provide the following three key features:

- possibility to share knowledge with experienced specialists on industrial safety (Sifa-Community),
- ability to promptly recognize critical topics in the field of their activities (Trend- Monitoring),
- opportunity to create track of records of further education on current topics, including the validation and certification of work-related informal learning (Sifa-Portfolio).

Sifa-Portfolio and Trend-Monitoring are based on Sifa-Community, an exchange platform (www.sifa-community.de) with currently 5.000 members established in the context of a longitudinal study on Sifas. This paper will focuses on the concept of Sifa-Portfolio that was developed as a prototype of further education application based on the concept of EPortfolios. It allows Sifa's to share their knowledge, recognize critical topics and create track of records of their informal further education to showcase their competencies and eventually receive certification.

Design/methodology/approach – In the paper authors present the approach of Sifa- Portfolio - an application for further education, based on Sifa long-term study (Sifa- Langzeitstudie), data mining (text mining), and user centred design. It starts with the description of results of an online study and specific requirements that have

to be considered when designing applications for specialists on industrial safety. It then presents the trend monitor based on Sifa-Community posts, which provides up to date information about most important topics that are being discussed within the community. It finally introduces Sifa-Portfolio, a high fidelity prototype of an expansion module for Sifa-Community.

Originality/value – Until now, there are no dedicated solutions for further education of professional group of Sifas, which comply to the specific requirements of this group and which enable to react promptly to changing demands of the safety issues in dynamicly growing companies.

Practical implications – The presented approach delivers a concept of a software-module that could be implemented into Sifa-Community Forum. Due to evaluation with users, we could identify requirements and specifications of Sifa-Portfolio. Furthermore this concept can be transferred to variety of professional-groups, which are working in dynamic professions to support their work-related informal further education.

Keywords – e-portfolio, specialists on industrial safety, further education, validation of informal learning

Paper type – Academic Research Paper

1 Introduction

The digital age is marked by an entropic growth of data and information , which entails a continuous change and increasing complexity of the world of work by itself. This change in the world of work, confronts specialists for industrial safety (Sifas) with new challenges. There are types of training required that enable the experts for industrial safety on the one hand to adapt in a flexible way to the constantly changing demands of the workplace, and on the other hand promote knowledge exchange amongst them. To tackle these problems, the concept of a Sifa-Portfolio presented in this paper, proposes a work-integrated training concept for Sifas, which addresses the following three objectives.

First, the prototype should provide Sifas an opportunity to gain an overview of the current issues and problems that are discussed within the Sifa community. This creation of „awareness“ about changes in the regulations on safety at work should help to choose appropriate measures of continuous education and training. Secondly, the prototype aims to help the professionals to create a training portfolio that can be shared with other specialists for occupational safety, to exchange views on relevant

topics and to facilitate collaborative skills development . Third, the continuing education program is designed to help in future to certify or recognize the activities and learning outcomes that have been documented within the portfolio. The prototype was developed and evaluated with the help of user-centered methods (Knight et al. 2014). The concept offers the possibility of documenting training as a specialist for occupational safety digitally and to link their own Sifa-Portfolio with other experts within the Sifa-Community to exchange knowledge in a targeted way. A special account within the concept will be given to informal learning processes. Thanks to the evaluation of the prototype information on use practices, usability and expandability of the training concept were compiled.

These findings serve as implications for the next stages of development: the graphic design and programming.

2 Problem Outline

Specialists for occupational safety have a special position in the company (Köhler et al. 2015). Regardless of whether they are trained internally, or if they are appointed externally, they are always responsible for security across the entire organization. The level of safety in the workplace decides in the strict sense on productivity and status of employee's illness. In a broader sense , occupational safety affects the competitiveness of the company. For these reasons, the specialists for industrial safety are required by law to continually educate themselves.

Sifas in Germany can be appointed in different ways within companies. They can be employed as intercompany full-time professional, as intercompany part-time professional with or without management function, as external freelance specialist and as an external expert in inter-company services (Trimpop et al. 2013). Regardless of the type of appointment, Sifas must have a constantly updated knowledge from the varied field of industrial safety and the adjacent domains (Kahnwald/Köhler 2009). During the practice of the profession, it is possible for Sifas to close knowledge gaps by visiting in the sectorspecific and cross-industry training seminars (formal learning). Alternatively, they can obtain the necessary knowledge independently through, among other things, the exchange with other specialists for occupational safety , literature review, analysis of legal regulations or through Internet research (informal learning).

Sifas can choose from an extensive range of training seminars. For professionals who only start their activities as Sifa many opportunities exist to expand their knowledge. However, these offers do not always cover the needs, which are continuously created by the dynamics of the working world. Especially on new types of hazards in enterprises existing regulations need to be applied, which is not always adequate

and productive.Furthermore, a training offer can train on new demands only with a time delay, that is connected on one hand with the development of new security regulations and on the other hand with the time needed to develop new seminars. There is therefore the need for a more agile training concept, which is similar to the dynamic working context of Sifas and can contribute to a timely coverage of the skills gap.

Because informal learning in adulthood occurs predominantly voluntary and incidental, it lacks a certain structure and methodology that mainly enhance the effectiveness of learning and that would facilitate recognition and certification of completed learning activities.

Despite high participation rates, for example, massive open online courses (MOOCs) display only a low success rate compared to formal learning methods. You can reach a large number of participants but only a fraction of the users remains in such an online course until completion. By analyzing studies on MOOCs and e-portfolios, as well as blended learning and e-learning, the critical success factors for an effective training concept for Sifas can be derived.

The analysis of an online survey amongst Sifas provided evidence that the professionals have to deal with an additional problem with their informal learning. They obtain missing information and the knowledge necessary for their work from numerous external sources such as different online portals. This decentralized allocation of information leads to a lower awareness on current issues.

Low Awareness in turn has a negative effect on the quality of work, because it results in unconscious incompetence. In this case, a person is not aware of the existence of a possibly relevant thread. For these reasons, research is carried out within this paper to develop a training concept specially adapted to the professional group of Sifas.

2.1 Competencies for Sifas

In today‘s society competence became according to Erpenbeck and Sauter the „economized version of the classic concept of education“ (Erpenbeck/Sauter 2007, p. 7). The future development of the professionals must adhere to changes in the fields of life and work. Erpenbeck and Sauter describe this constellation with the help of five points that have a direct impact on the competence, and four levels that have an indirect influence.

The criteria of competence include:

- Capacity for self-organization
- Value orientation
- Differentiation from qualification
- Usability
- Subject centeredness

These factors are dependent on the levels of complexity , networking , uncertainty and dynamics. In 2008, Kuhlmann and Sauter anticipated what learning culture in the 21st century might look like (Kuhlmann / Sauter 2008, p. 7). Aspects such as changing learning habits, changing learning processes, changes in media usage and changing learning requirements can nowadays no longer be overlooked. The learning habits changed in the way that formal learning is increasingly supplemented by informal learning.

Informal learning through information gathering by means of various media and the Internet depends in turn closely on changes in media usage. Altered learning requirements are for instance observable in the fact that nowadays a college degree does not guarantee immediate employment what was the case in the past (Brenke 2015). Altered learning processes in terms of continuous learning are by the ubiquity of the theme „Lifelong Learning „ no longer mere ideas, but are realized today in business. In the professional environment of the specialists for industrial safety, a specific competence setting has emerged. It can be divided into two areas: core competencies acquired during Sifa training; including amongst others: workplace analysis, workplace design, industrial safety, accident prevention, fire protection, ergonomics, security, risk analysis and safety technology. Skills that are acquired during the practice of the profession are for instance: Occupational Medicine, work science, safety of transport, customer service and customer care, noise and radiation protection, environmental protection and technology (BA 2016). This systematization is considered within the further education concept developed by the authors.

3 Approach

The proposal of the Commission of the European Communities entitled „Memorandum on Lifelong Learning“ addresses the issue of different learning facets that are completed by every person throughout his life - formal learning, Non-formal learning and informal learning. Each of the facets demands specific measures to develop and transfer knowledge. Currently there is a lack of solutions specifically designed for professional groups and combining all three facets of learning in a coherent learning environment. This paper presents a continuing education program, which is aimed at professionals for occupational safety and supports sustainable knowledge acquisition that promotes a life-wide continuum of learning (European Commission 2000, p. 9).

This paper presents a prototype of an application, that supports Sifas in their inservice training (non-formal learning) and in the phases of informal learning in three ways. First, the prototype should provide Sifas a way to get an overview of the current issues and problems that will be discussed within the Sifa community. Improving the awareness of updates in the professional field will help to identify personal shortcomings and to take further training. Secondly, the prototype enable Sifas to create a training portfolio, with the option to share the portfolio or its single elements with other specialists for occupational safety, to exchange views on and to promote collaborative skills development. Thirdly, the concept of further education should help, to certify or recognize the activities and learning processes that have been documented within the portfolio in the future.

4 Methods

In order to develop the prototype, this investigation combines empirical methods with user-centric development (Wilson 2013; Lambropoulus 2006). To filter out patterns of quantitative data an empirical analysis of an online survey of Sifas was conducted. In the next step a trend monitor has been developed which makes it possible to visualize, by statistical analysis of the posts from the Sifa-Community issues and their relevance or intensity of the debate over time. From the literature review and the case studies research and interviews with Sifas the first requirements of the training concept were determined in a design thinking process. Based on the first steps a prototype was developed and evaluated with a focus group with the help of user-centered design methods. As a result, a high-fidelity prototype was created as an extension module for the platform Sifa- Community.

4.1 Design Thinking

The methodological basis of design thinking approach was chosen for the development of Sifa portfolio because of its suitability. Design Thinking is an iterative and recursive problem solving approach developed by Winograd, Leifer and Kelley, and the Hasso Plattner Institute both taught and practiced it (Hasso Plattner Institute 2016). Design thinking originally is based on four steps: 1. observation 2. idea generation 3. prototyping 4. conducting tests (Norman 2013, p. 222). The method has been further developed and reached its maturity when the first step (observation) was divided in three steps: 1.Understand 2.Observe respectively Research and 3. find position respectively interpret results (Gabrysiak et al. 2011, p. 220). Design Thinking has emerged as an approach to problem solving, which is based on the basic idea of the design process, that is referred to by Norman as „The Double Diamond Model of Design“ (Norman 2013 , p. 220). The process of finding a solution is split into two sections. On one hand the problem section is defined, on the other hand the solution section. These two areas can be described as a problem space and solution space

The problem space is diverged at the beginning to identify the right respectively the actual problem to be solved. In the process of this divergence, the problem space is expanded to consider potential alternatives. In the following a convergence of the problem space will take place to identify from the extended space of the alternatives, the correct candidate. Once a specific problem to be solved has been identified out of the problem area, the second phase begins. This takes place in the solution space, that is in analogy first diverged or expanded to increase the number of alternative solutions, so that later in the convergence or constriction of the solution space, the right solution can be found (Norman 2013, p. 217–220).

The double diamond of design proposed by Norman has an intersection with the approach that is called by Leifer as „the dance with ambiguity". This ambiguity refers to clashing worlds of analysis and design. Leifer describes the process of analysis as a mechanism of decomposition and disassembly. An item that is broken down into individual parts in order to be able to understand what it is made of and how the components relate to each other.

Design again is referred to as a mechanism of synthesis and of assembly. The analyzed and understood components are combined in the design process in a new unit. Since this process is always dependent on context, there is no „single correct design solution" that can be applied to all problems. The process should be designed not only with consideration, but with the active involvement of the context (Leifer, 2012). Design Thinking was chosen as a suitable method for this work because it is oriented towards practice, takes into account the context of users and allows for iterative improvements.

4.2 Requirements Analysis

A questionnaire was completed in the testing phase in the summer of 2015 by 47 specialists for industrial safety, in paper form. The following question types have been implemented: in general, open, scalar, multi -choice and ranking questions. The survey was conducted during an information event where Web 2.0 applications, MOOCs and learning within social networks were discussed.

Within the questionnaire general information was asked for in the first part: the age, the duration of employment as Sifa and the size of the business in which the Sifas were appointed. In the next section participants were asked for their use of web 2.0 applications: Social networks, video telephony, instant messaging and chat, blogs, microblogs, content sharing and cloud services, Internet forums, and video community portals. The second part of the questionnaire dealt with the scenarios: „Training and MOOCs" and „social network". Respondents could enter their comments and remarks in a free text field. In the following the results of analysis are presented.

The average age of the 47 surveyed Sifas is 45.6 years. The youngest participant of the survey was 29 years old, the oldest 61 years old.

The average duration of the activity as a specialist for occupational safety among participants was 7.9 years. Eight participants were working as Sifa for only one year. The longest working experience reported three participants with 20 years Sifa - activity, one with 23 years and with 35 years of professional experience .

Concerning the use of different types of Web 2.0 applications, the survey provided the following results. Of the survey participants

- 57 % use video community portals - both privately and job-related.
- 55 % use social networks - both privately and job-related.
- 55 % use video telephony/VOIP - mainly privately.
- 53 % use Internet forums - mostly job-related.
- 31 % use blogs/weblogs - mostly job-related.
- 29 % use content sharing services - privately and job-related.
- 10 % used microblogging services - privately and job-related.

The final question addressed the hurdles that exist in companies and could prevent Sifas from using Web 2.0 tools. As most prominent obstacles firewalls and regulations were specified, as well as system constraints to impede the use of Web 2.0 applications in some companies. Enterprises deploy security mechanisms to protect internal knowledge and IT systems from outside access. It showed in the context of data analysis, that the protective mechanisms affect access to content, which may be used to gain knowledge. This effect can be long-term negative effect on the company‘s market position. Recommended are agreements respectively conditions that would promote knowledge expansion throughout the company.

In the second part of the questionnaire, the participants were asked to evaluate two scenarios that were presented and explained to them beforehand. The first scenario involved trainings through MOOCs, the second approach the use of social networks created around personal profiles. These scenarios were assessed in terms of support for skills development as well as feasibility and usefulness of the approach as a means of expanding training possibilities for Sifas. The majority of respondents believes that the approach of training through MOOCs is a good addition to skills development, can be realized in practice and supports practice in the field of occupational health and safety. The approach „social network“ has been judged even more positively (positive answers by nearly two thirds of the participants). From this generally positive assessment it can be subsumed that Sifas are open towards new approaches to training and networking supported by new media.

5 Sifa Trend Monitor

Requirements for the Sifa portfolio were determined partly based on the analysis of results, which were created by the Sifa-Community Trend Monitor. The Trend Monitor is a functional prototype developed specifically for the purpose of analyzing postings within the Sifa-Community. It is a text mining tool, by means of which the Forum Posts, are statistically analyzed and visualized in consideration of the time dimension. Development ot the trend monitor was based on the approach of Bensberg (Bensberg 2012 p. 434), who determined future training needs by means of a systematic analysis of job posting. Within this approach careers were analyzed using text mining tools to determine the need for experts on various subjects. With support of the trend monitor the Community Posts were analyzed from the period between 01.12.2013 to 30.06.2015. The data to be analyzed included 125,273 records and was extracted from 1127 forum discussions. Each record included the term, the date of publication, the author‘s nickname, category, respectively the subject in which it was written. After export from the Sifa community the data was processed in Excel and visualized using the data analysis program tableau. The goal in designing the trend monitor was to allow an analysis of all topics by visualizing the frequency of words from all community contributions. The aim is to support the identification of seasonal trends or newly arising topics, regular repetition of themes and the intensity or the frequency with which the issues were discussed.

To create the trend monitor text mining methods were applied which allow to discover contextual patterns in large amounts of data and visualize the relationships. This methodology makes it possible to create visualizations that have a large information content, which is displayed in a compressed manner. For the analysis, a quantitative approach (Content) is combined with the qualitative approach (context). The evaluations that are generated by the trend monitor have a diverse character. On one hand purely statistical information can be visualized, for example, number of posts per month, number of published words per year or the number of words an author has published in a defined time span. Secondly, the visualizations include a contextual component, taking into account the time dimension, thereby producing a richer information. As an example, the activity of individual authors on specific topics can be visualized over time. Alternatively, the frequency of topics discussed in each month of a given year comparing over several years could be displayed.

Within the time period between 01.12.2013 and 30.06.2015 1127 topics or questions were discussed in the forum on the website of Sifa community. In the following, a visualization is presented, which addresses the frequency of given words over time (figure 1). Although a data volume of several thousand subjects would be advantageous in order to derive reliable information, still a pattern can be seen already when analyzing about thousand posts and debated issues. Themes like:

- Employees – in the months of December of 2013 and January 2014 discussed just as often as a year later than December 2014 and January, 2015.
- Community – was picked up particularly intense in June and September 2014 as compared to months before and after.
- Cost – the cost issue was discussed comparatively strong in months December 2014 and March 2015.
- ASR – abbreviation in the context of „Technical regulations for workplaces“ was much more discussed in May 2014 and in February 2015 than in other months during the period selected.

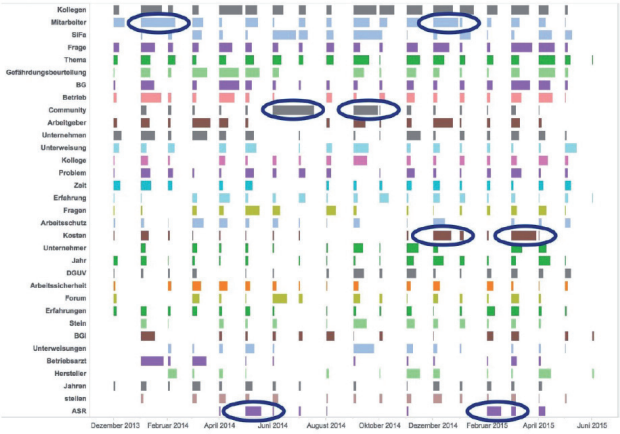

Figure 1: Frequencies of Keywords used in Sifa-Community discussions

6 Design Concept

The schematic illustration of Sifa portfolio architecture (figure 2) illustrates the type of portfolio creation, the portfolio presentation and cooperative learning which is aimed at through the concept developed. In the center of the architecture are the individual learning artifacts created by Sifas. The artifacts may have an individual character, in which they are visible only to the author, but they can also be shared so that each professional within the Sifa community can find it. The shared artifacts can be included in the portfolio of another person and commented from another perspective thus creating a personal view and perspective of the artifact.

Participating Sifas can decide which artifacts they release from their own portfolio. Furthermore, it can also be determined which artifacts are included in a public portfolio that is intended for presentation purposes outside of the Sifa Community. The public

portfolio is extended by a skills index and Badges area. For the administrators of Sifa community an area was designed in which access is available to additional functions of the trend monitor, and statistics on the activities of the authors and the variety of categorized learning artifacts created by Sifas within their portfolios.

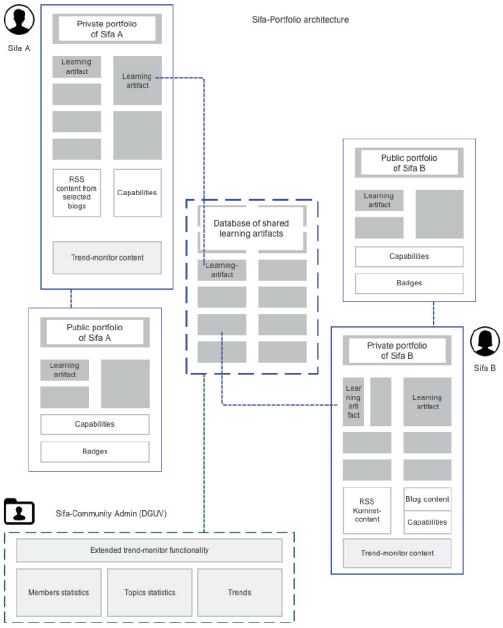

Figure 2: Sifa-Portfolio architecture

7 Conclusion and Outlook

The evaluation of a prototype of the Sifa-Portfolio, which was carried out with active public service Sifas, provided feedback on the concept and raised new questions. Based on feedback discussions some insight could be gained. It has been confirmed that the Sifas have a great interest in documentation of training activities, both formal and informal. The main concern was not about the hoarding of learning artifacts so that they fill the database, but in learning new skills, the knowledge gained and the potential possibility of documenting learning activities for the purpose of self-promotion and professional positioning to use.

In the first interviews, which were conducted to determine the requirements of the training concept, a certain dissatisfaction with the private providers of seminars was expressed. The concerns were primarily the poor quality of training, which was observed only during the participation in the training but not in advance. It turned out that the Sifa portfolio could also provide a positive contribution to the exchange of information on different trainings between Sifas. By intensive communication and cooperative learning by learning artifacts that can be shared and discussed within the Sifa portfolios among themselves, it is possible to filter out providers of low quality seminars of the vast amount of training opportunities.

The systematization of the requirements of the training concept in categories: 1. learning artifacts, 2. arrangement 3. rights and access, 4. ranking and quality, 5. career /self-promotion and 6. connectivity, reveals factors that can contribute to the training of Sifas. The concept is closely linked to the Sifas workplace activity. Thus, it can play an expanding role for Sifa skills. The personalization of learning artifacts helps to memorize the new knowledge in the long term and it makes its use more likely, because it touches the affective learning level.

The multiple perspectives on the portfolio elements expand the understanding of the learning material in the own professional context. At this point, the concept can benefit from the integration in the Sifa community. By extending the platform by the Sifa portfolio new possibilities of use open up for the registered members. Also the operators and administrators of the platform get enhanced insight into the learning activities of Sifas what may be promoting the development of future training. By Sifa portfolio a learning platform is established in the form of a Personal Learning Environment, which in turn creates an opportunity to analyze the learning behavior (learning analytics).

The integration of the trend monitor within the Sifa community and the Sifa portfolio promotes awareness on critical issues that are discussed between the members of the community. This can be useful to determine the right action measures, especially in the ever-changing field of regulation and legislation. The interviews have shown that especially when regulations are changing it comes to uncertainty, because the amended standards cannot always easily be implemented in and adapted to the individual business context. Therefore, it usually requires a period of time for the adaptation of new or amended regulations. Increased discussion on such issues can be identified in a timely manner within the trend monitor.

The advent of mobile and Internet-enabled devices in everyday life enables remote access to the contents that are stored in Sifa portfolio. This ensures access to the content and the possibility of contact with other specialists for occupational safety, not

only in the workplace. The survey showed that at an average age of 45 years, not every Sifa copes well with latest applications and Web 2.0 knowledge transfer methods. In this regard, an adaptation period is necessary, but the trend shows a fundamental interest of Sifas - regardless of age.

Particularly the use of text mining tools to visualize the Posts of Sifa community proved to be helpful. This approach can serve both new and experienced Sifa community members as an auxiliary tool to identify topics of intensive discussion and promote knowledge sharing.

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Analysing eCollaboration: Prioritisation of Monitoring Criteria for Learning Analytics in the Virtual Classroom

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Structured Abstract

Purpose – This paper is part of an extensive action research project on learning analytics and focuses on the analysis criteria in Virtual Collaborative Learning (VCL) settings. We analyse how the efficiency of virtual learning facilitation can be increased by (semi-) automated learning analytics. Monitoring items are the starting point that enable the learning facilitator to identify learning problems and deduce adequate actions of intervention. However, the sophisticated media-based learning environment does not allow monitoring of vast amounts of items and appreciate the learning processes simultaneously.

Design/methodology/approach – This paper fulfils the sub-goal of selecting and prioritising monitoring items for e-collaboration. The procedure is split into two Research Questions (RQ). A specification of the monitoring items will be compiled by a comparison and a consolidation of the already existing monitoring sheets. Therefore, we interviewed the responsible docents on differences and similarities. Additionally, we coded each monitoring item inductively due to their monitoring objective. As a result, we reduced the monitoring sheets to 40 final monitoring items (RQ1). In order to prioritise them, the learning facilitators scored the relevance and the complexity of the collection and assessment of data using a questionnaire. The analysis focused on differences in understanding of relevance and complexity. Further, we identified the highest scored monitoring items as well as scores with leverage potential. Afterwards we prioritised the items based on the applied analysis (RQ2).

Originality/value – While previous studies on learning analytics were mostly driven by the educational data mining field and as a consequence had a technological focus. This paper is based on an existing pedagogical concept of VCL and therefore prioritises monitoring items to be implemented as selected learning analytics. Hence, it is guaranteed that the analysis is related directly to the learning content.

Practical implications – This research paper achieved two outcomes: Firstly, a courseindependent standardised monitoring sheet. Thus, the reduction of the monitoring items should simplify and objectify the observation and clarify the performance review. Secondly, an insight into the relevance of each monitoring item had been delivered to the facilitators and provides significance on the quality of

e-collaboration. Furthermore, the complexity score shows the necessary effort for data collection and assessment while the combination of relevance and complexity scores leads to the prioritisation of the needs of (semi-) automated learning analytics to support the learning facilitation.

Keywords – learning analytics, eLearning, eTutor, eCollaboration, learning facilitation

Paper type – Academic Research Paper

1 Introduction

The increasing number of students issue a challenge for the education institutes that they meet with eLearning offerings (Bratengeyer et al., 2016, p. 83). Especially modern eLearning courses integrate the students according to a constructivist approach where they have to share and align their individual opinions, experiences and knowledge (Wheeler et al., 2008, p. 987). But the students feel mostly uncertain about this new field of teaching and learning because of rare experiences in (virtual) group work. Thus, it is not sufficient to simply let the students work together. There need to be concrete incentives to support and foster interactions (Murphy, 2004). Thus a transparent communication of the monitoring and grading criteria is suggested at the beginning (Kalb et al., 2011).

For a long period, it remained unclear how to rate the results of online learning, respectively, how the working activities can provide significance on performance and progress (Liang and Creasy, 2004). For several years, approaches in the field of educational data mining and learning analytics were developed to monitor the student activities better. The learning management systems and their databases serve as a basis to reflect and structure these activities. The analyses can be used to measure the success of courses and subsequently derive aspects for improvements (Long and Siemens, 2011) as well as to grade the participants and intervene appropriately (Dawson et al., 2008).

However, previous studies on learning analytics were mostly driven by the informatics and consequently had a technological focus, ignoring the pedagogical demand. So analyses were created which have no specific statement on the status of the learning process (Littleton and Whitelock, 2005). But it needs meaningful and targeted analyses and visualisations to provide users the necessary information for their further actions (Coffrin et al.). This paper is based on an existing pedagogical concept and therefore focusses on monitoring items of an observation sheet. Hence it is guaranteed that the analysis is related directly to the learning content. Unfortunately, the amount

of monitoring items cannot be implemented in learning analytics simultaneously. Currently a strategy is missing that recommends the sequence of items for implementation.

Virtual Collaborative Learning

The underlying course setting of the referred observation sheet is a virtual collaborative learning (VCL) project. Herein, interdisciplinary small groups from four to six persons solve complex and authentic, but ill-structured problems. The collaborative group work continues over several weeks and is organised in steps. The courses are split into a couple of tasks that run one after another and in sequence (Balázs, 2005; Tawileh, 2016b). Students are solving the tasks using social software. Therefore, the platform elgg is provided that offers central tools for practicing eCollaboration (see Rietze and Hetmank, 2016; Tawileh, 2016a).

During the course, the participating students are accompanied by eTutors. The eTutors follow the entire process and are available as contact persons if necessary. Beside the passive role of a learning facilitator, the eTutors also have to be active to evaluate the group work and intervene if required. It is necessary for the eTutors to observe the activities of individuals and the group and monitor their interaction and progress. They identify and solve especially start-up difficulties as well as stagnating collaboration (Rietze and Hetmank, 2016). Their actions ensure the success of the learning objectives of the course. These learning objectives address the Bologna goals to improve teaching and learning due to interdisciplinary group work between partners of various countries by using modern information and communication technology. Furthermore, they evolve the ability to compile new connections and develop adaptability, as well as professional competence, team competence, media competence, and intercultural awareness (Bukvova et al., 2006).

Beginning with the analysis of complex tasks and the deduction of subtasks for the group and their group members by the means of the self-initiated search on relevant information for the solution, the meaningful integration of information and the creation, evaluation and deciding of alternatives for a solution through to the presentation and defence of the decisions and proposals for a solution (Rietze and Hetmank, 2016). These learning goals thus focus the analysis, evaluation and creation of knowledge (Anderson and Krathwohl, 2001). Subsequently the learning facilitators and later on the graders cannot concentrate on checking the fact knowledge but rather have to consider the dependences and the contexts of constructing the solution (Rietze and Hetmank, 2016). To assure all these goals and process steps an observation sheet serves as a checklist for the eTutors' work.

2 Research Design

Within an extensive action research project on learning analytics this paper focuses on the monitoring items in VCL settings (Balázs, 2005). We analysed how the efficiency of virtual learning facilitation can be increased by (semi-) automated learning analytics. Monitoring items are the starting point and enable the learning facilitator (lecturers and eTutors) to identify learning problems and deduce adequate actions of intervention. However, the sophisticated media-based learning environment does not allow monitoring the extensive amounts of criteria and appreciate the learning processes simultaneously. Hence an optimal support to succeed the learning objectives cannot be guaranteed by the facilitators (Rietze and Hetmank, 2016). For the purpose of the main project's research objective to ensure qualitative learning facilitation in formal eLearning settings through learning analytics, this paper fulfils the sub-goal of selecting and prioritising monitoring items for eCollaboration. To reach the previously mentioned sub-goal, the following research questions (RQ) will be addressed:

RQ1: Which kind of monitoring determines the quality of eCollaboration?

RQ2: Which necessity needs to be considered when implementing (semi-) automated learning analytics?

The paper focuses on both of these research questions and is thus two-parted. The first part answers RQ1 based on a concrete eLearning arrangement and the respective learning facilitation (paragraph Virtual Collaborative Learning). Hereto, we reduced to original 109 monitoring items of three existing monitoring sheets (state Summer Semester of 2015) to 40 items. The three sheets have been used in courses with comparable learning goals empathising eCollaboration. In a first step, data was collected from responsible lecturers using a group interview to identify and eliminate course specific monitoring criteria. Afterwards the monitoring sheets were further adjusted from 35 duplicates. The remaining monitoring items were analysed based on their content and inductively coded according to their monitored characteristics (Döring and Bortz, 2016, p. 541 pp.). Similar items within a sheet were consolidated before the three sheets were merged. As a result, we created a shortened and simplified list of monitoring items that can be applied course spanning (paragraph Creation of a generalised Monitoring Sheet).

The second part rated the monitoring items from the part before. According to Heinrich et al. (2014, p. 371 p.) we created an online questionnaire with the dimensions 'relevance' and 'complexity'. These two dimensions were rated on a four-step ordinal scale (irrelevant | low relevant | relevant | very relevant respectively simple | low complex | complex | very complex) by eTutors and docents. The characteristic values represent the metric values 1 (irrelevant/simple), 3 (low relevant/low complex), 5

(relevant/complex), and 7 (very relevant/very complex) for further calculations. Beside the content-related questions we gathered the respondents' experiences, the time of the last participation in a VCL as an eTutor or docent, the experiences as a student participant, the course of study, the already achieved or targeted degree of studies, as well as gender. The answers of the socio-demografic data can be seen in Fig. 1. It shows that the majority of the respondents already participated as students (Experiences as a Participant). We can also see that the experiences of a large part were recent (Last participation as an eTutor/Docent). Furthermore, it shows that students of Business Education have the highest count, followed by Business Informatics and students of general Business Administration.

After a pre-test with three test persons we carried out the survey in the timeframe between 05.09.2015 and 07.10.2015. All participants were contacted individually via email and remembered on participation twice. As an incentive, we gave away three Amazon vouchers à 10€. Therefore, the respondents were free to add their contact details to be informed about the potential prize; nevertheless, the questionnaire remained anonymous.

Because of the relative sparse persons who are experienced with the course setting, we contacted nearly the whole population. The exceptions were three eTutors of those we had no contact details. Out of the 48 delivered answers 28 have been completed. The docents reached a participation ratio of 56% (5 of 9), the eTutors reached 43% (23 of 53) (paragraph Scoring of the Monitoring Items).

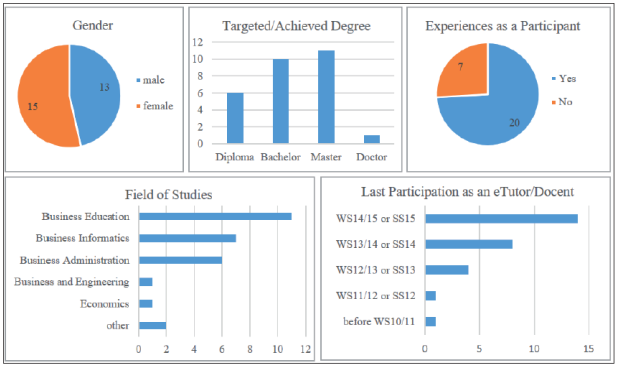

Fig. 1: Results of the socio-demografic data collection

3 Results

Before we focus on the actual content of this paper, the initial situation is elucidated as a basis. An observation sheet serves as a checklist for the learning facilitators to analyse the students' work. The sheets have been applied practically, adjusted demandoriented and improved iteratively by experts over years. Based on the items, the learning facilitator gains an overview of the individual participants and their group work. The items are ascertained manually, rated according to the degree of achievement and annotated with notes. All findings are currently documented in an Excel file. Right now no real-time analysis tool exists to determine the monitoring items more efficiently. A manual monitoring is necessary even though the process is very demanding because of the vast amount of items and can thus be rarely realised simultaneously.

3.1 Creation of a generalised Monitoring Sheet

During the summer semester of 2015 three observation sheets of different docents are used. They are used in three slightly different courses which focus on partially different learning objectives (see paragraph Virtual Collaborative Learning). However, eCollaboration serves group spanning as a learning objective as well as a way of working together to reach all other goals. The courses address different target groups at Bachelor and Master level. Because of these differences the sheets contain 73, 35 and 20 items that are assigned to different monitoring fields.

The objective of a first step of this research is to create a generalised, course spanning monitoring sheet and therefor eliminate the course individual and redundant monitoring items (see chapter Research Design). The result contains a list of forty monitoring items (see Tab. 1) that are grouped by Communication, Teamwork and Result. Thus considering the collaboration process as well as the final product is ensured (column Monitoring Items). To simplify referencing of each monitoring item we introduced abbreviations (column Code). The importance for implementation in learning analytics is mentioned based on three steps of prioritisation whereas 1 means very urgent, 2 urgent and 3 subordinate (column Prio). The reasons for the classification will be explained in the upcoming chapter.

Tab. 1: List of Monitoring Items

Monitoring Items (M)		Code	Prio
Communication	Is the participant actively looking for dialogues with other participants?	C1	3
	Is the participant discussing comments and following up them?	C2	3
	Is the participant stimulating discussions on his/her own contributions?	C3	3
	Is the participant also acting asynchronously (posts in forums etc.)?	C4	1
	Is the participant asking actively if he/she does not understand something?	C5	3
	Is the communication objective and constructive (also in conflicts)?	C6	3
	Is the communication steady and transparent (at absence)?	C7	2
	Is the communication understandable (ideas, proposals)?	C8	
	Is the group communicating to come to an organisational arrangement?	C9	3
Teamwork	Is the participant fulfilling the tasks of his/her role?	T10	3
	Are all tasks completely carried out (overall task, group contract)?	T11	1
	Are subtasks derived from the overall task?	T12	3
	Are subtasks derived transparently from the overall task?	T13	2
	Is the participant encouraging and motivating others for the work?	T14	2
	Is the group working together to find a solution?	T15	3
	Is the group helping each other if needed?	T16	3
	Is the participant undertaking additional tasks actively?	T17	2
	Are the activities of the participant contributing to a common and high qualitative result?	T18	2
Teamwork	Are the activities of the participant reasonable to reach the overall result?	T19	2
	Is the participant referring to others‘ contributions within the solution?	T20	3
	Are various alternatives considered within the solution?	T21	3
	Are decisions made and accepted by the whole group (incl. individual opinions)?	T22	3
	Are decision processes executed structural?	T23	2
	Are decisions reasoned replicable in the documentation of the results?	T24	3
	Is the solution worked out systematically?	T25	3
	In case of crises/problems, which consequences occurred?	T26	2
	In case of crises/problems, were they discussed and solved?	T27	2
	In case of crises/problems, how were they solved?	T28	3
	In case of crises/problems, which cause did they had?	T29	2
	Is the selection of the tools reasonable?	T30	2
Result	Are deadlines adhered (date of delivery, single tasks)?	R31	2
	Is the length adhered (group contract, result, single tasks)?	R32	2
	Is the group contract written detailed and coherent?	R33	1
	Is the elaboration structured logically?	R34	3
	Is the elaboration documented appealingly (group contract, result)?	R35	2
	Is the elaboration documented neatly?	R36	2
	Is the elaboration documented understandable (group contract, result)?	R37	3
	Are references used scientifically sound?	R38	2
	Is the solution qualitative in every detail?	R39	1
	Is the solution fitting to the overall task?	R40	2

3.2 Scoring of the Monitoring Items

To determine the list of priorities of the monitored items, they have been rated by docents and eTutors (see chapter Research Design). Now the results will be analysed to achieve a list of items that should be implemented in learning analytics. The prioritisation takes place according to the importance of the monitoring items, whereas the importance is measured by two dimensions:

- Significance on the quality of eCollaboration (**Relevance**); and
- Effort that is necessary from the beginning at the monitoring and the following abstraction of the monitored content as well as the deduction of feasible actions of interventions (**Complexity**).

Because both of the stakeholders have different views on the monitoring items, they will be asked as independent samples. While a docent takes the role of an administrator of the course and adjusts the monitoring items on the learning objectives and subsequently provides them to the eTutors, they have to operationalise the monitoring items. Hence, the research subjects come from an upper level which aligns the items to the objectives and from the lower level that have experiences from the daily usage. So we can assume that eTutors and docents rate the monitoring items differently. This circumstance in turn derives aspects for prioritisation. They are based on respective extreme values of:

- large differences in understanding of relevance and complexity (**Analysis 1+2**);
- highest relevant and complex monitoring (**Analysis 3**); and
- inefficient monitoring and immediate ability for forecasting (**Analysis 4+5**).

At the end of the survey we received a very small sample size of the docents ($n_{Doc}=5$) and a small sample size of the eTutors ($n_{Tut}=23$). These few participants set special requirements for the analysis because the publicly known statistical methods need larger samples sizes. Hence we will use non-parametric methods to analyse the data sets (Bortz et al., 2008, pp. 56–60). The used analysis methods will we explained shortly before the particular paragraph.

Analysis 1: Focus on large Differences in Understanding

As a first aspect we now compare the ratings of relevance and complexity of docents and eTutors. Basically the ratings should be similar to ensure learning facilitation that is aligned with the learning objectives. In case of differences between the both groups the reason can be a missing insight into the intended results and the learning objectives of thecourse. As a consequence, eTutors - as the operative learning facilitators - would not focus on the actually important items but less important ones.

A similar problem occurs if large differences in complexity exist. It could be a sign that docents would face other data than eTutors. This would bias the underlying data collection and would affect the determination of necessary interventions. In an extreme case, reaching the learning objectives could be hindered due to misunderstandings between docents and eTutors.

Subsequently, we analyse if both target groups rate relevance and complexity similar to each other. Instead of the Chi²-Test we use the Freeman-Halton-Test because the sample size is not large enough. It cannot be ensured that 80% of the characteristics have at least five votes and that every characteristic was voted at least once. Even the normal distribution is not guaranteed (Bortz et al., 2008, pp. 94–98). As the results of the Freeman-Halton-Tests we identified the highest differences in relevance at the monitoring items R39 (p=0,05137), R35 (p=0,1255), C7 (p=0,1449), R32 (p=0,1587) and T11 (p=0,1816). But we can state a significant difference α=0,1 only for R39. The distribution of the answers can be seen in Fig. 2, wherein the relative frequencies of the votes for each monitoring item is visualised.

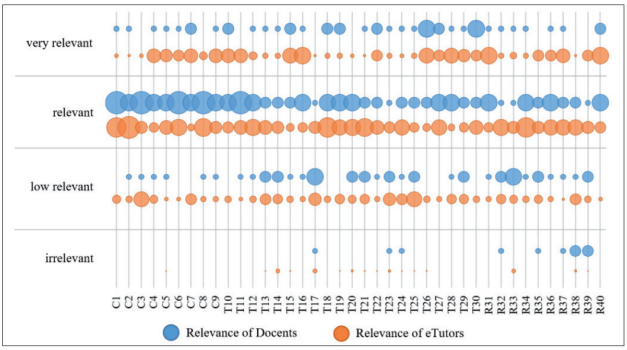

Fig 2: Distribution of Answers on Relevance

Regarding the answers on complexity the highest difference can be seen at the monitoring items C4 (p=0,0422), T14 (p=0,0422), T13 (p=0,0737), R33 (p=0,1224) and T11 (p=0,1365). Especially C4, T14 and T13 showing statistically significant (α=0,1) differences for the effort for processing the relevant data.

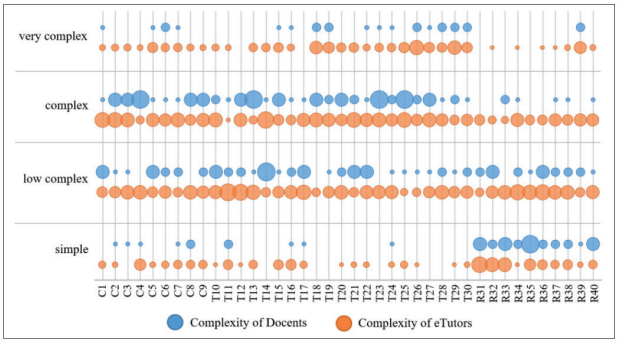

Fig. 3: Distribution of Answers on Complexity

The analysis of different understandings on the monitoring items showed the main disagreements on monitoring items. The reasons should be examined in future. Therefor the implicit concepts of docents on the application and especially the ways of operationalisation through the eTutors should be further analysed. In the end a consensus on the What? (data), Where? (platform/additional data generation), Who? (individual/group) and How? (methods) has to be achieved to objectify the monitoring findings (Rietze, 2016).

Analysis 2: Focus on highest ranked Monitoring Items

Looking at the field in which the target groups have their expertise we use the answers of the docents on relevance and answers of the eTutors on complexity. The points in Fig. 4 represent the averages μ(Complexity of Tut) and μ(Relevance of Docents) of the coded scales (see chapter Research Design) (according to Heinrich et al., 2014, p. 373).

The highest ranked monitoring items are located in the upper right area. To select them, we summarize the belonging averages of the monitoring items.

$$S(M) = \frac{1}{d}\sum_{D=1}^{d} R(M,D) + \frac{1}{t}\sum_{T=1}^{t} C(M,T)$$

S=Sum, M=Monitoring Item, D=Docent, T=Tutor, R=Relevance, C=Complexity

As the items with the five highest S(M) we identified T26, T18, T19, T27 and T30. These monitoring items produce the highest effort and deliver the maximal evidence on the quality of eCollaboration (**TOP5**).

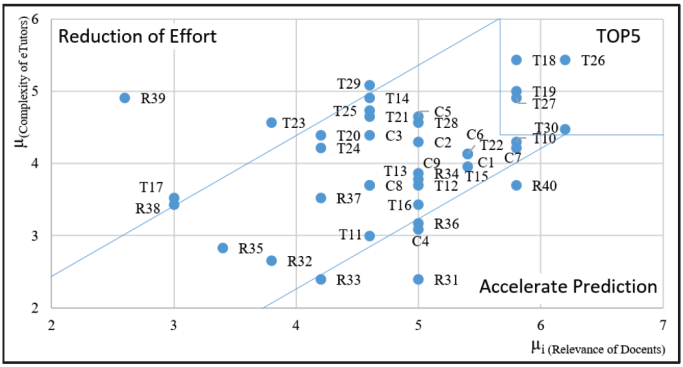

Fig. 4: Ratio of Relevance and Complexity

Analysis 3: Lever Mechanisms

At the same time, Fig. 4 shows observations that are very exhausting but deliver only a minor contribution. These points are located in the upper left side. The eTutors invest much time to monitor while they receive no equivalent benefit. This wastage can be avoided through automatization of monitoring items and thus increasing efficiency of the learning facilitation.

To identify the lever mechanisms, the following formula to calculate the balance of both averages is used:

$$\mathrm{B(M)} = \frac{1}{d}\sum_{D=1}^{d} R(M,D) - \frac{1}{t}\sum_{T=1}^{t} C(M,T)$$

B=Balance, M=Monitoring Item, D=Docent, T=Tutor, R=Relevance, C=Complexity

At first, we focus negative - minimum - values of B(M) that signalised a higher effort than benefit. This is especially relevant for R39, T23, T17, T29 and R38, so they should be automated to avoid the low productive observations (**Reduction of Effort**).

In contrast to these just mentioned monitoring items the opposite area in Fig. 4 shows items with low complexity that are very important to determine the quality. Referred to the formula above, B(M) is maximized and a good prediction can be achieved with low effort. Hereto belong the monitoring items R31, R40, C4, R36 and R33. These observations can be made by eTutors because of their low complexity. But at the same time their easy way to observe and abstract (Bravo et al., 2008) predestines them as first outcomes in learning analytics that can be possibly achieved quickly (**Accelerate Prediction**).

Both minimum and maximum values serve as lever mechanisms for further implementation. While the monitoring items of 'Reduction of Effort' are very timeconsuming and complex to determine, an automation would take the time pressure off of the eTutors. The other way around, the items of 'Accelerate Prediction' could process the data easily and thus would provide predictions as early as possible.

Summary of Priorities

The chapters above described the various procedures for selecting the monitoring items that should be prioritised in the implementation of learning analytics. Tab. 2 summarizes the five types of TOP5-items. Duplicates are marked bold and should be implemented at first because they address two columns. Afterwards the remaining prioritised – in Tab. 1 as Prio 2 marked – items should be treated. Finally, the unmarked monitoring items should be implemented. The order of the prioritisation is mapped in Tab. 1 in column "Prio".

Tab 2: List of Prioritised Monitoring Items

Different Understanding of Relevance	Different Understanding of Complexity	Highest Complexity and Relevance	Reduction of Effort	Accelerate Prediction
R39	**C4**	T26	**R39**	R31
R35	T14	T18	T23	R40
C7	T13	T19	T17	**C4**
R32	**R33**	T27	T29	R36
T11	**T11**	T30	R38	**R33**

To avoid misunderstandings, we make aware of the prioritisation that is not exclusively driven by the highest rank in relevance and complexity. Especially the monitoring items with Prio 1 do not fulfil this criterion but rather were selected because of their multiple listing in the above mentioned five analyses.

4 Conclusions

Summarizing the findings of this paper, we achieved two outcomes: Introductory we described the course concept as a basis for the further analyses. Herein we explained the principles of the arrangement and eCollaboration as the central learning objective. As a support of the virtual group work we introduced the eTutors and their observation sheet as a checklist for learning facilitation. The first part of the conducted research consolidated three practical applied observation sheets and standardized them to a course-spanning one that contains 40 monitoring items. Thus the reduction of the monitoring items simplifies and objectifies the facilitation and clarifies the performance review.

Afterwards this observation sheet was sent to eTutors and additional docents who rated the monitoring items due to their relevance and complexity in an online questionnaire. This insight on the one hand provides significance on the quality of eCollaboration and scores the necessary effort for data collection and assessment while the combination of both leads to the prioritisation of the needs of (semi-) automated learning analytics to support the learning facilitation.

The subsequent summary of the conducted analyses prioritised four monitoring items as very urgent und 17 items as urgent for automation. These should be preferred to for further research and the implementation in learning analytics. Hereby the ideas of the docents have to be aligned with the expertise of the eTutors to gather the relevant data. In case of different opinions, they have to be solved consensually to enable an objective evaluation of the situation.

Critically we have to mention the calculation of the ratio of relevance and complexity. Against the statistical rules of analysing ordinal scales based on the median (Kuckartz et al., 2013, pp. 61–67), we have calculated the average to integrate the opinion of the otherwise ignored minority (according to Heinrich et al., 2014, p. 372). Also the dimension ‘complexity’ just indicates the effort of eTutors to gather information and thus the prioritisation rely on that. The technical complexity of data gathering and processing is not mentioned yet. Especially items that analyse qualitative data are much more difficult to analyse than quantitative ones and mostly need very complex methods (Pozzi et al., 2007, p. 171). First quantitative analyses have already been compiled as a technical feasibility study (Tawileh, 2016a, 2016b) which now have to be integrated demandoriented into the observation sheets. The next steps should evaluate the technical effort for implementing the other monitoring items before a final strategy on learning analytics can be derived.

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Gamifying Higher Education. Beyond Badges, Points and Leaderboards

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Structured Abstract

Purpose – Gamification or related concepts such as serious games and playful design are discussed intensively in the field of academic education. Since 2011, gamification has continuously been recorded as a medium-term trend of online education in the annually published Horizon Report. In all areas in which engagement, participation, and motivation of individuals are the key success factors, strategies of gamification are considered. But, what are potentials of gamification in the field of higher education? How can educational technologies such as learning management systems be gamified? An essential part of this article is a study regarding the gamification of the learning management system OPAL.

Design/methodology/approach – Based on a master thesis at the faculty of educational sciences, a study was conducted in order to investigate how the use of game elements can increase the attractiveness of OPAL for students. OPAL is the central learning management system at the Technische Universität Dresden. The study should answer the question: Which game design elements increase the attractiveness of OPAL for students? The research question was answered with a qualitative approach, while the collection of data was carried out by a focus group and expert interviews. The sample included six master's students and one expert. The findings provide recommendations for redesigning OPAL.

Originality/value – Often gamification is related to tools like points, badges, and leaderboards. But what elements exist beyond these? The contribution initially provides conceptual foundations and refers to game mechanics as the specifics of games. Based on this, the potential of gamification in higher education teaching was discussed. Practical implications – The article describes the concept of gamification and how this approach can be used in university teaching, especially for designing Learning Management Systems.

Keywords – Online Education, Gamification, Learning Management Systems, Higher Education

Paper type – Academic Research Paper

1 Introduction

The success in higher education is strongly dependent on the motivation of the students. Therefore, gamification – as one tool which focuses on helping to increase motivation – fits the scope of activity of higher education institutions. Furthermore, gamification is mostly connected with the use of digital media. Today every institution of higher education provides one or more learning management systems for organization and learning. This situation opens a great opportunity by gamifying the existing digital infrastructure of higher education institutions (such as universities and universities of applied sciences) to increase student motivation in different aspects.

The current discussion about gamification is strongly connected with elements like points, badges, or leaderboards. We want to go beyond that and show which further game principles can play a role in student life to improve the students' situation. Therefore, initially the concept gamification will be discussed and afterwards it will be shown how game design thinking can help to rethink digital learning at institutions of higher education. Finally, a study which analyzes gamification potentials of an existing learning management system will be presented to show the potentials of implementing gamification within the existing digital infrastructure.

2 Theoretical Insights

"Gamification means many different things to many people" (Ramirez/Squire 2014, S. 629). But the definition that gamification is the use of game design elements in nongame contexts is commonly accepted (Ramirez/Squire 2014). Caponetto, Earp and Ott (2014) analyzed 119 publications with gamif* in the title between 2000 and early 2014 with the confirming result that 75 percent define gamification as the application of gaming mechanics and tools in non-game environments and make a clear boundary to game-based learning. This definition of gamification from Deterding et al. (2011) is the most popular (already cited 1461 times alone on Google Scholar (19th of April 2016, see: http://0cn.de/scholar) – he describes gamification or gameful design as the use of design elements characteristic for games in non-game contexts. The latest literature goes further, now speaking about "[…] the integration of gaming elements, mechanics, and frameworks into non-game situations and scenarios […]" (Fotaris et al. 2016). Fitz- Walter (2015) adds the following qualities to this definition for a gamified application to contrast gamification more clearly from other terms (as serious games, game-based learning and, of course, games in general) and to help recognize gamification research results:

- more gameful than playful
- not a complete game
- both a tool and game
- not primarily for entertainment
- not a pervasive game

While the definition of gamification seems quite clear in fundamental aspects since 2011, the list of gamification mechanics, elements, and so on is very heterogeneous and a popular research result. Research on gamification is already common, especially literature reviews about game design elements, where researchers explored possible gamification mechanics and game design mechanics. The following list provides a short overview about the quantity of these game (design) mechanics, collected over separated comprehensive literature reviews by several researchers:

- points, leaderboards, challenges, levels, reward systems, badges, etc. (Dabbagh et al. 2016)
- points, leaderboards, game-like graphics, levels/rank, competition, avatars, feedback/rewards, achievements/badges, virtual currency, teamwork, minigame, challenge, fantasy, roleplaying, quiz, tangible rewards, narrative, virtual pet, goals, experience points, curiosity (Fitz-Walter 2015)
- point systems, achievements, quests, challenges, narrative structures (Ramirez/Squire 2014)
- points, levels, challenges, trophies, badges/medals and accomplishments, virtual goods, classification table, ranking, score table
- game dynamics: reward, status, accomplishments/fulfillment, selfexpression, competition (da Rocha Seixas/Gomes/de Melo Filho 2016)
- goals, challenges, quests, customization, progress, feedback, competition, cooperation/social engagement loops, accrual grading, visible status, access/unlocking content, freedom of choice, choose own sub-goals, freedom to fail, storytelling, new identities/roles, onboarding, time restriction (Dicheva et al. 2015)
- points, leaderboards, achievements/badges, levels, stories/themes, clear goals, feedback, rewards, progress, challenges (Hamari/Koivisto/Sarsa 2014).
- reward elements: achievements, awards, badges, classification, gifting, charity, leaderboard, levels, notifications, feedback, progress bars, rewards, virtual currency, virtual/real goods (Conger 2016). This list shows game mechanics which support gamification as more than just points, badges, and leaderboards. A gamification framework can help in the design of learning scenarios.

2.1 The Octalysis Framework

Many researchers complain about a generally strong focus on elements (Werbach & Hunter, 2015). Moreover, there are game mechanics that need to be taken into account. Game mechanics make characteristics of games significant and in turn can be implemented by a specific set of game elements. One concept to visualize these mechanics and put them in an order is the Octalysis Framework. The gamification expert Chou (2014) created a frame of reference which helps gaming and software designers to develop strategies for a successful gaming and software design. Following

Chou (2014), gamification framework is essentially a human-centered design theory, as a counterpoint to functional design. Based on the investigation of games and their motivational factors, he developed the Octalysis Framework. The framework includes the following eight core drives of gamification (Chou 2014):

- **Epic Meaning & Calling** – a player is doing something greater than himself or he was "chosen" to do something
- **Development & Accomplishment** – making progress, developing skills, and eventually overcoming challenges
- **Empowerment of Creativity & Feedback** – users are engaging a creative process where they have to repeatedly figure things out and try different combinations
- **Social Influence & Relatedness** – all the social elements that drive people, including: mentorship, acceptance, social responses, companionship, as well as competition and envy
- **Ownership & Possession** – users are motivated because they feel like they own something.
- **Scarcity & Impatience** – wanting something because you can't have it
- **Unpredictability & Curiosity** – wanting to find out what will happen next
- **Loss and Avoidance** – motivation to avoid something negative from happening

Core drives are equal to game mechanics. Every core drive can be implemented by a set of tools or game elements, such us points, challenges, avatars, etc. In this way the Octalyis Framework can help in the understanding of the rules of games or playful design and it can help to create game-like learning environments.

2.2 Gamification in (higher) education

The phenomenon of gamification is growing rapidly in the sector education (Caponetto/Earp/Ott 2014). Since 2011 gamification has continuously been recorded as a medium-term trend of online education in the annually published Horizon Report by the New Media Consortium (Johnson et al. 2016). Increasing students' motivation and engagement as well as the efficiency of learning are the main reasons for implementing gamification (Burke 2014; Caponetto/Earp/Ott 2014; Fotaris et al. 2016). Dabbagh et al. (2016) discovered that a framework connecting penalty and reward increases the attendance, performance, motivation, and the grades of students. These potentials of gamification are very suitable to the field of higher education. Studying at university is not a game, but that does not mean it is not possible to enhance studying efforts through game elements or with a game design within a common learning management system. The principles (or elements – but we define them as more concrete and smaller things) relatedness, competence, and autonomy

affect students' motivation (intrinsic and extrinsic) and have an impact on the engagement of students (Deterding et al. 2011). When we speak about implementing game elements into an existing learning management system, the difference between the terms becomes interesting again. A big difference between game, play, serious game, simulation, and gamification is that gamification always has a result in the real world (Herger 2014). If we understand gamification as a learning-supporting tool, it is necessary to make clear which learning aims can be supported and how. Different game elements serve different learning aims. Therefore, Kiesler (2014) matched the two types of gamification to the revised Bloom's Taxonomy levels of learning: levels 1-3 to structural gamification and levels 4-6 to content gamification (see table 1). Furthermore, sample game activities are shown in the same table.

Table 1: Gamification as a support for learning

Revised Bloom's Taxonomy (Krathwohl 2002)	Kapp's types of gamification (Kiesler 2014)	Sample Game Activities (Kapp/Blair/Mesch 2014)
Remembering (1)	structural	matching, collecting
Understanding (2)	structural	puzzling, exploring
Applying (3)	structural	role playing
Analyzing (4)	content	resources allocating
Evaluating (5)	content	strategy
Creating (6)	content	building (own game)

There are many examples of gamification in the field of (higher) education (19th of April 2016, see: http://0cn.de/examples) and many examples already show that the implementation of gamification elements into learning management is possible or that learning management systems already have gamification opportunities, if didactical reasonings can be identified (19th of April 2016, see: http://0cn.de/lms).

2.3 Gamification in learning management systems

Learning management systems play a central role in the provision of educational content, the organization of learning processes, and the exchange between students and teachers. The evolution of learning management systems began with a simple requirement for file storage and sharing purposes. Over time, the developers of these learning management systems started to introduce more features into their system to accommodate the users' requirements. But not everywhere learning management systems are used are their potentials and opportunities fully exploited. There is a need to improve the students' engagement and motivation to use learning management system in their studies. One opportunity for improving the use of learning management systems is to integrate gamebased concepts which these students are familiar with, e.g. leveling up and gaining experience, into the system through the process known as gamification (Azmi/Singh 2013). What separates gamified learning management

systems from conventional learning management systems? The idea of implementing gamification concepts in the learning management system depends on the game design element used. On the cognitive level this can be a complex system of tasks and rules where the students advance step by step through the learning process. Game mechanics can be avatars as a representation of the users, a leaderboard for long-term motivation through the comparison of statistics, and leveling up through gaining experience (see also table 2).

Table 2: Gamification elements in Moodle version 2.5.1. (Amriani/Aji 2013)

Gamification elements	Description
Score	Each student will receive a score for their assignment performance and their various activities in the system.
Badge	Students will be awarded with badges by completing various actions that are related to their activities.
Leaderboard	Top ranked students will be displayed in leaderboard based on their scores and badges collected.
Title	Each student will get a title based on their received score. The titles are presented in different levels and will be attached to their account name.
Completion track	Each student can see their own progress in the system, what tasks they have finished, and what material they have viewed.

These features make learning management systems more interactive and engaging to the users. It creates a draw for the students to spend more time with the learning management system and builds a more fulfilling experience while using the system (Azmi/Singh 2013). Game elements and mechanics create an active atmosphere (Amriani/Aji 2013) and have positive effects of the emotional engagement of the students (Souza-Concilio/Pacheco 2013). The possibility of emotional participation is important for communication in a learning management system. Learning management systems can be perceived as being better through an activating and emotional environment utilizing gamification.

But studies on the gamification of learning management systems still refer to another important aspect, namely that gamification did improve student participation. However, these effects are not possible without the active role of facilitators which support this process effectively. Teachers or facilitators are required to create dynamic interaction between all involved in the learning process. Their task is to accommodate and facilitate the needs of the students by being involved in the learning process, triggering them to be active, and providing feedback. Gamification elements and mechanics in learning management systems are like boosters for the students. To maintain a real class-like environment in the learning process, facilitators are needed (Souza-Concilio/Pacheco 2013).

3 Empirical study

How can the gamification approach be applied in higher education? A promising field would be to provide this in the study introduction phase (first year), because most dropouts occur in this time. To assist students during the introduction phase at the Technische Universität Dresden, an innovative study support service should be developed based on available learning technologies and providing game-elements for study relevant information. Thus, it is intended to integrate quizzes, self-tests, challenges, points, or badges in order to introduce study related information for new students. The whole scenario is embedded in a narrative framework. The service is to be implemented with the learning platform OPAL, the central learning management system at the Technische Universität Dresden. OPAL is primarily used to support academic, administrative, and coordination processes, such as course and student registration. But for supporting gamification, OPAL must contain game-like tools and functions. For this reason, before starting the implementation of the above-mentioned project, the potentials of OPAL regarding gamification have to be analyzed. This will be the focus of a study which will be introduced in the following chapter.

3.1 Research design

Within a master thesis at the faculty of educational sciences, a study was conducted in 2014 in order to investigate how the use of game elements could increase the attractiveness of using OPAL for students (Rohr & Fischer, 2014). The research question was as follows: Which game design elements increase the attractiveness of OPAL for students?

From the study recommendations, for redesigning of the learning management system was derived. Thus, the investigation refers to a concrete object - the learning management system OPAL. Therefore, the transferability of the findings to other learning management systems is restricted.

The research question was answered with a qualitative approach. The collection of data was carried out by focus groups and expert interviews. The sample included six master's students who knew OPAL from their student life and regularly work with it, and one expert. Through two different focus group interviews, first two and then four students were interviewed. The conversation was standardized with a questionnaire. The expert interview (one person) was conducted afterwards. Finally the data was analyzed using a qualitative content analysis. The conceptual template of the questionnaire and the coding scheme for qualitative content analysis was the above-described Octalysis framework of the American gamification expert Yu-Kai Chou (2014). The study should find out with which elements or tools the game mechanics can be implemented. But, to simplify the data collection and analysis, the eight core drives of the Octalysis framework were compressed to six categories. The final categories which were investigated within the study are shown in table 3.

Table 3: category scheme for the study

category (game mechanics)	category description
epic meaning, narrative access	epic important task; Attention Activity by narrative access; convey feeling of being part of something big („Heroes Mission“)
achievements	visualization of learning progress, skill development, mastering challenges
stimulus for creativity, feedback	Interactivity to encourage creativity and immediate feedback
social relationships	communication and interaction between people, arranging affiliation, competition, helpfulness (mentorship)
exclusivity	privileges & status, directing the attention to other offers (recommendations/“Glowing Choice“), „free play“ of content, level up
loss, prevention	avoidance of punishment, fear of losing points, privileged status etc.

3.2 Findings

The study was carried out as follows. Within both focus group interviews, the students were introduced to the gamification context by going through a game situation. They were asked to watch the video „The fun theory“ (19th of April 2016, see: http://0cn.de/theory). Following, the students were asked to discuss the six categories. They should suggest elements of implementing these mechanics and discuss the usefulness of these elements for student life. Finally the students discussed limitations of gamification in a learning management system and student life. The following table 4 presents the suggestions of the students after conducting the interviews.

Table 4: Game mechanics and game design elements

Dimensions	Game design elements found by the study
epic meaning, narrative access	- Welcome Page or Welcome Movie - Personal Welcome and Introduction
achievements	- Points/Badges for non-curricular achievements - Progress bar for status quo in the study program - Display of certificates - Tests for exam preparation
stimulus for creativity, feedback	- Avatar as personal profile - User interface customization - Icons for reviews, feedback
social relationships	- Publicly visible status - Group quests/challenges and peer review - Mentorship programs
exclusivity	- Glowing Choice - Privileges for usage of OPAL - Learning track control, level up
Loss, prevention	should not be applied within learning

From the information of the two focus group interviews, recommendations for the redesign of OPAL were derived. In the final stage of the investigation these recommendations have been evaluated and commented on by an expert for online teaching and game-didactics, who is also a teacher at the Technische Universität Dresden. Thus, the result of the investigation was a list of recommendations for a motivationcentered redesign of OPAL. Since these recommendations are specific to the learning platform, general recommendations that are applicable to all learning management systems are presented below.

- The homepage should be self-explanatory and motivationally designed to be (for example, by personal welcome, a welcome movie, guided tour).
- Reward systems such as badges or points earned for additional learning activities or bonus systems should be considered as an alternative option to marks or grades.
- Punishment mechanisms such as losing points or badges for nonfulfillment of a performance should not be used in learning situations.
- For the award of points and badges, clear rules for a fair evaluation should be defined.
- In social scenarios (study groups), the status and activity of all participants should be visible.
- Assessment and feedback symbols for postings or course content enable fast and immediate quality measurement/evaluation.

In the last step of investigation, risks of gamification have been discussed and evaluated by both the students and the expert. Mainly, the following risks should be considered for gamification of learning management systems or learning arrangements:

- **Workload:** For gamification of learning arrangements, the high workload for teachers has to be considered.
- **Level of abstraction:** During gamification the serious nature of learning must not be lost. The correlation between game-element and learning process must be clear.
- **Rules for reviews and assessment:** Feedback rules should be developed, with the peer review or peer assessment process designed to treat all students with respect. This assessment process requires a high monitoring effort on the part of teachers.
- **Data security/Privacy:** For gamification, user data is collected and evaluated. The compliance with privacy requirements must be ensured. Students believe that the optional anonymization of their own profiles should be possible and the public display of one‘s status should be voluntary.
- **Punishment mechanisms:** As already mentioned, the surveyed students and the expert criticized the possible use of punishment mechanisms in the learning process.

3.3 Limitations

The study findings provide valuable information for gamification in higher education, but are limited in their expressiveness due to context and limited in their significance based on methodical specifics:

- The investigation focused on the learning platform OPAL. The statements of the students and the experts are therefore only valid in this context. The transferability of the findings to other learning management system is limited.
- The sample consisted of six students from the master's studies and an expert. The influence of the expert view is very limited. In addition, variance among students is missing. In subsequent studies, students of different disciplines and phases of study should be interviewed in order to capture the views of students more comprehensively.
- The study does not allow conclusions about the possible effects of gamification. Respondents were asked to evaluate elements in advance. To what extent they would also use them in student life or whether this could be technically implemented into OPAL cannot be determined.

4 Conclusion

The present article deals with the gamification of learning management systems. It became clear that gamification goes far beyond the use of points, badges, and leaderboards. Rather, gamification refers to a mindset which puts motivation, engagement, and emotions at the center of the design of learning technologies and learning scenarios. However, for the implementation of game elements within learning scenarios, matching technologies are needed. The purpose of this article is to show what kind of elements or functions for gamification are required and what students expect from this trend.

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Virtual International Learning Experience in Formal Higher Education – A Case Study from Jordan

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Structured Abstract

Purpose – International experience is important to prepare university students for successful career in the globalized knowledge economy. However, learners in developing countries have limited access to international educational experiences due to travel costs and constrains, political instability that prohibit academic visits from foreign students and instructors, societal restrictions on certain groups like female students, or old educational systems that resist didactical and organizational changes. The emergence of Social Media enabled the development of interactive learner-centered virtual learning environments that enable collaborative knowledge building in online social communities.This empirical study aims to explore how to provide Jordanian university students with international academic experience during their regular study programs without travelling abroad. Virtual Collaborative Learning has been introduced and examined in this specific context due to its reported high potential for developing countries.

Design/methodology/approach – Following an educational design based approach, a Virtual Collaborative Learning arrangement has been re-designed to involve Jordanian students in a formal masters' course with German students at the Technische Universität Dresden. Factors that affect participated Jordanian students' perception of this experience have been examined using deep interviews and qualitative content analyses methods.

Originality/value – The value of this study lays in the innovative approach to provide Jordanian university students with international learning experience by integrating them in a virtual community with peers from Germany using Social Media application.

Practical implications – This study delivers empirical evidence on the potential of welldesigned Virtual Collaborative Learning arrangements to provide students with enjoyable, high-impact, immersive international learning experience at their home university. This helps universities, especially in Arab and developing countries, to grant their students a new learning experience using affordable easy-to-use Social Media solutions.

Keywords – Virtual Collaborative Learning, Social Media, Online Learning, Internationalization at Home

Paper type – Academic Research Paper

1 Introduction

Providing university students with international experience is becoming more important in the globalized economy. However, this can be challenging, especially in developing contexts, where academic exchange of students, researchers, and teaching staff is restricted by multiple factors like travel costs, visa regulations, security concerns, conservative traditions, and renovation-resistant educational systems. Modern information and communication technologies offer affordable, flexible alternatives for locationindependent knowledge exchange in the virtual space.

While technology-enhanced learning applications were implemented widely, also in developing countries, over the last decades to enhance learning processes, classical elearning applications often focused on learners' interaction with digital learning materials (Gulati, 2008). The emergence of Web 2.0 shifted the users' role to be the key contributors using online collaborative applications (Gillmor, 2006). Interactive learning settings, like "Online Collaborative Learning", benefit from new participation chances to implement effective pedagogical approaches and integrate students in virtual social learning environments that facilitate intensive interaction within and between students' groups (Selwyn & Grant, 2009). This paper presents an empirical case study of integrating Jordanian students in an international Virtual Collaborative Learning course at the Technische Universität Dresden in Germany using interactive Social Software.

2 Virtual Collaborative Learning (VCL)

Within the constructivist learning paradigm, project-based learning scenarios concentrate on the role of students' self-regulated knowledge construction and exchange, which can be facilitated by interactive information and communication technologies. Computer-Supported Collaborative Learning (CSCL) aims at utilizing these technologies to enhance learning processes with benefits including: skills improvement, positive impact on atmosphere, positive attitude towards learning, acceptance to deal with more difficult problems, effective group dynamics, and enhanced students' performance (Lehtinen, Hakkarainen, Lipponen, Rahikainen, & Muukkonen, 1999). Virtual Collaborative Learning integrates these benefits in the Virtual Classroom as an effective group-learning environment (Hiltz, 1988). The Chair of Information Management at the Technische Universität Dresden develops and implements Virtual Collaborative Learning arrangements in formal higher education

to improve students' professional competence, team competence, media competence, and intercultural awareness (Schoop, Bukvova, & Gilge, 2006). Through cooperation with international partner universities, students have the chance to collaborate with peers and instructors form other countries and gain international academic experience during their regular study program at their home university.

Virtual Collaborative Learning has a considerable potential to enhance teaching and learning practices and outcomes in developing countries, as it can (1) increase access to educational materials and the educational experience in the virtual classroom, (2) increase cost efficiency by allowing flexible location-independent tutorial support and optimizing workload, (3) increase gender equity by enabling female leaners and instructors to actively participate in the learning process in the virtual social environment from their own place, (4) increase employability by improving learners' interpersonal and professional skills and prepare them for the modern labour market, and (5) foster capacity building on teachers' side by enhancing their media competence and teaching practices (Tawileh, Bukvova, & Schoop, 2013).

3 Methodology

This study aims to integrate Jordanian university students in an international Virtual Collaborative Learning course and investigate their perception, as natives of an Arab developing society, of this innovative approach to gather an international academic experience virtually while they are still at their home university. Jordanian students from Princess Sumaya University for Technology in Amman attended a Virtual Collaborative Learning course at the Chair of Information Management in Dresden and were interviewed to explore the factors that affected their perception of this experience.

3.1 Course description

The course "Collaboration in the Virtual Classroom" is a regular masters' module at the Faculty of Business and Economics of the Technische Universität Dresden and is offered as a Virtual Collaborative Learning arrangement. Students from Germany and international partner universities work in small groups on a case study with a given illstructured problem they should solve collaboratively. During their work, they practice: virtual team work, critical thinking, problem solving, collaborative decision making, professional negotiation, presentation skills, cross-cultural communication, and academic English language. Eighteen (10 Female and 8 Males) students from the Technische Universität Dresden and eight (4 Female and 4 Male) students from Princess Sumaya University for Technology participated in this course in the summer term 2015.

In five groups of 5-6 members, the participants had the main task to develop an intercultural communication training concept for a fictive company. A closed Social Network was created using the open source software "elgg.org" as a central communication platform for the course. In a written team agreement, each group documented its organization, skills, responsibilities, and communication rules. Selected readings and e-lectures were provided as self-study preparatory materials on: Virtual Collaborative Learning, Performance in the Virtual Classroom, Project Management, and Cross-Cultural Communication. The intensive virtual collaboration phase lasted of four calendar weeks and the final outcome was a virtual presentation of the recommended solution and its rational developed by each group.

3.2 Data collection and analysis

To explore the factors that affect Jordanian students' perception of Virtual Collaborative Learning, a guideline for standardized semi-structured in-depth interviews was developed to address: previous e-learning usage, previous international experience, participation motivation, course structure, teaching method, problems and difficulties, the technical learning environment, perceived learning impact, tutoring and support, overall satisfaction, and enhancement recommendations. Seven (4 Female and 3 Male) participants accepted to attend the evaluative interviews. This data collection method was selected to gain an in-depth understanding of participants' perception of the program (Patton, 1990). The seven interviews of 38-55 minutes were conducted in June 2015 using the online conferencing tool AdobeConnect and were recorded and transcribed with the permission of the interviewees. Interviewees' names were replaced with codes to protect their privacy (F=Female, M=Male). The smooth verbatim transcription method was selected to produce an understandable text in the original wording (Howitt, 2010). For this explorative study, the inductive category formation procedure of the qualitative content analyses method was applied to code the interview transcripts using the online software qcamap.org (Mayring, 2014).

4 Results

The seven interview transcripts were inductively coded and a set of twenty-four distinct categories represented the factors that affected the interviewees' perception of the Virtual Collaborative Learning experience. These were clustered in the three main categories: contextual factors, design factors, and individual factors. Table 1 lists the categories in a descending order of the their absolute frequencies. It also displays the number of interviews they were mentioned in (fifth column) and the categories' frequencies according to interviewees' gender (sixth and seventh column)

Table 1: Category frequencies in the analyzed interview transcripts

Main Theme	Category/ Code	Sub-category Title	Absolute Frequency	Occurs in n Docs.	F	M
Contextual Factors	CF1	Classical teaching style	26	7	15	11
	CF2	Limited use of e-learning	18	7	9	9
	CF3	Low extrinsic motivation	18	6	11	7
	CF4	Limited access to international experience	10	7	6	4
	CF5	Limited connectivity	3	3	1	2
Design Factors	Groups Characteristics					
	DG1	Effective virtual teamwork	19	7	10	9
	DG2	Multidisciplinarity	18	7	9	9
	DG3	Mutual peer support	18	7	11	7
	DG4	Familiarity with group members	7	4	5	2
	Content and Organization					
	DC1	High workload	18	6	8	10
	DC2	Tutoring and support	14	6	6	8
	DC3	Initial anxiety and confusion	9	7	5	4
	DC4	Materials and tasks	8	5	3	5
	Technology Characteristics					
	DT1	Useful / Easy-to-use tools	18	6	11	7
	DT2	Structure and design	11	4	6	5
Individual Factors	Anticipated Benefits					
	IA1	Flexibility of online learning	29	7	12	17
	IA2	Preparation for study and work	15	6	12	3
	IA3	Learning from foreigner peers	13	5	9	4
	Interest in New Experience					
	II1	New teaching/learning methods	27	7	19	8
	II2	New people and cultures	15	6	8	7
	II3	New technology use for learning	12	7	6	6
	Personal Perception					
	IP1	High satisfaction	43	7	28	15
	IP2	High intrinsic motivation	21	7	15	6
	IP3	High enjoyment	13	7	7	6

4.1 Contextual Factors

The contextual factors that affected Jordanian students' perception of Virtual Collaborative Learning are mainly related to local academic conditions in their country as described in this section supported by anchor examples from the interviews (Table 2).

Table 2: Anchor examples of the category Contextual Factors

Code	Anchor examples
CF1	"in our regular study it was like just ‚here are the books, here are the sources, here are the references, read and study and come to write traditional exams'" (F41)
CF2	"Now E-Learning is practically available in all countries, but in Jordanian universities you do not feel that it has a role or that it plays an important role in teaching" (F51)
CF3	"their fear from the local instructor, that he tells them like ‚work with the Germans and I will not calculate it, it is your work in your option' this is how they were afraid" (F61)
CF4	"at the university no, I did not have relationships to foreigner instructors or students" (M21) "I never traveled abroad and never worked with someone aboard, I did not see people aboard" (F51)
CF5	"challenges or difficulties, like the internet [connection] sure (laughing), that it was always disconnecting so you may miss a part of the meeting or so, like these technical issues I guess" (F51)

Classical teaching style (CF1): All interviewed students assume that the teaching practices at their home university are old-styled and limited to frontal teaching. They never tried teaching approaches similar to the one they experienced in this course before.
Limited use of e-learning (CF2): Despite the existence of a Learning Management System (LMS) at their university, all interviewees considered the use of teaching and learning technologies to be very limited or absent. They connected this to technical issues in the installed system, instructors' attitude, and students' commitment.

Low extrinsic motivation (CF3): Although local instructors have an essential role to motivate their students for active participation in international learning activities, Jordanian students attended this Virtual Collaborative Learning course developed a feeling of not being supported by their local responsible instructor. Four Jordanian students withdrew from the course just after it began to avoid unjustified bad evaluation.

Limited access to international experience (CF4): Although most Jordanian masters' students have to work to finance their studies, none of the interviewees reported a considerable international experience. The majority has never been abroad of never had a direct communication with foreigner people neither at the university nor at work.

Limited Connectivity (CF5): Students' access to the Internet in Jordan has increased rapidly in the last years as the connection costs keep decreasing. Only three students mentioned Internet connectivity as a source for technical complications during the virtual collaboration phase, mainly when joining videoconferences from mobile devices.

4.2 Design Factors

In addition to the contextual factors described above, a set of factors related to the design and organization of the Virtual Collaborative Learning course that affected the perception of the Jordanian attendees were identified in the interviews as described in this section. Table 3 presents supporting anchor examples form the interviews.

Table 3: Anchor examples of the sub-categories under Design Factors

Code	Anchor examples
DG1	"it would be the same I guess if we were a group in the same university" (M21) "what may motivate, or make the team more or less active is not if people see each other virtually or physically or if they meet or not, but the harmony among the team itself" (F11)
DG2	"If I had to do it alone I would not see the points of view I've seen […] the points of view were a very useful thing, and important" (F51)
DG3	"we all were accepting each other, we all supported each other, we all worked, collaborated and helped each other" (F11)
DG4	"As we do not know the competences of each one, maybe one might add something he thinks it is useful but when the group looks at it and find it not related to the case we are talking about" (M51)
DC1	"there was a time pressure and time limitation that the task did not had enough time to be done, so we were in a challenge with time, that we want to finish fast and get to know each other" (F41)
DC2	"alone my feeling of the presence of the instructor with me was, reducing the fear very much or even destroy it, because practically you are not afraid, there is somebody who will help you" (F51)
DC3	"how big the tasks are and so, and if I will cope or not, I did not know that, I did not prepare myself that I will be stressed or surprised by the work volume and the sequential tasks" (F41)
DC4	"the tasks to be clearer than this, I do not know, I felt them a bit, not always clear enough" (F51) "when the tasks are posted, I mean to have a bit more detailed description" (M51)
DT1	"easy and straight forward and implemented in a right way […] they are easy and dealing with them was normal" (F41)
DT2	"when I was posting comments when I was at work, I was suffering very much even with just posting a comment, but when you use it on a laptop it is better" (M21) "if it was a mobile application it would be better, as we practically in the mobile application era, that everything is coming to you as an instant notification on the mobile" (F51)

Group Characteristics:

Effective virtual teamwork (DG1): Despite their limited experience with e-learning applications, all interviewed Jordanian students experienced flexible, effective teamwork in the virtual classroom, that can be compared or even outperform classical teamwork.

Multidisciplinarity (DG2): Another new experience for all Jordanian participants was to work on a learning assignment in an interdisciplinary group. This gave them the chance to consider different perspectives and connect their discipline to different others.

Mutual peer support (DG3): A facilitating factor of effective virtual teamwork was the mutual readiness of the group members to help each other. For the most of the Jordanian interviewees this was very important for successful, comfortable collaboration.

Familiarity with group members (DG4): This course required Jordanian students to work with foreigner peers they never knew or seen before. The previously mentioned mutual peer support helped them to overcome the barriers and get to know their partners.

Content and Organization:
High workload (DC1): As the Virtual Collaborative Learning project was introduced as a part of a regular masters' seminar in Jordan and assigned with only 40% of its total workload, the students reported a very high time pressure during the course alongside their other commitments and work. The differences in the academic calendar between the two universities required a strict time plan and increased this pressure even more.

Tutoring and support (DC2): Most of the interviewed students were satisfied with the presence of the instructor and the tutors on the platform. They felt supported and included in the virtual space just like in a real classroom experience.

Initial anxiety and confusion (DC3): Before this Virtual Collaborative Learning course, an academic visit by the instructor from Germany was conducted to prepare Jordanian students for the course. However, they were still confused at the beginning before they knew their group members and understood the tasks and the requirements.

Materials and tasks (DC4): The teaching method of this course is based on an authentic case study and self-regulated group work. This was new for Jordanian students, who requested more detailed tasks' description and a demo of the collaboration platform.

Technology Characteristic:
Useful/Easy-to-use tools (DT1): The interviewed students valued the technical arrangement of multiple Social Software functions as an important enabler for effective virtual collaboration. They could deal with the most of the tools easily and efficiently.

Structure and design (DT2): As students of Computer Science, some Jordanian participants had an eye on the collaboration platform and reported some technical and navigation issues that should be enhanced by restructuring the user interface. They also recommended having a mobile application for permanent flexible interaction.

4.3 Individual Factors

The subjective students' perception of the Virtual Collaborative Learning experience is the most important aspect for this study. The individual factors identified in the interviews are described here, supported by the anchor examples presented in Table 4

Table 4: Anchor examples of the sub-categories under Individual Factors

Code	Anchor examples
IA1	"it was more flexible than the class at the university […] I sit the way I want at the place I want, this was nice and at the same time I did not feel that there is a problem in commitment" (F11)
IA2	"when you enter the job market it is not a must to work in a company and all in it are Jordanians like you, so no, you have to have learned something like this" (F51) "one of the ideas was continuing with a PhD, one had like fear to continue a PhD outside the country or fear to interact with people from outside, to study in universities abroad" (M52)
IA3	"I felt it very important for us as a society to take from them the seriousness in everything they do. I mean we miss this things very much here in Jordan as a culture in general" (F11) "I saw how Germans are committed more than us in work, how they know things we do not know, how they search for resources we did not learn how search for them" (M51)
II1	"it was something nice, that you are discussing to solve a problem, not like we are attending just to solve assignments or we have to solve a quiz" (F41)
II2	"you deal with people from another culture, from another country, maybe from another religion and from another mentality, this adds the thing I said, that it enhances student's competences" (F11)
II3	"the platforms and these things I knew them for the first time […] using these things was new and it was useful very very much" (F51)
IP1	"It was very beautiful, I thank you so much that you offered our university the chance to try it […] I advice to create a dedicated course for it, and all the students visit it" (M52)
IP2	"I would like to learn, the mark from the instructor would have not concerned me" (F61)
IP3	"enjoying because this is the internet era and technology era, so all students who study who are mostly in youth age, they enjoy these things" (F11)

Anticipated Benefits:

Flexibility of online learning (IA1): Although they reported a very limited use of elearning applications in their university, all Jordanian interviewees were aware of their benefits and repeatedly mentioned the flexibility and advantages of this virtual course.

Preparation for study and work (IA2): The use of modern collaborative technologies to work in an international team and the acquired communication, analysis, and problemsolving skills gave the Jordanian students confidence for future work or study abroad.

Learning from foreigner peers (IA3): Five interviewed participants considered it a good chance to deal with German students and learn from their working and studying style. This should positively affect their perspective and participation in the local society.

Interest in New Experience:
New teaching/learning methods (II1): One of the main motivations for all interviewed Jordanian students to participate in this course were new teaching and learning methods they expected to see at the organizing university in Germany.

New people and cultures (II2): Another important motivating factor was the interest in knowing new people from a different part of the world and explore their culture if possible. This was a "unique" chance as some Jordanian students mentioned.

New technology use for learning (II3): Although they are aware of the benefits of elearning applications and they use Social Media privately, all Jordanian interviewees considered learning new uses of technology for study and work a benefit from this course.

Personal Perception:
High satisfaction (IP1): All interviewees reported a high satisfaction with the benefits they had in the course and the overall experience. They all would attend and recommend the attendance of similar courses to all other students.

High intrinsic motivation (IP2): Despite the high workload and the limited extrinsic motivation and support by the local instructor, a high intrinsic motivation to continue in the course till the end was obvious in all interviews.

High enjoyment (IP3): Integrating the students in an enjoyable learning environment would enhance their attitude toward learning and facilitate their active participation, as all interviewed Jordanian students reported and acknowledged..

5 Conclusions and Future Research

In this empirical case study, Jordanian students were integrated in a regular masters' course at the Technische Universität Dresden in a purposely re-designed Virtual Collaborative Learning arrangement to offer them an affective international academic experience without travelling abroad. To explore their perception of this modern approach, in-depth interviews were conducted with seven Jordanian students attended the course. Twenty-four factors that influenced students' perception were identified in the three main categories: contextual factors, design factors, and individual factors.

Introducing Virtual Collaborative Learning on a regular basis in a developing context can face multiple challenges like local accommodation to classical teaching styles, limited exposure to technology-enhanced learning practices, non-motivating instructors, and technical infrastructure problems. These contextual factors identified in

this study highlight the importance of international cooperation to provide universities in developing countries with the required know-how to implement innovative collaborative learning settings and offer their students the important international academic experience at home. Virtual Collaborative Learning implements a project-based learning approach that requires intensive students' participation. Design factors like course timing and duration should be carefully considered when integrating international students for the first time in a similar experience. Extensive explanation and preparation are also essential to enhance the performance of this target group and increase its benefits in pilot courses. This should also reduce possible anxiety or confusion at the beginning of the course. Considering technical collaborative tools that work in a developing context, including low-bandwidth flexible mobile applications is another design factor that can enhance students' Virtual Collaborative Learning experience.

Virtual Collaborative Learning has a considerable potential to include students from developing countries in affective, motivating, enjoyable virtual social learning environments as an efficient and effective alternative to provide these students with valuable international experience they might not have the chance to collect otherwise. This can be concluded from the high satisfaction reported by the Jordanian students. One limitation of this study is the sample size and variation. As the participation in the evaluative interviews was voluntary, it is possible that most interviewees were satisfied motivated participants, who do not hesitate to share their positive experience with the instructor. However, the participation of seven students in the evaluation (out of a eight Jordanian course participants) reduces the chance to have reluctant opinions that significantly change the study results.

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Migration to the Flipped Classroom – Applying a Scalable Flipped Classroom Arrangement

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Structured Abstract

Purpose – This paper is part of an extensive project[1] which focusses on creating and implementing a scalable flipped classroom framework to broaden information and media competencies in university staff in Saxony. A flipped classroom arrangement with a sensible mix of multimedia tools promotes meaningful learning and lowers travel costs by avoiding content consumption in face-to-face time and instead offers content beforehand using various sources. This paper will in particular focus on the approach to gradually apply a flipped classroom arrangement to a B2B-Marketing course specifically designed for part-time students and use the implications to promote this method and further the step-by-step migration to the flipped classroom at universities in Saxony.

Design/methodology/approach – Gathering information by reviewing previous experiences in E-Learning over the past decade, we were able to create an overview of how to approach part-time students and identified various concepts to create a more flexible and meaningful learning environment. We decided on a flipped classroom arrangement which offers time sensible teaching and promotes meaningful learning. A flipped classroom framework has been created which can be adjusted freely. Finally, we implemented the framework to a B2B-Marketing course by adapting it to the course content, time frame and attendance number. This procedure is designed to gradually increase usage of multi media tools and self efficacy and thereby steadily migrates the course to the flipped classroom.

Originality/value – Focussing on part-time students' needs and satisfying them with a flipped classroom arrangement is an entirely new approach. This project connects parttime- learning with online learning in a yet unprecedented manner.

1 MigraFlipScale sponsored by Saxon State Ministry for Higher Education, Research and the Arts

Practical implications – This paper describes the project's two main outcomes. Firstly, an independent scalable framework which can be adapted to different learners' and teachers' needs. Secondly, the application strategy is described in detail and offers explicit indications and methods to implement the flipped classroom gradually. Also, there will be an evaluation which will be interpreted and summarized in a guideline as well as patterns and lessons learned. In general, this project aims to broaden media and information competencies and encourage and strengthen collaboration in higher education in Saxony.

Keywords – Flipped Classroom, Online Education, ICM, E-Learning, Part-Time learning

Paper type – Practical Paper

1 Introduction

Most university courses aim to provide a high number of students with large quantities of information. Most teachers revert to handing out extensive materials in big lecture halls and give recitation (Butt, A., 2014, Cassidy, S., 2011). That leaves the students to deal with the main part of learning and understanding alone and out of reach of the teacher. Introducing the flipped classroom method to any course or content offers the opportunity to further meaningful learning as well as provide flexibility to both learner and teacher and provide opportunity for learning among participants from diverse disciplines and locations (Arbaugh, J.B., 2000). How should a course be organised to satisfy all participants' needs for transparency, coaching, organizational flexibility and success in learning?

This paper provides the reader with explicit techniques and methods to plan and implement a flipped classroom arrangement successfully. These methods are based on a literature review and an extensive knowledge base we derived over the past decade from numerous practical blended learning arrangements at our institutions (Lerche, J., 2015); they also represent a theoretical approach which has been implemented and will be evaluated during this semester.

2 Designing the scalable Flipped Classroom Framework

The flipped classroom method enables the teacher to shift the data-driven part of the lecture outside of class to make room for meaningful learning in class and evolve from a one dimensional mediator to an actual partner in learning (Bull, G., Ferster, B., Kjellstrom, W., 2012; Handke, J., 2013; Koh, C., 2016). In addition, the flipped classroom offers numerous opportunities to allow part time and distance learning because it leaves the student free to decide how, when, where and for how long they work on the material (Schäfer, A. M., 2012).

Following the three cycles of design science combined with our proceedings through the cycles (Hevner. A., 2007), we were able to compile a scalable framework (Jantos, A., Heinz, M., Schoop, E., Sonntag, R., 2016). Consequently, we describe the prototype design which, under ideal circumstances, creates a learner-centred environment providing steady input via an online platform, regular face-to-face meeting opportunities to broaden and intensify the learning, and both online and personal feedback as well as peer review and self assessment. Figure 1 shows the scalable flipped classroom framework with its' five phases.

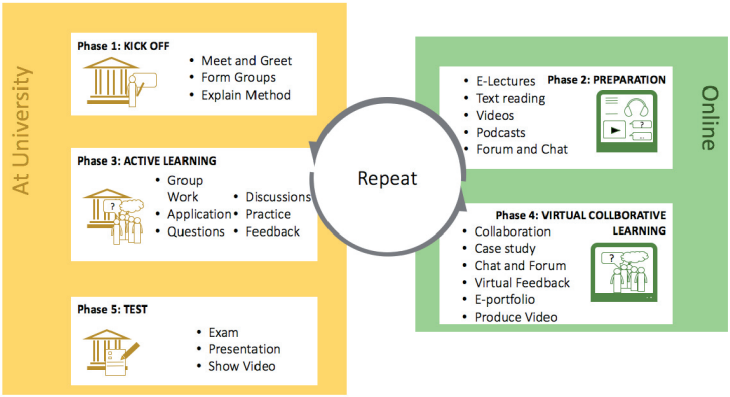

Figure 1: Design of the scalable Flipped Classroom Framework

To ensure stable learning success, the didactical design for the scalable framework for part-time students follows a more flexible and time-saving way with successive phases that ensure constant steady learning with comparatively long preparation phases and face-to-face session which are spread evenly over the learning period (Handke, J., 2013). The kick-off phase gives teachers and learners the opportunity to get acquainted with each other and with the flipped classroom method. Teachers give an overview of the upcoming phases and their challenges. They form groups and introduce the media that are going to be used. Preparation phase enables the learner to get acquainted with the topic by consuming contents specially prepared for the coming phases. The active learning phase offers educational space for varied learning activities. Teachers function as tutors, coaches, guides or moderators to oversee and encourage the transmission of meaning. In Virtual Collaborative Learning (VCL), learners check their understanding with reflexion tools and extend their learning (Balázs, I.E., Schoop, E., 2004). Phases 2, 3, and 4 are supposed to be repeated regularly until the course aims are met. The organisation of the cycle will depend

on the scope of the course in general as well as on the number of students and the available time frame to finish the course. All of the activities taking place on this platform can be monitored by Learning Analytics to assist the e-tutor and increasing transparency for all participants (Long, P., Siemens, G., 2011). The course ends with either the obligatory exam or with any other kind of learning artefact, such as a video presentation or a personal presentation, which is assessed by the teacher with consideration of online and face-to-face interaction and e-portfolio work.

3 Application

The University of Applied Sciences Dresden offers a part-time course in B2BMarketing with 5 ECTS points awarded to every student who is enrolled in a business Master program. The course is addressed to master students in their first semester. All participants were expected to have fundamental knowledge of multimedia usage and basic knowledge of Business and Management. They were expected to be between 20 and 30 years of age and to have previous experiences with various teaching and learning methods. This course was chosen for the trial run of the research as it had not yet been planned and offered a suitable subject and a promising audience.

Applying the framework to an actual course, required research to be carried out with more specific focus on the target group. Various factors that influence students learning in virtual classroom situations have been identified. Students show a rather non-independent behaviour in new learning environments. Most students find coordination and communication in teams to be the main challenge in online learning and prefer detailed guidance as they work on their assignments and frequently ask for help regarding content and organisation (Jödicke, C., Schoop, E., Freudenreich, R., Lorenz, T., Claus, T., Schuster, E., and Kawalek, J., 2014).

An interview with Prof. Dr. Ralph Sonntag at the University of Applied Sciences Dresden, who will be teaching the B2B-Marketing course in question showed that the target audience is even less self-efficacious. He pointed out that students usually participate passively in lectures delivered in big lecture halls. Group work is usually not a part of regular courses and an interaction with the lecturer is not common. The professor reported that it is necessary to introduce the new approach of teaching slowly and gradually to ease the audience into the new learning and teaching style because he feared that the slightest obstacle would scare students off. He suggests to clearly point out that there is much to be gained by this change and students should be constantly motivated to make sure they are aware of the opportunity and willing to take a risk. Based on the literature review and the information above a shortlist of today's students' needs was possible to be compiled:

- Students demand higher flexibility in learning (Lübben, S., Müskens, W., Zawacki-Richter, O., 2015);
- They are less willing to travel to lectures or study groups (Lübben, S. et al 2015);
- They ask for learner-centred learning and teaching (Minks, K.-H., Netz, N., Völk, D., 2011);
- They need transparent organisation of time and place (Minks, K.-H. et al 2011);
- They want to use multimedia as a crucial part;
- They require frequent help and motivation (Jödicke, C. et al, 2014).

Even though there is a great number of issues which affects learning and learning organisation, time proves to be the main factor (Maschwitz, A., Brinkmann, K., 2015). Most of these issues amplify when working with part-time students. They frequently face the following issues when they study part-time (Fischer, M., Spannagel, C., 2012):

- They have a fulltime job but still want to study;
- They rely on income from the daytime job;
- They take care of family members such as elderly or children;
- They cope with illnesses or disabilities;
- They have to commute to attend classes.

Within the kick-off session, we handed out a questionnaire which identified several factors about the actual audience. It contained questions concerning the students' online behaviour and preferences in online tools as well as their employment and degrees. The class counted 30 students. All of them show very high affinity to social media (Facebook) and online video (Youtube) consumption (90%). The following online tools turned out to be merely used (neither passively nor actively) by our focus group (20%-30%): blogs, file-sharing, photo-sharing and Wikipedia. About 50% of the audience are employed and consequently study part-time. All of the participants have a bachelor's degree in business.

Table 1: Organisation of B2B-Marketing

Phase	Content	Methods	Duration
Kick Off	Introduction to B2B-Marketing	- meet and greet - short lecture by the professor to introduce the flipped classroom method - introduction to B2B-Marketing	90 Minutes
1.Online Preparation	Organization and Processes in B2BMarketing	- links to videos and literature send via email - task to submit 2 questions via email	7 Days
1. Face-to-Face Session		- form groups - small group work - discussion and feedback - professor moderates discussions	120 Minutes
2. Online Preparation	Buying behaviour and customer benefit	- videos, literature and e-lectures available on - interactive social media learning platform - submit at least 2 questions via blog or comment	14 Days
2. Face-to-Face Session		- short lecture to address questions - group work - short student presentation - discussion, feedback	120 Minutes
3. Online Preparation	Different kind of Businesses	- videos, literature and e-lectures via platform - small online group work, concept map, e-portfolio, - submit at least 2 questions via email	14 Days
3. Face-to-Face Session		- short student presentation - discussion, lecture, feedback	120 Minutes
4. Online Preparation	Marketing Mix	- videos and literature via platform - VCL to create case study - write e-portfolio	14 Days
4. Face-to-Face Session		- short student presentation - discussion, lecture, feedback	120 Minutes
5. Online Preparation	Trade Marketing	- videos via platform - VCL - e-portfolio - peer review artefacts and e-portfolio - prepare interview	14 Days
5. Face-to-Face Session		- students interview expert - discussion, feedback	120 Minutes
6. Online Preparation	Quality Management	- literature and videos via platform - create videos - VCL, cooperate on platform - e-portfolio - peer review artefacts and e-portfolio	14 Days
6. Face-to-Face Session		- short student presentation - discussion, feedback	120 Minutes
7. Online Preparation	Customer Relationship Management	- students' videos via platform - e-portfolio - peer review	14 Days
Final Session		- feedback - summary - peer review	180 Minutes

Table 1 shows the detailed plan for this semester's course in B2B-Marketing. It consists of eight face-to-face sessions which include the kick-off session in the beginning and the final session in the very end. The course load was designed to fit 150 working hours. Also visible are the seven sequenced online preparation phases which are placed right between the face-to-face sessions.

We gradually raise the learners' autonomy by changing the tasks accordingly with the progress of this course. Figure 2 shows that with passing time we have arranged 1779 learning opportunities with increasing complexity and virtuality to address all taxonomy levels (Bloom, 1956). Face-to-face sessions are depicted as orange diamonds. Accordingly, orange bars show activities in face-to-face session. Green arrows show virtual or asynchronous activities, which can be worked on at home. On the right you find the taxonomy levels arranged according to their autonomy in learning. As you can see, autonomy increases over time, as do the taxonomy levels, which we aim to address.

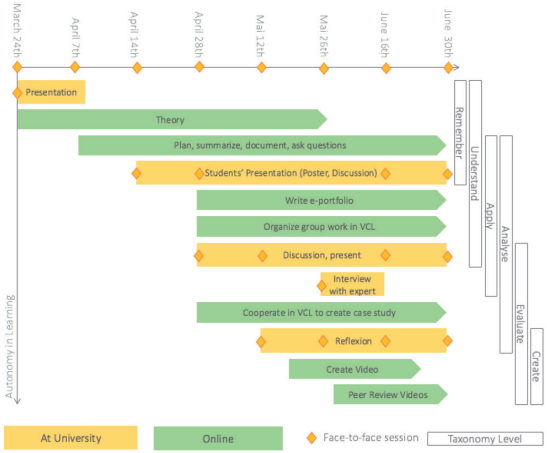

Figure 2: Learners' Autonomy in different Stages of the Course

Knowledge acquisition takes place in online preparation phases. E-tutors and Learning Analytic techniques identify problems and analyse their source to address them in face-toface sessions (Long, P., Siemens, G., 2011).

For the knowledge consolidation in the face-to-face session we have prepared several techniques for group work and active learning in big crowds, such as: case studies, pro and contra debates, poster creation and jeopardy question rounds. Face-2-face

sessions will be video-taped and provided online for those who could not attend the session. Thus, we hope to create content and give students the opportunity to watch themselves and improve their presentation technique.

These face-to-face techniques are going to be intensified with the progression of the course. Soft and less intimidating forms will suffice for the first two sessions but more complex and demanding tasks will be part of the active learning as the course progresses to increase meaningful, autonomous, and self-efficacious learning (Boekaerts, M., 1999). This progression will be mirrored in the online preparation work as there will be more reflexion of the learning progress as well as peer review and self assessment of all artefacts.

The final task in this course will be the creation of a video in group work showing the work in progress of the collaborative work online and all artefacts the group will have worked on. This video will serve other teams as content delivery in future and will be subject for grading the teams – together with any other artefact they have submitted and a detailed evaluation by the teacher. Each group submits the video they produced and other teams are required to review and feedback those videos. The following list describes each and every technique that has been or will be part of B2B-Marketing this semester:

Presentation – Face-to-face sessions are spread evenly over the entire learning period (March to June). Prof. Sonntag will start every face-to-face session with a short introduction and will address the submitted questions to connect the theory based preparation over the past weeks with the upcoming knowledge consolidation. In the very first session (kick off) he took more time to introduce the new teaching and learning method and gave an introduction to B2B-Marketing and focused on motivating the students to stay open to this new approach. He also talked about new media and the challenges and opportunity they bring. Autonomy in learning is low and students participate passively. We address taxonomy levels remembering and understanding.

Theory – Information acquisition mainly takes place by the means of e-lectures, videos and literature in preparation phases. In the very first online phase we provided content using an e-mail to keep it simple and not to overwhelm students. This creates a bridge between preparation and application and offers the teacher to address these questions and watch the students' progress. Students must be prepared to really participate in the active learning so we will not provide any content delivery while meeting face-to-face. Individual links for each student help to keep track of who visited the document and when. Autonomy in learning is low and students consume content passively. We address taxonomy levels remembering and understanding.

Plan, summarise, document, ask questions – Starting April 8th we introduced a social media platform (elgg) to the course which offers all necessary tools to cooperate and create an online community in this course (Rietze, M., Jödicke, C., Jung, M., Tawileh, W., 2013). Students are required to plan and organise their learning regularly. Content is provided without any assistance on how to process the new information. However, we ask students to each submit questions concerning the content to be addressed in the following face-to-face session. They use the online platform to navigate through their theory and accompanying tasks. We organised all participants in virtual groups and offered them a portal to communicate freely in their own group or to the whole course as well as to individuals such as the e-tutor or the professor. We upload all necessary material such as videos, literature, and tasks to this platform. We thereby offer the opportunity to share experiences and knowledge among all participants. Autonomy in learning is higher. Students participate more actively and apply and analyse their knowledge.

Students' Presentation – In every face-to-face session, students take part in group work. The course counts 30 students who are divided into six groups with each five members. They are faced with case studies or current events to be worked on using the information they gathered in online preparation. Students will work autonomously with help and guidance by the tutor. They then present their findings.

Virtual Collaborative Learning – To intensify group work even further, we offer VCL which will focus on the creation of a case study by student teams (Balázs, I.E., 2005) and will be monitored and supervised by e-tutors who are fully trained in pedagogics and marketing. They will chaperone the students throughout the course and offer help and feedback (Jödicke, C. et al, 2014). Every interaction within this collaboration will be monitored by the means of Learning Analytics to create a picture of all existing connections between all group members to identify strong bonds or participants who are not integrated in the collaboration (Rietze, M., Hetmank, C., 2016; Tawileh, W., 2016). Students work very independently as they apply and analyse their knowledge in teams.

E-portfolio – Previous sessions as well as learning artefact, student's presentations, and the progress in the VCL are evaluated separately or in groups by means of peer assessment and e-portfolios (Andrade, H., Valtcheva, A., 2009; Snow, A., M., 2013). Autonomy in learning is high.

Interview with expert – We organised a meeting with an expert in one of the face-toface sessions. He will be part of a discussion and agreed to be interviewed. Students will be asked to prepare for this interview in the preceding online phase and

independently research interesting background stories or issues his company faced in the past. The result will be available in following courses as content in preparation.

Create video – Students design input for knowledge acquisition for the other teams by presenting their group work via video. They produce videos with sensible content and thereby consolidate their knowledge as well as their pedagogical and technological skills (Dinse de Salas, S., Spannagel, C., Rohlfs, C., 2016). Learners' autonomy is very high as students create their own learning artefact.

Peer Review of videos – Students cross review other teams' videos autonomously on a video-based learning environment (Vi-Lab) by annotating specific sections of the video and giving detailed feedback (Seidel, N., 2014).

We focussed on enriching this courses content in face-to-face session with realistic and application-oriented cases studies (and various pedagogical concepts to intensify knowledge consolidation and to keep the students motivated and involved.

We shall evaluate the results of this particular course and hope to improve the framework further. Learning Analytics will be used to monitor every student's performance and based on the aggregated interactions we can evaluate the adaptability of the flipped classroom arrangement and the chosen methods to this course. If needed, we will refocus our efforts to different methods, organisational tactics or content. We hope to achieve better results for future application of the flipped classroom framework to other courses. We shall use the results for redesign and adjustments of the methods and tools we suggested above.

4 Problems

While applying the framework to the B2B-Marketing course we faced a great number of problems which arose both on teacher's and students' side, regarding to the content of the course as well as its organisation and technology. Firstly, there were legal issues to be dealt with. Some universities obligate their students to attend all sessions to get the credit and thereby don't allow working from home. We did not face that particular problem in this case, but still were forced to ensure that this approach was in fact legally acceptable.

Secondly, professors might not wish to merely be moderator or coach in learning – they are used to their position in front of the class and are not necessarily comfortable with this approach. They might also fear loss of image because the visibility of the course decreases. Furthermore, they have to cope with the additional workload to apply the flipped classroom and face new challenges in didactics, technology, and organisation.

Thirdly, we assumed a lot of commitment from the students, which can not be depended on universally. Students might not want to change their learning habits or fear the additional work triggered by this new approach. They might prefer the regular teaching methods and be reluctant to put dedication into this new approach.

Fourthly, even though most people use new media, we can not take it for granted, yet, that every student has proper access to all sorts of media. There are no requirements for students to own technological devices or have the know-how on online collaborative work.

5 Conclusions and further proceedings

We have found that applying a new framework to an actual course creates a number of difficulties and are therefore interested in the outcomes of this trial run and are positive that a flipped classroom actually provides many advantages to new learning methods and the ever changing needs of today's students. But of course, this demands not only learning processes on students' but also on teachers' and course designers' side.

We will increase the effort to use Learning Analytics to identify problems early to notify the e-tutors before participants have to ask for help themselves and thereby achieve higher and more complex educational objects and promote sensible usage of all available online cooperation tools.

After our current prototype is evaluated, we intend to apply our scalable framework gradually to other courses and to spread the method of flipping a course further. In future, we also see a high relevance for the business world. A transfer of the suggested framework to learning-on-the-job situations seems promising. On the conference, we plan to present first results of our practical project in forms of lessons learned and discuss the potential of our approach for transfer into further educational and business qualification scenarios.

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MOOC@TU9 – Common MOOC Strategy of the Alliance of Nine Leading German Institutes of Technology

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Structured Abstract

Purpose – Since April 2014, the alliance of leading German Institutes of Technology (TU9) has been jointly producing and running massive open online courses (MOOCs) on the subject of engineering. On the one hand, the collaborative MOOC@TU9 project aims to combine the unique characteristics and strengths of the engineering courses offered by the TU9 universities, making inter-institute, cooperative, open learning both visible and accessible. This will enhance both local teaching and the national and international marketing of the universities. On the other hand, the project also aims to help build communal experience and develop quality and production standards for the use of different MOOC formats in digital higher education teaching. In this sense, the MOOC@TU9 project contributes to the vital development of sustainable digitalisation strategies at German universities in the form of a feasibility study, which can then be used in other contexts as a valuable example of best practice. Design/methodology/approach – The MOOC@TU9 project has a primarily practical approach. The focus of the collaboration between the TU9 universities is therefore the discussion, exchange and coordination of concrete actions in addition to the evaluation and assessment of the solutions reached and implemented. The collaboration within the TU9 network results in inter-organisation working and learning processes for the parties and institutions involved. These have a particular value, as this is how, through collaboration, we can build an effective, sustainable, multi-dimensional experience.

Originality/value – MOOC@TU9 is a joint inter-university project with the aim of strategically testing the possibilities, parameters and benefits of using massive open online courses in higher education teaching, the like of which has never been seen before in Germany. There is, therefore, currently no systematic development of quality and production standards for MOOCs: a gap, which MOOC@TU9 is actively attempting to fill.

Practical implications – Results and findings of the project are not only taken from specific practical work, they are also fed directly back into it. In this respect, it can and should provide valuable insights not only for course participants, but also for other universities and/or initiatives.

Keywords – MOOC, open online courses, higher education, digital strategy, interuniversity cooperation

Paper type – Practical Paper

1 Introduction

For some time now, German universities have been making increasing efforts to develop higher education-level digitalisation strategies for teaching. To some extent, this is long overdue, as after over 15 years of the E-Learning debate, German universities' digitalisation opportunities seem to have been insufficiently exploited, as revealed by a Centre for Higher Education Development study in late 2013 (CHE, 2013). An associated position paper set out a range of strategic action areas (access to education, efficiency of teaching, quality of teaching, further training, recruiting, university marketing), which could benefit from digitalisation measures. The universities' task here would be to more clearly determine what contribution digitalisation could make to achieving their strategic objectives and in terms of the institution's individual arrangements, as well as creating and implementing appropriate measures (Bischof and von Stuckrad, 2013, p. 52f.). It is clear, however, that this conflicts with the existing structural, financial and legal conditions of traditional universities. Even more insistently, a recent discussion paper by the German Forum for Higher Education in the Digital Age – a Federal Ministry of Education and Research-sponsored expert panel made up of representatives of the Stifterverband für die Deutsche Wissenschaft, the German Rectors' Conference (HRK) and the Center for Higher Education Development (CHE) – called for the active tackling of these "barriers to digitalisation" with the ultimate aim of overcoming them (HFD, 2015, p. 15). "Digitalisation" can, according to the paper's authors, "increase existing challenges and intensify inherent stresses", but it can also help to "face many of these challenges" and offer "unprecedented opportunities to develop teaching and universities" (Ibid. p. 4).

A central element of the considerations regarding developing digitalisation in university teaching continues to be so-called Massive Open Online Courses (MOOCs), which first emerged as an education trend in the US. Since the phenomenon reached German education in 2012/2013, questions have been raised about the potential and added value that MOOCs have in the context of university teaching. As expected, however, a survey of committees and vice-rectors of German universities in 2015 showed an ambivalent attitude to the approach. Nevertheless, around 40 per cent of universities declared that they were dealing with the topic on a strategic level (Jungermann and Wannemacher, 2015, p. 49).

These approaches include MOOC@TU9, a collaborative project undertaken by the alliance of nine leading German Institutes of Technology, which aims to jointly produce MOOCs in the field of engineering. This article presents the project in terms of interuniversity strategy development, with a particular focus on dealing with the universityspecific challenges of digital, network-based teaching.

2 The MOOC@TU9 project

2.1 TU9 project framework

TU9 is an association made up of nine technical universities in Germany, which are renowned for their leadership in research and teaching. The group was founded in 2006 and includes RWTH Aachen University, TU Berlin, TU Braunschweig, TU Darmstadt, TU Dresden, Leibniz Universität Hannover, the Karlsruhe Institute of Technology, TU München und the University of Stuttgart. It has its own office in Berlin and works towards strengthening science and research in the STEM subjects. One of the ways this is done is through cooperation with the different German federal states and scientific organisations, scientific research bodies, State Rectors' Conferences, the German Rectors' Conference (HRK), universities in other countries, industry and the economy, but also, last but not least, through inter-university cooperation in the form of TU9 panels, events and projects and establishing and clearly and consistently communicating positions with regard to university and educational policy (see: http://www.tu9.de/tu9/1473.php). This is the main way that the TU9 network constitutes a strategic alliance.

The arrival of the 'MOOC hype' in Germany meant that the TU9 universities were introduced to the topic in a specific way, with the open E-Learning format combining the idea of cutting-edge innovation and the opportunity to open up and internationalise teaching. Based on their initial university-specific MOOC activities of some TU9 members (RWTH Aachen University, TU Dresden, the Karlsruhe Institute of Technology and TU München), the MOOC@TU9 project was founded in spring 2014 as an interuniversity project for the whole TU9 network.

2.2 Project aims

The aim of the MOOC@TU9 project is the strategic testing of MOOCs in the field of engineering. First and foremost, this means working together to gain common experience in designing, producing and running MOOCs, along with developing specific processes and standards for implementing and establishing them under higher education teaching regulations. The project is a feasibility study for the institutes involved. This consists of the TU9 members combining their individual skills, experience and local media production and study structures and using the resulting synergy.

Furthermore, the project also aims to systematically establish the potential of using MOOCs in terms of the future expansion and enhancement of local teaching, by creating inter-university courses or integrating new target groups, for example. The different institutional and organisational regulations affecting each TU9 member play a particularly important role, as a wide spectrum of individual circumstances must be taken into account, while aspects of the collaborative implementation of digital courses could also be considered.

Finally, the MOOC@TU9 project also aims to use its coordinated German Engineering MOOC programme to establish a position on the international digital education market. This is why the project is also indirectly focusing on boosting the national and international public perception of the features and advantages of the TU9 universities' engineering courses as part of an innovative university marketing strategy.

2.3 Project structure

The MOOC@TU9 project, which has been adopted by all TU9 universities, is run by an editorial team of representatives from all of the TU9 members, all with relevant skills in the technical production or didactic design of digital courses. The team holds monthly status meetings and topic-based meetings via telephone or videoconference using Adobe Connect, and around twice a year, a joint workshop is held over several days at one of the TU9 institutions. The editorial team is assisted and guided by the assembly of the vicerectors or vice presidents of the TU9 universities. The project is coordinated by TU Dresden.

3 The MOOC@TU9 concept: experiences from the pilot phase and conclusions for the continuation

Based on the common objective of the TU9 universities to find innovative ways to develop engineering courses and make them more accessible and more visible on an international level, an initial joint MOOC was designed, produced, run and evaluated by all of the TU9 universities between April 2014 and March 2015. The 9-week, Englishlanguage course featured a series of lectures, which presented a different engineering discipline each week. The aim was to make prospective students around the world aware of the diverse, advanced range of courses offered by the TU9 universities and ensure that they know the quality, variety and prospects of German engineering studies. Besides comprehensive information about prospective TU9 institutions, the participants primarily received an overview of the key issues, content and working methods in the different fields and example tasks gave them the opportunity to test and expand their specialist knowledge. Viewed from this angle, the course was an instrument used to strengthen the German Engineering brand, but the participants could also use it to check their suitability for, and look into, further study in the field.

A total of 1,328 people from 80 countries attended the pilot course. The results of the follow-up survey show overall satisfaction in terms of fulfilling expectations of the course. 94% of respondents would recommend it, and almost half (48%) said that taking part in MOOC@TU9 helped them to evaluate and make a decision on their studies (a further 32% said that it was at least partially helpful). However, it is also clear that the pilot phase's conceptual approach of an overview-style series of lectures had a negative impact on the course itself. For example, the registered participants took a very selective approach to the different weekly topics and were also much less likely to take part in active course elements such as weekly tasks, chats and forum discussions. The effect of the accessible, collective course experience did therefore not materialise, which was viewed particularly critically by the 21 participating TU9 professors. In addition, the overview style of the lecture series allowed no meaningful link between the MOOC and the local course offering.

The focus of the second phase of MOOC@TU9, which has been underway since April 2015, is the collaborative design and production of thematically distinct specialist courses in the field of engineering. On the one hand, this conceptual shift from university marketing to specialist course takes up TU9's interest in a stronger link between the courses produced within the project and what is offered by standard teaching. On the other, it allows detailed analysis of the concrete questions and issues of a standard digital course in the context of higher education teaching. What is different about TU9 MOOCs is their consistently cooperative approach: at least two, ideally three or more, lecturers from different TU9 universities take part in producing each MOOC, giving it unique characteristics on a content and/or thematic level, which go far beyond the scope of a conventional local course.

4 Theoretical classification of TU9 activities in terms of effects

As should have already been made clear, the MOOC@TU9 project has a primarily practical approach. The focus of the collaboration between the TU9 universities is therefore the discussion, exchange and coordination of concrete actions in addition to the evaluation and assessment of the solutions reached and implemented. This approach does not only have a content-related dimension; it is also, and above all, crucial from a structural point of view. The collaboration within the TU9 network results in interorganisation working and learning processes for the parties and institutions involved. These have a particular value, as this is how, through collaboration, we can build an effective, sustainable, multi-dimensional experience.

The joint development, discussion and practical testing of approaches, as carried out within the MOOC@TU9 project, is also fundamentally interesting in terms of feasibility. Here, the question of the suitability of different MOOC formats (xMOOC

versus cMOOC) is a lesser focus than the creation of a highly effective and cooperative process in the university network.

If we look more closely at approaches and procedures from the perspective of the different parties involved in the project, different impact models can be developed depending on the position or task within the university and the relevant focus. Proportional to the limited scope of the paper, it should be sufficient in this case to briefly describe the basic expectations and designate an appropriate theory area without going into detail, e.g.:

- Objective: international recognition of German engineering - Relevant approach or theory: marketing/persuasion
- Objective: inter-organisational collaboration/saving resources/sharing production skills/mutual experiences - Relevant approach or theory: organisational learning/training
- Objective: transferring specialist knowledge of German engineering - Relevant approach or theory: learning and learning effectiveness
- Objective: feasibility study on collaboration in a virtual organisation - Relevant approach or theory: feasibility and/or production management

There are most likely other expected effects to be worked out. However, the variety listed above already shows that integrating expectations is no easy task. Specifically, there is mostly a lack of transparency in terms of these expected effects. In the present case, they would at least be discussed during strategy development, but theory-based processing has not yet explicitly been carried out. There are a number of references in specialist literature to widely established theories like marketing (in economics) or persuasion (in communication science), but also learning success (in education science and psychology). Somewhat less extensively covered is the issue of inter-organisation collaboration, which has only recently been explored (Köhler et al., 2010; Köhler and Neumann, 2011), at least in a university context, and the use of social media and the format of MOOCs provides new impetus.

5 Strategic challenges in the second phase

As the MOOC@TU9 has progressed since April 2015, the TU9 MOOC concept has shifted its focus towards the target group of students at the participating universities and producing online-based course content for engineering, which can be integrated into the standard courses at the TU9 institutions. This has led to specific legal and administrative challenges with regard to the examination and accreditation procedures of MOOCs as a component or foundation for a course, and also the burden of

producing and running MOOCs on the workload of the lecturers involved. There are also further organisational costs and issues, which are the result of the specific characteristics of creating a joint course.

5.1 Measurement of learning success and examination procedures

Clarifying how learning success and competence gains through course participation can be documented is generally a central issue in planning a MOOC (Pscheida et al., 2014): what scope should the activities have, and how is this recorded and verified? How can the knowledge acquired by the participants be made visible in the context of MOOCs?

In the pilot phase of MOOC@TU9, statements of accomplishment were issued to confirm successful completion of the course. In order to receive such certification, students were required to complete and submit a minimum of 19 of the weekly tasks. However, only the submission was registered, not the accuracy of its content. Focusing on integrating the TU9 MOOCs into standard higher education teaching in the TU9 universities, while opening them up to external participants, brings up totally new questions, which must be considered and resolved while developing an examination and certification concept. Initially, this concerns the awarding of ECTS credits for MOOCs: converting an attendance certificate into credits relevant to studies. As ECTS credits can only be awarded for passing a module examination, in principle, tests must be included in the course descriptions. This is regulated by each university and each course, and therefore presents a particular challenge when several universities are involved in one MOOC. There is also the principle question surrounding the reliability of online examinations. Authenticating those taking the examination via the MOOC platform is problematic, and a number of the universities are not familiar with the necessary procedures (Schultz, 2014, p. 19 f). In addition, teaching and learning content from outside of the university's own learning management system cannot be used as an examination requirement due to data protection laws. Last but not least, universities often lack the necessary infrastructure (e.g. large enough PC pools) to run the online examinations in the MOOCs themselves (Michel, 2015, p. 25).

Furthermore, the question remains, especially for the target groups of international students and other interested parties, to what extent acquiring an often paid attendance certificate from MOOC platforms can be a requirement for acquiring ECTS credits from the universities participating in the MOOC, such as by taking a module examination.

5.2 Compensating for teaching workload/production efforts

Depending on the methods and assessment types used, substantial staff effort is required for preparing and running MOOCs (Schultz, 2014, p. 23). Those responsible prepare the teaching material for the participants and are available for any questions. They also moderate the communication channels and provide replies. The time expended here far exceeds that of a conventional course, as Loviscach and Wernicke (2013) describe in detail in their remarks on creating and managing MOOCs (p. 88 ff). It is therefore important to find an incentive and/or compensation system, which offsets the enormous development and management effort involved in the MOOCs. Appropriate adjustment or compensation of the lecturers' teaching workload as part of MOOC@TU9 is primarily a legal obstacle, due to differing state legislation regarding compensating ELearning courses. The teaching workload amount, the number of higher education teaching hours required of lecturers per week during the semester, is regulated at German state level via appropriate regulations concerning teaching commitments (e.g. the Saxonian public service task regulation for higher education institutions, SächsGVBl. 2011 No. 12, p. 611). In the majority of states, with the exception of Brandenburg, Saarland and Saxony, this also applies to creating "multimedia", "internet-based" and "online" courses, as well as courses for "distance learning" (Faller, 2015 p. 8). In five states (Berlin, Bremen, Hamburg, Saxony-Anhalt and Schleswig-Holstein), a comparability test with classroom teaching is required: creating (preparation and followup) and running E-Learning courses must be converted into hours per week during the semester, which would be required for a comparable in-person event (e.g. Teaching obligation regulation for Saxony-Anhalt §3 (2) sentence 3). In two states (Bremen and Saxony-Anhalt), the time accrued for this must also be documented. Baden-Württemberg, Hamburg, Hesse, Lower Saxony, North Rhine-Westphalia and Thuringia restrict eligibility to a maximum of 25%, and Baden-Württemberg and Thuringia limit the duration of compensation to a maximum of two years (Faller, 2015 p. 8). North Rhine- Westphalia and Thuringia only permit compensation for E-Learning courses when they are required to safeguard the overall range of courses (Ibid.). Transferring this to the MOOC@TU9 project means that compensation for the teaching workload of MOOCs is fundamentally possible at eight of the nine participating universities, but this depends on the different conditions and requirements in individual states. There are therefore also other incentive systems to consider, where applicable, in order to convince higher education teachers to stage MOOCs.

6 Current approaches from the MOOC@TU9 project

6.1 Scenarios for the measurement of learning success and examination procedures

Due to the different target groups and the aforementioned challenges in terms of recognising performance in MOOCs for studies, a number of different test scenarios must be devised. These should recognise students' performance and the knowledge they acquire for their studies during the MOOC on the one hand, and allow external participants to gain certification on the other. The following three scenarios were developed for the MOOC@TU9 project:

(a) Formative assessment in MOOCs for all participants
The first performance assessment scenario within the MOOC concerns all participants, both registered students and external participants. The formative assessment comprises quizzes and other tasks, such as homework and peer reviews carried out on the MOOC platform and awarded marks. At the end of the course, the marks are compiled and, depending on the score obtained, certification for successful completion is awarded. This primarily takes place automatically via the MOOC platform. Depending on the platform, the attendance certificate may be subject to a fee. For registered students of the universities that take part in the MOOC, it does not count as a certificate of achievement or a precondition for examinations.

(b) Summative assessment for students of participating universities
In order to obtain a certificate of achievement after the successful completion of a MOOC, students registered with a participating university must take an exam, which complies with the relevant regulations and is compatible with the relevant module catalogue for their studies. Due to the aforementioned challenges, the successful participation in a MOOC is not recommended as a requirement for module examinations. It is also advisable to provide the teaching and learning content on the MOOC platform (e.g. videos, quizzes, additional materials, tasks) and additional sub-services and tasks via the university's learning management system or website. In the event of several universities participating in one MOOC, it must be ensured that the examination takes place at the same time at each institution in order to provide the same examination conditions for all participants.

(c) Recognising the performance of external participants
Participants who are not registered with the universities participating in the MOOC can easily obtain a certificate of attendance in scenario 1 (a). Sitting in-person university examinations is only possible when the relevant examination and study regulations are bound to the university in question, and some university fees may be charged (this

is the case for TU Dresden, for example). However, the certificate of achievement awarded by the TU9 universities participating in the MOOC following an in-person examination should be recognised by the other TU9 institutions in order to enable students to change universities without issue. Furthermore, it is conceivable in this scenario that recognition of the certificate of attendance awarded via the platform, such as for international students, would be required to sit the module examination. International students, who have successfully completed the MOOC, would only have to sit the next in-person examination after registering with the relevant university to be awarded the corresponding ECTS credits.

6.2 Compensating for teaching workload/production efforts

Differing legal regulations mean that consistent compensation for lecturers' teaching workload in terms of producing and running MOOCs is not possible within the MOOC@TU9 project. But even at the universities where compensation would be fundamentally possible from a legal perspective, it is proving difficult, as it requires conversion into hours per week during the semester (see 4.2). An initial step for MOOC@TU9 is therefore evaluating the time and staff required to produce and run a MOOC. This takes into account lecturers' resources in terms of staff, time and finances during the production phase (up to the end of the summer semester 2016) and the implementation phase (starting from the 2016/17 winter semester). Lecturers are also sent spreadsheets by the local project coordinators to be completed during the production and running of the MOOC. The number and status of the staff used is recorded (e.g. scientific assistant, student assistant), along with the time taken for individual stages (concept development, video production, etc.) in hours, the financial cost of any necessary additional purchases (e.g. technology) and the timing (length) of each stage. In addition to accounting for MOOC tasks in the lecturers' workload, there is also the opportunity to provide them with support staff, such as student assistants. In the long term, universities should also provide IT services for MOOCs on site and/or integrate support options for lecturers in existing services to create online courses. Looking ahead, it is also important to automate as many processes and procedures as possible as far as preparing and running MOOCs are concerned in order to minimise the time spent by organisers on this.

7 Potential and added value of joint MOOCs: an interim conclusion

The use of MOOCs in academic teaching is linked to vague expected effects. Its possible strategic potential is often insufficiently explained and differentiated from a theoretical standpoint. In addition, current scientific discourse focuses primarily on the financial implications of MOOCs, such as the discussion surrounding business models (Fischer et al., 2014). The project MOOC@TU9 makes clear that the creation and running of MOOCs in higher education primarily brings about a range of open

legal and administrative issues, to which there have as yet been no pre-packaged or standardised solutions whereas the educational and learning related outcomes will not be considered adequately.

The central challenge is to harmonise different state regulations for universities on the one hand and their stages of development in terms of e-assessment and online courses on the other. In addition to legal and administrative issues surrounding documenting and measuring learning success and MOOCs compensating for lecturers' teaching workload, special collaborative MOOC productions are also faced with specific challenges in terms of content. This includes determining a joint course curriculum, which is equally compatible with the respective range of courses and/or curriculum at different institutions, as well as determining a required level of prerequisite knowledge for taking the course (Möller et al., 2016). But there are also clear advantages to producing the courses collaboratively for the universities involved. Collaborative production enables sharing the creation of the required content, dividing the necessary effort between several partners and relieving the burden on one individual university. The same applies for the marketing and public relations work to advertise the MOOCs to the relevant target groups. A content-related benefit for the courses is that sharing the course between at least two lecturers opens up different perspectives on the topic at hand. Ideally, this enables reflection on interdisciplinary issues and clarification of complex areas through additional input from the lecturers involved. This also benefits the lecturers, who achieve a clear appreciation of their course through collaboration, just as it does the students, who also gain from the knowledge of lecturers from other renowned universities and providers and can develop their knowledge accordingly without needing to physically attend lectures – event though there are no statistical data yet about the effective usage of that opportunity in the chosen approach.

This opening up and development aspect also applies to involving target groups outside of universities' own students, such as those from other countries or the field of training. MOOCs do not only offer this target group new opportunities to take part in the respective university course, the university itself, its lecturers and its students can also benefit from the accessibility of MOOCs. MOOCs provide students in particular with a learning experience in a large, diverse group with the anonymity provided by the internet, stimulating increasingly important skills for the future such as searching for and selecting information and self-management (Pscheida et al., 2015). For the university or participating lecturer, MOOCs are 'cost-effective' ways to boost reputation for their course and support offering (Schultz, 2014, p. 32).

Above all, however, collaborative MOOCs, as conducted as part of MOOC@ TU9, allow the parties to work together to tackle the aforementioned challenges of developing a MOOC for higher education. The universities can benefit from their experiences on a number of levels and there is an exchange of ideas on key issues such as examination rights, data protection and teaching workload compensation.

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A Survey on Knowledge Management in Universities in the QS Rankings: E-learning and MOOCs.

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Structured Abstract

Purpose – Many public organizations are employing Information Technology "IT" in Knowledge Management "KM" (Silwattananusarn and Tuamsuk, 2012; Alavi and Leidner, 2001; Chatti et al., 2007). Within universities, the use of IT could be an enabler to create and facilitate the development of knowledge (Joia, 2000; Garcia, 2007; Tian et al., 2009; Sandelands, 1997); to improve knowledge sharing (Aurelie Bechina Arntzen et al., 2009; Alavi and Gallupe, 2003); to develop communities of practice (Adams and Freeman, 2000). In the educational organizations IT is also a tool to improve the quality of learning (EC, 2000). E-learning is based on digital technologies (Aspen Institute Italy, 2014), through multiple teaching methods (Derouin et al., 2005), as tools for KM (Wild et al., 2002). The websites of some universities allows anyone to follow free lessons, through the internet. These types of free online courses are known as Massive Open Online Courses „MOOCs" (EC, 2014; Sinclair et al., 2015). The purpose of this study is to verify the type of teaching adopted by European universities and understand how training through e-learning can improve the processes of transmission and sharing of knowledge allowing everyone, not only to students, to take lessons through the web.

Design/methodology/approach – The analysis allows detecting data on universities by region through the study of the websites of the top 100 European universities present in a ranking called Quacquarelli Symonds, "QS World University Rankings 2015/16". The method used to collect the data was marked by the creation of a specific database in which are inserted, for each university, different information: status (public/private), size, age, number of enrolled students, references on websites. In this Excel spreadsheet was also taken into account the type of educational offer provided by each university, with particular reference to the provision of online courses and courses open to all.

Originality/value – The article aims to provide a detailed study on the use of technology in the educational context. The exploration allows you to design, within other universities unranked, styles of teaching online to share knowledge.

Practical implications – The survey, currently, is the first step of a larger project which aims to analyse the different types of e-learning platforms used by 100 universities in the European rankings QS to make teaching online. From the results of this first phase, it has emerged that all the surveyed European universities provide training not only through classroom lessons, but also with a variety of courses through e-learning even for free through MOOCs.

Keywords – Knowledge Management, Universities, E-Learning, MOOCs.

Paper type – Academic research paper.

1 Introduction

The Knowledge management "KM", according to a systemic approach and organizational, is a process, characterized by creation, use, storage, sharing, transfer and retrieval of knowledge, which aims to improve the performance of an organization (Aurelie Bechina Arntzen et al., 2009). Hansen et al. (1999) argue that it is possible to define two strategies to implement the KM: one focused on the technology called „codification strategy", in which knowledge is carefully codified and stored in databases, and the other closely linked to the role of individuals „personalization strategy" which is shared mainly through direct person-to-person contacts. Nonaka and Takeuchi (1997) argue that the use of information and communication networks in organizations facilitate, within the combining process, the conversion of knowledge.

IT in universities is a tool to improve the quality of learning (EC, 2000), to redefine some of the strategies and concepts of teaching and learning (Klimov, 2012), to allow evolving from traditional forms of learning in e-learning. (Alkhalaf et al., 2012). Elearning is in fact based on digital technologies and is spread through the web (Aspen Institute Italy, 2014), through multiple teaching methods (Derouin et al., 2005), to deliver and distribute learning through education and training programs (Esposito and Mantese, 2003), as KM tools (Wild et al., 2002).

The purpose of the study is to examine how learning through the network (e-learning) adopted by the European universities can facilitate transmission processes and knowledge sharing.

The article aims to provide a detailed study on the use of technology in the educational context. The survey, currently, is the first step of a larger project which aims to analyse the different types of e-learning platforms used by 100 universities in the European rankings QS to make teaching online.

The paper is organized as follows: some preliminary considerations; exhibition on the research method adopted; show the main results obtained and discussion; conclusions.

2 Some preliminary considerations

Development of the Internet and its applications have led to an increase of the computer in the learning process (Oproiu, 2015). This is the reason why educational institutions have an increasing need to use virtual learning environments "VLE", namely the e-learning platforms that accompany the traditional teaching-learning process, through e-learning. The EC (2001) defines e-learning as „*The use of new multimedia technologies and the Internet to improve the quality of learning by facilitating access to resources and services as well as remote exchanges and collaboration*". Holmes and Gardner (2006) consider e-learning simply as a „*Online access to resources for learning anytime, anywhere*". Alkhalaf et al. (2012) state that the term E-learning refers to a type of education and learning system in which time, distance, or both physically separate students and teachers. This separation is filled with the help of communication technology, including the Internet and emerging educational technologies. E-learning is understood by Clark and Mayer (2011) as an instruction given on a digital device, such as computer or mobile device, which is designed to support learning, through education and training programs (Esposito, and Mantese, 2003), delivering training content electronically through computer based learning, Web-based learning and virtual classrooms (Asfor Glossary, 2007). In fact, develop an e-learning system means increasing an integrated training environment using network technologies to design, deploy, select, manage and expand the resources for learning. The most frequently used methods for achieving this integration are: the asynchronous self-learning through the use of pre-packaged content available on the delivery platform; synchronous learning through the use of video conferencing and virtual classrooms; collaborative learning through the activities of virtual learning communities. According to Garrison (2011) e-learning is an electronically mediated communication asynchronous and synchronous with the aim to build knowledge. Guri-Rosenblit (2005) states that E-learning is "*A new phenomenon and relates to the use of electronic media for a variety of learning purposes that range from add-on functions in conventional classrooms to full substitution for the face-to-face meetings by online encounters*".

Nacamulli (2003) asserts that the e-learning includes the processes of training, learning and KM enabled by the Internet (network). The e-learning relates more specifically, the processes of transmission, exchange and development of knowledge among individuals, groups and organizations. E-learning can be used as an important tool for KM (Wild et al., 2002). E-learning allows participants to gain new insights.

The use of groupware, work-flow systems, communications via email, chat rooms, work spaces, discussion rooms, forums and message boards help students create knowledge through collaboration (Lau and Tsui, 2009). Students share ideas during social interactions and all that translate into the transfer of knowledge through the stages of outsourcing and internalization of knowledge. Learning is actually highly social activity and the implementation of electronic social interaction helps students gain knowledge exchange through socialization.

Barker (2005) states that knowledge sharing can be done in two basic ways: by going to the various artifacts of knowledge storage (such as books, websites and experts) or through the creation of a community of practice.

Zemsky and Massy (2004) identify three different definitions of e-learning: (1) as distance learning via the Web; (2) as a set of software for organizing online courses and present materials; (3) as learning electronically mediated.

(1) The term e-learning is often used interchangeably with that of distance education (Holsapple, and Lee-Post, 2006). Guri-Rosenblit, (2005), however, says that training at a distance, by its very definition means the physical separation of the learner by the teacher, differs from e-learning for three reasons. (a) Physical separation between teacher and student, in distance learning, occurs in some stages of the learning process. The new technologies offer, instead, a rich plethora of uses of learning and teaching processes; (b) A second distinctive feature of distance education is its focus on the needs of specific clienteles who for various reasons cannot participate in a face to face meeting, a school or a conventional campus. (c) A third important feature of distance education at the university level in recent decades has been its ability to expand access to higher education by providing economies of scale.

(2) E-learning includes a wide range of instruments that are used for distribution, presentation and transfer of educational content (Klement et al., 2015). Internet Based Training "IBT" consider all network technologies such as email and newsgroups, the contents of which cannot necessarily be distributed via the web. (Esposito and Mantese, 2003). Web Based Training "WBT" allows the distribution of educational and training content through a web browser (Internet Explorer, Firefox) on the public Internet, extranet. Learning Management System "LMS" is a software platform that allows the management of both Internet and in intranet in the training process. The Learning Content Management System "LCMS" is a software solution that should change some of the management functionality of an LMS with those needed to create, manage, store with ease and simplicity the content of the training courses. LMS represents a virtual environment ‚class` consists of tutorials, quizzes, study instructions, exercise plans or discussion forum (Klement et al., 2015).

(3) The third e-Learning category turns attention to learning materials themselves, rather than their distribution (Zemsky and Massy, 2004). Despite their seemingly diffuse nature, what all of these products and resources have in common it is that they involve being mediated electronically and that learning in a digital format is interactive. According to Sangrà et al. (2012) definitions emerged in the literature on e-learning can be grouped into four categories.

- *Technology-Driven:* the definitions of this first category emphasize the technological aspects of e-learning, while presenting the rest of its characteristics as a secondary.
- *Delivery-System-Oriented:* this second category presents e-learning as a means of access to knowledge (through learning, teaching, or training). In other words, the focus of these definitions is the accessibility of resources and not the results of any achievements.
- *Communication-Oriented:* This third category consider the e-learning is a communication, interaction, and collaboration tool and assigns secondary roles for its other aspects and features.
- *Educational-Oriented Paradigm:* this fourth category defines e-learning as a new way of learning or as an improvement on an existing educational paradigm.

In table 1 were classified in the above categories, the main definitions of e-learning studied in this paper.

Recent studies analyse different aspects of e-learning in universities in Europe and beyond. Castillo-Merino and Serradell-Lopez (2014) dwell on how students enrolled in courses via the web are more motivated and achieve the high performance, achieving better grades when they carried out examinations than students who attend the university campus. Yilmaz et al. (2016) examine how motivation, in the e-learning process, it is considered an important factor in student learning. Alkhafat et al. (2012) have shown that the use of e-learning services, in universities, allow you to provide basic information and also help students to take important decisions effective and precise, thus increasing the overall productivity of the process of teaching and learning. Huang et al. (2012) states that, unlike traditional classroom teaching, e-learning has the intrinsic limitation of being able to provide an interactive feedback. A mixed mode - the integration of e-learning in a traditional classroom setting - seems to be a more reasonable solution. The authors refer to the mixed approach in e-learning “MMEL”. MMEL is a kind of mixed or hybrid learning that integrates online learning and the classroom, to improve learning efficiency. Lin and Wang (2012) argue that the Blended learning combines two teaching methods: the face to-face teaching in the classroom and e-learning-based teaching platform based on web. Students can use the e-learning system for the recovery of teaching materials and to

obtain information about the course directly by the teacher. Masud (2016) states that any e-learning system can be considered as a closed system, as it allows the access of learning materials only to users registered at the university. The current e-learning systems do not allow a user to access the e-learning content in other systems, even if the user has the cooperation with other institutions. A collaborative e-learning environment facilitates the sharing and access to e-learning content (e.g. handouts, videoconferencing, audio, text, the testing samples, discussion, etc.) between users (i.e. teachers, students and researchers) in different systems.

Table 1: The classification of the main definitions of E-learning.

No.	Category	Definitions of E-Learning	References
1	Technology-Driven	- Online access to resources for learningvanytime, anywhere. - The use of electronic media for a variety of learning purposes. - Processes of distance teaching / learning based on digital technologies and, in most cases, distributed via the web. - As distance learning via the web; as a set of software; as learning electronically mediated.	Holmes and Gardner, 2006 Guri-Rosenblit, 2005 Aspen Institute Italy, 2014 Zemsky and Massy, 2004
2	Delivery-System-Oriented	- Instruction delivered on a digital device such as a computer or mobile device to support learning. - A powerful tool for delivering many and varied instructional technologies and methods. - Educational methodology that offers the possibility of deliver training content electronically (e-learning) over the Internet or intranets.	Clark and Mayer, 2011 DeRouin et al.,2005 Asfor Glossary, 2007
3	Communication-Oriented	- A type of education and learning system in which time, distance, or both physically separate students and teachers - An electronically mediated communication asynchronous and synchronous with the aim to build knowledge.	Alkhalaf et al.,2012 Garrison, 2011
4	Educational-Paradigm-Oriented	- The use of new multimedia technologies and the Internet to improve the quality of learning. - All those tools and processes that are realized with the use of IT and not, to deliver and distribute learning through education and training programs.	EC, 2001 Esposito and Mantese, 2003

Source: Adapted by Sangrà et al. (2012)

Some universities offer courses via the web not only to students enrolled at the university, but also to other parties, non-members, free of charge. These types of free online courses that are offered by the universities are known as Massive Open Online Courses “MOOCs”. MOOCs are, in fact, online courses open to all without restrictions (free of charge and without a frequency limit), usually structured on a set of learning objectives (EC, 2014). A MOOC is an online course with the possibility of free and open registration (McAuley et al., 2010), from any geographical location and

without the need to meet the formal entry requirements (Sinclair et al., 2015). Course participants form a learning network and support the knowledge that is provided not only by experts, but also by all the supporting members of the same community.

3 Methodology

The survey was implemented through the acquisition of documentary information found on the internet, (Corbetta, 2014). Were taken into consideration the activities carried out by different universities through the analysis of their websites. It was adopted this method, compared to others, since it was considered more convenient, in order to obtain quantitative data on European universities in a short time.

The investigation, in particular, was carried out by examining the websites of the top 100 European universities in a ranking, which allows you to collect data on universities by region. An international ranking was used called Quacquarelli Symonds, better known as the QS World University Rankings 2015/16. This ranking detects the first 800 universities worldwide that have distinguished themselves in four areas: research, teaching, employability and internationalization (ANVUR, 2014).

For every university it has been given a final score, based on detection of six indicators related to performance. (1) The first indicator is the academic reputation, which is measured through a survey in which academics are invited to identify the institutions in which it is carried out for the best job in their field of expertise. (2) The reputation of the employer is based on a survey in which it asks for employers to identify the universities that are able to offer a better preparation. (3) The student ratio and faculty determines the number of academic staff employed compared to the number of enrolled students. (4)The citations per faculty aim to assess the impact of the research in universities and collect information using Scopus, the largest database in the world of abstracts and research citations. Must be counted, finally, (5) the proportion of international faculty and (6) proportion of international students that indicate the number of teachers or existing international students in the universities.

The specific ranking, which was used for this study focused only and exclusively the top 100 universities, found by geographic area, by including in the website drop-down list „QS World University ranking 2015/16“ the word „Europe“. It was selected this ranking than others, because it allowed to perform, in a simple, research of universities by region. The method used to collect the data was marked by the creation of a specific database in which are inserted, for each university, different information i.e. those relating to the status (public/private), size, age, number of

enrolled students and references on websites. In this Excel spreadsheet was also taken into account the type of educational offer provided by each university, with special reference to the training practices through technology platforms, with the delivery of online courses and courses open to all.

The research, in particular, made it possible to check for every single university in the presence of their website of appropriate e-learning platforms. The survey was carried out by placing on the homepage of each university in the box „find" keywords: „E-learning"; „MOOCs"; „Online Courses" and „Distance Education".

4 Results and Discussions

The analysis of the results, through the Excel spreadsheet, has identified the presence in the sample of the study of the elements referred to: status; size; age of each university, the number of enrolled students; references to websites.

In reference to the status of the universities, it has emerged presence of No. 97 public universities and only No. 03 private universities which are respectively (Ecole Normale Supérieure-Paris; Chalmers University of Technology, Universitè Catholique de Louvain „UCL").

In reference to the size of the universities, the data collected have identified universities: extra-large, large, medium and small. (See table 2). No. 24 universities are extra-large with more than 30,000 students. No. 58 universities are large with fewer than 30,000 students. No. 14 University are medium and have less than 12,000 students enrolled. No. 04 are small universities with less than 5,000 students.

The universities that have less than 50 years of history are No. 05; No. 14 universities have less than 100 years; the rest of the universities, namely No. 81 universities, have over 100 years of history. (See table 3).

The analysis of the number of students within the 100 universities, showed that the University of Geneva has the fewest students enrolled (1,413). La Sapienza University of Rome has the largest number of students enrolled (115,304).

The 100 universities, according to the country of origin, are distinguished: No. 30 universities are in the United Kingdom; No. 14 are German; No. 12 of the Netherlands; No. 08 is the Swiss Confederation; No. 07 France; No. 05 Belgium and Sweden; No. 04 Spain; No. 03 Denmark and Italy; No. 02 Austria, Finland, Ireland and Norway; No. 01 Russia. (See Figure 1).

The study of the websites of 100 European universities present in the ranking it shows that training is provided not only in the classroom, but also with a variety of courses implemented through e-learning. These online courses are not intended only to students enrolled at the university, but also extended to other entities not registered, free of charge. The survey, currently, is the first step of a larger project. From the results of this first phase, it has emerged that European universities surveyed providing training not only through classroom lectures, but also with a variety of courses that are required by the web (E-learning) also in a free (MOOCs). The educational activities are provided at distance: with access restricted to members only (32%); with free access through MOOCs (22%); mode is reserved is free (46%)

The e-learning services provided by European universities are available and can be accessed by anyone through websites (62%). The remaining 38% of e-learning services are not available to everyone on the website of the universities and therefore must register to be able to consult their e-learning courses offered.

They have been selected, in this ranking, No. 06 European universities that adopt courses through e-learning, to examine the contents of the respective sites e-learning. It is possible to supply, currently, the data of No. 02 universities (Technische Universität Dresden "TU" and Ecole Normale Superieure-Paris "ENS") which were chosen for two criteria: university that belong to the European Union and different in size.

TU of Dresden is a public university, is among the extra-large universities, according to the ranking Qs, it has a number of students amounted to 36,284. This university has a website for managing courses through e-learning through the learning platform called OPAL (Online Platform for Academic Learning and Teaching) in which students and teachers can access by registering. This website provides manuals and other useful information, both for students and for academics, in order to easily use the service. The list of courses offered by e-learning, is not freely available, but it is only available to registered users on the platform.

The Ecole Normale Supérieure-Paris „ENS" is a private university, has only No. 2,166 enrolled students and is among the smaller universities, according to the QS ranking. The ENS offers MOOCs courses through the platform called Coursera. It has a website where they are exposed all the courses that can be followed for free, all the information on these courses, programs of study and the names of teachers who hold them.

The study of methodology that was used, through the analysis of the websites of the universities, has the advantage of analysing the universities according to a predetermined parameter in the ranking „QS Rankings 2015/16“. This criterion has allowed to obtain the objectives and results devoid of evaluation subjective in analysis and in the choice of universities.

5 Conclusions

This research has allowed us to observe in a short time, through websites, the number of universities that adopt the e-learning platforms. The exploration, however, at present, has revealed, through the construction of a specific database, the presence in 100 universities in e-learning platforms that offer courses not only to enrolled students, but also for students not enrolled (MOOCs). The survey, at the same time, it does not have, in this phase, data from interviews to insiders, to understand how e-learning takes place in some universities selected in the same ranking.

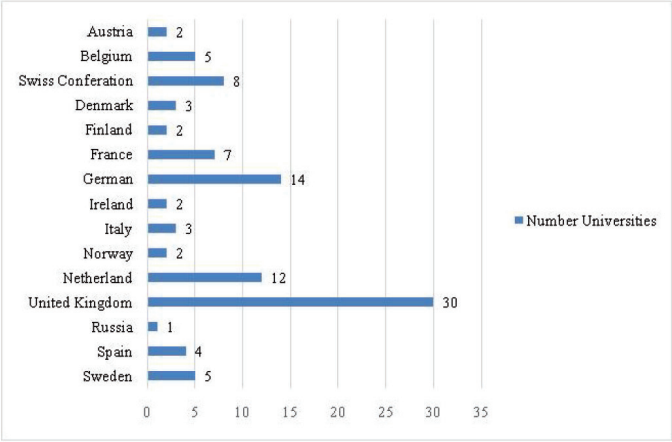

Figure 1: Number of Universities by country.

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Visual Knowledge Media

Generating implications for design in practice: How different stimuli are retrieved and transformed to generate ideas

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Abstract
Design idea generation is a significant part of a designer's work and most frequently associated with creative problem solving. However, an outstanding challenge in design is translating empirical findings into ideas or knowledge that inform design, also known as generating implications for design. Though great efforts have been made to bridge this gap, there is still no overall consensus on how best to incorporate fieldwork data into the design idea generation process. The generation of design ideas is a process that is rooted in individual knowledge and is often considered a precedent-based type of reasoning, where knowledge is continuously transformed to produce new knowledge and this creative leap across the divide is very difficult. And it is believed that designers could potentially benefit from external stimuli that would provide a starting point or trigger and make the ideas generation more efficient. Most researchers have examined when and what type of stimuli designers used to support design idea generation. Nevertheless, it is still not clear how the different types of stimuli are retrieved and transformed during idea generation phases, and the knowledge transformation during this phases need to be clarified. In order to resolve this issue I conduct an open-ended semi-structured qualitative interview to learn about student and professional designers' knowledge on how they select stimuli and transform it into design ideas, then compare with professor's opinions. The interview would be conducted in terms of one-on-one face to face or online interview depending on the availability and accessibility of the interview respondents which would be audio recorded. Knowing more about how different designers, especially professional designers, to retrieve and transform preferred stimuli into ideas, and the design thinking involved in the process, is a significant step towards investigating the influence of stimuli during idea generation. Ultimately, I intend to build a general mechanism for designers to conduct an appropriate selection of functionally useful stimuli to transfer empirical findings to knowledge that inform design. The results try to help professional designers get more scientific structure, give student designers

more practical guidance, but also help design education refine design idea generation methods and improve resulting techniques to discover a dynamic balance among theory and practice.

Keywords – stimuli for design, design idea generation, empirical findings, implication for design, student and professional designer

Paper type – Academic Research Paper

1 Gap between empirical research and design ideas generation

From the point view of Tim Brown (2009), CEO of IDEO, design projects normally develops through three stages: inspiration, ideation and implementation. Inspiration means gathering insights from every possible source and identifying an opportunity, whereas ideation translates insights into ideas and conceive general solutions. The function of research in the design idea generation process, which is from "inspiration" to "ideation", is to ensure the evidence and insight obtained enables the designer to answer the initial question as unambiguously as possible (De Vaus, 2001). This ultimately affects the design process because it helps define the challenge, and the way problems are solved (Singer, 2003). Within the design thinking tradition, it is the designer who generates, selects, tests, and refines ideas as a means to refine the design problem and arrive at an effective solution. Thus, it is important for designers to understand how they influence this process via generating a creative and innovative design idea (Gonçalves & etl, 2014). This is crucial as design idea generation is the activity most frequently associated with creative problem solving. As the ideas generated in this stage are used throughout the creative process, taking the idea generation phase seriously is central to the success of the creative problem solving process (Herring & etl, 2009).

Nevertheless, an outstanding challenge at the beginning stage of design process is translating empirical findings into ideas or knowledge that inform design, also known as generating implications for design (Meneweger & etl, 2012; Obrist & etl, 2012; Crabtree & Rodden, 2002). The challenge has led to a perceived gap between empirical studies and design idea generation (Paay, 2008). This creative leap across the divide is very difficult, and more structured methods are needed to guide the process of envisioning design from fieldwork outputs. Generating meaningful and actionable implications from empirical research is a significant part of a designer's work in the design process. However there is still no overall consensus on how best to incorporate the results of fieldwork data into the design idea generation processes. Despite many research efforts, bridging the gap between fieldwork data and design idea generation still remains a matter of concern to designers today (Diggins & Tolmie, 2003).

2 Sources and types of design implications from empirical findings

Implications for design are a specific type of design knowledge for which prior work has referenced two contrasting sources from empirical findings: fieldwork-, design practice-, (Sas & etl, 2014). These two sources and their specific types of design knowledge are reviewed below to acknowledge the unique value of each of these two sources.

2.1 Fieldwork-informed design implication

2.1.1 Requirements

Requirement gathering is a common method for generating design knowledge, but critiqued for its lack of capturing the richness of social settings (Crabtree & Rodden, 2002). Requirements result from fieldwork in order to support a situated design in a specific setting. It captures product goals that lead to incremental improvements to existing products and inspirations to new products in well-understood settings (Sas & etl, 2014). Overall, requirements are highly prescriptive and implementable but are difficult to generalize beyond the investigated settings.

2.1.2 Thick Descriptions

As its core, ethnography studies human behavior and their culture: how people experience and make sense of what they themselves and others do in specific social settings (Masten & Plowman, 2003). They address the limitations of requirements gathering methods and are typically used in settings where complex social factors exist. These methods representatively use analytic approach that generates rich descriptions of social settings.

2.1.3 Scenarios

Scenarios capture narratives describing users' activities in terms of product goals, and users' context of activity. They are described from the perspectives of users and tend to be highly situated (Guren, 2000). To review a design in a systematic way, it is better to put it into an actual scenario rather than independently analyzing its different factors. The scenario-based design can support the characterization of users behavior and use the information for design (Kusano & etl, 2013), but also an application of the visual dialog to envision of conceptual models or as an effective tool to formulate uncertainty.

2.2 Design practice-informed design implication

A typical approach to generating design heuristics is to critically analyze the successful product and design process in practice. Design heuristics are design-oriented rules of thumb to guide practical product design. They are usually derived from designers' expertise and reflections on successful prior practice of product design (Dix & etl,

2004). The objectives of design heuristics are to improve specific product rather than to design new product and they are typically generative knowledge in interaction design, e.g. Nielsen's principle of "minimalist design" and "visibility of system design". Additionally, a profound thinking would be highly needed regarding how and to what extent the design heuristics could be applied in the intended product design in practice.

After reviewing the prior work of the sources and types of design implications, it was found that they have a respectively different scope of application along with various advantages and disadvantages in different settings. It is valuable to know how to make good use of them and to put this design knowledge into practice to generate design ideas. Before that, it is essential to know about what is the current state of research in design idea generation area.

3 The current state of research about design idea generation

Regarding the current state of research in design idea generation, I can see that varying papers focus on different aspects of design ideas generation. Some discussed the idea generation in different professional areas such as interaction design, fashion design, architectural design, game design and mechanical design and so on (Sas & etl., 2014; Hagen, 2009). Meanwhile, other discussed different types of design implications that identify a broader range than previously described, and then proceed the roles and types of design implications (Sas & etl., 2014). Some other researches discuss when inspiration and design ideas emerge (Cross, 2011), who thought that the inspiration comes when hard work sessions are alternated with periods of mental relaxation. Rapanta and Cantoni (2014) identified the end users as the primary trigger for design idea generation, aiming at showing how to plan for reducing the design problem complexity by empathizing with users. Some other studies showed the influence factors during generation of design ideas, such as how student designers tend to use reflection to reconstruct experiences relating to the generation of design ideas (Hutchinson & Tracy, 2015). Furthermore, there is also research focusing on what stimuli trigger the awareness or formation of design ideas, which would be discussed as follows.

4 What external stimuli are used during design idea generation

The generation of design idea is a process that is rooted in individual knowledge and is often considered a precedent-based type of reasoning, where knowledge is continuously transformed to produce new knowledge (Gonçalves & etl, 2014). During idea generation, designers use their background experience, skills, as well as different types of external stimuli in their surroundings include pictorial, verbal, audible or tangible stimuli. Designers have defined inspiration in design as a process

that can integrate the use of any entity in any form that elicits that formation of creative solutions for existing problems (Eckert & etl, 2000). However, the overwhelming amount of possible stimuli a designer could use adds to the complexity in understanding how inspiration influences the outcome of a solution. Presently, there are some articles about different types of stimuli designers reportedly prefer to generate design ideas.

Research has shown that designers have a preference for visual stimuli (e.g. Gonçalves, 2014; Malaga, 2000), which provide straightforward and intuitive cues that do not require translation between different perceptual modalities. Visual stimuli is one of the most important instruments to stimulate knowledge building, and the enrichment of reasoning and idea forming (Cross, 2011). Visual stimuli is a significant way for designers to acquire a deep understanding of a problem and to explore the board space of design solutions (Meyer, 2013). There are several common visual stimuli including sketching (Chansri & Koomsap, 2014), collages (Saunders, 2009; Mckay, 2006), prototypes (Gerber, 2012) and storytelling (Quesenbery & Brooks, 2008), which the designers usually use to explore and inspire during the idea generation process.

4.1 Sketching

Sketching has been introduced to support creativity in idea generation process, a natural and intuitive visual procedure to demonstrate empirical findings, initial idea expression or capture relations to pre-given requirements. Sketches help designers generate ideas (Pan & etl, 2013) by helping to refine creative concepts. This echo Remko's statement showing that the function of sketching is to support a re-interpretive cycle in the individual thinking process or to enhance the access to earlier ideas. Besides the immediacy and flexibility of traditional sketching (Chansri & Koomsap, 2014), which allows controlled vagueness and natural interaction, the emerging digital sketching tools have advantages in following ways: mix aspects of sketching and full annotation are supported, they are portable and easily navigable, and the allowance of duplication and transfers between different tool-environments, the ability to work on more details and try different effects easily, but with less room for imagination and creativity as paper sketching.

4.2 Collages

Collage is a technique of an art production, where the artwork is made from an assemblage of different materials (e.g. magazine clippings, handmade papers, photographs) thus creating a new whole (Saunders, 2009). It has more recently been used by designers to investigate feelings and emotions of users to capture or test their initial ideas. The use of consumer collages help designer to identify emotions and experiences of participants. This statement was supported by Mckay (2006) who

pointed out that the use of collage help to elicit requirements. Collage when used as a tool support potential end-users expression of impression, understanding, and emotions regarding a product which otherwise have been inaccessible to a designer. Collages can overcome the verbal communication issues of articulation and verbosity, but also limit the problems of disclosure reluctance in order to increase trustworthiness of the empirical finding and idea analysis (Saunders, 2009).

4.3 Prototypes

A Prototype is an early sample or model built to generate design ideas. Brown (2009) stated that prototyping is always inspirational because it inspires new ideas. Prototyping intends to find the manifestation in its most economic form, and will filter the qualities in which the designer is interested without distorting the understanding of the whole. The rapid visualization of multiple ideas through low-fidelity prototyping allows designers to reframe failure as an opportunity for generating and improving (Gerber, 2012). Most research regarding prototypes have centered on evaluation functions rather than support of design ideas exploration (Pniewska & etl, 2013)---the generative role in enabling designers to reflect on their design activities in exploring ideas. However, by way of working with prototypes, designers can identify design opportunities, and explore other design alternatives, that is, “learning by doing” and actively searching and experimenting any possible solutions.

4.4 Storyboard

Storyboard is another popular visualized technique for designers to generate design implications and verify design ideas. Combining aspects of imaging, graphics and scientific visualization, as well as information technology, the designer is faced to solve real-world problems and make these comprehensible for human perception with the help of storyboard. Storyboards not only help designers to explain the research and demonstrate the design ideas (Quesenbery & Brooks, 2008), but are also used to create compelling experiences that build human connections. Additionally, as indicated by Robert and Jock, storyboards are important to generate design ideas in many collaborative scenarios such as when working as a design team. Moreover, storyboards offer a way for designers to really understand the audience that they are creating it for, therefore they are able to get more specific design ideas. Storyboards allow for the most complex of ideas to be effectively conveyed inside the design team or to a variety of people. This designed product can then offer meaning and emotion for its users.

4.5 Other kinds of stimuli

The results showed that the designers seem to give an exaggerated importance to a restricted number of stimuli, such as the visual stimuli mentioned above, when they could alternatively take advantage of other available resources. There is also research indicating the positive influence of using text stimuli (Goldschmidt & Sever, 2010), object stimuli (Gonçalves and etl, 2014), and verbal or conversational stimuli (Salter & Gann, 2003) during design idea generation. In a word, through the review of the various external stimuli, it is believed that designers could potentially benefit from exposure to external stimuli which would provide a starting point or trigger and make the idea generation more efficient. Most researchers have examined when and what type of stimuli designers might be using to support design idea generation (Gonçalves & etl, 2014). Nevertheless, it is still not clear about how the different types of stimuli are retrieved and transformed during idea generation phases. The knowledge transformation between designers preferred stimuli and design idea generation need to be clarified so that designers know how to make use of stimuli to generate innovative design ideas more effectively. It is significant to consider the value of widening the search for different stimuli typologies and representation modalities as cues to creative problem solving.

5 Compare the situation between student and professional designers

The external stimuli frequently used by the designers do not only rely on their individual culture, but also on their professional backgrounds. Expert and novice designers tend to categorize information in different ways: novice designers organize information according to more superficial characteristics, whereas experienced designers are able to analyze information on the basis of many cases of solution principles they have stored in the past (Gonçalves, 2014). It is imperative for novice designers to take the time to learn from professional designers and develop their own methods and codify them into reproducible processes and artifacts (Shedroff, 2003). Further effort would be made to have a comprehensive and holistic understanding about how different designers utilize specific stimuli to generate design ideas, which include the student and professional designers in my case, as it offer a wide variety of resources that help designers, especially student designers, reach beyond the constraints of their individual world-view and into a new world of choice and diversity (Ireland, 2003).

As one of the great designers of product development methodology and practice, Pugh's concern was that the academic teaching of design was aloof from industrial practice, while industrial practice suffered from the lack of reflective structuring and refining theories that can be achieved in the university (Daniel, 2002; Pugh & Clausing, 1996). Previous research conducted in different disciplines compared what stimuli was choose in regard to ideation between student and professional designers,

but so far less studies have explicitly addressed how such stimuli are used during ideation (Gonçalves, & etl., 2014). In addition, most education programs stop short by focusing on the development of specific knowledge and skills without addressing the concurrent transformation and design thinking during the idea generation process (Dall'Alba, 2009). As a result, it is therefore essential to investigate how the professional and student designers use stimuli to generate design ideas in practice in comparison with what are the professors opinions in academic area. The results try to help professional designers get more scientific structure, give student designers more practical guidance in stimuli supporting the design idea generation aspect, which also helping design education refine design idea generation methods and improve resulting techniques to discover a dynamic balance among theory and practice.

6 Research questions

Therefore, it is my research topic to study how different designers preferred stimuli are selected and how they may contribute to generating design ideas and enhancing designers' creativity. The research questions are as follows:

- How do designers conduct an appropriate selection of functionally useful stimuli, amongst the overwhelming diversity of available sources?
- How different types of stimuli are transformed during design idea generation from empirical findings?
- What might be the difference between student and professional designers on their way to utilize specific stimuli during design idea generation phases?

Ultimately, through my research, I want to create an environment that helps the varying designers discover and reflect upon their own design knowledge. Knowing more about how different designers, especially professional designers, to retrieve and transform their preferred stimuli into ideas, and the design thinking involved in the process, is a significant step towards investigating the influence of stimuli during idea generation. Moreover, understanding the different approaches of student and professional designers on this matter can potentially help to investigate what novice and student designers need to learn from effectively utilizing different stimuli. In turn, this would also create effective knowledge transformation from stimuli which would support the innovative design idea generation. In summation, I intend to build a general mechanism for designers to conduct an appropriate and balanced selection of functionally useful stimuli, to transfer empirical findings to one kind of knowledge to inform design.

7 Methodology

7.1 Sampling

Essentially, all respondents should be predominantly comprised of students and professional designers, which include employee, freelancer designers and design professors. Most student designers are IF concept awarded designers. The most important evaluation criteria in IF concept design is the creative concept behind a submitted product, which usually sources from good design ideas (Goldschmidt & Tasta, 2005).

Additionally, some other professional designers are also included in my research such as outstanding designer employees and freelancers, and design school professors. The number of respondents has initially been set to 20, who come from different countries with different industrial design focus areas. At the beginning of the research, 'convenience sampling' is applied to choose the interviewee which means the participants are firstly selected on the basis of accessibility, in order to 'identify the scope, major components, and trajectory of the overall process' (Mose, 2007). This initial analysis of interviews would indicate 'how participants themselves partition the emerging phenomena'. Accordingly, the method of 'purposeful sampling' is then applied. This method is intended to choose the interviewee according to the way this scheme sorts the phenomenon. During the interview, I will try to explore these designers' principles of generating design ideas based on their perspectives while also investigating additional materials such as their awarded work, practical projects, visual dialog and so on.

7.2 Instrument

In order to investigate research questions, I will conduct an intensive qualitative interview to learn about student and professional designers' knowledge on how they select stimuli and transform it into design ideas. The qualitative interview has the common features of grounded theory: open-ended yet directed, shaped yet emergent, paced yet flexible (Charmaz, 2006). It was Charmaz who proposed that the combination of how the researcher constructs the questions and conducts the interview shapes how a balanced open-ended interview that focuses on significant statements can be achieved. My interview would be semi-structured which combines the structure of a set of core questions together with the freedom to follow up points as necessary (Zina, 2010). The advantage of a semi-structured interview with open-ended, non-judgmental questions is being able to come away with all the intended data but also interesting and unexpected statements and stories that emerge (Charmaz: 2006). Charmaz also stated that the combination of flexibility and control inherent in in-depth interviewing techniques fits grounded theory strategies for increasing the analytic incisiveness of the resultant analysis. The interview would ultimately be

conducted in terms of one-on-one face to face or online interviews (Skype, FaceTime, iChat and other audio tools) depending on the availability and accessibility of interview respondents. Furthermore, the interview would be audio recorded. The use of a tape recorder will allow me to give full attention to my research participants with steady eye contact while also providing detailed data when reviewing the recordings at a later time. Second time interview with Delphi method characteristics (Linstone & etl, 2002) would also be used, not only to elicit their design methods or techniques, but also to make better use of different expert opinions and let opinions react with each other when needed.

7.3 Data analysis

The audio data from interviews would be completely transcribed, thematically coded and analyzed. Firstly, Charmaz (2006) pointed out that transcribed audio or tape-recorded interviews make it easy to see when your questions do not work or forces the data, and studying the data prompts the researcher to learn nuances of his research participants' language and meaning. Subsequently, it is much easier for the researcher to define the directions where the data can take him, and learn about the participants' meanings rather than make assumptions about what they meant. Secondly, coding the data is the first step in moving beyond concrete statements to making analytical interpretations, which means "categorizing segments of data with a short name that simultaneously summarizes and accounts for each piece of data" (ibid: 2006). This way of coding show how the researcher selects, separates and sorts data to begin an analytic accounting of them. Therefore, my interview question data would be analyzed with a matrix structure. All designers would be put in a line and interview questions would be put in a column. The data could be displayed in a way of one designer to each questions, but also with formation of all designers to one question. A conceptual framework developed from prior literature provided initial classification of types of design implications and their information sources and so on. This would be further revised and refined as new codes emerged to capture specific types of implications, and additional sources and methods of generation, especially the visualization techniques. This information would then be compared with the perspectives of student and professional designers in practice along with professors in academia, and the profound causes that lead to specific phenomenon.

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Behind the data – preservation of the knowledge in CH Visualisations

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Structured Abstract
The basics of visualisations in the context of Cultural Heritage are not broadly defined. But this is the precondition to find out suitable and practical strategies to document and manage the knowledge contained therein. For this, the paper focusses the properties, potentials and typologies of Cultural Heritage visualisations related to application fields and possibilities as well as documentation strategies, creation process and methodology.

The paper starts with a theoretical overview of the properties and potential of visualisation related to the usability in the context of Cultural Heritage. On this basis the correlation between application possibilities and the three application fields - research, transfer of knowledge and preservation - will be discussed.

In a second part, the paper identifies the similarities and differences of typical working processes and methodologies by the study "Investigation of 3D modelling workflows in CH with the object of development of key concepts and definitions". This is a subproject of the project COSCH with the purpose to create a framework called COSCHKR as an international and interdisciplinary platform for state-of-the-art documentation of Cultural Heritage. For this, the main topic of the study was the analysis, evaluation and comparison of thirty different 3D projects of three institutes. It was possible to define different types of CH visualization and framework of a working process.

Third topic is the documentation and management of knowledge of such visualisation in the field of Cultural Heritage. The paper compares three current research projects and points out commons and differences of the different strategies.

At the end, a synthesis gives a first idea for common strategies and best practice guidelines of Cultural Heritage visualisation related to the process, methodology and documentation.

Purpose – Find out general strategies to document and manage knowledge

Design/methodology/approach – Based on investigation and evaluation of different projects.

Originality/value – Most of the projects are a special application for one research question, this methodology raises a common claim.

Practical implications – The outcomes of the investigation is a basis for further practical applications with a high range of usability.

Keywords – Best-practice-strategies, Documentation, Cultural Heritage, Knowledge

Paper type – Academic Research Paper

1 Introduction

Three-dimensional computer models as digital reconstructions have been at the interface of architecture, archaeology and the history of art and building for about 25 years. There they have been involved in the dissemination of knowledge of complex research topics to a broader audience (Frings, 2001). The history of the models lies primarily in their original application context - the dissemination of knowledge. The result is thus the hitherto existent understanding of 3D-models as a tool devoted purely to visualisation, often tinged with prejudices.

The prejudices – often even academic – are demonstrated in the trend toward "high-end" presentation and the question of findings, hypothesis and scientific verifiability of results within the context of Cultural Heritage (Münster et al., 2015).

Virtual 3D-models are often used in media presentations in museums, exhibitions or also in documentary films in order to produce a space-related context for exhibits or to visualise historical events and structures. During the last decade the use of these models has been expanded to other areas of application, such as research or the preservation of cultural heritage by means further development of technical applications (Pfarr-Harfst, 2014).

While in the humanities some methodological approaches and rudiments of standards have been established in various areas of digitality. They are largely lacking in the area of 3D- computer models. A reaction to rapid technological development and the accompanying necessary formulation and establishment of standards or guidelines for methodology and procedures had been urged even in the early years (Koob, 1995). However, to date there have been no comprehensive integration of the community nor incentives for the establishment of such basic principles and the general theoretical discussion of 3D-computer models with respect to methodology, terminology and organisation or even documentation (Münster et al., 2015, Pfarr, 2010).

2 Characteristics, Potentials and Possible Applications

2.1 Characteristics and Potentials

Firstly, comprehensive analysis and evaluation of the connections between the characteristics, potentials and possible applications of 3D-computer models in the area of CH are necessary for the development of basic principles. These specific characteristics are the starting point from which the potentials generate their use. These potentials, also on the basis of technological developments, in turn result in possibilities for use in three main fields of application – research, preservation and dissemination (Pfarr-Harfst, 2014).

Presently three properties - digitality, three-dimensionality and language of pictures - can be defined for these 3D-models.

Digitality means that the information lying behind the digital data sets is composed of strings of undamaged characters that can be disassembled or reassembled as needed. This is the basic requirement for the availability of a wide range of outputs.

Three-dimensionality constitutes space as a central theme in the culture of buildings and structural cultural heritage in its entire complexity. The interplay of space-creating elements, their ambience and the perception of space itself can become perceivable and understandable.

The language of images is universal, a language which requires no knowledge of its coding to understand it. It contrasts, for example, to technical drafts that are subject to normed coding and thus are not accessible to everyone.

The following potentials of 3D computer models result and are generated from these characteristics:

- diversity of forms of output
- illustration of complex content and spatial interrelationships
- representation of variations
- consolidation, generation, verification and dissemination of knowledge
- communication
- virtuality

These potentials manifest themselves in various application possibilities that can be transferred to the three mentioned application fields, the boundaries of which however are fluid. In the following, the potentials and examples for their application will be put into the context of intention and demand.

2.2 Potentials and applications possibilities

2.2.1 "Diversity of output forms":

The basis here is primarily the property of digitality that allows a digital data set to be displayed in any technically possible way. This ranges from dynamic or static formats of output such as film or rendering to interactive formats or augmented reality, virtual reality and 3D plots. Most have been available in the dissemination of knowledge for many years. If one transfers these application formats or potentials to the application field of research, the format of output must be adapted to the intention and adjusted to scholarly investigation. Indirectly, this implies that it is not possible to find an application for all such scholarly questions. In this case an exact analysis of the project intention and the formats of output (Sander 2014) is required to establish a best-practice strategy.

Thus, for example, simulations can place time-based events into context with the built-up environment and superimposition with real pictures can clarify spatial relationships, for instance, between hypothesis and finding. Accessible real time models can serve as virtual research environments and can be verified by means of immersive experience space concept; construction principles or construction details can be verified. The application/output as 3D Wiki can be understood as an open research model in Wikipedia format that can be enhanced and updated as a type of 3D archive system, also for the preservation of cultural heritage.

2.2.2 Clarifcation of complex spatial and/or temporal correlations.

This potential is based on three-dimensionality and the language of images. Here, as well, many application possibilities have been established.

By means of 3D-models non-visible structures are recorded, made visible and understandable and thus can contribute to finding their context, for example settlements and the development of cities. By means of integration of various original data, it could be possible to localise individual finds or objects in buildings and to draw conclusions as to position, construction or function. In virtual space it is possible to test and correct construction principles and constructive details 1:1. This also applies to the temporal components that can be directly superimposed by the spatial aspect. As a result, various construction phases and various states in the history of a building can be generated and conclusions drawn as to building history and structural changes. It is just this temporal and spatial contextualisation that offers great advantages for the dissemination and processing of research results in the museum.

2.2.3 Representation of variants

A further potential is opened up in immaterial space through digitality and the resulting research work: “representation of variants”. It is possible to verify scholarly assumptions and to compare various approaches as three-dimensional propositions or outlines. 3D-models could be used as a medium of scholarly discussion and thus reveal discrepancies and contribute to new insights.

2.2.4 Consolidation, generation, verification and dissemination of knowledge

Academically founded 3D-models rest upon a basis of knowledge that is generated from sources of various types, origins and authors. From this arises the most important group of potentials. It focuses on knowledge within digital scholarly models and concerns the consolidation, fusion, verification, generation and dissemination of knowledge.

This is particularly relevant for the application field “research”, as previous research results can be brought together and new knowledge generated. Consequently, these models reflect current scholarly discourse and constitute the basis and starting point for further research.

2.2.5 Communication, interaction and intuition coupled with virtual space

If digital scholarly models are to be understood as innovative future research methods, communication, interaction and intuition are important components. This is underscored by the great success of such technical devices as tablets and smartphones, directly based on these potentials. In industry, for example in the area of product development, such applications have already arrived and established themselves. For research application this could be a future vision of communication, the meeting of involved persons in virtual space in which problems and solutions can be discussed in three-dimensionality.
In future, this potential can, in the sense of citizen science, serve the dissemination of knowledge by enabling the participation of the public in the research process by means of virtual systems as virtual museums.

3 Challenges

This is a still very young research field that uses 3D-models in CH. It unites potentials and opportunities with numerous challenges.
In examining the challenges, one must first confront the question of the position of digital scholarly models within the scholarly landscape. Where do these models belong? To the digital humanities, architecture or computer science? Are they subordinate or do they stand for themselves.

If these 3D-models are deemed an independent typology, then it is necessary to generate an epistemology and construct a scholarly structure.
The difficulty in applying for appropriate funding is a result of the lack of positioning and theoretical substantiation, since most sponsors still regard these models as a tool exclusively for visualisation. As yet there is no common understanding in the sense of UNESCO to regard them as a disseminator of knowledge.

Certainly the complexity of the issue as a whole is one of the next challenges. Many issues have arisen from a recent survey within the current community from which topics of concentration indicating need for action were initially filtered (Münster et all, 2015).

In addition to basic research and the typification of 3D-models orientated to the type of application and intention, the topic of sustainability is currently of great interest. Preservation of knowledge, documentation, long-term accessibility or long-term archiving and publication can be classified under the concept of sustainability.

The preservation of knowledge should take place by means of suitably practicable documentation methodology similar to a drag-and-drop solution, far removed from complicated data bank systems. In addition the accessibility of data must be ensured by a suitable archiving method. Thus it is not only the archiving of digital data and the attendant guarantee of accessibility to them decades later that challenges us, but also the availability of knowledge.

That means the availability of results, that is, the models for subsequent generations of researchers. In addition the topic of resource preservation plays a large role. This, too, is a challenge. Here the focus lies on the availability and editibilty of models. However, thus far the questions are unsettled as to the missing basis with regard to methodology and the accompanying question as to verifiability of a scholarly approach to a digital academic model. Guidelines must be found that imply a sort of quality assurance that, in the so-called brave new world, models without scholarly basis can be distinguished from the academically-based so that the dissemination of false knowledge to the broad public can be prevented.

A challenge in technology certainly involves rapid development of technical systems. This holds opportunities as well as dangers. A problem of current research is that technology is more important than content. This applies to the area of dissemination, where content and didactics often lag behind technical applications. The question of additional value offered by the applied technology is always paramount.

Virtual environments certainly represent a special case in the area of challenges. Here, as well, the question of additional value must be posed. Do these research methods in virtual space really have a use and which advantage do they have as opposed to other methods? The networking of the community is also a great challenge at the national as well as international level. It must be recognised that networking advances the entire field and does not stand in the way of one's own research. Interdisciplinary discussion must be encouraged, just as the various requirements for 3D-models on the part of research must be elaborated in order to aim selectively at strategies. Subject-oriented, institutional and national boundaries must be surmounted.

4 Challenges

With all of the mentioned challenges, knowledge is the focus of digital scholarly models and its scholarly basis. This problem must be effectively solved (Mahr, 2004). Currently there is a wide range of different typologies of 3D-models in the context of cultural heritage.

All of these typologies can be summarised as a contribution to a uniform terminology under the concept "Digital Knowledge Models" and can be defined as follows.

Digital knowledge models are computer-based models of buildings, building structures or structural elements in which object-based knowledge is gathered, consolidated, compacted and visualised. The consequence of this process is the regeneration of knowledge. Thus these models effectively reflect current research and the object of future research. As such they are an innovative and future-orientated tool in the research, dissemination and preservation of building culture.

Most of these knowledge models are also to be understood as repositories of knowledge and Digitally Born Objects. They are a fusion of various types of knowledge that can be termed primary and secondary sources.

Primary sources are the results of excavations, knowledge gained from research, extracts from literature, surveys, plans etc.

Secondary sources are sketches, comparable structures and, above all, personal knowledge.

This personal knowledge is often essential for the construction and, in turn, is the result of a complex process of creation.

In the ideal case knowledge is generated during such a process. Consequently, there are three categories of knowledge:

- Knowledge within the model stored from the various sources that is transferred into three-dimensionality
- Knowledge concerning the models containing the context of the models, important background information on the project, project partners, technical systems, intention and objectives, that is, all factors directly influencing the model and the end result.
- Knowledge from the model that is regenerated from the transfer into three-dimensionality and fusing of the sources

5 Process

The existence of these various forms of knowledge follows from the process in which knowledge is fused and knowledge is newly generated. Thus they are not only bearers of knowledge, but also sources of culture and science. They are a synthesis of sources, historic and cultural context, project backgrounds and reconstruction process. Within them information is gathered, consolidated, filtered and compiled in a digital data set.

This information can then be further processed for various areas of application, which in itself illustrates the great complexity with regard to the creation process of these digital knowledge models. In the case of digital reconstruction, they are usually subject to a non-automatic modelling process, which means that such models depend upon the person processing them and his or her technical and specialist expertise.

Today, projects in a scholarly context include a number of disciplines, whose participation in a model is dependent upon other influential factors such as the idea, occasion, aim of the project, project partner and so on (Münster, 2011). There are two basic types of participation:

- Content-related participation - archaeology and the history of culture, art and architecture, building research, and at times also architecture
- Technical participation (model creation) - IT, architecture, earth and engineering sciences.

However, the boundaries here are often somewhat blurred.
The consequence of the participation of various disciplines is the use and integration of various initial data or typologies in the three-dimensional data set and the further processing of the same. Laser scanned data or results from SFM procedures are often integrated.
In a study within the context of COSCH - Action the processes of various projects were compared in order to examine the question of commonalities within the process and, in association, the definition of guidelines and strategies for quality assurance. These studies were carried out at the University of Sarajevo and King‘s College London (Pfarr-Harfst, 2015a, 2015b).

As an initial result it was possible to generate a scheme consisting of four main stages: preparation, data collection, data processing and completion
This scheme is based on a linear project sequence among the individual work packages. However, it is already evident that various typologies of 3D-models flowed into the end product.
In a second step, this scheme could be verified and supplemented through the investigation of projects at King’s College. These projects were far more complex, a combination of various typologies and methods and approaches. Here, the work

packages were no longer a linear process, but were seen as linked into a cross-over process, or were a combination of various links. However, the results of these processes, both in London and in Sarajevo, were always a digital data set.

This enabled us to filter out and recognise the commonalities. On the one hand, it was possible to confirm the project phases after my stay in London and on the other, the input-output principle. At the end of this process a digital data set is generated that decides the input for the end phase of the project, the type of presentation or the output formats. The phases are anchored in a project framework. The definition of the background of the project, the intention, underlying technology, the disciplines involved, should be made at the beginning and provide the framework for the remainder of the project. This is absolutely crucial. There must always be a milestone, a quality check at important points in the process where the output from one phase generates the input of the next one. This needs to be considered, and any necessary adjustments made.

6 Documentation

6.1 In General

The necessity for documentation is demonstrated by the highly complex process of the consolidation of heterogeneous information, data and knowledge into a digital three-dimensional data set as the basis for subsequent processing for various applications. However, the idea and the posing of the problem are not new. This is shown in four publications that deal with general challenges and in particular with the knowledge stored in these models. They call for action.

As early as 1995 in his paper “Architectura Virtualis” Prof. M. Koob drew attention to the absence of a suitable archiving system as follows:

“We research and work on the new technology, we document our knowledge with an old technology”. ”We are entering a new territory and do not yet have rules.” At the time, this was an extremely visionary way of thinking (Koob, 1995).

The next publication is from the year 2001, “The Virtue of Models – CAD and New Space in Art History”. It deals with a subject that was most controversial at the time, the question as to what these models can and should achieve (Frings, 2001).

For the first time, the London Charter of the year 2006 put the aspect of an independent typology into an international context and transferred the demands of the UNESCO Charter into the area of three-dimensional computer models in cultural heritage (Denard, 2009).

The initial ideas for courses of action are shown here in the background In five guidelines. In addition to the normal use in dissemination, research and conservation

have also been included and defined as further topics.
The Seville Charter from 2011 is based on the London Charter, but substantiates the application areas as well as current challenges and adapts them to further developments (International Forum of Virtual Archaeology, 2012). These publications are theoretical essays with a marginal practical relevance that as yet has not been established.
What could this sort of documentation look like, and what is the least it must contain in order to present the knowledge in, of and from the models?

6.2 Documentation Strategy – Four Level System

In 2010 a four-level-system had already been developed as a documentation strategy. It attempted to represent the complexity of the process (Pfarr, 2010).
Level 1 is the background for the project – that is, the knowledge of the models, project partners, intention, technology, results, etc.
Level 2 includes the project context – the knowledge that demonstrates the knowledge in the models. This involves cultural, historic and architectural backgrounds. One needs this background knowledge in order to reconstruct a building, a town.
Level 3 defines the classification of the documentation. This should be done individually, since every project has its own structure of rules.
The main focus is what is known as the level of proof – level 4 -, where both the origins and the creation process, the milestones are depicted. The starting point is the text-based construction description, an overview of the key data on the building with cross references to the so-called source and methods catalogues. In a building‘s source catalogue, the source is assigned directly to the project, and in the methods catalogue the project is assigned to the sources and the process.
This strategy was transferred to a particular 3D-model, the digital reconstruction of Xi´an.
The tomb installation consists of the entire installation and four main sections with a total of 29 individual buildings. The documentation for all of these buildings was provided at the level of proof. The buildings in each section were summarised in a building catalogue, a sort of table of contents. The catalogue contains the reference number of the building, as well as further information such as the shape of the roof and the number of floors.

The document is clearly assigned to the project in the sources catalogues. You will find the source here, along with the nomenclature and designation, information on its meaning, use and origins. The process is illustrated in the method catalogues. Input-output presentations are used to illustrate clearly the sources, the steps in the procedure and the results.

You can see how complex this type of scholarly documentation can be, and the question arises as to the absolute minimum required for the dissemination of knowledge in a museum.
The four-level-system presented here corresponds to a type of documentation strategy for the preservation of knowledge but also for the process and its confirmability.

6.3 Dohna-Schlodien – a virtual exhibition catalogue

The Dohna-Schlodien project at the TU Darmstadt ties in with an on-going project at the Herder-Institut Marburg in which the digital infrastructure WissKI SOUR was developed as a documentation tool (Kuroczynski et all, 2014). The goal of the project at the TUD is, on the one hand, the digital reconstruction of the architectural structure of the palace in East Prussia and, on the other hand, the linking of this 3D-Model and its basis to WissKI-SOUR. The digital reconstruction will be presented in the Internet as a virtual museum that, in addition to linkage with knowledge, also offers the opportunity for immersion into content as well as verification.

A further goal is the evaluation of the platform WissKI-SOUR with respect to usability in a concrete international and interdisciplinary project. The platform is based on the principles of semantic annotation and WebGL-technology. The user can annotate information according to object, person, source and process by means of four input fields. Thus the system complies with the requirements for scholarly documentation of editability, confirmability and the direct linkage of object to document. Notice that the four levels of the documentation strategy from 2010 can also be seen here.

During the course of the project it became apparent that the extensive and complex input possibilities in practice require a maximum of discipline from those involved. The information must be updated regularly. This involves additional staff including the accompanying expense. The question arises directly here as to what extent such a complex documentation system can be pegged on a long-term basis to the real practice of model creation. The establishment of such a system requires rethinking in project planning and by the sponsors; additional resources for staffing must be taken into consideration.

6.4 TOPORAZ

The current project TOPORAZ presents a further strategy in terms of linkage of knowledge and virtual research environments (VRE). Here geo-referenced 2D-data und 3D-models serve as a navigation platform to which heterogeneous research data are annotated by means of hotspots. The platform is based on open-access and accommodates the requirements of editability. Since it is a matter of VRE and not of a

documentation system for 3D-models per se, verification functions indirectly through overall linking. A direct allocation of the 3D-objekt, source and process is as yet not provided for. It remains to be seen to what extent this approach is still functional with respect to preservation, linking and verification of knowledge in the sense of usability. This must be evaluated at the end of the project.

6.5 Not yet another platform

The on-going research projects attempt to connect topics such as open access, linked data, big data, semantics and ontologies with each other. For the most part the generation of a new platform, aligned with the given project, is the result. Hence in research one speaks today of the phenomena "yet another platform", the sustainable use of which is often, due to various factors, not comprehensively secured and the editability in other projects is difficult to achieve. As already mentioned, usability plays an important role.

A fundamental and structured analysis is necessary for requirements, practical suitability, processes, participation in comparison with available technologies.

7 Conclusions

Guidelines on the basis of the process framework from the COSCH-project and the insights of the documentation strategy can contribute the first step to a practicable approach to the preservation of knowledge in CH.

Minimal guidelines to achieve knowledge preservation, quality assurance and sustainability might be:

- Determination of a project framework at the onset of a project with the definition of binding model structures, nomenclatures for model structures, nomenclatures for sources and 3D-data as well as milestones within the process.
- Inspection of output data with regard to scientific and technical quality.
- Systematisation of sources and buildings as well as generation of source catalogues.
- Archiving of the most important model state points along the defined milestones of the project framework.
- Documentation of the processes by means of documentation forms (source, work, questions, result) and storing in a simple databank system.

The necessity for the securing of knowledge, information and data in 3D-models is uncontested, as well as the achievement of long-term availability of 3D-data sets.

However, a simple way of data storage and knowledge linking must be developed that requires no great outlay for staff and other funding. A comprehensive analysis and basic scholarly groundwork, including such factors as usability and universal applicability, must be of primary importance. Only in this way is it possible to meet the expectations of London and Seville as well as those of the UNESCO Charta.

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Building a Wiki resource on digital 3D reconstruction related knowledge assets

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Structured Abstract

Purpose – While single theoretical approaches related to visual humanities research and in particular digital 3D reconstruction – as the virtual, interpretative 3D modeling and visualization of historical objects – are widely described in compendia like Wikipedia, and various publications discuss approaches from certain disciplinary perspectives, a comprehensive and multidisciplinary systematization is still missing. Against this background, the research activity described within this article is intended to gain a wide and multidisciplinary overview for research approaches, theories, and methods which are relevant to investigate or explain knowledge-related phenomena in the context of visual humanities research and education.

Design/methodology/approach – To meet these interests we intend to set up a Wiki resource as a structured repository. The content will be based on (a) interactive workshops held at conferences to collect and structure knowledge assets on visual knowledge involving experts from different domains. Moreover, (b) a student seminar starting in early 2017 is designated to describe some typical research designs as well as amend related methods and theories in the Wiki resource based on Wikipedia articles. A content structuring principle for the Wiki resource follows the guidelines of Wikimedia as well as plans for the results to be populated again in Wikipedia.

Originality/value – While Wiki approaches are frequently used in the context of visual humanities, these resources are primarily created by experts. Furthermore, Wiki-based approaches related to visualization are often focused on a certain disciplinary context as, for example, art history. A unique aspect of the described setting is to build a Wiki on digital 3D reconstruction including expertise from different knowledge domains – i.e. on perception and cognition, didactics, information sciences, as well as computing and visual humanities. Moreover, the combination of student work and assessments by experts also provides novel insights for educational research.

Practical implications – The intended product is a comprehensive and multi-disciplinary structured repository on digital 3D reconstruction research approaches, methods, theories, publication bodies, and good practice examples. The editing of

the project results into the Wikipedia will lead to a wide dissemination and visibility of group activities and outcomes as well as enhance competencies of all contributors on collaborative work.

Keywords – wiki, visual humanities, digital 3D reconstruction, education, visual knowledge

Paper type – Academic Research Paper

1 Research question

Theoretical approaches related to visual humanities research and, in particular, digital 3D reconstruction, i.e. the virtual, interpretative 3D modeling and visualization of historical objects, are widely described in compendia like Wikipedia and discussed in numerous publications from different disciplinary perspectives. However, a comprehensive and multidisciplinary systematization of research, procedures, and formal methods, as well as basic principles, is still missing. Against this background, the research activity described within this article is intended to gain a wide and multidisciplinary overview for research approaches, theories, and methods, which are relevant to investigate or explain knowledge-related phenomena in the context of visual humanities research and education. A particular interest is to map their epistemological and methodological interconnections and to refer to related good practice examples.

1.1 Definition

Computer-based, i.e. digital, 3D reconstructions have become increasingly important for sustaining conservation, research, and broad accessibility of cultural heritage as knowledge carriers, research tools, learning materials, and means of representation over the last three decades (c.f. Favro, 2006; Greengrass and Hughes, 2008; Sanders, 2012).[1] Concerning digital 3D reconstruction, the focus of most projects is put on the creation of a spatial, temporal, and semantic virtual models. Main differences refer to the kind of object of assessment in terms of material and immaterial objects (e.g. usages or digital data). Furthermore, in regard to the question of how to proceed, the difference between (a) the reconstruction of objects which are no longer existent or which have never been realized (e.g. the current status of plans which have never been realized) and the (b) digitalization of objects which are still existent is essential (De Francesco and D'Andrea, 2008). While a digitalization describes the technological transfer of an object to a digital asset (e.g. by means of a semi-automatic modeling with the help of laser scans or photogrammetric technology), a digital 3D reconstruction process includes the necessity for human interpretation of data. This further means that digital reconstruction does not describe a type of project or object, but a particular work style (Münster, 2013).

A digital 3D reconstruction process creates 3D models from various sources - for instance, photographs and historic drawings. With regards to a function, the generated 3D models support preservation, reconstruction, documentation, research, and promotion of cultural heritage. Finally, the created virtual 3D models will be presented to an audience as visual output, which could be static images, animations, or even interactive visualizations such as computer games. An adjacent phenomenon is that digital reconstruction projects require skills to cope with both highly specialized and complex software as well as humanities interpretation. For this reason, most projects are addressed in the scope of cross-disciplinary projects (Münster, 2016).

1.2 Discussion

There are various attempts to evaluate, to quantify, as well as to qualify a state of usage of digital 3D reconstruction and visualization for particular fields of visual humanities by using social empirical methods. Most of these approaches focus on a qualitative analysis, e.g. by expert boards or surveys. The European Network of Excellence in Open Cultural Heritage (2004-2008) employed focus group discussions to evaluate a current state as well as perspectives on digital 3D techniques in Cultural Heritage studies (Arnold and Geser, 2008). The German Workgroup on Digital Reconstruction (Arbeitsgruppe Digitale Rekonstruktion des DHd e.V.) used similar instruments to investigate ongoing research challenges specifically for digital 3D reconstruction in Germany (Münster et al., 2015). While qualitative approaches are appropriate to identify and explain (Dilthey, 1970) phenomena in terms of evolutions, current states, and perspectives, they show only limited usefulness for quantifying uncovered phenomena or investigating scientific structures. The Visualisation in Archaeology (VIA) project organized a series of workshops and questionnaire-based surveys to investigate a situation specifically on visualization in archaeology in the UK (Gibbons, 2012). Since 2012 the Enumerate project has performed a bi-annual monitoring of digitization activities of Cultural Heritage institutions within the EU area – primarily focusing on museums and archives (Stroeker and Vogels, 2012, 2014).

According to research on methodologies, investigations on methods in digital 3D reconstruction and more generally digital humanities, as the use of digital methods to answer humanities research questions (c.f. Schreibman, Siemens, and Unsworth, 2004), are widely driven by researchers originating in humanities and methodically mostly focus on exemplification and problematization within a certain disciplinary context. With regards to the use of digital methods in art history, Drucker (2013) sketches a historical evolution as well as a current state of application of digital methods in humanities. Complementary, Kohle (2013) defined fields of supplementation by digital tools and practices in art history and Heusinger (1989)

for a general visual humanities research process. Similarly, many texts describe a comprehensive state of the art as well as methodologies for digital archaeology (e.g. Evans and Daly, 2006; Frischer and Dakouri-Hild, 2008; Kansa, Kansa, and Watrall, 2011). Furthermore, there are many standards and guidelines as well as rules defined and discussed for dealing with historical content (Beacham, Denard, and Niccolucci, 2006; Bendicho, 2011; Kiouss, Karoglou, Labropoulos, Moropoulou, and Zarnic, 2011; Pfarr, 2009; Sürül, Özen, and Tutkun, 2003). An adjacent question is for a general workflow modeling of archaeological reasoning. Against this background, Barceló (2010) discusses various approaches for computable reasoning and artificial intelligence to support archaeological reasoning. Moreover, there exist some meta-reviews on similar aspects in museology (e.g. Huvila, 2014; Romanelli, 2015). Some further elaborated methodological overviews are available for adjacent disciplines, such as game research (Lankoski and Björk, 2015), editorial studies (Sahle, 2013a, 2013b, 2013c), as well as graphic design (Noble and Bestley, 2014). In contrast to philosophical approaches, there is little empirical research on practices and users of digital 3D reconstruction (c.f. Huvila, 2014). Huvila (2006, 2010) investigated user roles and practices in archaeology as well as certain practices within the ongoing Archaeological Information in the Digital Society (ARKDIS) project. Another empirical perspective is the research on usability and requirements for software design for humanities researchers which was investigated within the Virtual Environments for Research in Archaeology (VERA) project (Fisher, Terras, and Warwick, 2009; Warwick, 2012).

Against the background of these activities and according to our interest in creating a knowledge body on digital 3D reconstruction, Wiki repositories are well-known and established approaches to build collaborative electronic knowledge repositories. Wikis are "World Wide Web (WWW) site[s] that can be modified or contributed to by users" (Dennis, 2014) via a web browser. The use of Wikis as knowledge compendium in education and research has been widely practiced and discussed in literature (e.g. IT-User Services, 2008; Konieczny, 2007; Lundin, 2008; Parker and Chao, 2007). With regards to digital humanities and, in particular, archaeology, they have been used especially to collect and manage knowledge around certain Cultural Heritage objects (Chudyk, Müller, Uhler, and Würriehausen, 2013; Henze, Lehmann, and Fischer-Genz, 2005; Khazraee, Malek, and Forghani, 2008; Kondo et al., 2011; Mantegari, Cattani, Marinis, and Vizzari, 2006; Parcero-Oubiña, 2012; Vernicos et al., 2004). Moreover, they have been discussed as a general approach for knowledge organization (Artese and Gagliardi, 2012; Fazal, 2008; Huvila, 2011; Johnson, 2008). A good-practice example from the field of art history is the Wiki resource on digital art history, which was created by the German task group on digital art history (Arbeitskreis Digitale Kunstgeschichte). A major obstacle for collaborative Wikis is

to develop, communicate, and keep a consistent structure of contained information as well as articles (Huvila, 2011). In large-scale Wiki repositories like Wikipedia, articles follow specific structuring rules and use specific vocabularies according to subjects, areas, and topics (Gerlach and Altmann, 2014). Against this background, the Wiki Education Foundation offers various principles for structuring and quality control in Wiki resources (Wiki Education Foundation, n.a.-a) as well as suggestions for designing and performing academic projects (Wiki Education Foundation, n.a.-b).

2 Research design

With regards to design of the proposed research activity, (1) initially a structuring blueprint was developed and tested in April 2016 involving members of our departments. As an ongoing task, (2) interactive workshops will be held at conferences, as for example the IFKAD 2016, to collect and structure knowledge assets on visual knowledge involving experts from different domains. While these activities lead to a structured overview about typical research designs in digital visual humanities, a future step will be (3) to describe methodologies to make these adoptable for scholars. For thus, a student seminar starting in early 2017 is designated to describe some typical research designs as well as amend related methods and theories in the Wiki resource based on Wikipedia articles.

Figure 1: Clustering of terms (yellow: research interests, green: procedures, red: formal methods, white: basic principles, blue and orange: categorization of terminology)

2.1 Expert workshops

Starting from the previously mentioned recommendations for knowledge organization via Wikis, a preparing task is to develop a workshop layout for enquiring about expert opinions via semi-structured questionnaires and group discussions (Lamnek, 2005). A general function of these workshops will be:

- Identification of a scope of research interests and questions in the field of digital 3D reconstruction
- Provide a scheme of related research methodologies
- Provision of related state-of-the-art literature and good practice examples
- Against this background we developed an initial workshop design (c.f. Table 1).

Table 1: Initial expert workshop design

Part	Method	Questions / procedures
1. Naming of research interests or research questions in digital 3D reconstruction	Capture on a pre-structured worksheet (used for parts 1-3, max 3 minutes)	Question: What is your most important research interest or research question in digital 3D reconstruction?
2. Structured description of associated research methodologies	Bilateral interviews (Role change after 5 minutes)	Questions: - What are outcomes / additional values of that research (e.g. overview of significant actors, functional prototype, distribution function; max. 1 item like word, phrase, sentence)? - How did you proceed (max. 3 items)? - Which methods did you employ (max 2 items)? - Your data, sources (max. 3 answers)? - Your theoretical background (max. 3 answers)?
3. Referencing	Capture on a pre-structured worksheet (max. 3 minutes)	- Which literature describes your research activity (max. 3 answers)? - Which literature describes related theoretical background (max. 3 answers)? - Which literature describes employed methods (max. 3 answers)?
4. Structuring of research designs	Group discussion, comprehensive mind map	- Clustering of research designs (Group discussion, arrangement on a flipchart, max. 5 minutes) - Selection of one prototypical question per cluster (max. 2 minutes)

A pilot study to assess feasibility and improve quality as well as efficiency was conducted at Julius-Maximilians-Universität Würzburg with six researchers from the chair for Human-Computer Interaction. After introducing the procedure of the study as shown in Table 1, structured questionnaires were handed out. The participants then continued to note research interests, structured descriptions of methodologies, and

references without interference from the instructor. In a group discussion, research interests, methods, procedures, and theory were then categorized and clustered to create the schema shown in Figure 1.

As a general implication from that pilot study, several participants reported that availability of the questionnaire prior to the study would have enhanced the quality of their answers, in particular with respect to formal research methods, basic principles and references.

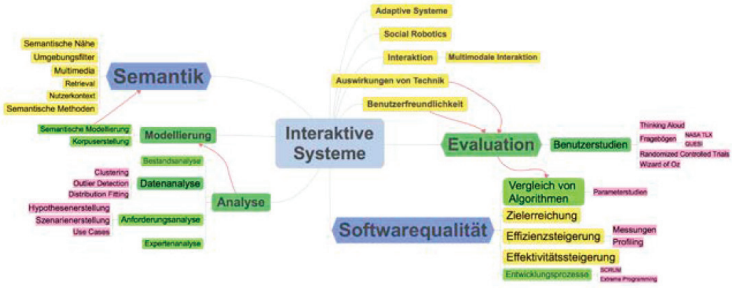

Figure 2: Final mind map created in the pilot study

It was noted that five minutes was too short to perform bilateral interviews in Part 2 of the study. Furthermore, when trying to structure research designs during Part 4, it became clear that degree of detail as well as formalization of answers to questions in Part 1–3 were not homogenous between the participants. An additional, time-consuming unification of terminology was then performed in a group discussion prior to clustering and categorization of the resulting abstract concepts. During wrap-up of the workshop, a mind map showing relations between the identified and clustered concepts was created by the organizer of the study (c.f. Figure 2). Conclusions from the pilot study were used to create an amended study design for the workshop (c.f. Table 2).

To stay within the proposed time frame, it was decided to hand out the questionnaires in advance to enable the participants to perform a structured description of their research themselves in the first part of the study. The second part then is adapted to formalize the research interests, methods, and principles by working out key words in bilateral interviews with another researcher. A collaborative clustering of research designs is then to be performed interactively on a flip chart.

In a next step the presented scheme will be employed to perform short workshops at IFKAD 2016 as well as the ARKDIS conference in June 2016.

2.2 Student Seminar

While these workshops are proposed to generate a structured overview about typical research designs in digital visual humanities, a future task will be to describe related methodologies to make these adoptable for scholars in digital humanities and, in particular, digital 3D reconstruction. Against this background, a student seminar starting in early 2017 is designated to describe some typical research designs on digital 3D reconstruction aspects within a Wiki resource. Even if using a separate, self-managed Wiki system to meet legal and practical requirements, we intend to follow both the structuring and quality principles of the English Wikipedia (Wiki Education Foundation, n.a.-a) as well as the Wiki Education Foundation suggestions for designing and performing academic projects (Wiki Education Foundation, n.a.-b). Moreover, comprised descriptions of related methods and theories are proposed to be based on Wikipedia articles, but being amended to the specific needs for research description. The intended product from this research activity is a comprehensive and multi-disciplinary structured repository on digital 3D reconstruction research approaches, methods, theories, publication bodies, and good practice examples. As a structuring approach, a decision tree is intended, leading from prototypical research questions to methodological options and highlighting good practice examples. This structure is intended to allow scholars in the field of digital 3D reconstruction to adopt already tested research designs in case of similar research interests. A major challenge is not only to create appropriate articles on certain topics, but to classify, structure, and interconnect these knowledge assets properly and make information findable and browsable in an appropriate manner for an intended usage and for designated users. Against this background we intend to populate outcomes of our activities as, for example, amended versions of articles on specific methods or theories within Wikipedia again.

The editing of parts of the project results into Wikipedia will lead to a wide dissemination and visibility of group activities and outcomes as well as enhance competencies of all contributors on collaborative work (Purdy, 2009).

3 Summary

Within our article we described the general motivation as well as a tested design for a workshop which is proposed to gather a scope of research interests as well as related methodologies by querying experts. This workshop is proposed to take place at IFKAD 2016 as well as the ARKDIS conference in June 2016. Furthermore, this workshop proposes to set the cornerstone for further activities. As a future task, a student seminar which is intended to take place in summer 2017 is proposed to create a Wiki resource which provides a structured overview on research designs in digital 3D reconstruction to make them adoptable for scholars in this field of research.

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Visual media as a tool to acquire soft skills — cross-disciplinary teaching-learning project SUFUvet

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Structured Abstract

Purpose – SUFUvet is a cross-disciplinary teaching-learning project designed to adapt students' soft skills and track usability and the concrete surplus value of work techniques in the field of visual media design.

Design/methodology/approach – For SUFUvet, a collaboration between the Institute of Food Hygiene/University of Leipzig and the Media Center/Technische Universität Dresden was initiated. Bachelor students of media informatics generate 3D visualisations in the framework of SCRUM: Undergraduate veterinary students issue instructions in order to create an e-learning class. During the project, questionnaires, group discussions, and feedback methods are used to detect changes in selected soft skills.

Originality/value – This design is meant to increase knowledge and employability by adapting student's media, communication, and project management competences. Using SCRUM appears to be a new approach, not only in the field of programming, but for media production as well. Additionally, it offers an interdisciplinary work environment, which is rare but considered fruitful within university studies.

Practical implications – The outcomes of the application are a 3D-visualised meat inspection e-learning class for veterinary students plus a documentation of SCRUM as a framework for visual media design. It is seen as an experiment for future applications in a variety of cross-disciplinary learning and media design cases.

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Keywords – didactical development, soft skills, cross-disciplinary e-learning, veterinary study, study of media informatics

Paper type – Method Paper / Practical Paper

1 Introduction

The demands on university education and, in particular, on the understanding of educators' and students' roles have changed remarkably over time from teacher-centered to learner-centered education and from content-based to competence-based curricula (Bergsmann et al., 2015). In addition to pure knowledge acquisition, also named hard skills, the necessity of learning so-called soft skills is attracting more and more attention from educators and students (Shakir, 2009). Students expect a "holistic development as learners and human beings" (Nikitina and Furuoka, 2012). A common definition of soft skills comprises seven categories, namely, communication skills, critical thinking and problem-solving skills, teamwork, lifelong learning and information management skills, entrepreneurship skills, ethics and professional morals, and leadership skills (Shakir, 2009). These competencies are important prerequisites for a modern, highly project-driven professional culture. Both in the study of veterinary medicine and in media informatics, the application of these skills is estimated to be very important – either in anamnesis (Byron et al., 2014; Kinnison et al., 2014) or in stakeholder communication (Itani and Srour, 2016). Nevertheless, there are currently no suitable courses available for acquiring these soft skills; any such programs are most often conducted within internships. In addition, the change of perspective and intense contemplation have a positive influence on the development of soft skills (Shelley, 2015).

Therefore, the aim of this study is to develop and train certain soft skills in a problem-based learning (PBL) scenario in which the students reflect their needs as learners and switch into the role as teachers and product owners. Since the intended outcomes are 3D visualisations and other visualisations within the framework of an e-learning course, this approach can also be known as the Learners as (Multimedia) Designers approach (Lehrer et al., 1995). Previous studies in this matter showed evidence that "(1) learners develop critical thinking skills as authors, designers, and constructors of knowledge and (2) learn more in the process than they do as the recipients of knowledge prepackaged in educational communications" (Jonassen and Reeves, 1996).

2 SCRUM as a framework for visual media design

SCRUM is "[a] framework within which people can address complex adaptive problems, while productively and creatively delivering products of the highest possible value" (Schwaber and Sutherland, 2013). Basically, SCRUM structures workflows and responsibilities throughout problem-based and goal-oriented projects. It has been used since the early 1990s (Schwaber and Sutherland, 2013) and been approved many times for software and web engineering processes (e.g. Park et al., 2016). The complexion of programming (see Figure 1) allows a cut-through of the

overall task: Created subtasks are rather independent from one another, which, therefore, leads to intermediate results that are more approachable in less time. A main aspect of SCRUM as a management and control process is teamwork and tracking work progress as well as advancements on a regular basis.

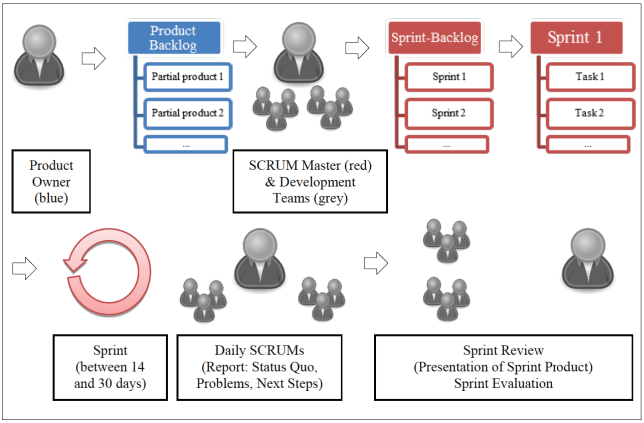

Figure 1: Regular SCRUM procedure (Schwaber and Sutherland, 2013)

Now, how can this method be applied to media design? For this project, slight modifications of the SCRUM framework have been made. This applies to both SCRUM meeting intervals plus several roles within the framework as can be seen in the following Figure 2.

One of the main challenges in using this method as a framework for this project is to split overall visualisation goal(s) into independent subtasks that can be prioritized freely by each person in a design team. Visualisation tasks, within the meaning of SCRUM, shall not consist of a single person task or dependent subtasks as it would make nonsense of design team work. If it succeeds in generating feasible product and sprint backlogs, using SCRUM has the potential to adapt students' competences such as team, planning, and communication skills. In this project, it shall be investigated how both product and sprint backlog can be successfully created within media design and if there is a surplus value of this method – in addition to the theoretical SCRUM knowledge and media engineering literacy that is supposed to be facilitated.

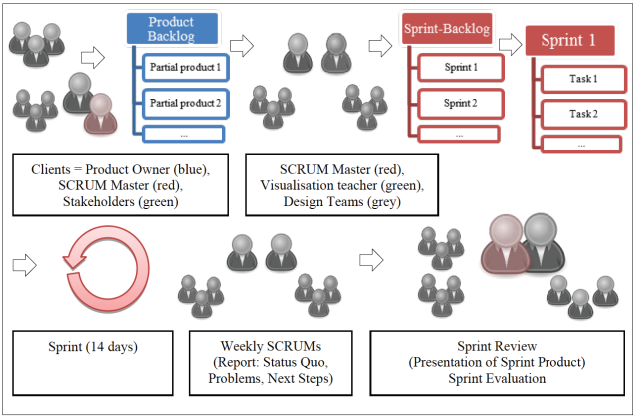

Figure 2: SCRUM alteration in the project SUFUvet

3 Cross-disciplinary educational project SUFUvet

SUFUvet is a pilot project between the Media Center/Technische Universität Dresden with students of media informatics and the Institute of Food Hygiene/University of Leipzig with undergraduate veterinary students (preclinical and clinical part). As study design, a PBL scenario was chosen, which has been shown to facilitate the development of soft skills (Riggio and Saggi, 2015). Content of this cross-disciplinary project in the joint research project "Lehrpraxis im Transfer (LiT)" is the creation of a multimedia, 3D visualised teaching-learning class about ante-mortem and post-mortem meat inspection of domestic swine.

The visualisation of carcases, offal, and gastrointestinal tracts of pigs is the link between the students of media informatics and veterinary medicine in this project. The aim of the study – to develop and train the students' soft skills – is reached by two aspects: (1) Reflecting the needs as learners and switching into the roles of teachers, product owners, or designers and (2) applying the framework of SCRUM.

Planning behaviour, personal responsibility, and ability to cooperate (translated from German: Planungsverhalten, Eigenverantwortung, Kooperationsfähigkeit) are the chosen soft skills to be evaluated. Each of them covers a different field of competency regarding the KODE®-, KODEX®-system (Erpenbeck, 2009). Planning behaviour represents a professional-/methodic competence (German: Fach- und Methodenkompetenz), personal responsibility a personal competence (German: personale Kompetenz), and the ability to cooperate a social-communicative

competence (German: sozial-kommunikative Kompetenz). Especially planning behaviour is supposed to be trained by applying the well-structured process of SCRUM. The personal responsibility of media informatics students is trained by creating the 3D models of pigs independently during the SCRUM-sprint. Concerning veterinary students, personal responsibility is trained by (1) generation of expectations for the 3D models and (2) additional videography and photography for the e-learning class. The ability to cooperate is trained by cooperative and collaborative work (1) between media informatics and veterinary students during the SCRUM-sprint planning meeting and sprint review meeting, (2) within the groups of media informatics students that work together on a 3D model, and (3) within the groups of veterinary students that plan the structure and content of the e-learning class and create the videos and pictures about meat inspection.

3.1 General structure of the project

The collaboration within SUFUvet occurs between different student groups which were asked to participate on a voluntary basis. Both groups are headed by a scientific assistant and coordinated by a graduate assistant (see Figure 3).

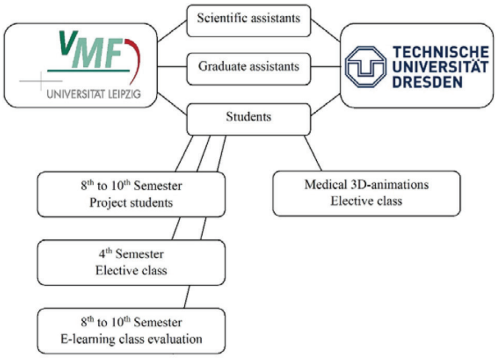

Figure 3: Structure of persons involved in the project SUFUvet

The bachelor students of media informatics take part within an elective class about medical 3D animations.

In veterinary study, students have to participate in a certain amount of elective classes too. Four veterinary students (three from the 8th and one from the 10th semesters) chose SUFUvet as a scientific student project, which has to be successfully

completed for admission to the state examination. In groups of two, they created an e-learning class about ante-mortem and post-mortem meat inspection. Their work is supplemented by contributions of 4th semester veterinary students, who take an elective class about ante-mortem or post-mortem inspection and work out basic information with the knowledge they have already achieved.

The project is completed with the support of external professionals. (1) A reflection on the learning experience and role switching of students is guided by a psychologist, who also trains them in technologies of communication and time management. (2) An external professional teaches the SCRUM concept to everyone involved. (3) The students of media informatics are introduced to a 3D animation software by an external professional. (4) The veterinary students receive further information and material from a veterinary and food control authority.

A formative assessment will take place to monitor the quality of the project, which includes periodical questionnaires and student feedback sessions. Moreover, the intelligibility of the created visual learning materials will be tested periodically by key users (Krug, 2006).

3.2 Importance of visualisation

Within SUFUvet, the relevance of visualisation becomes apparent regarding the following aspects:

(1) Visualisation in this project builds a feasible and naturally perceptible common ground for cross-disciplinary communication (Tversky, 2005). The 3D models and their visualisation are also intended to work as boundary objects within the cooperation (Star and Griesemer, 1989), e.g. for idea exchange and quality negotiation. (2) A creation of visual representations fosters an intensive understanding of the represented objects and e.g. their physical properties (Mintzberg and Westley, 2010). (3) Visual media – especially when combined with other media as dual coded assets (Paivio, 2006) – facilitate a deep understanding and learning effect for complex objects (Nelson et al., 1976, Nelson. 1979).

For veterinary students: Previous didactic research elucidated the students' preferences for mixed method learning within medical studies (Bhagat et al., 2015, Marwaha et al., 2015). Students are aware of different learning styles and try to adapt different learning strategies (Bhagat et al., 2015). Visualisations, especially by means of 3D models, may be one of those and are often described in human medical anatomy classes. Students appreciated working with this kind of visualisation and, additionally, showed an increased learning outcome afterwards (Allen et al., 2016).

Furthermore, 3D models also led to a better anatomic understanding (Pujol et al., 2016). This is also applicable to the study of veterinary medicine in general and, particularly, in post-mortem meat hygiene. The students have to examine carcases, offal, and gastrointestinal tracts and inspect the different lymph nodes (visual inspection, palpation, and incision of the lymph nodes are trained). Therefore, the enhanced visualisation which will be developed within SUFUvet is considered useful to increase the learning outcome as well.

For media informatics students: In their elective class, the development of 3D visualisations is a key for the support of several dimensions of e.g. Baacke's "Medienkompetenz" (can be translated as "media literacy", although the English term has different definitions): Firstly, students are taught what 3D models are, what types exist, and what they are used for or how they are created. This is knowledge gained about 3D visualisation ("Medienkunde"). Secondly, they are taught how these models can be created step by step in the 3D visualisation software "3dsMax". Therefore, they are given the opportunity to learn how to use this software receptively and practically ("Mediennutzung", "rezeptiv, anwendend"). Last but not least, they build their own 3D visualisations using this knowledge in a prospectively creative way ("Mediengestaltung"). (Baacke, 1999)

This supportive environment for 3D-visualisation-"Medienkompetenz" is considered valuable in combination with the opening of the medical visualisation market for future media informatics graduates.

4 Research interest I: Planned evaluation of SCRUM

A primary goal of formative assessment is "to provide feedback to teachers and students over the course of instruction" (Boston, 2002, p. 1). Generally, formative assessment practices comprise a variety of methods for a longitudinal evaluation: (1) learner driven self-assessment methods as portfolios or learning diaries (Winter, 2008), (2) group-assessments like classroom discussions, or (3) a monitoring through records or performance indicators (Lynch et al., 2004). In contrast, a summative approach is generally proposed to evaluate competencies or outcomes at a specific time and "sums up the performance or learning level of achievement" (Dumit, 2012, slide 10). Due to the periodic and intensive process documentation, SCRUM frames offer various opportunities for both formative and summative assessment. For instance, Igaki et al. (2014) conceived a ticket-driven evaluation of workflow progress and assessed the team performance of a SCRUM-based team PBL scenario in information sciences university education. Similar, Santos and Pinto (2013) practiced team performance monitoring employing SCRUM and – as a similar project management approach – Kanban within a training course in Software Engineering. From a methodological

perspective, an assessment within this latter research work took place for both content and process quality at the end of each sprint and was performed by team supervisors according to previously defined assessment guidelines. While both approaches evaluate and compare team performance, Scharf and Koch (2013) developed criteria to assess an involvement of individual students into a SCRUM-based project-based learning course. Comprehensively, the assessment model developed by Vasilevskaya et al. (2014) proposes a comprehensive evaluation scheme for SCRUM.

Table 1: Perspectives and types of assessment proposed to be used (according to Santos and Pinto, 2013; Vasilevskaya et al., 2014)

Assessment Perspectives	Formative	Summative	Instrument
Process	x	-	Moderated group discussion during retrospective
Output	-	x	Backlog analysis Guideline-based peer-review on outcomes
Performance	x	-	Teacher-based assessment Questionnaires on skill development
Client	-	x	Client feedback via questionnaire

An overall assessment within the proposed PBL course arrangements is intended to take place via combined formative and summative assessment stages. According to this scheme, assessment instruments in the context of the proposed PBL course will be (c.f. Table 1):

Process quality will be assessed at the end of each sprint within a moderated group discussion during the retrospective. Main questions which are discussed include: "(1) What was good in the iteration?, (2) What did not go well?, and (3) How can we improve?" (Vasilevskaya et al., 2014)

Performance assessment takes place at the end of each sprint via a teacher-based assessment, according to a criteria catalogue developed by Santos and Pinto (2013). Moreover, an overall competency development regarding soft skills will be examined by using questionnaires.

An Output assessment will take place via a guideline-based peer review of each team's results in the final session. Additionally, a retrospective analysis of the backlog of each project by involved teachers provides clues on the grade of objective achievement.

Client satisfaction will be summatively assessed by a guideline-based questionnaire answered by the involved veterinary medicine students in Leipzig.

5 Research interest II: Planned evaluation of skill advancement

This teaching-learning project focuses on the three soft skills "planning behaviour", "personal responsibility", and "ability to cooperate", which each concerns one core competency (Erpenbeck, 2009).

Of course, the possibilities of skill measurements are rather unsatisfactory. How would one investigate a person's competencies or his/her skill improvement? From a theoretical and pedagogical point of view, this is rather impossible. Most of all, one cannot reduce a person's competence to their answers to a series of questions (e.g. clarified by Schorb, 2014), although there are researchers who do so (e.g. Kommer 2010).

Regarding the character of being a pilot project, the authors still decide to indicate changes by the following three psychological questionnaires, which are completed by all students involved at the beginning and the end of the term. To ensure the assignability of all questionnaires and guarantee the privacy of all participants, each student signed all questionnaires with an individual, secret personal code.

1) The questionnaire testing "planning behaviour" was developed by Grob and Maag Merki (2001, pp. 513-518, pp. 528-543) and consists of 15 items with a verbalised four-step response scale. Of these 15 items, five items each measure planning strategies, elaboration strategies, and monitor behaviour compared to the aim.

2) The skill "personal responsibility" is tested by using a psychometrically proved creative common (CC BY-NC-ND 3.0) questionnaire from Bierhoff et al. (2005a). The questionnaire is accessible within the test database PSYNDEX of the Leibiz Institute for Psychology Information and consists of 18 items with a verbalised six-step response scale (Bierhoff et al., 2005b).

3) The questionnaire regarding the skill "ability to cooperate" is also developed by Grob and Maag Merki (2001, pp. 410-424). Nine items test general ability to cooperate (verbalised four-step scale), while four items focus on the cooperation experiences during the study (3 items, verbalised five-step response scale) or in general (1 item, verbalised five-step response scale). One item also questions the personal assessment of cooperation income (verbalised four-step response scale).

These questionnaires have been chosen because (1) they seemed most suitable to indicate the status of the three described skills within situations, (2) each questionnaire is short and has a comparable extent and (3) the questionnaires were tested at least in one test run. Furthermore, only tests available in German have been considered to

avoid additional bias from translation. The developers of these three questionnaires described satisfactory results for reliability, validity, and internal consistence of all used items within their original use. Regarding analysis, the developers of questionnaire 1) and 2) described the possibility to create common scores for each. The items of questionnaires 3) have to be evaluated separately. Because of the study design (e.g. lacking control group, repeated use of the same questionnaire), the results are reflected critically and only used in the matter of change indication, which can be useful for qualitative research on this topic afterwards.

6 Summary and outlook

SUFUvet is in several respects a pilot project. The collaboration and cooperation within each level (research and graduate assistants, students) and, as mentioned above, between the participating students and the assistants are an innovation. The connection between both studies is made by the PBL scenario and realised by the SCRUM framework. So far, both student groups seem motivated to work together, although the working topic (visualisation of porcine carcase, offal, and gastrointestinal tract) is unusual and may cause bias within the design teams.

Known for its usability in informatics, SCRUM in SUFUvet is tested for visual media design. The application of this framework is a novelty as well. Despite the known use in informatics, SCRUM is now adapted for visualisation design and used in a marketplace situation by the veterinary students as product owners and the media informatics students as design teams. Except for a few of the media informatics students, the students have no previous experiences in communicating and working in this manner. Therefore, the initial phase within the framework may be reflected critically.

SUFUvet offers many possibilities to train different competencies; therefore, the authors try to indicate this development by using each of the three questionnaires at the beginning and at the end of the term. The results must be interpreted carefully and should be seen as a general tendency only. However, the authors expect that the mentored independent work of the participating students will increase the mentioned soft skills.

The experiences resulting from this cross-disciplinary teaching-learning project offer impetus for further cooperation. Other approaches can be an adaption to other “product owners”, e.g. human medicine, archaeology, or further extended multimedia learning environments for veterinary students. Regarding the competences, also service-learning (Bringle and Hatcher, 1996) ought to be considered in order to enhance the training of soft skills and, thus, to improve the necessary practical, social, and teaching skills.

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Graphing Meeting Records - An Approach to Visualize Information in a Multi Meeting Context

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Structured Abstract

Purpose – Meeting notes are effective records for participants and a source of information for members who were unable to attend. They act as a reference point to decisions made, to plan next steps, and to identify and track action items. Despite the need for a multi meeting solution (Tucker and Whittaker, 05), meetings are often displayed as separated as well as descriptive documents. The aim of this work is to enhance access to overlapping meeting contents and existing coherences beyond a decoupled description. A visual representation of meeting content can lead to meeting records which are more comprehensible and more time efficient. Furthermore, it enables the depiction of knowledge that is often lost in conventional meeting records.

Approach – Our goal was to define a general structure for meeting items, integrating content categories and relations between successive meetings. In this paper, we present a model based approach to visualize meeting content as well as content relations in order to support the preparation, execution and follow-up of meetings. Due to the fact that contents of consecutive meetings refer to each other (Post et al., 04), we consider meetings as a series of events. The resulting model substantiates the transformation of content as well as content relations into a visual form.

Value – The proposed solution focuses on the model that is integrated into an interactive visualization. Thus, a novel approach to explore meeting records is provided. The model was proved to be suitable for meeting contents in various use cases. Examining the content in its visual representation across multiple consecutive meetings enhances the identification of any linked information at a glance over even long periods of time. Hence, important pieces of information will not be disregarded.

Practical implications – The approach of our multi meeting protocol application is realized as a browser-based implementation that displays data from JSON objects. With this interactive visualization, the user can browse, search, and filter meeting content and get a deeper understanding of topics, their life cycle and relations to other topics. This leads to an overall comprehension of project or business progression that

highlights topics that need to be addressed. Thus, the viewer is supported in preparing, executing, and following up meetings successfully and qualified to structure records in order to keep a clean transcript of a meeting.

Keywords – Multi Meeting, Interactive Visualization, Meeting Records, Meeting Content Relations, Topic Evolution, Meeting Model

Paper type – Practical Paper

1 Introduction

Different methods and tools exist in the field of automated meeting capturing and analysis in order to reduce loss of knowledge (Geyer et al., 05; Yu and Nakamura, 10) or structuring the captured contents for easier retrieval (Richter et al., 01). Their objective is to support carrying out tasks on a day to day basis or help making important business decisions. Conventional meeting records often exist in the form of single text documents. They are most likely stored in individual file systems as separate files, one for each meeting, without their contents explicitly or visibly referencing contents from preceding meetings. This makes it difficult for anyone to locate specific information over the course of time – even more so, when meeting participants do not know or remember the respective meetings. In the following, they do not know which files to go through to find objects of conversation or decision.

Surprisingly, only few systems provide access to contents of successive meetings. This stands in contradiction to the fact that meetings refer to each other. They should not be regarded as single, but as a series of events and thus should be viewed jointly (Post et al., 04). Tucker and Whittaker state that available meeting browsers[1] deliver a solution for this problem by providing search mechanisms for a set of meeting recordings. Yet, with the query leading to one or more single meetings that match the search criteria, the records are viewed separately again (Tucker and Whittaker, 05). Even if search mechanisms solve the problem of identifying a single relevant meeting from a series of meetings in parts, it is not yet satisfying. As a consequence, Tucker and Whittaker further express the need for a system that is able to examine decisions and other content items across a series of meetings. They predict that a "multi-meeting analysis tool" would be of great value to meeting participants. Such a system should be able to integrate multiple meetings in one view instead of displaying single meetings separately.

1 Meeting browsers are a form of user interface that supports meeting information retrieval. They can be part of a larger smart meeting environment (Yu and Nakamura, 10).

We intend to redesign the process of retrieving meeting information following these requirements by providing an interactive visualization for meeting contents and their relations across a series of meetings. This paper introduces a protocol-browser that displays multiple meetings and their coherences simultaneously, giving the viewer a powerful tool for analysing, exploring and searching information in its entirety.

State of the art meeting browsers[1] and visualization techniques for text documents are described in section 2. Subsequently, section 3 introduces a model for meeting contents and relations. It factors in user studies that we considered to be relevant for the development. In chapter 4, the concept for an interactive visualization is presented that is based on the model and the previous research. A description of benefits, followed by an outlook on future work and a summary in chapter 7, concludes the paper.

2 Related Work

We reviewed related work in three different areas: Meeting Browsers for meeting content analysis and as a state-of-the-art overview, a topic evolution model for content relation analysis, and text mining visualization techniques.

2.1 Meeting browsers

Beyond conventional meeting records in the form of text documents, meeting browsers are able to store multimodal data. This includes, for example, textual transcripts from recorded conversation, with additional information such as the speaker of a certain piece of information. On top of that, the meeting browsers “Archivus” (Lisowska et al., 05) and “TeamSpace” (Richter et al., 01) provide access to a series of meetings. Both tools store consecutive meetings and implement search mechanisms for a set of recordings as described in section 1. The tools display one meeting record at a time without explicit reference to preceding or successive meetings. However, their overall handling and classification of meeting content provides a solid basis for structuring meeting contents and the derivation of relevant interactional necessities.

2.2 Topic evolution

A wide range of tools compute topic evolution from large time based text collections using mathematical algorithms and probabilistic models (Blei and Lafferty, 06; Liu et al., 12; Gohr et al., 09; Cui et al., 11). On top of that, the text mining tool “TextFlow” (Cui et al., 11) includes a visualization for the gathered data. After extracting topics from a set of documents, their life cycles are traced and their changes are displayed along a timeline. Cui et al. further give an insight into the dynamics of the topic evolution theory. They define four major events in the “life” of a topic: topic birth, topic death, topic merging and topic splitting. The latter events concern more than

one topic at a time. Thus, relations between different pieces of time based content can be established. Their solution for illustrating the topics is based on the stream graph[2] visualization. In addition, they use glyphs to represent the events (topic birth, death, split and merge), integrating them into the stream graph at the point of time they occur.

2.3 Visualizing time-based text collections

Besides TextFlow, "Event River" (Luo et al., 12) and "StoryFlow" (Rose et al., 09) present two alternative visualization techniques that focus on topic evolution in time based text collections. They show topic relations and topic development in different ways, with the joint objective to support information retrieval and understanding. In Event River, topics emerge from real life events. They are represented as coloured bubbles. Their size correlates to their importance at the time and their colour links them to other bubbles with the same colour, forming a story in their entirety. In addition to the visual representation, the authors provide interaction mechanisms to get an overview as well as detailed information. StoryFlow is simpler in its presentation and without interactive elements. Yet, the tool covers another aspect of topic evolution that is not immanent in Event River: topic splitting and merging. This feature includes the ability to draw a link between different topics by use of plain lines, regardless of their affiliation to different stories.

3 Meeting content and relational structure

In order to create an interactive visualization for several successive meetings, the initial step was to define a general model for meeting contents and their relations across multiple meetings. In the following subsections, we describe the underlying model of the multi-meeting-protocol-browser. It consists of a content structure as well as a relational structure.

3.1 Meeting content structure

As part of the long term evaluation of the TeamSpace meeting browser, Lipford and Abowd conducted a user study. Among other things, it revealed that most meetings share a common order of events and comparable goals (Lipford and Abowd, 08). At the same time, they discovered that the contents are similar in their structure for a wide range of meetings. The results of the study further suggest that a meeting is identified primarily by the date it took place on, and that the topics discussed in a meeting are the main indicators for structuring its content. This observation is of great value to our approach, as it enables applying only one model to different kinds of meeting situations and contexts.

2 Another example for a stream graph visualization is ThemeRiver (Havre et al., 00).

Another relevant aspect for building a model was to categorize content items. Therefore, types of meeting content were considered. The review of four studies and concepts (Brandl et al., 10; Ispas et al., 10; Khan, 93; Lisowska et al., 04) that vary in purpose, but hold answers to this question, helped us to identify the following categories as most common regarding different kinds of meetings: tasks, ideas, decisions, dates and general information. The last mentioned category covers all content items that do not fit any of the other categories. In summary, the first part of the meeting structure is developed from common meetings that were subdivided into topics. Each topic contains one or more content items of different categories.

3.2 Content relations

As a next step, a specification for links between those topics and content items is needed. For this purpose, the previously described topic evolution theory (Cui et al., 11) and the general meeting cycle were considered. The latter evolves around the fact that meetings follow an order of preparation, execution, recording and processing of their contents in a possibly infinite loop (Jain et al., 03). This implies the occurrence of dependencies between meetings. The fact that the content of consecutive meetings does relate has already been established by Cook et al. With “Project Nick”, they developed a system that supports the execution of meetings by technical means (Cook et al., 87). Part of their system is based on the idea that information enters a meeting through different channels, with the prior meeting and its recordings being one of them. A piece of information that emerges in one meeting, or information is derived from it later on, can be part of a successive meeting. This means that former information influences current and future pieces of content. Therefore, the theory of content items splitting up or merging with one another as described by Cui et al. (Cui et al., 11) can be sustained.

In order to define specific kinds of relations, we reviewed Marchand-Maillets model for meeting recordings (Marchand-Maillet, 03) and a user study conducted by Lisowska et al. preliminary to the development of the Archivus meeting browser (Lisowska et al., 03). In accordance to our prior definition of a general meeting structure, we extracted the following types of relations:

- topic is part of multiple successive meetings (r1)
- information is mentioned in multiple meetings (r2)
- content item is linked to a topic and the other way around (r3)
- content item is related to another single content item (r4)
- topic leads to a different topic (r5).

Relations (r1) and (r2) differ from the others, as they describe an ongoing link for continuous pieces of information, while relations (r3) to (r5) lead to a different topic or content item, whereby a new link is defined. The complete model including meeting structure and content relations across a series of meetings is shown in Figure 1.

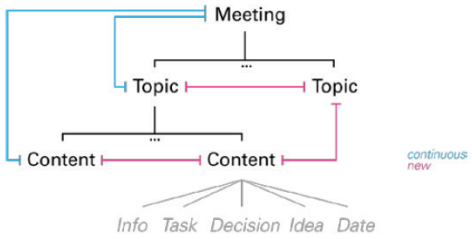

Figure 1: The derived meeting content and relation model, with the abstract relations leading across successive meetings

4 Interactive visualization

Based on the meeting model, the transformation of meeting contents as well as their relations into a visual form is required to transfer knowledge effectively and efficiently. A time and topic based interactive visualization has been developed to ensure traceability. The key factors that build the foundation for the concept emanate from the described model and the reflections of the preceding chapters. The realization as an interactive visualization is explained in the following subsections.

4.1 Visual representation of multiple meeting records

As pointed out earlier, the most important indicator when looking up information from a series of meetings is the date on which the meeting was held (Lipford and Abowd, 08). Therefore, we decided to use a time based visualization for the integrated view of multiple meetings. We arranged the meetings of interest along a horizontal timeline that depicts the respective dates. Since the basic structure of a single meeting is determined by its topics, we clustered the individual content items by the topic they belong to. The blocks that are formed using this approach are stacked vertically below the regarding meeting date at the timeline and tagged with a label that displays the topic's identifier. The content item categories are represented by a different color for each category. The content item is visualized as a rectangular instance within its topic and colored accordingly. The height of the rectangle refers to the amount of contained information (without weighing in its importance or priority). This visual representation of meeting content enables the viewers to identify separate topics as well as the kind and amount of information at a glance. At the same time, users are not restricted to view only one meeting at a time, but enabled to scroll through the whole duration of a project, business related conferences, scientific reviews or any other field of work that includes a set of conversational recordings.

Existing relations between topics and content items are illustrated across meetings as path elements, leading from one item to another. Narrow lines link different topics or content, while broad grey or colored paths illustrate continuous information. The endings of the relations that represent new links convey information as well. It is possible that the linked item is not displayed in the current view and therefore the viewer does not know which type of content or topic the item leads to or is derived from. Due to this, we added colored elements to both ends of the links: circles for a content item and straight lines when the link is connected to a topic. In case of a content item leading to a topic, for example, the beginning of the line would be a grey circle (grey for the topic), while the end would be a straight horizontal line in the color of the content's category (Figure 2).

4.2 Interactive elements

Beyond the overview the visualization provides, the user can gather information from comprehensive meetings by using simple mouse and tap interaction. Each visual element implies some form of interaction, and the visualization offers several methods to explore, search and filter the recordings for general or specific information.

First, there is the timeline that can be dragged in order to scroll back and forth. It can also be resized. This interaction changes the zoom level of the visualization in terms of narrowing or widening the time scale, bringing more meetings into the view or pulling them further apart. The depicted meeting dates themselves include interactivity as well as the topic label and the content item's rectangle. Clicking on any of these elements will show all written conversation they contain – from the transcript of the whole meeting down to a single line of text in a content item.

Lastly, the relation lines and their endings can be selected. On the one hand, a selected relation shows every piece of information that is connected to it, thereby fading out everything else. Selecting its anchor points, on the other hand, leads the user directly to its linked item, whether it is a topic or a content item. The latter interaction only works for new links, since continuous relations are not equipped with an ending due to the fact that the connected elements represent the same content. Additional filter and search components help to find specific information. Selecting a value from a list of topics focuses the selected topic in the view. A range of checkboxes highlight contents according to their category. In addition, a plain search input shows the search results by scrolling to and opening them within the visualization.

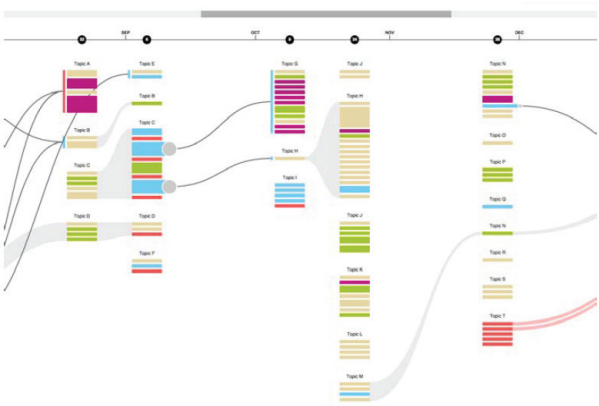

Figure 2: Visual representation of multiple meeting records

4.3 Realization

The design of a multi meeting protocol is realized as a browser-based application. HTML, CSS and JavaScript ensure the basic functionality and layout. D3.js (Data Driven Documents; Bostock, 15) is used to draw the visual elements as scalable vector graphics (SVG). The data is bound to the SVG elements via d3.js and integrated as JSON objects. For application and review of the interactive visualization, we used the transcripts of 21 project meetings that were held over the course of 20 months. After transforming them into JSON, relations and categories were added to the content. The result is shown in Figure 3. Viewing the transcripts in the multi-meeting-protocol-browser, it becomes clear that all contents fit the structure and no content-related aspect is missing in the application, compared to the textual documents. The visible relations clarify that some topics influence the project from the beginning to the last recorded meeting. This would likely have remained undiscovered without the visualization.

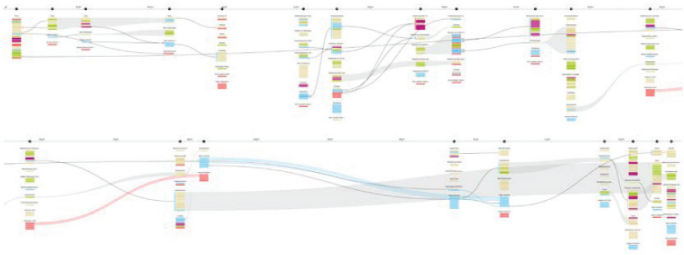

Figure 3: Meeting transcripts visualized by the multi-meeting-protocol-browser

5 Benefits

The specified requirements are met by the implementation. Most importantly, the defined structure is visually represented by the timeline, the topic blocks and the coloured content items. Relations are graspable in form of lines as well as paths and therefore cannot be missed by the viewer. This leaves a reinsuring sense of completeness, while knowing that no important piece of information will be overlooked.

In terms of information retrieval, the protocol browser supports both the need to look up specific contents by providing search and filtering functionalities, as well as the ability to get a general overview over dialogues. The user can easily learn which topics are very large or complex. By means of the interactive elements, the user can switch between overview and detail, fading out information that does not bare relevance for the task at hand or fading in a particular piece of information. The timeline transfers the content in chronological order, thus disclosing dependencies. This enables the viewer to trace the dynamic evolution of a topic for the duration of its presence – the time the topic emerges, the context it was mentioned in first, when it ceases to exist and the outcome if it leads to new topics or content items. Thereby, the visualization is able to display all of the four events in the life of a topic as defined by Cui et al. (Cui et al., 11). All in all, the multi-meeting-protocol-browser creates a deeper understanding of the information at hand and reduces the complexity when looking at a set of meeting recordings simultaneously.

By offering a general structure to the meeting participants, the transcription process can be facilitated in terms of organizing the content. As to whether the approach supports the preparation and planning of upcoming meetings, the tools does not tell the viewer which steps need to be tackled next. It does display the state of a topic implicitly, though. This is achieved by the thorough composition of contents, based on meeting transcripts and built on the presented content and relation model. The state of the topic would be defined by tasks issued, decisions made or ideas mentioned. Decisions mostly represent closed matters, whereas ideas and tasks suggest that there is work to be done and things to be discussed in the future.

6 Future Work

The paper presents a tool as a standalone solution, missing import for meeting recordings. The tool does not yet include any form of information capture – the content needs to be integrated via structured JSON. In a further step, we will develop a designated meeting protocol editor that includes tagging and linking of content and provides export and import functionality for standard text document files.

Except for our own intense utilization, the interactive visualization has not yet been evaluated widely. While the theoretical aspects of the model could be demonstrated suitable, an evaluation of the interactive elements and tangibility of the visualization needs to be conducted in order to improve and extend its functionality and presentation.

On another note, the approach to describe different types of content items using only five fixed categories is an attempt to fit the concept to a wide range of meetings. When it comes to a tool that supports individual workflows, the categories should be kept open for expansion. Therefore, our visualization is not limited to these five categories. Adding more categories would simply result in extending colours and category names, without altering the core of the model or the visualization in general.

7 Conclusions

In this paper, the authors present a novel approach to explore meeting records. The proposed solution focuses on a model for multiple meeting contents and their relations as well as its application in an interactive visualization. The model has proved to be suitable for multi meeting contents. Examining the content in its visual representation across a series of meetings, it is possible to identify any linked information at a glance, no matter how much time has passed between the items. Hence, important pieces of information will not be overlooked. Furthermore, the user can access all information available to a series of meetings, using mouse or tap interaction combined with filter and search mechanisms provided by the multi-meeting-protocol-browser. This helps accessing information quickly and changes the way meeting recordings are perceived – not as a mere collection of text files, but possibly as a "multi meeting analysis tool" (Tucker and Whittaker, 05).

Our main goal in developing this tool was to aid the preparation, execution and follow-up of consecutive meetings. At the moment, one key item is missing – an editor for meeting protocols. However, the visual representation and interactive elements enhance meeting information retrieval greatly, compared to the current usage of conventional meeting recordings.

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HistStadt4D – A four dimensional access to history

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Structured Abstract

Purpose – We propose a multidisciplinary approach based on an extensive data base which provides digitalized photographic material from the end of the 19th century up to recent times. Thus a large amount of photographic evidence will be exploited, structured and enriched by additional sources to serve as a foundation for an application relying on 3D visualizations. The application addresses scholars as well as the general public and will provide different kinds of information and tools for research and knowledge transfer.

Design/methodology/approach – The method applied will be diachronic: the virtual model may show one point in urban history depicting a certain state of past Dresden and also its development through the various eras. In addition the method works in a dualistic mode: on the one hand the physical development of the urban area will be explored and presented in detail, on the other hand the analysis of the pictures will give profound insights in the specific perception of the urban space.

Originality/value – This methodology aims to make large repositories more accessible and proactive in information-seeking. Using a 3D application as an access for media repositories, research tools and functionalities which can improve the scientific handling of the data will be considered. How should the data and information be processed to meet the researcher's needs? Which information can be retrieved from the visual media? What needs to be considered to ensure scientific standards and motivation while working with the image repositories? Users of the virtual archives can benefit extensively form effective searching functions and tools which work not only content- and theme-based but also location-based.

Practical implications – The outcomes of the research will be presented in a 4D browser and available in an Augmented Reality presentation. The design will comply with the requirements of the field of application, whether aiming at a scientific, educative or touristic purpose. The paper itself considers three different approaches to the topic highlighting the multidisciplinary strategy and opportunities of the project. The first one considers research questions from art history. The second one reflects on concepts from information science, photogrammetry and computer vision for visualizations and the third one introduces an interaction concept for an AR application for the Zwinger in Dresden.

Keywords – Visual knowledge, image repositories, 3D reconstructions, mobile AR, interaction concept

Paper type – Academic Research Paper

1 Project Introduction

Dealing with multi modal accesses to photographic data bases to support historical research and communication the project HistStadt4D is financed by the BMBF supporting young scientists. The project is set to start in August 2016 with a planned duration of four years.

The interdisciplinary project aims to create a spatial visualization of Dresden's old city quarters, not in a conventional three-dimensional way, but with the fourth dimension included in the model. Therefore, it investigates and develops approaches in order to deal with image repositories of the city of Dresden. Historic photography, plan material, additional historic information and sources of the picture library of the Saxon State and University Library in Dresden (SLUB) provide valuable information on the appearance and architecture of the city and their development over time. Usually, access to information repositories relevant for a general public as well as scientific research is challenging and an intuitive interaction and navigation concept can at most be found for applications made for touristic and educational purposes.

The visualization of images and information within a historic 3D city model taking into account their location and time will allow gathering, systematizing, structuring, merging and annotating architectural and cultural history knowledge and provides a direct access to complex data. In consequence, the application tries to ease the research on urban history and cultural studies.

Involved Institutions

The HistStadt4D projected is carried out by a junior research group (Münster and Niebling, 2016) with participants belonging to the TU Dresden (Media Center, Photogrammetry) and the University of Würzburg (Human-Computer-Interaction, Art History). Other associated partners are the SLUB Dresden who provides the image data base through their picture library (Fotothek), the HTW Dresden (Dresden University of Applied Science) and Staatliche Schlösser, Burgen und Gärten Sachsen GmbH (State Palaces, Castles and Gardens of Saxony).

The Deutsche Fotothek (picture library) provides an extensive data base also including items from 80 partnering institutions which serves as the project's foundation for research concerning Dresden as well as knowledge that needs to be made accessible

for everyone interested. About 1.7 million photographs, paintings, graphics as well as a collection of maps and architectural drawings are available.

2 Increase of art history knowledge through 4D visualization

In modern art history the use of digital images steadily grows more important. Visual media is consulted in order to analyze buildings, to draw stylistic comparisons, to document changes in the building structure or – in general – to answer open questions on the history of a certain building, quarter or city. Finally, in case of a complete loss of physical traces historic pictures can form the basis for different kinds of reconstruction. Overall, for art history research images are a major source.

During the last years, gathering of large amounts of historic photography has become a main task for archives, libraries and museums (Hoppe and Schelbert, 2013), e.g. Deutsche Fotothek, Prometheus, Arachne, Foto Marburg, Biblioteca Hertziana and others. The digital photo data bases finally allow an examination of objects located spatially distant. Thus, the extent of this large data volume on the one hand offers big opportunities for academic research, but on the other hand creates an essential need to access and structure the information available through those sources (Kohle, 2013, p. 16). Only by means of this additional procedure the analysis and a further interpretation through scientific questions will lead to reasonable results.

The present inquiry standard is primarily concentrated on the embedded metadata, such as the author, the dating of an object or photography, a more or less exact localization, a description of the depicted matter and, of course, several keywords that classify the object in various aspects (Kohle, 2013, p. 23). Momentarily, the use of photographic data bases still requires a large amount of supplementary work, therefore methods to quicken and increase efficacy in research are desirable. Another valuable help would be an instrument to find cross connections that aren't necessarily traceable through a language based search but through the images themselves.

One possibility of deepening knowledge and opening up further scientific questions for single buildings or even wider spaces like cities can be reached through a computerized visualization. The number of projects in this field of interdisciplinary work increase each year, though major methodical and processual problems still remain open (Ioannides et al., 2013).

Usually, virtual 3D models are limited to a certain period of time, whose length depends on the temporal distance of the objects visualized. This method guarantees the scientific exactness by avoiding confounding the results with those of other time layers. Concurrently only a small part of the historic reality is illustrated, while even

more knowledge can be drawn from a synoptic view (Ioannides et al., 2013). We propose therefore to integrate a fourth dimension into such a model, namely the element of time. It allows widening the focus on the differences between the various time layers by employing a comparative analysis.

The method applied will be diachronic: This will lead to an additional increase of information which would not be possible if only three dimensions are taken into account, without considering other points in time. From an examination over a longer period of time and its visualization profound insights can be achieved that concern the urban tissue and its development throughout the years and decades, including turning points and breaks, but also continuity (Münster and Niebling, 2016). Besides large scale changes due to wars, earthquakes or simple city reorganizations, also smaller observations are relevant for art historians and building researchers, for example the changes of building details like the roofing, decorations or façade renovations. Another setting for art history research is the perception of the city and its stock of historic and modern building based on the analysis of photography. How did buildings determine the cityscape? Which buildings statistically tend to be photographed more than others? What does this tell about the interests, self-image and intellectual attitude of the photographer? Through the eyes of a contemporary it will be possible to evaluate which buildings dominated the idea of Dresden as an ancient city of culture and of vivid bourgeois participation in politics, arts and economy. It will be shown that a whole catalogue of further leading questions can be derived from the work with a 4D visualization that supports and pushes forward scientific tasks. In accordance with the computer based implementation additional information can be incorporated in the model: This concerns for example ground and elevation plans, written sources such as building invoices or descriptions and similar material which go beyond the mere photo which was included into the visualization. On the one hand this points exclusively to an academic target group of users, on the other hand one may also think of a pedagogical usage that introduces the history of a quarter to interested people in an adequate way.

2.1 The specific example Dresden

The project HistStadt 4D aims to develop answers to such questions and to test those basic thoughts by means of a specific example (Münster and Niebling, 2016). The city of Dresden is especially interesting as different time layers are extensively documented by historic images in the Deutsche Fotothek. As a basis we have a large amount of photos starting with the late 19th century with the black and white pictures of Ermenegildo Donadini, Hermann Krone, Walter Hahn and others. Furthermore, the booming époque of the early 20th century and the vibrant cultural development through those years that abruptly end with the time of the Third Reich and the almost

complete destruction of the city in February 1945 are recorded. Finally the years of the clearance of the ruins, the socialist rebuilding and the time after the fall of the Wall complete the picture of a rich historical and architectural development. Thus, a large amount of photographic evidence will be exploited, structured and enriched by additional sources to serve as foundation for the visualization.

2.2 Research questions raised by art history

Especially the methodical access demands an extensive research as some parts of the approach are not undisputed in expert groups (Kohle, 2013, p. 163). On the one part, this concerns the range and extent of visualizations: How should its design be chosen to emphasize that it does not portrait reality? Experience shows that a different design for distinct target groups can be useful as lay people often are enthusiastic about faithful and naturalistic reconstructions that also appeal on an emotional level and enables truly to experience the time layer in question. More educated and especially academic scholars on the contrary declare themselves in favor of a more simple and schematic model that explicitly shows its virtual character. Another problematic aspect results from weaknesses in the model itself. Gaps in the photographic documentation may lead to ambiguity which, of course, cannot be depicted in an optic model but only explained in a written form. How is it possible to deal with such problems and how can they be displayed in an appropriate way?

3 Potentials to support research using image repositories and visualizations

The vast increase in digitization of historic images, objects and information leads to more content available for investigation; more cross-analyses made possible; more knowledge collected, structured and shared (Schuller, 2009). Hence, the development pushes archives and researchers from humanities to become part of the open science movement. In recent years, the discussion on open science is growing and spreading. Scientists belonging to the fields of e.g., ecology, biology and medicine have already stated how open science increases dissemination, understanding of research results as well as transparency concerning quality and integrity of research (Groves and Godlee, 2012) which are also valuable for humanities.

With the massive amount of data available, the success of an archive and the actual benefit for users depend highly on usability of the application and suitability and efficiency of research tools. A lot of the existing tools of research programs and applications stem from computer science and do not necessarily meet the needs of humanities (Dudek, Blaise, De Luca, Bergerot and Renaudin, 2015). In order to improve research tools and applications, the desires of the stakeholders need to be identified, distinguished and processed for an implementation by computer scientists. Therefore, a distinct definition of the target group is essential.

3.1 Requirements of users

The use of archives and image repositories is usually open to anyone. Collaborating with the Fotothek for the project actually defines the target group generally as the users of their database. Sweetnam et al. nicely break down users of digital collections to be (1) professional researchers, (2) apprentice investigators, (3) informed users and (4) the general public (Sweetnam et al, 2012). The target group is obviously closely connected to its dedicated purpose, e.g., scientific research, pedagogical application, study of historical sites (Barreau, Gaugne, Bernard, Le Cloirec and Gouranton, 2014), etc. Within the HistStadt4D project a main focus lies on architectural and urban history of the research object Dresden documented through images.

Common requirements of the users may be an ease of understanding concerning the data and knowledge, the development and improvement of tools for accurate search/ research as well as an intuitive navigation and interface (Barreau, Gaugne, Bernard, Le Cloirec and Gouranton, 2014). Scientists will put high emphasis on adherence of scientific standards, a thorough documentation through the supply of metadata and the possibility for collaboration, cross disciplinary work and even crowd sourcing (Maina and Suleman, 2015). Whereas someone vaguely interested is more in need of a straightforward introduction to the data and topic (Maina and Suleman, 2015) as well as possibilities to select further material without getting frustrated by an overload of information.

3.2 Visualizations to facilitate research

Visualizations seem to be amongst the most promising presentation types that support additional information in the context of architectural and urban history research with image repository.

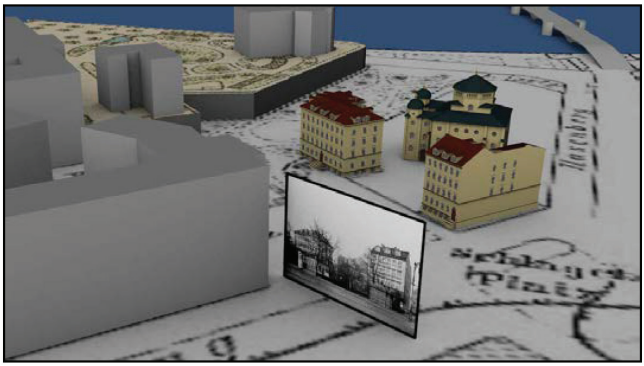

Figure 1: Display of a picture within a 3D city model

A very simple visual presentation is the display of a picture right at the position of the camera during its acquisition within a 3D model (see Figure 1). By including images taken over a certain timespan, this visualization can promote research on acquisition preferences of specific photographers or during certain years.

Virtual 3D reconstructions are digital three dimensional visualizations of an object. Different ways may lead to the creation of a virtual model. A digitization of the object's surface using a terrestrial laser scanner will give a very detailed and authentic point cloud of the object which can be turned into a virtual 3D model. This method can only be applied for existing objects. For the HistStadt4D project this technique may serve for comparison purposes to evaluate results of other reconstructions. Reconstructions produced for the HistStadt4D project will mostly be created automatically using SFM (Structure From Motion). SFM relies on processing several pictures of an object through corresponding features to derive the initial camera positon and eventually 3D coordinates (point cloud) of the object. A manual reconstruction can be done with the help of 3D computer graphics software using images and plans (Münster, 2013). Also, Lin et al. propose an algorithm for the creation of a depth map from a 2D image (Lin, Chang, Huang, Shen and Fan, 2012) which is relevant for 3D analysis when only single images are available.

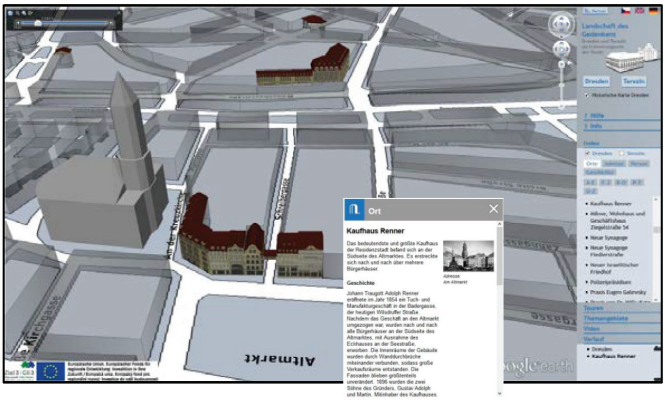

Figure 2: Screenshot of the GEPAM application (www.gepam.eu)

A 3D reconstruction is easily enhanced with further information on the appearance of an object through a texture. A virtual 3D landscape allows showing the location and duration of a visualization and its actual surroundings and can even provide further

detail information through text and media (see Figure 2). Moreover, visualizations support the depiction and validation of hypotheses and may communicate connections and coherences (López-Romero, 2014). Additional key words can be used as hyperlinks and put emphasis on further connections (Maina and Suleman, 2015). Image processing through e.g. feature tracking for historic pictures of buildings helps to detect changes within the cityscape or certain buildings.

3.3 Challenges for an implementation

The afore-mentioned methods for 3D reconstruction come from photogrammetry and computer vision. Their application fields are very different and dictate the importance of certain aspects like geometric quality and automatic processing. The photogrammetry community puts more emphasis on accuracy and reliability concerning image orientation and camera calibration whereas, the computer vision community focuses more on algorithms that promise a high degree of automation (Remondino, Del Pizzo, Kersten and Troisi, 2012). HistStadt4D is set up to consider different approaches coming from different disciplines which help to contribute to a technique for using historic pictures as a data base for the creation of a 3D research application. This is a great example of how cross- and interdisciplinarity can promote new solutions and encourage to seek innovative ways.

López-Romero points out that only few projects have considered the potential of historic images for 3D reconstruction. As pointed out before, pictures are sources which allow an authentic documentation of losses. He lists several issues (e.g., missing camera parameters, image quality, inadequate coverage of the object) encountered during the experiment of a 3D reconstruction using historic images (López-Romero, 2014). To ensure further use of the application interoperability of the data, open access, maintaining standards and a thorough documentation of the metadata must be taken into account.

A difficulty often pointed out by scholars is the authority that 3D reconstructions convey. A design approach that introduces possibilities to display different levels of reliability and vagueness within a model may remedy these concerns.

3.4 Research approach

In order to identify and investigate potentials that image repositories hold for a support of research an empirical inquiry and systematization of requirements need to be carried out. A concept for the data survey is essential and includes interviews and investigations concerning user needs, user behavior and user interaction. This will help to identify and assess possibilities of the application. Scholars from the humanities do not have an extensive knowledge of technical limitations and possibilities. Constant

dialog and exchange is necessary to ensure transparency and satisfaction on the user's side. An extensive literature review will support the identification of useful tools and functionalities. Research on open science, cross-disciplinary collaboration and knowledge transfer may bring further impulses. The proposed options will be turned into use cases to ensure a satisfactory transfer of the ideas and suggestions into software tools. All developed tools will be evaluated with the help of usability testing.

4 Interaction concept for a mobile AR application

The main goal is the development of visualizations and information access for a location and object-based knowledge presentation using Augmented Reality (AR). The application will present historical as well as actual information on the Dresdner Zwinger. So that the users can rely on their private mobile phone to get all necessary information. The interaction concept forms the bridge between the user and the developer. In this way the user requirements will be considered and translated for the technical implementation.

The main objective is to bring information about the building and its history closer to the public. The concept will base on a mobile AR application in order to immerse the user in the past and present detailed information on spatial objects. Finally, the main aspect is to motivate and to raise interest in learning in an intuitive way about the development and important events of historical buildings like the Dresdner Zwinger.

4.1 Augmented Reality

AR describes the enrichment of the real world with the addition of computer generated objects (Mehler-Bicher, Rieß and Steiger, 2011). The use of an approach with AR methods allows contextual data display combined with the reality and thus enriches the environment with further data of historical as well as current information. That means that additional information will be integrated in the visualization in the form of text, images or animations. The sensors of mobile device (e.g., camera, GPS, accelerometer, gyroscope, light sensor) which capture environment information play a significant role in the process. Among other details, they provide information on the camera angle, time or the exact geographical location. Linking the images with texts and geometry data and promoting interactions additional to the use of AR form the foundation of the work. (Guimarães, Figueiredo and Rodrigues, 2015; Azuma, 1997)

4.2 Use Case: Dresdner Zwinger

The Dresdner Zwinger is a building complex including a garden area. Figure 3 displays an aerial view of the Dresdner Zwinger. It is a beautiful outdoor area which was built in the 18th century for festivities of the high nobility. The architect Matthäus Daniel Pöppelmann and the sculptor Balthasar Permoser created courtly artwork.

Today, the Zwinger includes public art exhibitions inside the buildings and it offers an atmospheric ambience for different events in the closed garden area. In addition, the garden area showcases different water fountains that invite the visitors together with the different sculptures to stay.

Figure 3: Aerial view of the Dresdner Zwinger (picture from Fotothek)

The Application will provide points of interest (POI) to navigate through the important historical areas and give the users the possibility of a new perspective on the object. The navigation through historical information will only include places in the garden area but it will also present actual information about exhibitions inside the buildings, like name, opening hours or entrance fees.

4.3 The interaction concept

The interaction concept describes an application for knowledge transfer with AR methods and a guidance service with the private mobile phone. Klopfer and Squire describe the connection between physical objects and virtual information as a central point within AR (Klopfer and Squire, 2008). The user navigation will be enriched with concepts of storytelling and gamification, so that the user will be entertained by learning historical facts, immerses in the history and feels part of the story (Fevgas, Tsompanopoulou and Bozanis, 2011; Gouveia, Branco, Rodrigues and Correia, 2015; Guimaraes, Figueiredo and Rodrigues, 2015; Malomo, Banterle, Pingi, Gabelloney and Scopigno, 2015). The user begins at a defined starting point from which he is able to explore in a self-determined manner while investigating with the help of multimedia support. The attention will be guided to important POI through the

storytelling. The localization of the user is provided through the GPS signal of the device and depending on the position of the user, information on nearby POI will be displayed. Furthermore, the user will be able to navigate around considering his preferences. The information representation with AR supports the dissemination of knowledge concerning historical events of the Zwinger in Dresden. Historical images related to relevant events and changes are imbedded into reality which supports a personal experience of the data. Another point is to get detailed views of difficult to access object or possibly an alternative visualization.

The development of the interaction concept is carried out, on the one hand, through research on existing literature concerning AR, information visualization, user guidance for knowledge transfer, interaction and usability concepts for mobile devices as well as the analysis of the state of the art research on interactive AR applications in particular with a focus on interaction and navigation in 3D spaces and museum fields. On the other hand, a conception for a mobile AR application with an incentive in order to navigate to and interact with POIs connected to the Dresdner Zwinger is developed. Thus, a draft concerning the visualization of the AR interaction concept and the development of mock up prototypes will be a result.

5 Conclusions

The involvement of several disciplines within the HistStadt4D project proved to be essential to develop holistic solutions for advanced research as well as knowledge dissemination based on image repositories. Art history is one scientific field that may profit from the progress of the project, but scholars from other disciplines will be involved as well. The interdisciplinarity helps to identify requirements and opportunities and promotes a dialog on the relevant topics between the users and developers. The most promising concept for information processing and further research already identified are visualizations especially 3D reconstructions.

The potential of information retrieval from image repository for touristic purposes should not be neglected. A specific interaction concept will help to address that audience as well. Usability and user satisfaction will be considered for all kinds of application.

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Ideagrams: A digital tool for observing ideation processes

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Structured Abstract

Purpose – The paper reports on an ongoing research project of TU Dresden Laboratory of Knowledge Architecture aiming the investigations of the traceability and visualization of upcoming ideas and topics within discussions.

Communication and conversation analysis – to explore knowledge processes communication and interaction analyses emerged as a central scientific approach. Hereby knowledge creation and Knowledge Transfer are understood as collective and co-creative effort. Corresponding analysis tools and methods have been developed for the communication- and knowledge creation processes digital media extensively (Faraj et al 2011). However, research focusing on direct and immediate conversation, and not only based on digital media, rarely exists.

Development requirements – The existing tools for the analysis of digital communication data are yet not widely applied in the domain of spoken discussions. Whereas communication processes in the digital domain create their data automatically, the data from natural settings have to be extracted laboriously (Tonfoni 2004). Since there are no effective methods on data recording of voice communication yet existing, there are no strong and evident methods on computer aided conversation tracking and analysing existing too. The Ideagram tool tries to overcome this shortcoming.

Approach – A prototype of a transcription, visualization and analysis tool was designed, which is able to capture discussions by keywords and analyse them in real-time. The results are presented in several forms: histograms, semantic networks and mixtures between both. These visualizations allow identifying topic and concept dynamics, heuristic paths and creative moments. Central features of the discussion like knowledge communication, orientation for innovation and speech efficiency can be understood and designed. In the different figures - Ideagram - of spoken discussions the logged content is visualised. The program prototype counts the occurrence of the logged words. These can be marked within a chronological re-presentation graph and shows at what time which issue was discussed. By “peaks” and “valley’s” it is

obviously visible where the talk was most or least active. The prototype tool allows analysing the used phrases according to their frequency and their appearance during the captured conversation.

Practical implications & Value – In contrast of conventional protocol and transcription techniques this kind of knowledge mining allows a greater information bandwidth and a more efficient access on core topics, thematic conflicts, idea generation etc. Experiences in very different settings created a very rich data set and allows to state that the application in business and science seems to very useful according to recording, analysing and deepening of spoken discussions. Hence, the Ideagram is still a prototype version and need further investigation and development.

Keywords – Visualisation, Ideation, Creativity, Innovation, Interdisciplinary Groups, Tool, Method, Knowledge Transfer and Management

Paper type – Academic Research Paper

1 Pursuit of Ideas within dialogues - Motivation & Problem description

The interests in IDEAS are as old as human mankind. About 2350 years ago Plato argued that there is a realm of ideas or forms (eidei), which exist independently of anyone who maybe has thoughts, and it is the ideas which distinguish plain and ordinary opinion from knowledge, ideas are unchanging and nothing but just what they are, contrasting material things which are temporary and liable to contrary properties (see dialogues as the Phadeo, Symposium, Republic, and Timaeus) (Radke 2002). Nowadays, knowledge and creativity are described as the engine of welfare in our modern knowledge society (Drucker 2001). Both are based on innovative ideas driving as well the academic as the economic world. Ideas are drawn as an important attributes towards firms and projects potential of innovation, their competitiveness, and their progress in science and business (Taggar 2002; Miron et al. 2004).

This paper reports on an ongoing research project of TU Dresden Laboratory of Knowledge Architecture aiming the investigations of the traceability and visualization of upcoming ideas and topics within spoken discussions. Recordings of talks and discussion as visual recordings or other visualisation techniques are mostly done with pencil and paper. Hence they are hard to analyse digitally or only with an enormous amount of (digital) re-work. To explore knowledge processes communication and interaction analyses emerged as a central scientific approach. Hereby Knowledge Creation and Knowledge Transfer are understood as collective and co-creative effort. Corresponding analysis tools and methods have been developed for the

communication- and knowledge creation processes within digital media extensively (Faraj et al 2011). However, research focusing on direct and immediate conversation, and not only based on digital media, rarely exists yet.

A meaningful digital or technological pursuit of dialogues is difficult, and the development trends and quality of vivid discussions are hard to capture. For comprehensive recordings of dialogues conventional recording methods as written notes or audio recordings reach their limits. They are too static and do not cover the complex dynamics of a course of conversation (Selting 2009). An appropriate amount and the shape of the captured data which are either incomplete and thus less meaningful or too broad and complex are also challenging. Moreover the difficulties increase if discussions ought to be recorded in real-time, for instance to pursue the state of the discussion and its development in order to react on this possibly during the talk.

2 Overview on current theoretical background & technical developments

This section describes the underlying linguistic concept of catchwords and the state of the art in capturing discussions.

2.1 Catchwords as markers of idea generation

Several keywords which are captured by the Ideagram-Tool, mentioned as catchwords (Kaempfert 1990: 196), are regarded as markers of the process of idea generation. Catchwords are well researched in the field of public communication in politics. Varying terms and different characteristics in research prevent a general definition of a catchword so far (Niehr 2007: 497, Girnth 2015: 63). An overview of important characteristics of catchwords will be presented in the following as well as their special role in the process of idea generation. On the formal level catchwords involve abbreviations right up to word groups (Niehr 2007: 498). Forming a lexical unit, especially nouns but also adjectives, verbs and names are often used as catchwords (Felbick 2003: 17).

The generation of a catchword during the process of communication can be explained with reference to its semantic characteristics. A lexical unit which already carries a general meaning is mainly associated with a specific sense by a specific person, group or party. This case is labelled by Liedtke (1996: 5) as “process of semantic charge”. The function is not only to facilitate complex suggestions and ideas (Felbick 2003: 19f.) but also to represent the complex reality in a “condensed way” (Girnth 2015: 61f.) allowing for an interactive construction of reality.

The following example illustrates this process: The term “digitalization” refers to the process of digitizing data (also named “digitization”). As a catchword in public discussion it describes the expanding use of computers and other digital media in society. This complex process comprises diverse steps of the development in different areas of society, e.g. in work or private life. This process of reduction in complexity leads to the central property that catchwords are marked by an indefinite semantic field, i.e. different interpretations regarding a catchword are possible (Felbick 2003: 20).

Furthermore, party platforms, ideas or other issues as references of a catchword are connected with individual valuations and objectives (ibid.). Based on these factors there is a potential of conflicts regarding a catchword (ibid.: 21). Referring to the previous example, some people emphasize many possibilities in the use of digital media, e.g. the processing of a huge amount of data to get new insights, whereas other people expound the problems of the “digitalization”, e.g. by questioning the data protection. In reference to Kaempfert (1990: 199f.), beside semantic characteristics which were illustrated before, also pragmatic features in context of the theory of indirect speech acts (cf. Liedtke 1996: 3 and 5f.) have to be consulted for an adequate term description. In general, the discourse forms the framework for the discussion of different meanings or interpretations of a catchword (Felbick 2003: 21). Thus, catchwords are only identifiable within the frame of discourses.

Against this backdrop, the significantly increased usage of a phrase over a short period of time is considered to be another important property of a catchword (Kaempfert 1990: 201). By applying a time-series analysis, the Ideagram-Tool visualizes those increasing numbers of words over time. One should take into account that there is not a specific frequency threshold (ibid.). Function words, carrying mainly grammatical information, can be identified by the highest frequency rates. Regarding catchwords, not the absolute value but the increase in frequency is an important indicator (Felbick 2003: 18). The research focusses predominantly on political and public discourses. Following Felbick (2003: 33), catchwords can be formed even in the smallest discourses, e.g. a conversation between family members or a discussion among students. In addition to the condensation of complex suggestions and ideas, there is another important role of catchwords which is called “appellative function”, i.e. to persuade the interlocutors of the individual attitude or to spur the audience into action (ibid.: 23). In the context of politics, a discussion is metaphorically seen as a fight in which words are used as weapons (Klein 1989: 11).

There are different types or strategies of this semantic fight which can also be assigned to the process of idea generation. On the one hand, there is a dispute in designating. For instance if different ideas are condensed in competitive terms (Klein 1989: 18, Klein 1991: 51–57, Felbick 2003: 38). On the other hand, the "fight" is characterized by a competition based on the meaning of a catchword. In discourse different semantic characteristics or emotional values could be removed from or added to a catchword, to form, confirm or reject an idea or (political) point of view (Klein 1989: 21–23, Klein 1991: 57–65, Felbick 2003: 38). These modifications are possible by changing components of the phrase or words closely related to it, e.g. emotional adjectives referring to a noun, to carry another meaning in a process of semantic shift (Felbick 2003: 39). For instance, a neutral term like "the American State" could be changed in its meaning by replacing one component of the phrase by another one to "the American Empire" leading to completely different associations. As another example, positive or negative connoted adjectives could be assigned to a catchword, like "promising digitalization" versus "unstoppable digitalization" to change the emotional value. To sum up, catchwords are frequently used in discourses to condense complex ideas and to "promote" them. During discussions catchwords could be semantically modified or replaced by other terms to form an idea or reject and replace it by a competitive idea. Based on keywords as feature-set the Ideagram-Tool provides access to the process of idea generation by capturing the frequency of these words during an observed discussion within the framework of a time- series analysis. One has to take into account that not every frequent word is considered to be a catchword. As already mentioned, a significant increase in frequency is an appropriate indicator for catchwords. Furthermore, there are some boundaries in capturing ideas based on catchwords because even discussions about suggestions and ideas without referring to catchwords are possible (Kaempfert 1990: 202). 2.2 State of the art in technical discussion capture and analysis

Communication and discussions are central activities in knowledge based organisations. Therefore many disciplines are working on new methods and tools in order to understand and improve human communication. Computer-mediated Discourse Analysis (CMDA) was defined by Herring (2004) and focusses on all kinds of computer-mediated communication. It uses the advantages of the digital existence of communication data. Because the communication itself and metadata like author and time are usually available, there are many possibilities to analyse the underlying behaviour. In electronic mail or newsgroups it is digitally encoded vie sender-receiver information who said what to whom, which are crucial points in communication analysis. In synchronous text-based communication like chat, the linkages between messages are not stated explicitly and up to now have to be identified manually by coding. If this is done, several analysis procedures are possible in order to detect communication and discourse patterns as well as social communication networks (Holmer 2007).

The research area of Computer-supported Cooperative Work (CSCW) is an interdisciplinary approach of social and technical disciplines in order to design, create and evaluate solutions for supporting human cooperative activities. From the beginning electronic meeting support was one of its main research activities since face-to-face meetings are an everyday activity in organisations (Nunamaker et al. 1991). Most of the early approaches have focussed on written information in meetings like notes and whiteboards and on facilitating discussions by moderated agendas. The verbal communication could be captured by an audio recorder as reference material but the sound stream alone does not help in order to analyse the discussion.

Better approaches are tools which capture the video and audio signals for each participant in order to separate the speakers and make it possible to analyse their contributions separately. Lee et al. (2002) developed the Portable Meeting Recorder, which records a video of the whole group and identifies each speaker by face and audio position. The next generation of Smart Meeting Systems (Yu & Nakamura 2010) were designed to capture the whole meeting including audio and video streams as well as other sensor data like face orientation and body motion (Yu et al. 2010) in order to add more semantics to the data like user intention and attitude towards a topic (Yu et al. 2013). One of the biggest challanges is the capturing and analysis of speech. Automated Speech Recognition (ASR) is a topic were commercial applications like Dragon NaturallySpeaking are available for single user scenarios. But the integration of multiple user streams into a single discussion record and a summary is still a challenging research problem (Renals et al. 2007, O'Connell & Kowal 2009). Most recent approaches tackle the problem of meeting summarization by using keyword extraction and are quite successful for English speakers (Bokaetf 2015).

Nevertheless all of the reported solutions are still research prototypes, require a lot of information technology (like capturing devices for audio, video and other sensor data), prepared rooms and are only tested in English speaking environments so far.

3 IDEAGRAM - Tool & Methodology

Development requirements: The existing tools for the analysis of digital communication data are not extensively applied in the domain of spoken discussions so far. Whereas communication processes in digital domains create their data automatically, the data from usual spoken settings have to be extracted laboriously (Tonfoni 2004). Since there are less methods effective on data recording of voice communication yet existing, there are no strong and evident methods on computer aided conversation tracking and analysing too.

The Ideagram tool tries to overcome this shortcoming. A prototype of a transcription, visualization and analysis tool was designed and developed, which is able to capture discussions by keywords and allows to analyse them in real-time. The results can be represented in several forms: as histograms, semantic networks and mixtures of both. These visualizations permit identifying topics and concept dynamics, heuristic paths and creative moments. Central features of the discussion like knowledge communication, orientation for innovation and speech efficiency can be drawn and analysed, and therefore being understood.

The Ideagram tool was developed in order to capture talks and discussions easily and in real-time. There is no extra technology necessary. Only the software porotype browses via an internet connection is needed. Thus you can use it from everywhere very flexible.

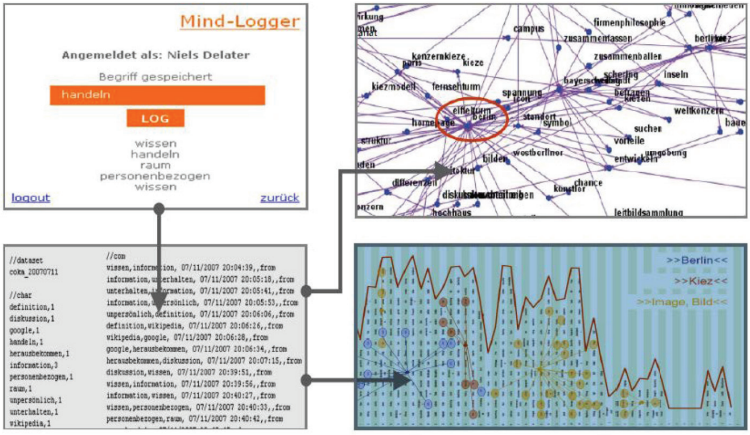

Figure 1: Transcription Tool „MindLogger“ (top left), discussion lag (left down), Network analysis (top right), and chronological Idegram (right down)

To record the spoken discussion a tool named mind-logger is used in a first step. To do the logging a new file has to be created and opened before the discussion is going to start. During the discussion the spoken words are typed into the log. So far the logging is done by one person. By this human coder no complicate voice recognition programmes are needed. The logger has to note the up-coming words, topics and contents in the same manner during one log – one discussion. Hence, the coder has to decide on each word being typed in the same way, e.g. knowledge for knowing,

known, know, learnings, etc. or another example: experience, expertise, know-how, learn, experienced, found out, practised, come to know, and so on. This is necessary because the software is not ably to join or sum up different semantic groups as nouns, verbs, adjectives etc., yet.

Each logged word get a timestamp be pressing enter automatically. So it is possible to visualise them later in a chronological order and with the exact time gap in-between the single logged words (see figure 2). After the talk is finished the discussion-log needs to be closed, and saved on the computer as text file. In order to visualise and being shown it to the discussion audience directly the created log-file has to be re-opened in a second web-based tool of the Ideagram software prototype.

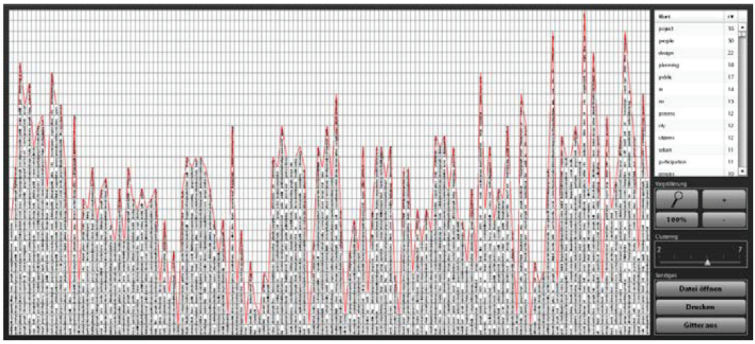

Figure 2: Ideagram of a discussion

Figure 3: Zoom in to Ideagram of a discussion

Within this tool each word being logged within one minute is visualised within one column. The first typed word on the bottom of the column, the last word of each minute on the top. Thus it makes very visible at what times of the discussion most or fewest words were spoken and logged. It shows “peaks” and “valleys” and makes it obviously visible where discussion was slow down or where it speeded-up, where people talked most or less active. The software prototype allows analysing the used phrases according to their frequency and their appearance during the captured conversation. The program counts how often each word appears and represent this analysis within an extra list at the left upper corner (see figure 3).

If one clicks at any of those listed words it get marked with colour simultaneously in the and in Idegram re-presentation. As an example you can see figure 4. Here the word design was selected and get marked in blue colour in the list as well as in the Ideagram. Thus it makes it obvious where the topic and theme design piped-up during the discussion.

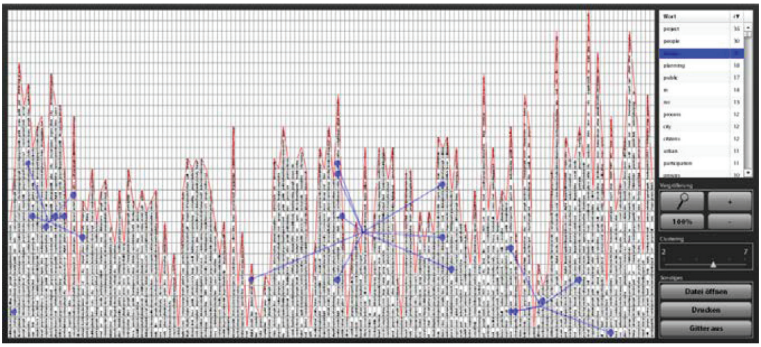

Figure 4: Ideagram of a discussion – word re-presentation

Hence we figured out, that the human coder is very efficient filter relating to the quality of the logs and the visualised Ideagrams out of it. Though, at the same time it is challenging to find adequate people who can code very fast and capture the main issues of a talk without being an expert content wise. In contrast of conventional protocol and transcription techniques this kind of knowledge mining allows a greater information bandwidth and a more efficient access on core topics, thematic conflicts, idea generation etc.

4 Sample Case: U_CODE Project Kick off

So fare we used the Ideagram tool in very different settings: (thematic) podiums & plenary discussions, student talks, brainstorming's, … , or internal Idea Talks at our Knowledge Architecture Lab in Dresden.

To make it more comprehensible we chose the Kick-Of meeting of our Horizon 2020 EU funded project U_CODE from March 2016 to present as a Sample Case for this paper. One hand side all authors were member of this meeting and on the other hand we logged four different types of settings. At this project kick-of 25 people took part and it lasted three days during we recorded four differing discussions: 1) partners self-introduction institution and person wise, 2) work package presentation, 3) free idea, topic and project needs discussion, and 4) final wrap-up and next step discussion.

4.1 IDEAGRAM Partner self-introduction

The aim of the first session was to introduce all partners and to get to know each other institution- and person wise. In figure 5 the whole presentation is visible. There were round about 15 different presentations being held. In this Idegram the valleys are identifiable as the turn taking of the different presenters. Not by surprise the word project was counted most often: 35 times and marked in green colour. Other examples are the word process (12 times, marked in blue), citizen (12 times, marked in light-blue), or participation (11 times, marked in pink).

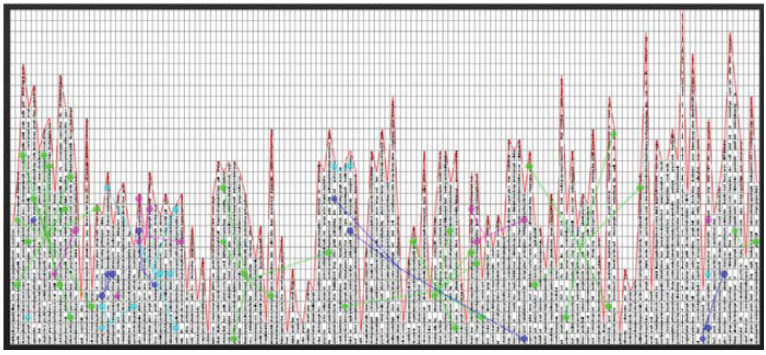

Figure 5: Ideagram of U_CODE partner self-introduction

Due to the frame setting of the talk there was no real surprise by nature. But the popping up of the same words throughout different presentations can be interpreted as a common project understanding and common interests in a first line. As the main threads: "public", "design", "change", "planning", "citizens", "participation", "media" "platform " were identified.

Figure 5a: word list zoom-in

4.2 IDEAGRAM Work Package presentation

The aim of the second discussion was to present the several work packages in contend and methodology detailed to all participants. In figure 6 we marked the basic words as the following ones use (24 times, marked in green), business (22 times, marked in blue),testbed (21 times, marked in yellow), and product (14 times, marked in light-blue) as remarkable for the U_CODE project. Though no surprises appeared the U_CODE aims and structure is visually well readable and re-presented.

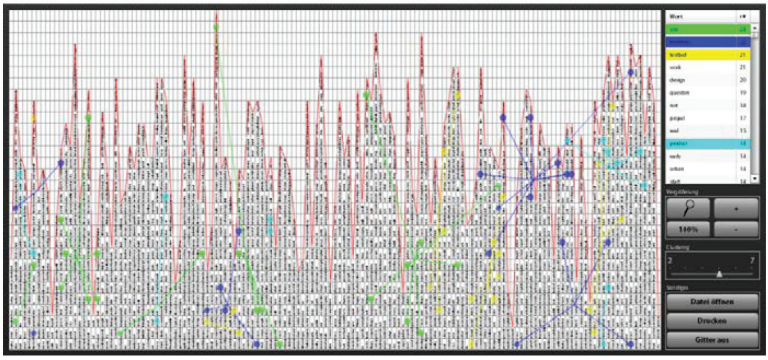

Figure 6: Ideagram of U_CODE work packages presentation

Figure 6a: word list zoom-in

Due to the frame setting of this talk the main threads: “testbed“, “design“, “planning”, “shit-storm“, “public“, “participation“ were identified.

4.3 IDEAGRAM Free idea, topic and project needs discussion

During this discussion a totally different type of an Ideagram was gained. As this talk was not pre-prepared and it was just implemented according to the needs of the Kick-off participants a very different graph evolved. A first reveal is that there are fewer words spoken within one minute but the talk is very smooth and there are only few valleys visible. Besides unsurprising words as public (8 times, marked in green), architect (5 times, marked in blue), citizen (4 times, marked in pink) or participation (4 times, marked in light blue) figure 7 also shows words as involve (5 times, marked in grey) or pain (4 times, marked in yellow) emerged during this vivid discussion.

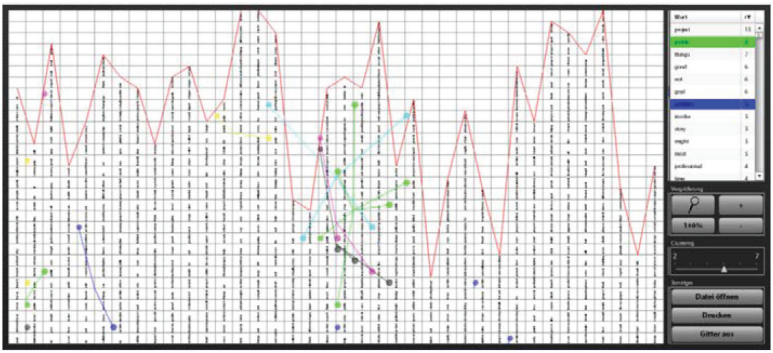

Figure 7: Ideagram of U_CODE aim discussion

During this rather short discussion of round about 40 minutes the following main threads appeared: “public”, “architect”, “involve”, “citizen”, “participation”, “crowd”, “design”, “pain”.

4.4 IDEAGRAM Final wrap-up and next step discussion

At the last day of the Kick-off the final wrap up and next steps discussion was recorded and logged with the Ideagram tool. This final discussion aimed gaining a common language and project understanding and can be described as a sum up in an initial version. Figure XX shows that newly emerged issues and topics during the Kick-off days were agreed upon among all U_CODE partners and appeared in this Ideagram graph finally. In figure 8 words as need (11 times, marked in green), testbed (9 times, marked in blue), or market (8 times, marked in pink) resulted in accordance to the U_CODE product going to be developed during the EU project. More over interesting and unforeseeable words as scrum (8 times, marked in yellow), agile (7 times, marked in light blue), and backlog (5 times, marked in grey) emerged in accordance to how the project participant lined out their way collaboration and working together on the project goals.

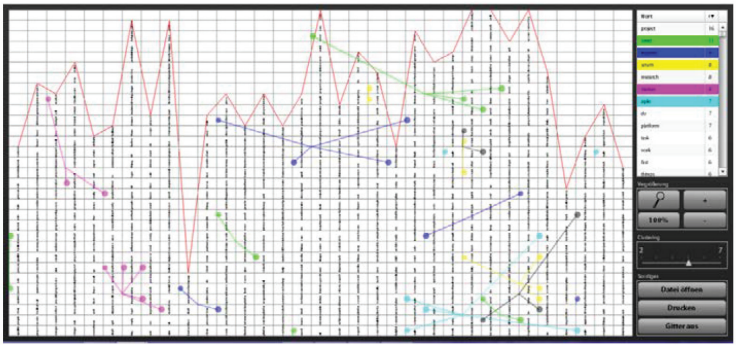

Figure 8: Ideagram of U_CODE wrap-up discussion

Loged issues as “need”, “testbed”, “scrum”, “agile”, “market”, “backlog” can be regarded as the main threads of this Ideagram graph of then round about 30 minutes lasting wrap up.

Figure 8a: word list zoom-in

5 Challenges, Conclusion & Outlook

Whereas researcher of TU Dresden Laboratory of Knowledge Architecture collected a lot of discussions visually with the Ideagram tool in the last years there are still some shortcomings and bucks within the software prototype on the one hand side and on the scientific investigations on the other hand. Since the Ideagram tool was developed about eight years ago it really needs to be updated. Due to the online version there are several uncertainties due to internet connection. Moreover there are some bucks as that the program crashes after marking more than ten words, colours disappear suddenly and so on so restarting is needed very often. So far we used the Ideagram tool in very different settings and gained a large data pool. However, we have a very inhomogeneous data pool and did not investigate the various dialogues systematically yet.

Yet there is no identification of the author of the logged words possible. That means we cannot show who was speaking and originating the different topics and words and who took them over. For the moment we can only count the logged word but we cannot investigate if it was only mentioned by one person or if the other speakers assumed it and developed this issue further. As a next step we want to rework the quality of the visual representation as this is directly linked to the quality of analytical issues. We need to investigate in existing and further developing effective methods on data recording of voice communication. Though the quality of a human coder is still not easily replaced and adopted by computer machines. And last but not least to establish a more scientific approach for the investigation in spoken Idea discussion with using our Idegram tool more systematically.

Following Schröter (2011: 252), there is an advice for further research: Collocations, i.e. different words that are in direct neighbourhood to or in contact with a catchword, could be used to comprehend the complex semantic field of a catchword. Different aspects of an idea are accessible in this way. To convert this approach, it is necessary to detect more extensive phrases, e.g. word groups as lexical units, than only single terms. To detect and understand how ideas are developed and modified or rejected and replaced by other ideas, it would be helpful to include the corresponding author of a phrase in further approaches of the Ideagram-Tool.

Though our Ideagram tool and method is still a prototype with bucks and deficits, we experienced a strong interest in it during the last decade of usage. People want to buy and use this tool. The benefit of recording, visualising and evaluating spoken discussions in real-time was mentioned as most liked by the audiences and very obviously. We state that due to the flexibility and easy use the Ideagram tool but moreover due to its ability of visual output and graphical analysis it is easy understand, utilise and make use of it e.g. by provoking new ideas and deepen the (follow-up-) discussions while showing the graphs to the interested audience. We assume that it is much applicable in business as well as in research.

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