MOVING

Deliverable 2.3: Final conceptual framework, curricula and MOVING MOOC for community building

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Work Package 2: Didactic and curricula development

TraininG towards a society of data-saVvy inforMation prOfessionals to enable open leadership INnovation

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Executive Summary

This report is an update of deliverable D2.2 and describes the progress on the learning and training features developed within the MOVING project and implemented in the MOVING platform. It documents the design, development and implementation process of the MOVING Curriculum for Information Literacy 2.0 and the implementation and testing of the "Learning-how-to-search" and "Curriculum reflection" widgets of the Adaptive Training Support system. It describes the development of the use case curricula for (1) auditors and (2) junior researchers and the production of learning materials and educational sequences. It also documents the implementation and evaluation of the MOVING MOOC *Science 2.0 and open research methods*, as a practical implementation of the use case 2 curriculum and as a community-building effort on the MOVING platform. Finally, this deliverable gives an overview of the development of the recommender system and shows its implementation on the platform.

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Abbreviations

Abbreviation	Explanation
AAE	Adversarial AutoEncoder
ADDIE (model)	Analysis - Design - Development - Implementation - Evaluation (model)
AE	AutoEncoder
ATS	Adaptive Training Support
CC	Creative Commons
CoP	Certificate of Participation
IL	Information Literacy
ISA	International Standards of Auditing
IES	International Education Standards
MLP	Multi-Layer Perceptron
MOOC	Massive Open Online Course
OER	Open Educational Resources
ReLU	Rectified Linear Unit
SELU	Scaled Exponential Linear Unit
SVD	Singular Value Decomposition
TF-IDF	Term Frequency-Inverse Document Frequency

1 Introduction

The progress in the digitization of our current information landscape provides access to knowledge for almost everyone at any time and offers an immense potential for innovation in all kinds of professional contexts. The competent search for, engagement with and management of information and knowledge are thereby preconditions for people and enterprises to develop their innovative capacities. The potentials of open collaboration and innovation are more and more appreciated in both academia and business. Openness is thereby not an end in itself and there are many ways to achieve openness. They differ in the underlying motives, the target groups addressed and the degree of exchange. *Strategic* openness means the development of new interfaces and infrastructures for the targeted openness of research and innovation processes and thus the development of new innovation potentials for research institutions and companies (Blümel, Fecher, & Leimüller, 2018) MOVING is contributing to strategic openness in that it offers an infrastructure for innovations in data and information driven workflows both academia and business. The goal of the MOVING project is to develop an open, free platform that serves as collaborative infrastructure and enables people from all societal sectors - research institutions, business, public administration, citizens - to improve their information literacy and digital competences and work together open and collaboratively. MOVING helps them to cope with large amounts of information by applying data and text mining techniques. The combined work and training environment of MOVING enables users to learn new skills and competences while using the platform, are encouraged to reflect on (and adapt) their behaviour and to integrate newly acquired skills directly into their workflow.

This report gives a summary of the learning and training features that were developed in work package 2 of the MOVING project. It contains an overview of the MOVING learning and training features. and examines the development and implementation process of the MOVING Curriculum for Information Literacy 2.0. It describes the use case 1 curriculum for public administrators *Digital Audit* developed by EY as well as the use case 2 curriculum for young researchers that was implemented in the MOVING MOOC *Science 2.0 and open research methods* for community building. It, furthermore, gives a comprehensive description of the Adaptive Training Support (ATS) widgets - the "learning-how-to-search"- and "Curriculum reflection"- widgets that support users in improving their data and information literacy on the MOVING platform. And it, finally, examines the Semantic Profiling and Recommender System that was developed in the MOVING project.

1.1 History of the document

Table 1: History of the document

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08/03/19	Moving_d2.3_v0.1_QA_draft
25/03/19	Moving_d2.3_v0.2_draft
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1.2 Purpose of the document

This report is the final update of deliverables D2.1 "Initial conceptual framework, curricula and technical prototypes for adaptive training support" and D2.2 "Updated curricula, prototypes for adaptive training support, introductory MOVING MOOC". It will also contain the results of user studies regarding the MOVING learner guidance, and an update of the MOOC to be built in Task 2.3 regarding community building. It draws on conclusions derived from deliverable D2.4 "Open innovation systems, state-of-the-art and beyond", particularly with regard to the close connection between Open Innovation, collaborative science, digital/information literacy and technology-enhanced learning (see D2.4 sections 2.3 and 3).

1.3 Structure of the document

This report is structured in 6 sections. section 2 gives an overview of the Learning and Training features of the MOVING platform and their contribution to the proliferation of open innovation and open science competences in wider society. section 3 describes the development of the MOVING Curriculum for Information Literacy. Based on the ADDIE model that we used to organise the curriculum design process, this section focuses on the Development, Implementation and Evaluation stages of the process. It outlines the badge concept

and documents the production of learning material and educational sequences. section 4 shows the use case specific implementation of the Information Literacy 2.0 curriculum for (1) training public administrators and (2) training young researchers. The use case 1 is implemented in the Learning Track *Digital Audit* developed by EY. The use case 2 curriculum was implemented in the MOVING MOOC Science 2.0 and open research methods and is documented in this section. section 5 describes the Development, Integration and Evaluation of the two widgets of the Adaptive Training Support - (1) the "Learning-how-to-search" widget and (2) "Curriculum reflection" widget. section 6 examines the Semantic Profiling and Recommender System that was implemented in the MOVING work environment to provide users with individualised recommendations based on keywords searches they perform on the MOVING platform. section 7 finally provides a conclusion and outlook for the MOVING Training and Learning approach that was developed in work package 2 of the project.

2 MOVING learning and training features

MOVING offers in one platform a unique combination of data discovery and text mining tools complemented with training features for data competence and information literacy. Heart of the training features is the MOVING Learning Environment. Here, all the learning content is organised and directly accessible to the users. The landing page (see Figure 1) gives an overview of the learning materials including the *platform demo videos* and video tutorials, the *Learning Tracks for Information Literacy 2.0* and the MOVING MOOC *Science 2.0 and open research methods*. The platform demos are videos that were produced by JSI and are hosted by Videolectures.net. They are embedded in the Learning Environment so users can learn about the different platform features and technologies developed within the MOVING project. Users can improve their data and information literacy as well as digital competences through the MOVING *Learning Tracks for Information Literacy 2.0*. The ATS (Adaptive Training Support) in the Working Environment of the platform regularly offers learning prompts via the "Curriculum reflection" widget to users based on their prior knowledge and guides them to the microlearning sessions in the Learning Environment. These small sessions are called *learning cards* and are based on the MOVING Curriculum for Information Literacy 2.0 that is described in the section below. They contain learning material in different media formats (text, video, infographics etc.). The MOVING MOOC *Science 2.0 and open research methods* is a 4 week online course hosted on the MOVING platform designed to give young scholars from a wide range of disciplines a comprehensive introduction to open science methods and open research workflows and was implemented in the Communities environment of the MOVING platform.

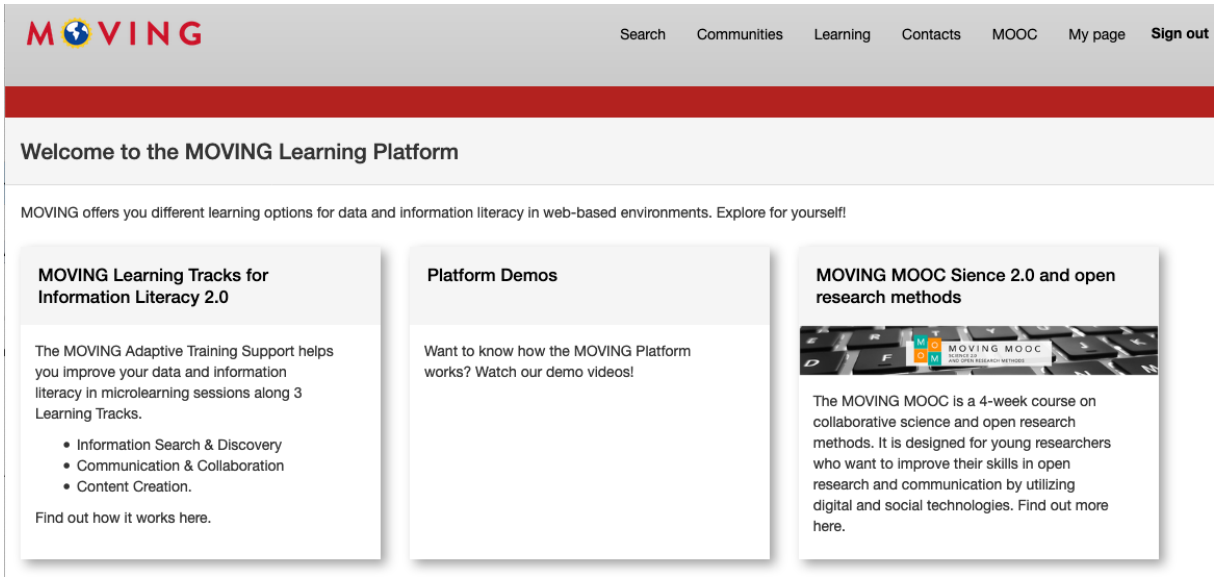

Figure 1: Screenshot: Learning environment landing page

3 MOVING curriculum for information literacy

3.1 Curriculum development

As documented in deliverable D2.2 we used an ADDIE (Analysis - Design - Development - Implementation - Evaluation) model for the curriculum design process (see Figure 2). The Analysis and Design stages of the curriculum development were comprehensively described in D2.2 (Chapter 3.2). In the following chapters, we will focus on the Development, Implementation and Evaluation Stages of the Curriculum design process.

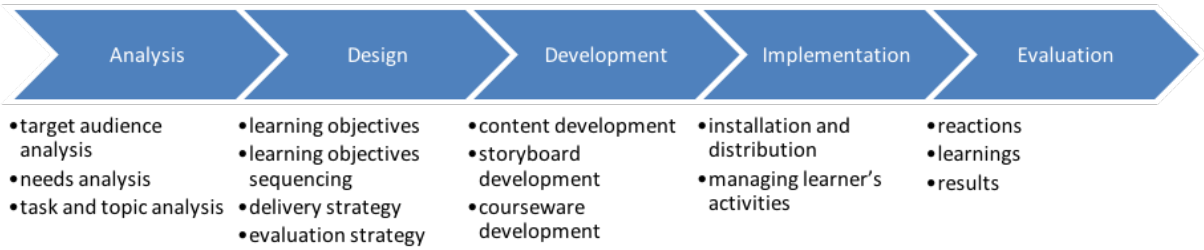

Figure 2: ADDIE model

The MOVING curriculum for Information Literacy 2.0 is based on the structure of the DigComp 2.0/2.1 (Vuorikari & Punie, 2016) and (Carretero, Vuorikari, Punie, et al., 2017) standard for digital competence and organised the learning sessions along three learning tracks. An additional learning track 4 for the use case 1 curriculum on Digital Audit and Applications (see Figure 3) was added as learning offer specifically for EY auditors to both the learning environment and the ATS curriculum widget (see Figure 3). It will be described further below in sections 3.5 and 4.2 of this deliverable.

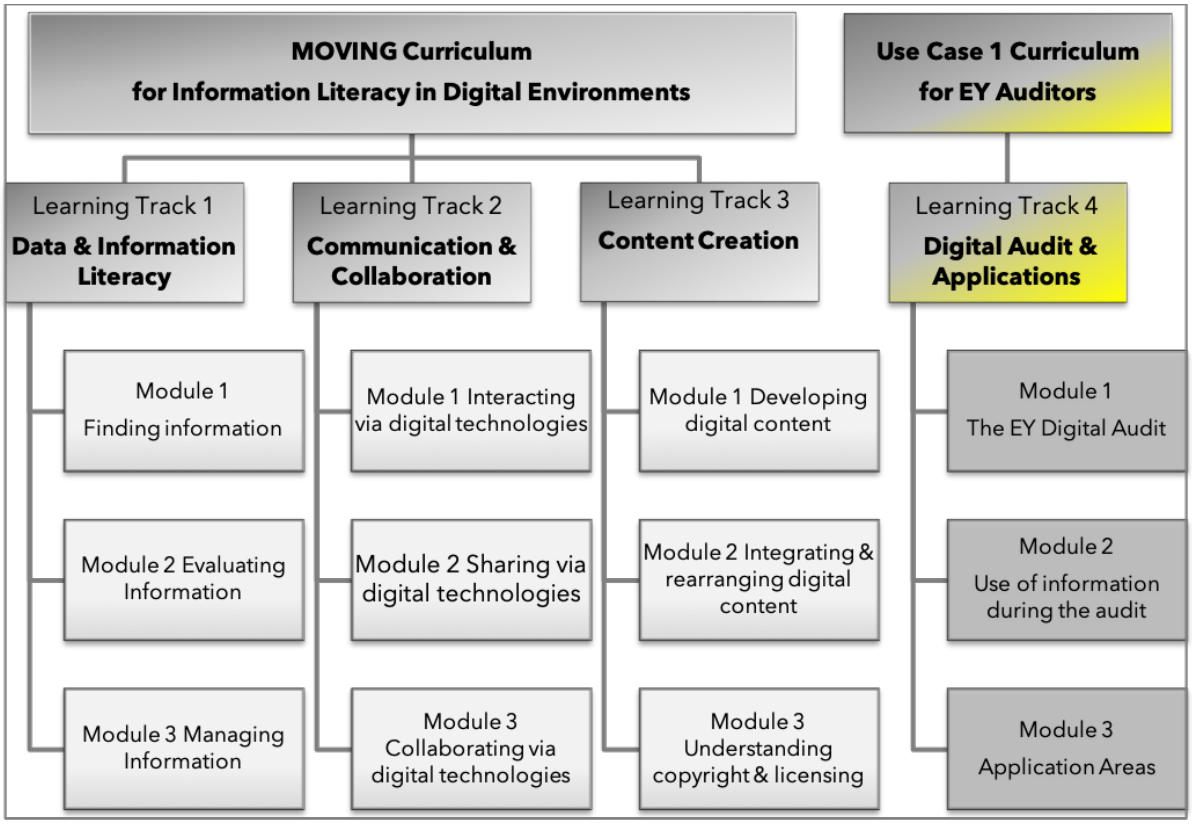

Figure 3: MOVING Curriculum for Information Literacy 2.0 structure

3.2 Development of microlearning units

The MOVING Curriculum for Information Literacy 2.0 contains a total of 61 microlearning sessions covering a wide range of topics related to data and information literacy, digital communication and collaboration as well as content creation. The microlearning units provide short and fast information transfer (max. 10 min) and are specially designed for the MOVING platform. They encourage users to develop creative and flexible strategies on how and where to find information using the internet and web 2.0 technologies (such as blogs, social network sites, wikis, microblogs and social media) and to critically evaluate and effectively manage this information. Learners will also be enabled to use web 2.0 technologies to share information and content with others, to apply knowledge of copyright and creative commons licensing to create their own and reused content. The microlearning units are organised as so-called "learning cards" in the learning environment of the MOVING platform (see Figure 4).

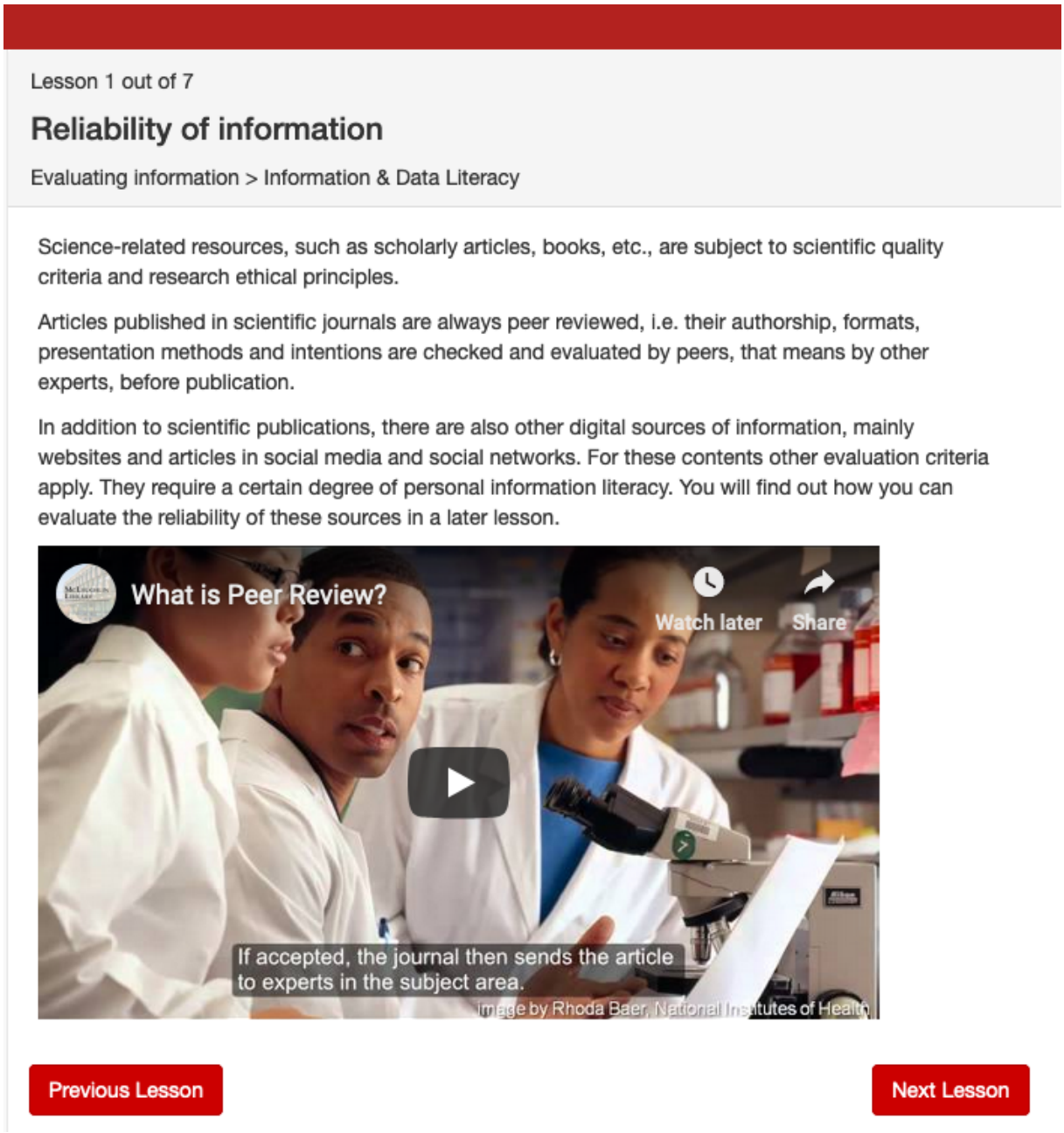

Figure 4: Learning card: Evaluating the reliability of information

The learning content of the MOVING curriculum for Information Literacy has been developed based on digital competency and information literacy standards (see D2.2 Chapters 2 and 3) and have been supplemented

by Creative Commons (CC) licensed media resources such as videos, infographics, web links to tools and platforms as well as scientific literature. The curriculum contains a mix of sessions covering general Information Literacy and digital competences and attitudes but also specific training sessions that can be applied in workflows on the MOVING platform. To ensure that learning prompts were perceived by users as unobtrusive and useful, learning units were written as compactly as possible and deliberately condensed into key information and application-oriented examples. A jargon-free and short sentence structure ensures ease of reading and motivation. For better understanding and exemplary illustration of learning content for the users, text passages were complemented with learning videos such as MOVING demo and tutorial videos, self-produced learning videos as well as CC-licensed YouTube tutorials. Further literature suggestions and links to digital tools and resources were added to the learning units whenever possible. In addition to the learning cards, short motivational text prompts were created for the ATS widget.

The microlearning units are subdivided into three main modules (learning tracks), each of which is divided into sub-modules and chronologically ascending levels of difficulty (level 1 - beginner, 2 - intermediate, 3 - expert).

1. Learning track 1: Data & Information Literacy
   - involves the development of search strategies; the evaluation and management of data, information and digital content; and the functioning of digital and self-directed learning
2. Learning track 2: Communication & Collaboration
   - provides knowledge about interaction, content sharing and collaboration using Web 2.0 technologies
3. Learning track 3: Content Creation
   - explains the creation, modification and preparation of digital content and provides information on copyright and Creative Commons licences

The learning content is described in further detail in section 3.3 below.

3.3 Production and provision of learning material

3.3.1 Learning track 1: Data & Information Literacy

Learning Track 1: Data & Information Literacy consists of 24 microlearning sessions and provides training in information search and discovery, methods for evaluating the reliability and validity of information, and, finally, lessons on how to effectively manage and store information in digital environments. Learning material consists of texts, videos, infographics and links to further information material or webbased tools and technologies. The learning sessions were built at the Media Center and included videos produced at JSI (Videolectures.net) and OER learning materials with a Creative Commons license.

Table 2 shows the topics of the microlearning sessions with the corresponding submodules and competence levels for Learning Track 1.

3.3.2 Learning track 2: Communication & Collaboration

Learning Track 2 consists of 20 microlearning sessions. On this track users learn about ways to use web-based and social technologies to interact, share, communicate and collaborate with others in digital environments. Learning sessions in this track include both practical applications for the features of the MOVING platform and tools and technologies - like wikis, etherpads, group communication etc. - that are commonly used in other web-environments too. This makes it possible that competences and attitudes that are being conveyed through the MOVING Learning Tracks can be applied in other work and research situations too and increases the general digital and information literacy of MOVING users. Table 3 shows all the learning sessions of Learning Track 2.

3.3.3 Learning track 3: Content Creation

Learning Track 3 contains 17 microlearning sessions on the topic digital content creation. In three modules users learn how to develop their own digital content in different media formats, how to integrate and rearrange content produced by others and how to apply copyright and licenses to digital content. The learning sessions include a wide range of topics that range from skills to create digital media to technologies technologies like HTML, Hyperlinks and RSS on which the world wide web is based. They also teach users about the benefits

Table 2: Microlearning sessions of learning track 1: Data and Information Literacy

Session Title	Module/level
MOVING Search domain	Finding information/beginner
New sources of information	Finding information/beginner
Simple Search	Finding information/intermediate
Search strategies	Finding information/intermediate
Search Operators	Finding information/intermediate
Advanced search mask	Finding information/intermediate
Adaptive Training Support	Finding information/intermediate
Social technologies as source of information	Finding information/expert
Video Linking	Finding information/expert
Search Engines	Finding information/expert
Reliability of information	Evaluating information/beginner
Evaluating Web-based information	Evaluating information/intermediate
Tag Cloud	Evaluating information/intermediate
Data Visualization	Evaluating information/intermediate
Top Concepts and Top Sources	Evaluating information/expert
Concept Graph	Evaluating information/expert
URank	Evaluating information/expert
Online Literature Management	Managing information & digital content/beginner
Online Learning & Training	Managing information & digital content/intermediate
Massive Open Online Courses (MOOCs)	Managing information & digital content/intermediate
RDF Resource Description Framework	Managing information & digital content/intermediate
Linked Open Data	Managing information & digital content/expert
Data mining	Managing information & digital content/expert

Table 3: Microlearning sessions of learning track 2: Communication and Collaboration in digital environments

Session Title	Module/level
Netiquette	Interacting via digital technologies/beginner
Social media & Social networks	Interacting via digital technologies/intermediate
Group Communication	Interacting via digital technologies/intermediate
Digital presentation tools	Interacting via digital technologies/intermediate
Online Survey Tools	Interacting via digital technologies/expert
MOVING Contacts	Interacting via digital technologies/expert
Digital content and knowledge dissemination	Sharing via digital technologies/beginner
Digital information and knowledge sharing via blogs and microblogs (e.g. Twitter)	Sharing via digital technologies/intermediate
Digital Pinboards and Note Organisers	Sharing via digital technologies/intermediate
Slideshare Servers	Sharing via digital technologies/intermediate
Open Data	Sharing via digital technologies/expert
Wiki-Software	Sharing via digital technologies/expert
Digital tools and technologies for collaboration	Collaborating via digital technologies/beginner
Online collaboration platforms and tools	Collaborating via digital technologies/intermediate
Create collaborative whiteboards and mindmaps	Collaborating via digital technologies/intermediate
Collaborative Writing Platforms	Collaborating via digital technologies/intermediate
Digital project management with Kanban Boards	Collaborating via digital technologies/intermediate
Virtual Research Environments (VRE)	Collaborating via digital technologies/expert
Croudsourcing Research	Collaborating via digital technologies/expert
Citizen Science	Collaborating via digital technologies/expert

Table 4: Microlearning sessions of learning track 3: Digital Content Creation

Session Title	Module/level
Creating Content	Developing digital content/beginner
Creating Videos & Social networks	Developing digital content/intermediate
Creating and remixing images	Developing digital content/intermediate
Websites and Blogs	Developing digital content/expert
Hyperlinks	Integrating & rearranging digital content/beginner
RSS and ATOM Feeds	Integrating & rearranging digital content/intermediate
MOVING Editor	Integrating & rearranging digital content/intermediate
Pre-Prints	Integrating & rearranging digital content/intermediate
Free & Open Source Software	Integrating & rearranging digital content/expert
Open Content	Integrating & rearranging digital content/expert
OER - Open Educational Resources	Understanding copyright & licensing/beginner
Open Content Licenses	Understanding copyright & licensing/intermediate
Creative Commons Licenses	Understanding copyright & licensing/intermediate
Open Access	Understanding copyright & licensing/intermediate
Open Source	Understanding copyright & licensing/expert
Open Data	Understanding copyright & licensing/expert
User interaction tracking	Understanding copyright & licensing/expert

and responsible engagement with open content and the possibilities to allow and restrict access to digital content by the means of licenses. Table 4 shows all the microlearning sessions of Learning Track 3.

3.3.4 Learning track 4: Digital Audit - Using the MOVING platform in an audit of financial statements

This learning track consists of 10 microlearning sessions about the usage of the MOVING platform in an audit of financial statements. It is structured along the international standards on auditing. The access is restricted to EY users. Further information about this learning track can be found in section 4.1.

3.3.5 Production of demo videos and project videos

Based on Task 2.3, JSI continued to produce relevant MOVING tutorials and guidance videos. The videos are provided in the learning environment of the MOVING platform and also at a MOVING dedicated VideoLectures.NET subsite: http://videolectures.net/moving_videos/. The aim of the videos is to train the platform users and also the public interested in the MOVING project, about the MOVING technology and services (introduction and explanation of the functionalities of the MOVING platform). Exploiting the full potential of the MOVING platform, users can become data-savvy information professionals. Until M35 of the project, MOVING is serving with 24 produced videos (see Table 5). The produced videos are divided into two groups, regarding the content: (1) Project Overview, (2) Technologies & Services Presentations.

3.4 Digital badges

Badges in the sense of an object that shows that a person has a certain rank and function were used in the military, for example, long before the invention of the Internet. In the Internet age, badges played a role as electronic insignia in online-games. The use of badges in education is relatively new ((Roy & Clark, n.d.), p. 2). Here, they are visual representations of competences and abilities, whether formal (certified) or informal (e.g. in social networks such as LinkedIn, Twitter, Facebook) ((Abramovich, 2016), p. 128). Digital badges "that are designed primarily as assessments can motivate students to learn by providing feedback that supports learning" ((Abramovich, 2016), p. 127). They also make it possible to visualise sub-compentencies or micro-skills that cannot be represented in a certificate or testimonial because they are too detailed (Shields & Chugh, 2017). Badges therefore do not replace formative or summative assessment but are used as a supplement to increase learner motivation. Especially in MOOCs badges are used as supplementary assessment systems. Here they offer the advantage that their automated allocation makes it easier to cover the usually high number of

Table 5: Platform tutorials and project videos

Video Title/Duration	Category
1) MOVING Project [01:50]	Project Overview
2) MOVING Project Overview [03:08]	Project Overview
3) MOVING use case: Financial auditors [02:42]	Project Overview
4) MOVING use case: MA, PhD students and researchers [02:53]	Project Overview
5) Strategy Building for a Knowledge Repository with a Novel Expert Information Fusion Tool [06:03]	Project Overview
6) MOVING platform: Search Features [01:21]	Project Overview
7) MOVING platform: Adaptive Training Support (ATS) v1 [02:08]	Technologies & Services Presentations
8) MOVING platform: Concept Graph [01:05]	Technologies & Services Presentations
9) MOVING platform: uRank [01:05]	Technologies & Services Presentations
10) MOVING platform: LODatio+ [02:08]	Technologies & Services Presentations
11) MOVING platform: Video Analysis Service [02:41]	Technologies & Services Presentations
12) MOVING platform: Lecture Video Linking [02:33]	Technologies & Services Presentations
13) MOVING platform: Adaptive Training Support (ATS) v2 [03:14]	Technologies & Services Presentations
14) MOVING platform: Concept Graph v2 [02:03]	Technologies & Services Presentations
15) MOVING platform: uRank v2 [02:38]	Technologies & Services Presentations
16) MOVING platform: LODatio+ v2 [03:00]	Technologies & Services Presentations
17) MOVING platform: WevQuery [03:20]	Technologies & Services Presentations
18) MOVING platform: Videolectures.NET Chapters [01:48]	Technologies & Services Presentations
19) Training Researchers with the MOVING Platform [15:47]	Technologies & Services Presentations
20) MOVING platform (Sept. 2017) [03:06]	Technologies & Services Presentations
21) Lecture video linking demo (Sept. 2017) [01:54]	Technologies & Services Presentations
22) Wevquery - A scalable system for testing hypotheses about web interaction patterns [02:55]	Technologies & Services Presentations
23) Lecture video linking demo [01:38]	Technologies & Services Presentations
24) EconBizRecSys Demo [01:57]	Technologies & Services Presentations

participants. In the MOVING project, the Open badge Framework is used to issue and manage badges. This will be explained in more detail below.

3.4.1 Open Badges

One possibility to assign digital badges is, to use Open Badges: "Open Badges are verifiable, portable digital badges with embedded metadata about skills and achievements. They comply with the Open Badges Specification and are shareable across the web" (https://openbadges.org/get-started/). Open Badges go back to Mozilla Open Badges, an open source badge infrastructure that makes it possible to create, assign and manage digital badges (for a brief history on Mozilla Open Badges see https://openbadges.org/about/). The Open Badges Framework consists of digital image files enriched with metadata and an open badge infrastructure that ensures that digital badges from different educational contexts can be collected and exported (Voogt, Dow, & Dobson, 2016). The metadata of a badge gives information about:

- who has assigned the badge, e.g. an educational institution or a provider of learning opportunities,
- which criteria had to be fulfilled in order to receive the badge,
- who got the badge and
- if applicable, links to the corresponding assessment (see (Shields & Chugh, 2017), p. 1818).

For the use of badges, Mozilla Open Badges proposes a distinction between larger badges and smaller badges (see Mozilla Foundation 2012, Working Paper). While smaller badges are intended "for motivational and formative feedback purposes" (Mozilla Foundation 2012, Working Paper), larger badges serve to certify the successful participation on a learning offer, e.g. a course or a self-learning module. Accordingly, it is possible to obtain several smaller badges, while larger badges are more attached to formal assessments and criteria. Depending on how the requirements for maintaining badges are defined, a predefined number of smaller badges may also be required to achieve a large badge. Before using open badges for a learning offer, it is therefore necessary to define clear learning objectives and requirements for achieving a badge. In addition, the Open Badges Infrastructure offers as standard the possibility to export badges, to "backpack" them. Badges that have been acquired on different platforms and in the context of different learning offers can be collected and presented (see D4.3).

3.4.2 The use of Open Badges for the Curriculum for Information Literacy 2.0

We developed badges for passing the "Information Literacy 2.0" curriculum. The aim of using badges in the curriculum is to motivate the platform users to go through all lessons of the three learning tracks "Information Search and Discovery", "Communication and Collaboration" and "Content Creation" of the curriculum and to get themselves an overview of the learning content. There is no formal assessment to evaluate what has been learned by the platform users, only a progress measurement with the help of the "Next" button on the pages of the individual lessons. If all lessons of a track are clicked through, the platform user receives the badge of the respective track. In this way, the MOVING platform supports the lifelong learning of platform users. We also developed badges for the MOVING MOOC, which is described in section 4.2.3.

Web 2.0 Information Discovery Badge

Description: The Web 2.0 Information Discovery Badge (Figure 5) shows that you have completed all lessons of Learning Track I "Information Search and Discovery" of the MOVING Curriculum for Information Literacy 2.0. In this track you learned about how to use digital tools and social technologies to effectively manage information and digital content and how to engage in self-directed learning within digital environments.

Requirements: Complete all lessons of Learning Track I "Data and Information Literacy" of the MOVING curriculum for Information Literacy 2.0.

Web 2.0 Communication and Collaboration Badge

Description: The Web 2.0 Communication and Collaboration Badge (Figure 6) shows that you have completed all lessons of Learning Track II "Communication and Collaboration" of the MOVING Curriculum for Information Literacy 2.0. In this track you learned about how to effectively communicate information with the help of digital tools, how to share data, information and digital content as well as how to use digital tools and technologies to collaborate with others.

Figure 5: Information Discovery Badge

Requirements: Complete all lessons of Learning Track II "Communication and Collaboration" of the MOVING curriculum for Information Literacy 2.0.

Figure 6: Communication and Collaboration Badge

Web 2.0 Content Creation Badge

Description: The Web 2.0 Content Creation Badge (Figure 7) shows that you have completed all lessons of Learning Track III "Content Creation" of the MOVING Curriculum for Information Literacy 2.0. In this track you have seen how to use digital tools to create digital content in various formats for different media. You learned about how to modify, refine, improve, and integrate information in different formats and how copyright and licenses apply to data, digital information and content.

Requirements: Complete all lessons of learning Track 3 "Content Creation" of the MOVING curriculum for Information Literacy 2.0.

Figure 7: Content Creation Badge

3.5 Curriculum implementation

The learning content of the MOVING Curriculum for Information Literacy 2.0 is organised along three learning tracks in the learning environment of the MOVING platform (see Figure 8). The respective submodules are approached via the ATS (Adaptive Training Support) "Curriculum-widget" in the Search environment of the MOVING platform. ATS prompts consist of short teasers that suggest appropriate microlearning learning units to users according to their level of previous knowledge. The prior knowledge assessment is a short survey that users fill out when first using the ATS widget. Additionally, all microlearning units are also available in the MOVING learning environment and can be accessed directly and individually. For the two use cases of MOVING, the general IL curriculum was adapted to the specific work contexts and training needs of (1) public administrators and (2) young researchers. In the following section the specific use case curricula are illustrated in further detail.

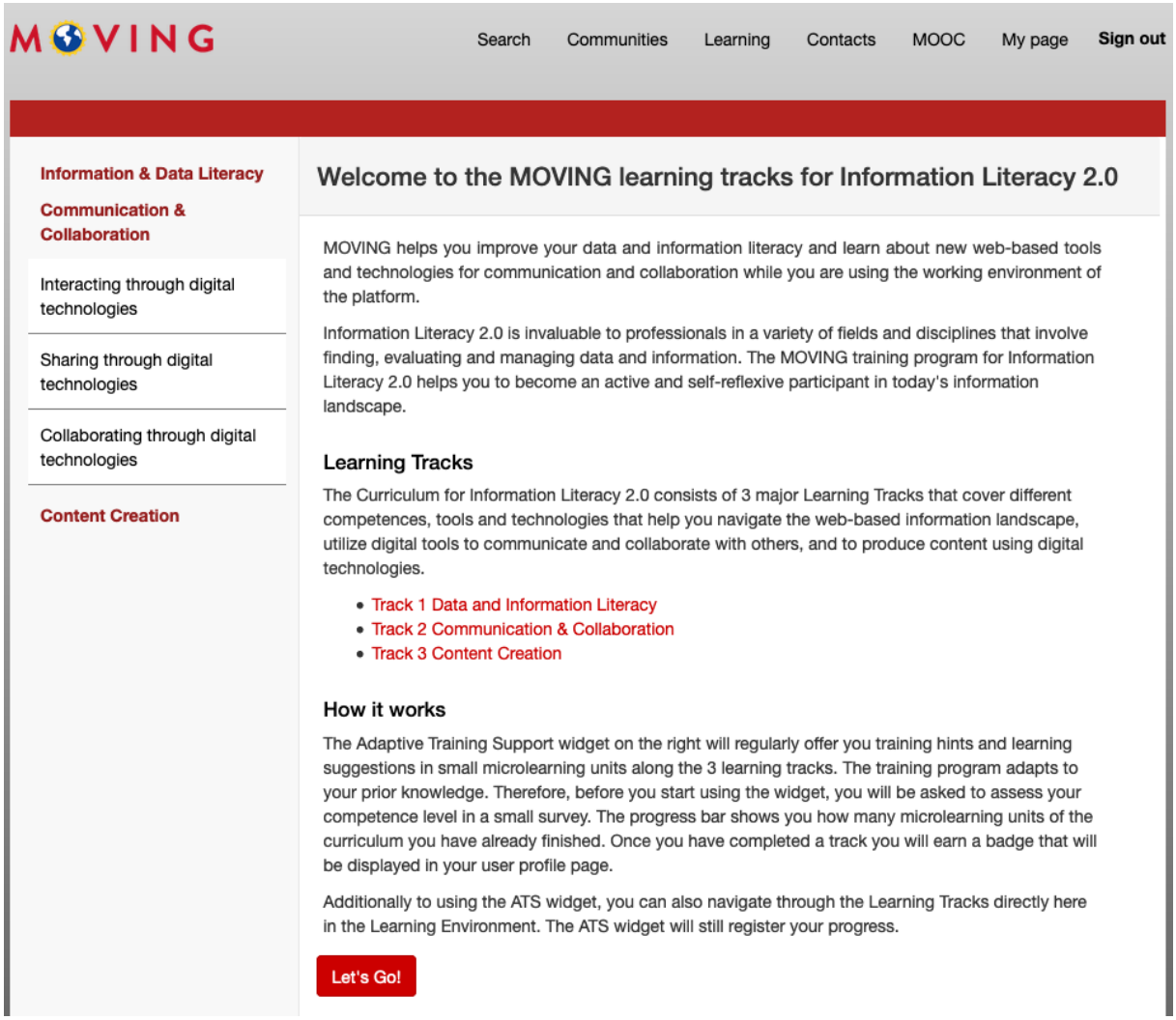

Figure 8: learning tracks for Information Literacy 2.0

4 MOVING use case curricula

4.1 Use Case 1: MOVING curriculum for public administrators

This section describes the final curriculum for public administrators (use case 1 users). Built on the initial structure provided in deliverable D2.2, the curriculum has been modified and extended to integrate the methodological requirements for the audit service delivery and the functionalities of the MOVING platform. The curriculum for use case 1 users was developed do address requirements from the International Standards of Auditing (ISA) and the related audit scenarios introduced in deliverable D1.1. The purpose of the curriculum and the competencies according to the International Education Standards 7 and 8 (IES 7, IES 8) have been previously described in detail in D2.2. The structure of the curriculum initially described in D2.2 is detailed further more in the following paragraphs.

The final curriculum for public administrators is integrated in the learning environment as a fourth learning track with submodules and lessons, similar to the general MOVING curriculum for Information Literacy that is accessible to all users. The access for this fourth learning module, however, is restricted to EY users only. The users are guided through the curriculum by means of prompts that appear in the ATS "Curriculum reflection"-widget on the right side bar of the working environment page. They can also manually go to the learning environment tab of the platform where they can consult the structured curriculum with learning objectives and links to further resources and learning materials. The curriculum is structured along the international standards on auditing. Currently, ISA 550, ISA 315 and ISA 250. Further lessons, e.g. on ISA 240, will be included based on EY's annually updated learning priorities. This learning module will be maintained and updated, once the MOVING platform has been integrated into EY's infrastructure by EY's learning and development group. Due to the speed of change in auditing and accounting regulation there needs to be a continuous process for content management of the platform.

4.1.1 Module 4.1 Course ISA 550: Understand and evaluate related parties disclosed by the entity

Learning objective: This course covers how the MOVING platform can assist the financial auditor in (1) identifying related parties, (2) assessing the completeness of related parties disclosed by the entity, and (3) evaluating the nature of the connections between the related parties identified. Meeting these objectives of ISA 550 is supported by MOVING's search environment, entity extraction algorithms, concept graph visualisation and uRank functionality.

Lesson 1: Background – Objective of ISA 550 For the definition of a related party, ISA 550 refers to the applicable financial reporting framework (ISA 550 para. 10 (b)). According to the International Accounting Standard 24 (IAS), a related party is a person or an entity that is related to the reporting entity. For example, a person or a close member of that person's family is related to a reporting entity if that person has control, joint control or significant influence, over the entity or is a member of its key management personnel. Another example is an entity related to the reporting entity if, among other circumstances, it is a parent, subsidiary, associate, or joint venture of the reporting entity, or it is controlled, jointly controlled or significantly influenced or managed by a person who is a related party. A related party transaction is a transfer of resources, services or obligations between a reporting entity and a related party, regardless of whether a price is charged.

Many related party transactions are in the normal course of business. In such circumstances, they may carry no higher risk of material misstatement of the financial statements than similar transactions with unrelated parties. However, the nature of related party relationships and transactions may give, in some circumstances, rise to higher risks of material misstatement of the financial statements than transactions with unrelated parties. For example, related party transactions may not be conducted under normal market terms and conditions. In addition, related party transactions may operate through an extensive and complex range of relationships and structures, with a corresponding increase in the complexity of related party transactions (ISA 550 para. 1).

The MOVING platform can support the auditor in obtaining an understanding of related party relationships and transactions to (a) recognise fraud risk factors, if any, arising from related party relationships and transactions that are relevant to the identification and assessment of the risks of material misstatement due to fraud and (b) to conclude, based on the audit evidence obtained, whether the financial statements insofar as they are affected by those relationships and transactions (ISA 550 para. 9). Relevant links: ISA 550[1]

Lesson 2: Entity extraction from client specific documents Using MOVING's document upload functionality, select a file containing the related parties disclosed by the entity. This may be, for example, the

[1] http://www.ifac.org/system/files/downloads/a029-2010-iaasb-handbook-isa-550.pdf

annual report, the list of shareholdings, or the notes to the financial statements. Unless explicitly specified in the upload interface, the document is uploaded only temporarily, i.e. it will be deleted from the platform after the current login session is closed. The metadata of the document will also not be indexed in the data model structure of the platform's database. When checking the corresponding checkbox, the document will automatically be added to the MOVING database. After uploading the document, the persons, organisations and locations ("entities") present in the document are automatically extracted by the platform. Simultaneously, the relations between the persons/organisations and the locations are measured and specified. After the extraction is completed, the entities are visualised in the concept graph. The relationships are weighted considering the co-occurrence and position of the entities within the document. You may use the concept graph to gain an initial understanding of the entities mentioned in the uploaded document as well as their relationships. General guidance on how to use and customise the concept graph is provided in the technical learning section available in MOVING's learning environment. Note that the entity extraction functionality may also be used when evaluating other information as required by ISA 720. This ISA requires the auditor to read other information (financial and non-financial information other than the financial statements and the auditor's report thereon) which is included, either by law, regulation or custom, in a document containing audited financial statements and the auditor's report thereon (ISA 720 para. 1, ISA 720 para. 5). The objective of the auditor is to respond appropriately when documents containing audited financial statements and the auditor's report thereon include contradictory information that could undermine the credibility of those financial statements and the auditor's report (ISA 720 para. 4). With MOVING's entity extraction functionality, the auditor can analyse this other information by extracting the concepts and visualising them on the platform, as described in lesson 3 of this course.

Lesson 3: Integration of relevant entities extracted from the databases connected to MOVING In a next step, the entities extracted from the uploaded document are used as the starting point for further search queries. That is, the top entities found in the uploaded document are automatically used by the platform to add more relevant documents from the databases connected to MOVING. By means of co-occurrence analysis, the related parties identified in documents from the MOVING databases are added to the concept graph in connection to the main entity of interest. When present together in the same document, the MOVING platform can specify the distance between the entity of interest and the related party identified, which is considered in properties of the respective nodes and edges of the concept graph. Future releases of the platform might enable to manually select the relevant entities and weight their importance. By extracting the entities contained in the client's document and integrating the relevant entities identified in the databases connected to MOVING, the concept graph supports assessing the completeness of related parties disclosed in the financial statements. Further guidance is provided in lesson 4 of this course.

Lesson 4: Assessing the completeness of related parties disclosed by the client In lessons 2 and 3 of this course, the related parties contained in the client's specific document uploaded as well as the entities identified in the databases connected to MOVING have been extracted and visualised in the concept graph. This lesson provides guidance in how to use MOVING's different visualisation functionalities to compare both sets of entities and inform the assessment of the completeness of the related parties disclosed by the client.

From the different highlighting applied in the concept graph you can tell which entities have been extracted from the client's document, which entities were identified in the databases connected to MOVING, and which entities are evident in both the document and the MOVING platform. It is recommended to set the starting node type to "Affiliation" and start filtering the graph to show persons, organisations and locations only. In exploring the remaining nodes step-by-step, you can easily identify related parties that are included in the client's file but not identified in the MOVING database and vice versa. When assessing the reasons behind any discrepancies identified, it might make sense to change the filter settings to show documents and keywords again.

You may also use the uRank functionality to follow-up on specific connections identified that do not meet your expectations (see Figure 9. For the assessment of co-occurrence of entities, you may select the tags with the client's name and another company of interest. By this, you can identify from the colouring the documents in the databases connected to MOVING that include both entities. The sorting of documents in uRank will automatically change to take into account the relevance (based on the frequencies of occurrence and tag selection). The "Shift" column indicates how selecting or unselecting a specific tag has impacted the sorting of search results. Clicking the document title will open a new browser tab containing the full-text, if accessible by your organisation.

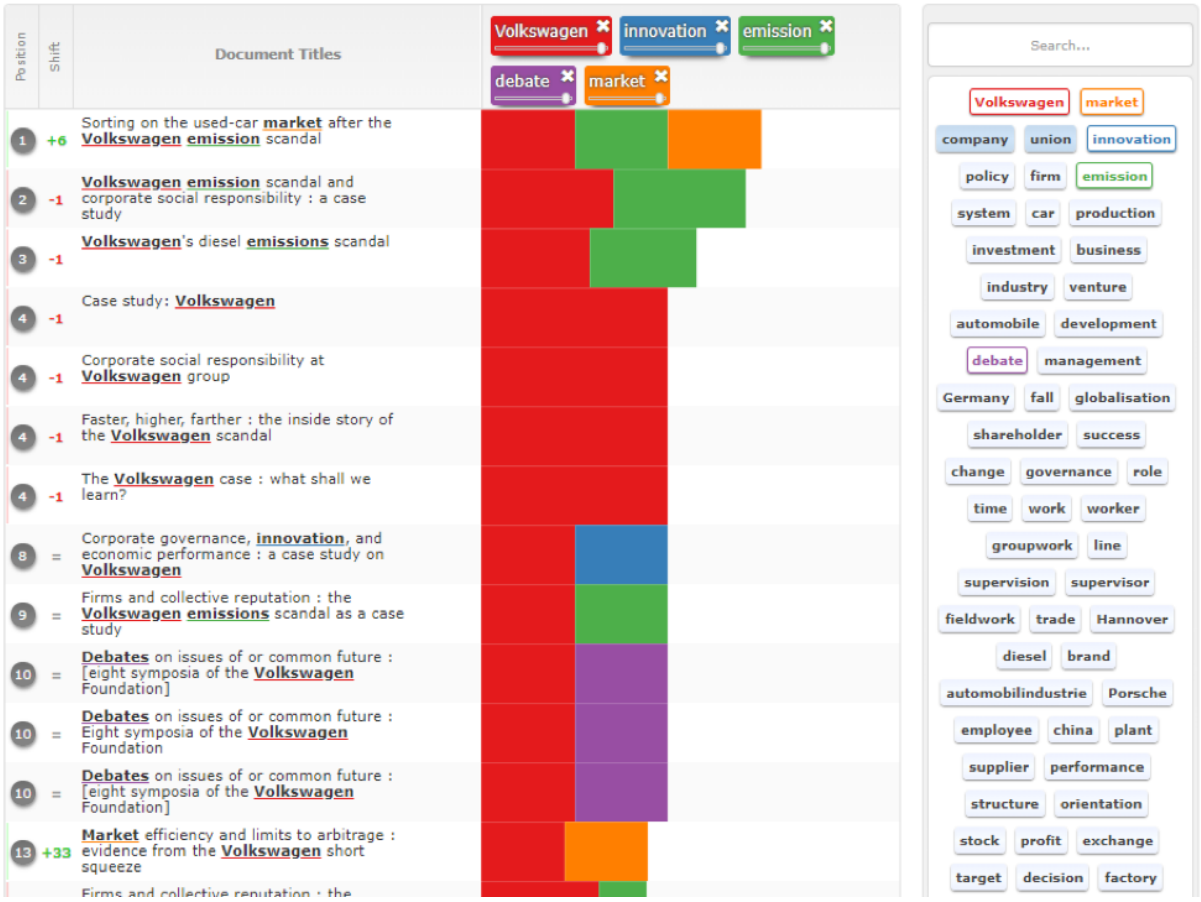

Figure 9: uRank visualisation

4.1.2 Module 4.2 Course ISA 315: Understand the entity and the environment

This course covers how to support understanding the entity and its environment with data relevant to the client that has been obtained from the semi-structured or unstructured data connected to MOVING.

Lesson 1: Background – Objective of ISA 315 ISA 315 requires the auditor to identify and assess the risks of material misstatement, whether due to fraud or error, through understanding the entity and its environment, thereby providing a basis for designing and implementing responses to the assessed risks of material misstatement (ISA 315 para. 3). To enable the understanding of transaction classes, account balances and disclosures expected in the financial statements, the auditor should obtain an understanding of the following (ISA 315 para. 11):

- Relevant industry, regulatory, and other external factors including the applicable financial reporting framework.
- The nature of the entity, including: (a) its operations, (b) its ownership and governance structures, (c) the types of investments that the entity is making and plans to make, including investments in special-purpose entities and (d) the way that the entity is structured and how it is financed.

In the following lessons of this course you will learn how to use the MOVING platform to efficiently inform the understanding of the entity and the environment with information relevant to the client obtained from unstructured data.

Relevant links: ISA 315[2]

[2] http://www.ifac.org/system/files/downloads/a017-2010-iaasb-handbook-isa-315.pdf

Lesson 2: Understand the nature of the entity MOVING's concept graph can provide valuable insights when obtaining an understanding of the nature of the entity. The nature of the entity includes its operations, its ownership and governance structures, types of investments, the structure of the entity and its financing. The text mining functionalities integrated in the platform will provide the necessary tools to extract information relating to operations, ownership, governance structures, types of investments and the structure of the entity, which help the auditor in understanding the nature of the entity.

You may use the concept graph to enrich your initial understanding of the entity with knowledge of specific nature regarding the company you are auditing. After performing a search or entity extraction analysis, the concept graph shows the ranked search results as nodes in a graph. Hovering over a node will display additional information about that node; for example when selecting the starting node type Document, this additional information will be a set of metadata available in the data model; in contrast, when switching to Affiliation, the additional information will simply be the number of documents sharing an edge with the node of the entity; the same will apply to the Year starting node. The size of the nodes is given by the number of edges (relationships) with other nodes that the node is sharing.

For a deeper understanding of this functionality, let's take the search for the Volkswagen company, set the starting node type to Affiliation and expand the graph by right-clicking on the node and then clicking on the outer ring, the farthest from the nodes icon. Expand to full screen mode for a better visualisation. You will notice the two biggest nodes are the Company node and the Year node sharing an edge with all documents displayed. In addition, Concept nodes are displayed; these connect to the documents and are extracted from the metadata of the search results documents. You can further select or deselect showing the tags of the nodes or apply various filters directly to the graph if you go to the top left corner of the visualisation.

Relevant links: Concept Graph Demo[3]

Lesson 3: Understand the relevant industry, regulatory, and other external factors Understanding the entity and the environment includes understanding the relevant industry the company is operating in, the regulations specific to the entity and other external factors that might apply.

Relevant industry factors include conditions like the competitive environment, supplier and customer relationships, and technological developments. Examples of matters the auditor may consider include the market and competition, including demand, capacity, and price competition, cyclical or seasonal activity, product technology relating to the entity's products, and energy supply and cost. The industry in which the entity operates may give rise to specific risks of material misstatement arising from the nature of the business or the degree of regulation. The regulatory factors include legislation and regulations that significantly affect the entity's operations, taxation, environmental requirements affecting the industry and the entity's business, etc. As far as external factors go, the auditor can include the general economic conditions, interest rates and financing or inflation.

The MOVING platform can be used to extract information related to all of the criteria described above. The search environment will support in finding the relevant regulations and provide insight on changes occurred over time. The databases connected to the MOVING platform provide information on the general external factors and the industry. The concept graph visualisation provides the means to go deeper into the search results and make the necessary connections needed to understand the industrial factors.

The uRank visualisation feature allows you to create and display document rankings. It helps to reorganise documents based on the current information interests. The right side of the visualisation includes all concepts and entities that have been identified by the platform based on your search query. You can use the search window at the top of the tags to search and select relevant keywords. The documents are re-ranked accordingly, taking into account the currently selected keywords and starting with the document containing the highest number of co-occurrence of these keywords. The bigger the bars, the higher the number of occurrence of the respective keyword.

You can further determine the relevance of selected keywords by adjusting their weights using the sliders provided at the bottom of each keyword selected. The visualisation will update to change the ranking of documents based on the importance of keywords specified.

4.1.3 Module 4.3 Course ISA 250: Identify applicable laws and regulations and changes therein

Learning objective: Noncompliance with laws and regulations can affect an organisation's economic and financial status. Understanding and identifying potential risks on whether changes in laws and regulations might affect the organisation's compliance is an important audit procedure in every audit of financial statements.

[3] http://videolectures.net/moving_platform_concept_graph_v2

This course covers how the MOVING platform can support to evaluate the client's compliance with laws and regulations, including applicable accounting standards.

Lesson 1: Background – Objective of ISA 250 The effect on financial statements of laws and regulations varies considerably. Those laws and regulations to which an entity is subject constitute the legal and regulatory framework. The provisions of some laws or regulations have a direct effect on the financial statements in that they determine the reported amounts and disclosures in an entity's financial statements. Other laws or regulations are to be complied with by management or set the provisions under which the entity is allowed to conduct its business but do not have a direct effect on an entity's financial statements. Some entities operate in heavily regulated industries (such as banks and chemical companies). Others are subject only to the many laws and regulations that relate generally to the operating aspects of the business (such as those related to occupational safety and health, and equal employment opportunity). Non-compliance with laws and regulations may result in fines, litigation or other consequences for the entity that may have a material effect on the financial statements (ISA 250 para. 2).

It is the responsibility of management, with the oversight of those charged with governance, to ensure that the entity's operations are conducted in accordance with the provisions of laws and regulations. This includes compliance with the provisions of laws and regulations that determine the reported amounts and disclosures in an entity's financial statements (ISA 2500 para. 3).

The objectives of the auditor are:

- To obtain sufficient appropriate audit evidence regarding compliance with the provisions of laws and regulations generally recognised to have a direct effect on the determination of material amounts and disclosures in the financial statements.
- To perform specified audit procedures to help identify instances of non-compliance with other laws and regulations that may have a material effect on the financial statements.
- To respond appropriately to non-compliance or suspected non-compliance with laws and regulations identified during the audit (ISA 250 para. 10).

Relevant Links: ISA 250[4]

Lesson 2: Identify laws and regulations relevant to the client Any organisation, research institute, university and company likewise needs to be compliant with the increasing number of current laws and regulations. Due to the high complexity and speed of change of the numerous laws and regulations as well as their inter-relationships, identifying laws and regulations that may be relevant to clients and staying up to date with changes within the relevant regulations for an entity can be tedious work. Applicable laws and regulations are usually referred to in the annual report of an entity. The MOVING platform supports the auditor in identifying and assessing (1) laws and regulations included in the entity's financial statements and (2) additional laws and regulations that may be applicable to the client.

Reviewing the laws and regulations included in the financial statements can be performed by uploading the company's annual report and performing an entity extraction analysis to specifically identify laws as entities within the document. The entity extraction functionality of the platform is covered in lesson 2 of the course to ISA 550.

To support assessing the completeness of laws and regulations and specific paragraphs mentioned in the client's financial statements, a laws and regulations dataset has been integrated among the data sources of the platform. This dataset could be regularly updated to include up to date laws and regulations from various industries. You can use the faceted search to specify the datasets that are considered for your search query on the platform.

When specific regulations that might be relevant for your client are identified in the search results, you can further analyse their relevance and context using MOVING's visualisation functionalities. For example, the top properties visualisation may be used to identify the top sources, keywords and concepts for the 100 most relevant search results of your query. If a specific law or regulation might be relevant, you can switch to the uRank visualisation. Here, you can select specific laws or regulations identified and investigate if they are related to the client or any competitors. Further guidance on how to use the uRank visualisation is provided in lesson 3 of the course to ISA 550.

[4] http://www.ifac.org/system/files/downloads/a013-2010-iaasb-handbook-isa-250.pdf

Lesson 3: Identify and evaluate changes within laws and regulations relevant to the client Besides the identification of laws and regulations relevant to the client, the financial auditor is required to stay up to date with any changes within these laws and regulations that may impact the client's business and the financial statements.

MOVING provides a unique functionality that supports reviewing and evaluating recent changes to the laws and regulations included in the datasets of the platform. Prior to performing the search query, ensure that only the laws and regulation datasets are selected in the faceted search on the right side of the platform. When searching for a specific law or regulation, the search result list will now include a history view that includes (1) the total number of changes to this law or regulation, (2) the date of the latest change, and (3) a timeline providing key information about each change that occurred. By this, the MOVING platform supports the auditor in determining if any changes to a specific law or regulation have occurred in the current audit period. If yes, by using the history timeline, the auditor can efficiently investigate these changes and evaluate the impact they might have on the entity and the financial statements.

4.2 Use Case 2: training young researchers with the MOVING MOOC "Science 2.0 and open research methods"

The curriculum for use case 2 *training young researchers* has been implemented in the MOVING MOOC *Science 2.0 and open research methods*. The curriculum design process has been detailed in Deliverable D2.2 section (3.3.2). The aim was to develop a course that gives junior researchers the opportunity to acquire academic information literacy along the principles of open science - open, transparent and collaborative. As shown in D2.2, information literacy and digital competence are the prerequisites for both Open Science and Open Innovation. In the MOOC, young scientists get an introduction to open research methods and learn to use social web technologies and online communities as research tools: to build networks, discuss findings and collaborate with scientists across disciplinary, cultural and geographical boundaries. They will understand that the use of social technologies in the context of movements such as Creative Commons offers completely new possibilities to publish, share, discuss and reproduce scientific knowledge and data.

The MOOC is a 4-week online course on the MOVING platform and was conducted twice under supervision at the TU Dresden Media Center. Every week a new lesson was released focusing on a specific aspect of open research. Participants had time to engage with the learning material and with their peers in the forum and complete small practical assignments that gave them the opportunity to try out methods and technologies for open research. Additional to these learning objectives the aim of the MOOC was also to build a community of practise on the MOVING platform for sharing ideas, discussing findings and collaborating with each other. Participants were motivated to create content that could then be used as learning material on the MOVING platform.

This section of the report shows how these objectives have been achieved. The further development and the actual implementation as well as the evaluation of the MOVING MOOC "Science 2.0 and open research methods" are described.

4.2.1 Curriculum design

As stated above, the curriculum structure for the MOVING MOOC is based on the general MOVING curriculum for information literacy (Deliverable 2.2, Table 8) and tailored to the needs of young scholars (use case 2). It contains three major units: (1) Search for information, (2) communication and collaboration in digital environments, and (3) digital content creation. The titles of each weekly session were adapted to the academic workflow. The first week serves as a introduction to the concepts of Science 2.0 and Open Science and to the topics of the course which are then examined in more depth each week.

1. Introduction to Science 2.0 and open research methods
   - Gives an introducing the concepts of Science 2.0 and Open Science, the benefits of open research methods and a broad overview about ways to make research more open
2. Understand the Web 2.0 information landscape
   - Provides an overview how scholars can benefit from opening up your research workflow, how to use social media and research platforms for information discovery and crowdsourcing for research and other academic tasks.
3. Become an active voice in the conversation with Web 2.0 technologies

- This lesson explains the use of social technologies for scholarly communication and collaboration. It explains why and how scholars should use social technologies to reach a wider audience for their research and what alternative metrics (altmetrics) and preprints are and how they rely on social technologies for academia

4. Make your research open!
   - Shows the participants an Open Science research workflow, including Open Access publishing, FAIR and Open Data and how to license their work using Creative Commons-licenses

The development and implementation of the curriculum in the MOOC will be described in further detail in the section below

4.2.2 Course development

Storyboard development

On the basis of the curriculum a four week course was developed with the respective learning objectives (see Table 6). For each week of the MOOC we developed a storyboard containing the structure, sequences, assignments and learning materials for each session. The storyboard helped organise the lessons and structure the content for the learners.

Table 6: MOOC curriculum structure and learning objectives

Week	Learning objectives
Introduction to Science 2.0 and open research methods	– understand the concepts of Science 2.0 and Open Science – understand the benefits of open research methods – get a broad overview about ways to make your research more open
Understand the Web 2.0 information landscape	– know where you can benefit from opening up your research workflow – know how to use social media and research platforms to collect information for your research – understand how you can use crowdsouring for research and academic tasks
Become an active voice in the conversation with web 2.0 technologies	– know how you can use social technologies for scholarly communication and collaboration – understand why and how social technologies can help you to reach a wider audience for your research – know what altmetrics and preprints are and how they rely on social technologies for academia
Make your research open!	– have an overview about Open Access publishing – know how to license your work using Creative Commons-licensing – understand the Open Science research workflow

Content development

In the MOVING project we support the open educational resources (OER) movement [5]. Therefore, the MOOC, including the course curriculum and learning materials, is published under a Creative Commons license (CC-

[5] OER are teaching, learning and research materials that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions (see https://en.unesco.org/themes/building-knowledge-societies/oer)

BY 2.0) and can be used as OER. The learning materials for each week consisted of a mix of media formats. Videos and interactive infographics were directly produced for the MOOC at the Media Center. In addition, appropriate OER and other Creative Commons licensed materials in different media formats were selected and integrated. Based on the storyboards, the learning materials were then arranged and brought into a sequence in weekly lesson and complemented by short texts and guidance instructions.

Before the learning material was selected, basic standards were agreed in the team to ensure the quality and the variety of the materials.

- The learning materials used in the course are mainly Open Educational Resources (OER).
- Furthermore, existing material from open science platforms and initiatives (e.g. Foster[6]) as well as high-quality scientific literature is reused.
- Various media formats, such as short videos, infographics, text, slides or blogs were used so that course participants could learn in as varied a way as possible.

In addition to this, videos were produced at the Media Center, which can be found on the MOOC channel on Youtube[7]. Short tutorials have been produced in which the participants can learn how the course, the forum and the wiki work. The videos were produced with Videoscribe[8] and screencasts. Two more videos were created with Videoscribe focusing on the principles and and the practical possibilities of Open Science[9] [10]. All material was linked or embedded in the course structure.

Courseware development - MOOC integration into the MOVING platform

The MOVING MOOC was integrated into the community environment of the MOVING platform. This environment provides multiple functionalities for engaging and motivating participants in discussions (forums with rating function, badge system) and finding supporting information (news board, wiki, summary and description area with CKEditor[11], further reading area). Figure 10 shows the overview page with the mentioned functions and areas.

The 4 weekly modules were each organised as subcommunities of the MOVING MOOC community and have the same structure as the overview page. In the description area of the overview page of the MOVING MOOC users find information about the subject of the course, learning objectives, how to proceed within the course and the course schedule. For each session we provided an overview of the topics for the week as follows: (1) Week/session name and duration, (2) short description of the topics, (3) link to the forum, (4) learning goals and (5) learning materials (see Figure 11).

In order to present the learning material in an orderly and comprehensible way the accordion interface of the CKEditor was used. The accordion interface is a graphical control element in which content can be organised through collapsible items. Figure 12 show an example of the learning material integrated in the accordion element. The first learning material is active and expanded. The two other materials are not active and therefore collapsed. Only one element can be active at a time.

4.2.3 Course implementation

Advertising the MOOC

The MOVING MOOC is a community of practice on the MOVING platform. We created a banner for the MOOC community on the landing page of the MOVING platform and a prominent overview page with a video teaser and enrolment button to attract both new and registered users on the platform to enrol in the course (see Figure 13).

The MOVING MOOC is designed as a collaborative learning experience. Hence, in order to facilitate a productive discussion between the course participants, it was important to attract a significant number of participants (at least 150). This number was reached in the 1st round and doubled in the 2nd round. In the following the advertising activities will be outlined briefly. Promotion of the 1st round was mainly concentrating on social media. In Juli 2018 we created a Twitter account @MoMoSci20 and advertised the MOOC and followed other open science initiatives. On Twitter, the tweets of the MOOC were then

[6] https://www.fosteropenscience.eu/ (last accessed on 08-03-2019)
[7] https://www.youtube.com/channel/UCmKm5gU6KISiGevziRC9hOA (last accessed on 01-03-2019)
[8] https://www.videoscribe.co/en/ (last accessed on 01-03-2019)
[9] https://www.youtube.com/watch?v=QeOXNyPI1TY (last accessed on 01-03-2019)
[10] https://www.youtube.com/watch?v=OJlrbvV_5hM (last accessed on 01-03-2019)
[11] For more information on the CKEditor see Deliverable 4.3.

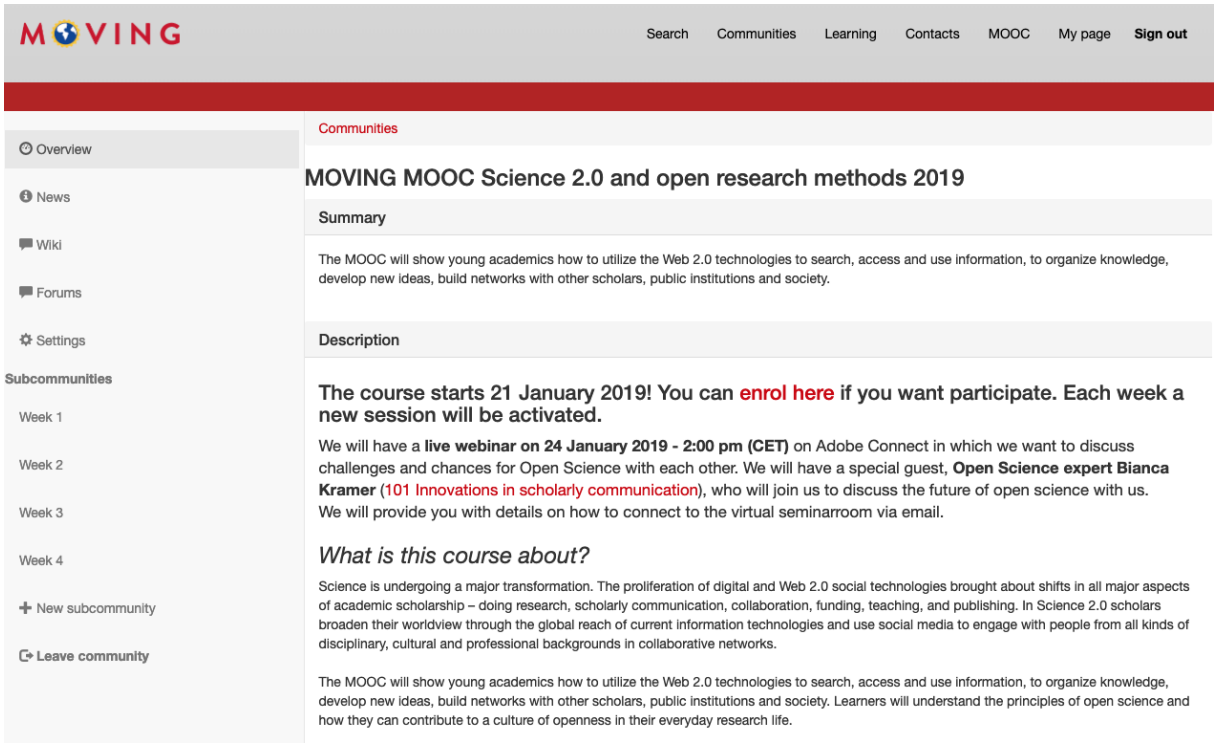

Figure 10: Screenshot: Overview page of the MOVING MOOC with navigation on the left and the summary and the description in the middle

distributed through the network of followers or through the use of prominent hashtags (e.g. #OpenScience, #openresearch) and gained a significant number of impressions. A short video teaser[12] for the MOOC was produced at the Media Centre of TU Dresden, uploaded to YouTube and shared via Twitter and other social media. In addition, flyers (see Figure 45 in the appendix) and posters were designed at the Media Centre and distributed. A press release (see Figure 44 in the appendix) was send to all project partners, relevant mailing lists and alliances (e.g. Leibniz Research Alliance Science 2.0). For the 2nd round, in addition to the measures mentioned, departments and institutes at the TU Dresden were also extensively addressed by e-mail.

The 1st course round was from November 12 to December 16, 2018. 170 Participants registered for the first round. The 2nd round started on January 21 and ended in February 17, 2019 with 300 registered participants in total. Shortly before the courses started the participants got an email reminder with general instructions on how to use the MOVING platform learning and on the course of the MOOC. Every week on Monday morning a new lesson was released. After each release the participants received an e-mail notification inviting them to go to the course platform, engage with the learning content and join the forum discussion. The participants then had one week to work through the materials and complete the assignments. The workload, as measured by the time to engage with the learning materials and to complete the small assignments, was estimated approximately 2-4 hours per week.

Webinar

After the 1st week the course we organised an online live webinar to discuss benefits and challenges of Open Science with Open Science experts that we invited to join. In the first round Dr. Jon Tennant (Imperial College London) joined the webinar and in the second round Dr. Bianca Kramer (Utrecht University Library) was invited as an Open Science expert. The experts discussed benefits and challenges of open research with the moderators and answered questions from the participants (1st round: approx. 20 participants; 2nd round: approx. 50 participants). Both webinars were recorded [13] [14] and added to the learning material of the MOOC so they can be used as learning resource for future learners.

[12] https://www.youtube.com/watch?v=3u9PFlBbTMA (last accessed on 07-03-2019). The teaser was adapted to the 2nd round of the MOOC.
[13] https://webconf.vc.dfn.de/pdiagnan4yt7/ (last accessed on 08-03-2019)
[14] https://webconf.vc.dfn.de/p4hso13jhl8p/ (last accessed on 08-03-2019)

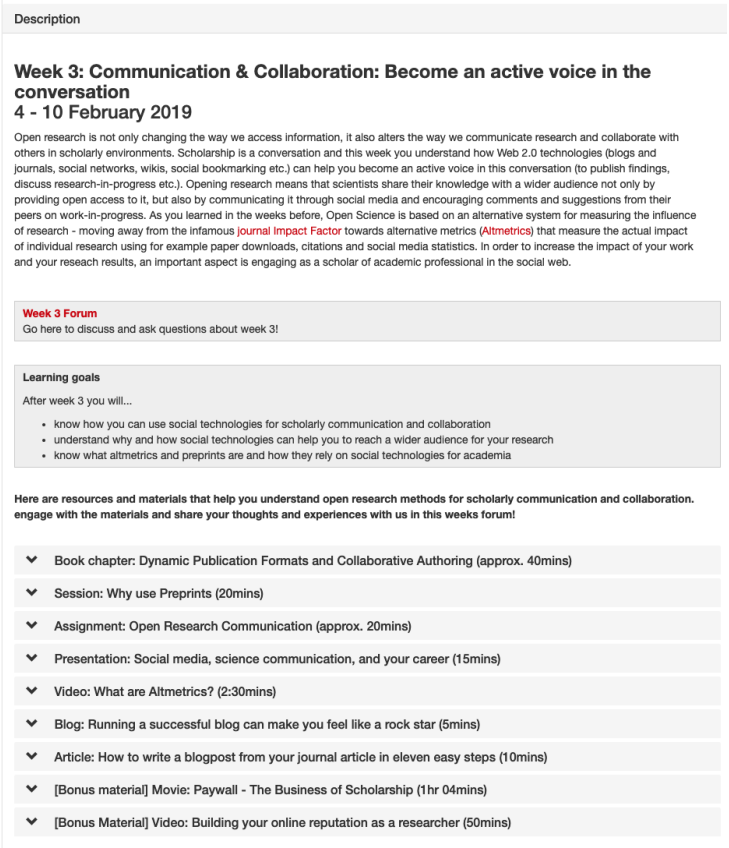

Figure 11: Screenshot: Week 3 with (1) Week/session name and length, (2) short description of the topic, (3) link to the forum, (4) learning goals and (5) learning materials

Assignments

Throughout the course, participants were encouraged to post in the forums and to engage in discussions with other participants. The weekly assignments were meant to motivate the participants to practically engage with the topics of the respective week. Therefore, tasks were chosen to encourage reflection as well as practical application. Practical assignments for the participants included, for example, a scientific crowd-sourcing exercise on Twitter (or any other micro-blogging service), setting up an ORCID[15] and sharing a presentation or poster in an open science repository like Zenodo[16]. An overview of the respective tasks and their actual completion measured by the threads/posts in the forum can be found in table 8. In the 2nd round of the MOOC the task of week 3 was transferred to week 2 and a new task for week 3 was created.

MOOC badges

In the second MOOC "Science 2.0 and Open Research Methods" 2019 both smaller and larger badges were awarded (see tab. 7).

Table 7: MOOC badges

Badge	Granulation
VOTES WINNER	Smaller badge
MOVLING	Smaller badge
OPEN SCIENCE AFICIONADO	Larger badge

[15] https://orcid.org
[16] https://zenodo.org/

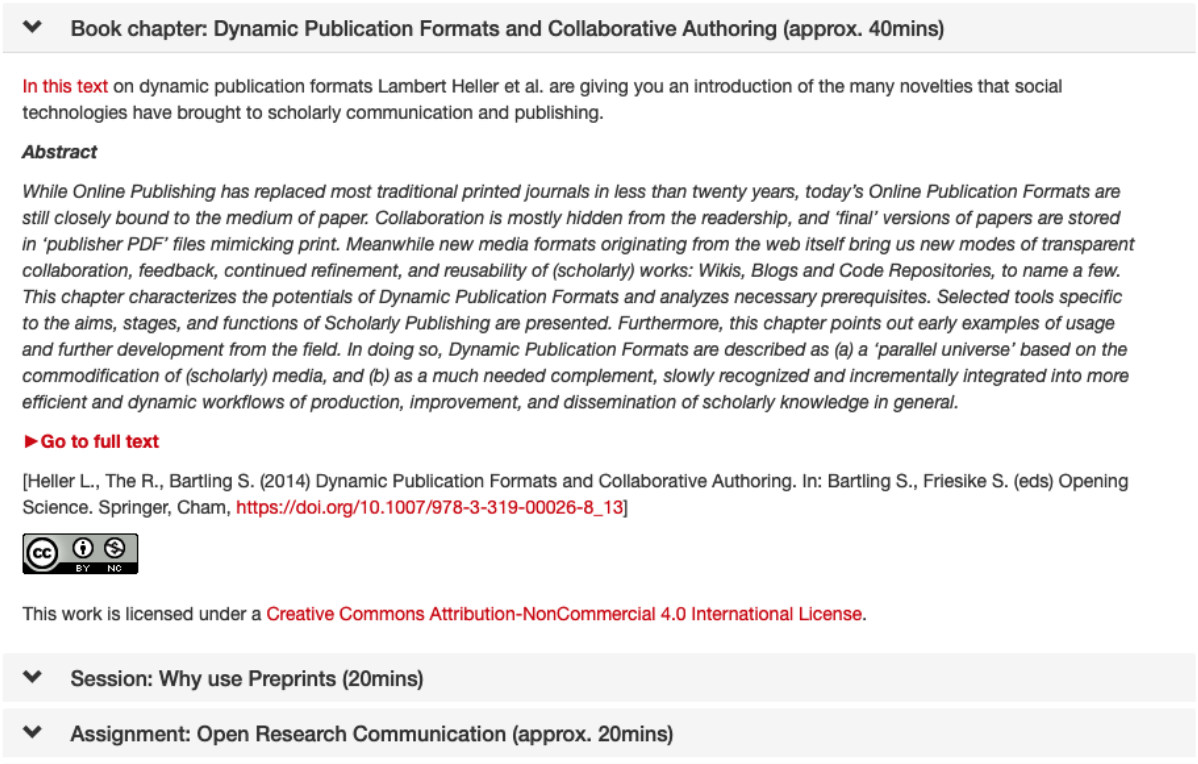

Figure 12: Screenshot: Learning material integrated as a accordion element

MOVLING

The MOVLING Badge (see Figure 14) was primarily intended to promote and communicate the MOOC to the public. In this regard, the requirements for awarding the badge were relatively simple and access to the badge was relatively low. The registration for the MOVING MOOC was sufficient to receive this badge. The participants were then able to publish this badge in their badge collection and thus draw the attention of other potentially interested researchers to the MOVING MOOC.

VOTES WINNER

In the context of collaborative online courses such as cMOOCs (connectivist Massive Open Online Course), which focus on participatory learning, the active contribution of participants to the course communication is essential (see (Haug & Wedekind, 2013). Therefore, participants must be motivated to make their contribution to the course. The "Votes Winner Badge" was developed to encourage MOOC participants to write substantial forum posts. This badge is manually assigned by the organisers of the MOOC and states who received the most votes for their forum posts in the previous week.

OPEN SCIENCE AFICIONADO

The Open Science Aficionado badge serves as a larger badge the purpose to support the summative assessment in the course. Similar to the Certificate of Participation that participants receive after successfully completing the course, the Open Science Aficionado badge is linked to the completion of certain tasks and activities. In order to make the assignment of the Open Science Aficionado Badge transparent to the learners and to be able to automatically issue the badge we developed an evaluation system for course participation that was based on a score system for different activities in the MOOC Forum. To earn the Open Science Aficionado-Badge participants have to achieve at least 12 out of 24 attainable points (see below). This is the description of the badge and the acquired competences that it certifies for the users.

The Open Science Aficionado Badge shows that you:

- understand the concept of Open Science and know the fundamentals of and open research methods

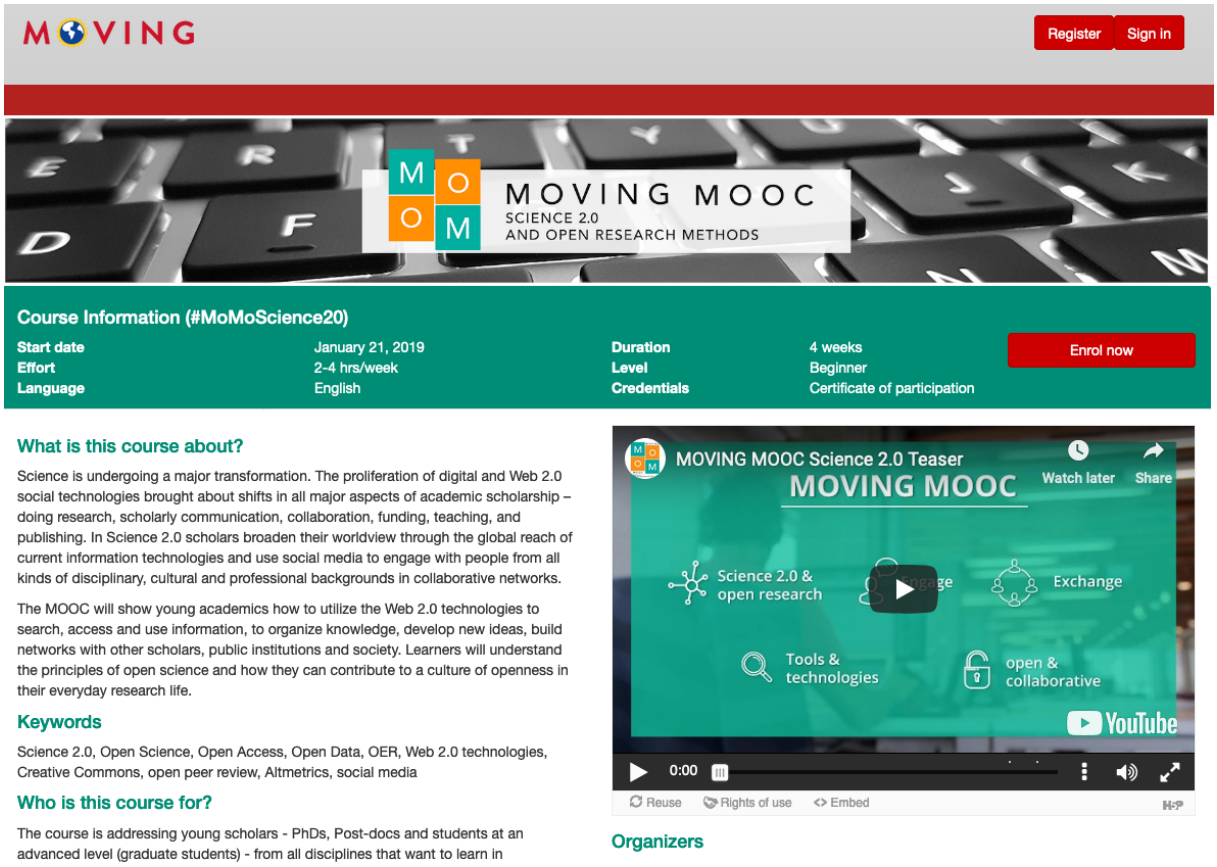

Figure 13: Screenshot: MOVING MOOC enrolment page

Figure 14: MOVLING Badge

- know how you can use open research methods for scientific collaboration
- understand why and how social technologies improve open scholarly communication and help you to reach a wider audience for your research
- know the open science research workflow and how it relies on the use of digital and social technologies

Requirements To get the Open Science Aficionado-Badge you have to complete the MOVING MOOC by conducting a number of weekly assignments. Below, you can see what kind of weekly activities there are in the MOOC and how many points you can earn for them.

Week 1

- 1 pt.: Vote on other participant's forum post
- 2 pt.: Comment on other participant's forum post

Figure 15: VOTES WINNER Badge

Figure 16: Open Science Aficionado Badge

– 3 pt.: Complete weekly assignment [start thread or write 2 comments]

Week 2

– 1 pt.: Vote on other participant's forum post

– 2 pt.: Comment on other participant's forum posts

– 3 pt.: Complete weekly assignment

Week 3

– 1 pt.: Vote on other participant's forum post

– 2 pt.: Comment on other participant's forum posts

– 3 pt.: Complete weekly assignment

Week 4

– 1 pt.: Vote on other participant's forum post

– 2 pt.: Comment on other participant's forum posts

– 3 pt.: Complete weekly assignment

Certification of Participation

Participants who completed the MOOC were eligible for a Certificate of Participation (CoP) (see Figure 43 in Appendix B). Other than the (Open Science Aficionado) badge that was issued automatically after participants completed the course, the Certificates were issued manually and individually for each graduate. To receive a personal certificate, participants were asked to contact the MOOC team directly via email. Most participants who completed the course were interested in a Certificate, so we issued 5 CoPs after the first round of the MOOC and 24 after the second.

4.2.4 MOOC evaluation

The participation measured by the forum posts and threads was was significantly higher in the second round than in the first round of the MOOC (see Table 8). This is mainly due to the number of participants (300 in the 2nd round and 150 in the 1st round). Looking specifically at the number of replies one can see that there was much more interaction in the 2nd round than in the 1st. round. Basically, for the 2nd round of the MOOC almost as many replies were started as threads, if not almost three times as many as in the Week 1 assignment. In the 1st week even three times as many replies were given as threads were started. Topics that were mainly discussed when looking at chances and challenges of Open Science were:

- Plagiarism/idea theft
- Changing academic culture: institutional incentives, research funding
- Open Science and Patents
- Open Science Infrastructures and Workflows

Table 8: Assignments of the MOVING MOOC and engagements measured in forum threads and replies

Assignments and completion	**Round 1**	**Round 2**
Week 1	Introduce Yourself! (10mins) 27 Threads; 24 Replies	Introduce Yourself! (10mins) 58 Threads; 35 Replies
	Discuss the challenges and benefits of open research (15mins) 8 Threads; 7 Replies	Discuss the challenges and benefits of open research (15mins) 36 Threads; 95 Replies
Week 2	Assignment 1: Which information do you use from the social web? (approx. 10min.) 7 Threads	Crowdsourcing your research (approx. 20mins) 38 Threads; 40 Replies
	Assignment 2: Show us your social media routine (approx. 20min.) 0 Threads	
	Assignment 3: Information discovery via Twitter (approx. 30min.) 3 Threads	
Week 3	Croudsourcing your research (approx. 20mins) 7 Threads; 3 Replies	Open Research Communication (approx. 20mins) 33 Threads; 25 Replies
Week 4	Open Science tools for your research (approx. 20min) 4 Threads	Open Science tools for your research (approx. 20mins) 33 Threads; 33 Replies

Evaluation MOVING MOOC 2018 (21 November - 9 December 2018). When the first round of the MOVING MOOC (November 12th - December 9th 2018) was finished, participants were asked to evaluate their learning experience by answering an anonymous online survey (see Appendix A). The main objective of this evaluation was to improve the MOOC for the second round starting on January 21st 2019 based on the feedback of MOOC participants of the first round. The online survey contained questions about demographic aspects followed by questions regarding their motivation to take part in the MOOC, how they became aware of the MOOC as well as questions about personal expectations, the quality of learning material, the workload and the clarity of course descriptions and course assignments. 150 users registered for the MOOC of which 14 participants actively started participating in week 1. The majority of users came from countries within the EU, but also from Pakistan, Brazil and the United States of America. At the end of the MOOC eight users completed the survey. The survey participant's gender ratio is balanced. In terms of age the majority of the survey participants indicates to be "25-34 years" and "35-50 years" old (three participants in each case), the remaining two indicate "17-24 years" and "over 50 years". Six out of eight participants had already obtained a

university degree (Master/Diploma) and most of them work as researchers at a university (4 participants). The remaining participants indicate that they are university students (2 participants), university teachers/lecturers (1 participant) or other (1 participant – teacher in secondary education). Awareness for the MOOC was predominantly raised through mailing lists (4 indications), and through friends and colleagues (3 indications). Participants decided to take part in the MOOC mainly because they are interested in the exchange with others and because they were interested in the topic in general. Overall expectations of the more than half of the survey participants were fully met (2 indications) or mostly met (3 indications). Nonetheless one participant indicates that only a part of her/his expectations were met and some indicate that only few of their expectations were met (2 indications). In terms of participation only three out of eight survey participants completed all weeks of the MOOC. Possible explanations for this are a lack of English knowledge or a lack of time to complete the assignments and engage with the learning material in general. However, survey participants were in particular satisfied with the support by the instructors, the course structure itself and the clarity of course description. The communication with the other course participants was less satisfying for the participants. Further information and statements have been evaluated in Figure 17 and Figure 18.

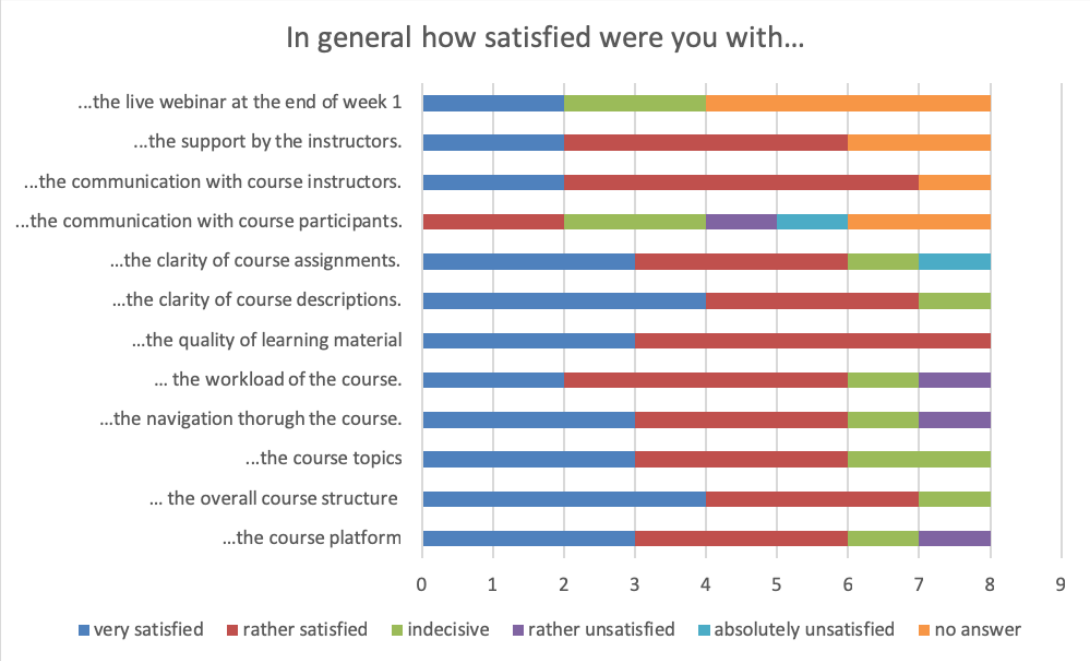

Figure 17: Overall satisfaction with the MOOC

Evaluation MOVING MOOC 2019 (21 January – 17 February 2019) After completing the course, participants of the second MOOC were again asked to fill out an online survey and evaluate their learning experience. 40 participants completed the survey. The MOOC had a very international group of participants from 16 countries on 4 continents (see Figure 19)

The majority of participants were university researchers/lecturers and were PhD Candidates or Post-Docs (see Figure 20). Learners came from a wide range of disciplines from natural sciences (15), engineering (9), social sciences and humanities (9), Environmental Sciences (3), Education (2) and Law (1). When asked what motivated them to take part in the MOOC, the majority answered they were interested in the topic (38). Most found the course was relevant for their professional (28) and personal development (14) and some were interested in the exchange with others (21) and in the course format (12).

We asked participants how familiar they were with the concept of Open Science prior to the MOOC: 22 said they heard of it, but never practiced Open Science and 17 said they already used some Open Science practices in their work. Only one participant stated that s/he was familiar with Open Science and practiced it regularly. When asked how satisfied they were with the individual MOOC features in general, the majority of participants was very or rather satisfied with the course (see Figure 21). Statements that participants made in the comments section indicated that for most learners the course was a valuable experience and the learning content was considered both helpful and beneficial. Learners expressed different preferences regarding the media formats of the course material - some stated they preferred text, others have applauded the videos

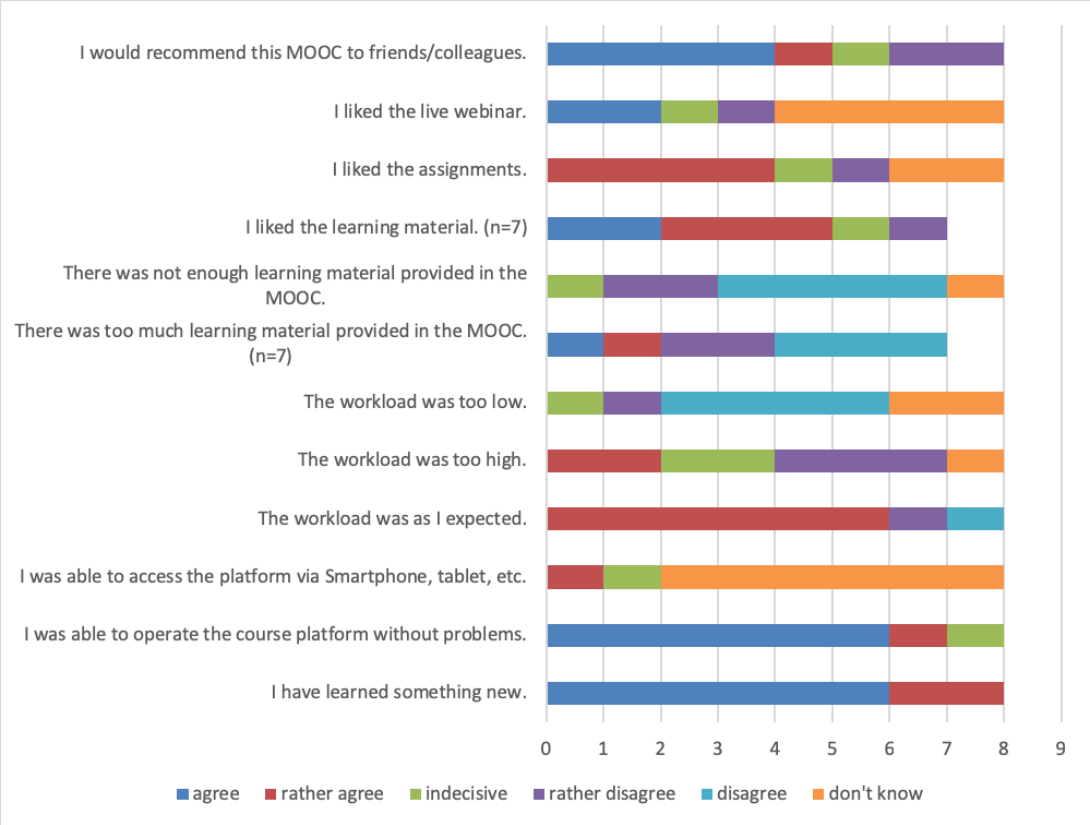

Figure 18: Participants' statements about the MOOC

and infographics. It has become apparent that the variety of media formats of the learning materials made available to the MOOC participants responded well to the different habits of learners. Most participants liked the practical assignments which gave them the opportunity to try out some of the tools and technologies in practice that they would otherwise just heard of in theory. Even though some participants praised the course format for its flexibility and independence of time and place, many highlighted the webinar - as the only time synchronous element of the MOOC - and stated that they really enjoyed having the chance to engaging live with each other and the course instructors. For many participants this was the first time they attended a MOOC and they expressed their intention to use this learning format more often. In some comments participants expressed their hope that there would be more specialised extensions or advanced level courses building on this introductory MOOC and some suggested to adapt the course to the different disciplines and their specialised scientific methods training in the future.

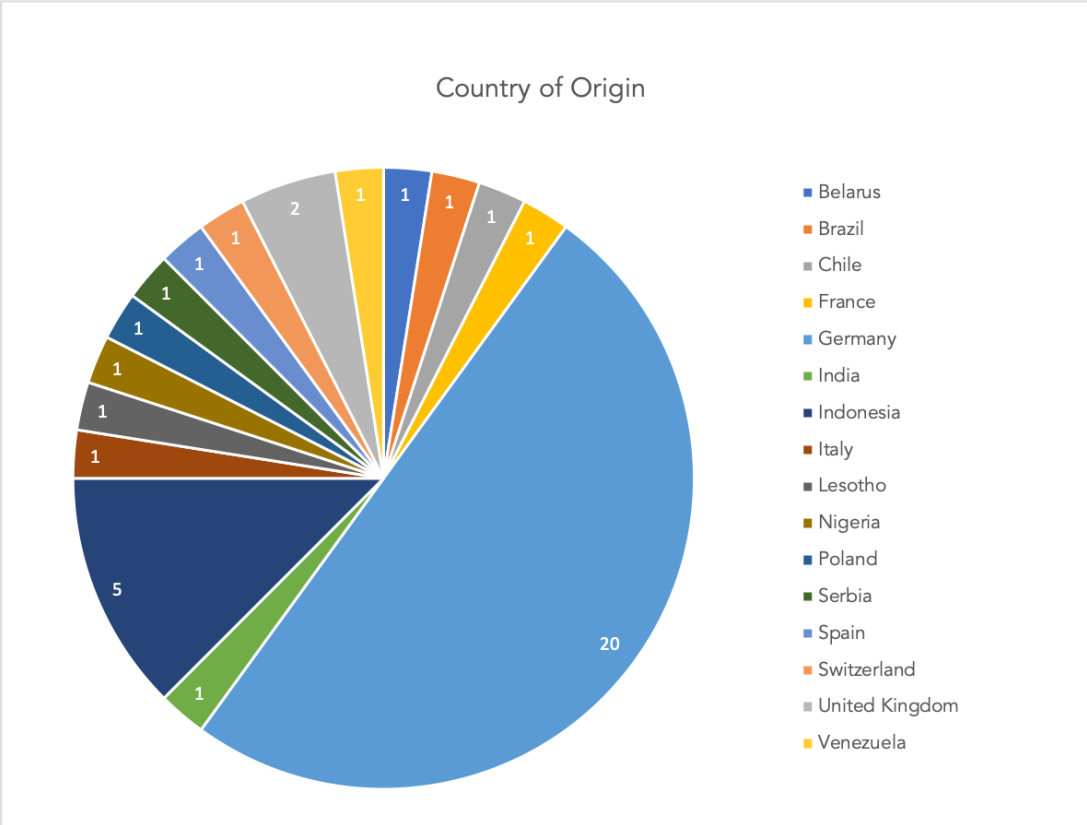

Figure 19: Country of origin of MOOC participants

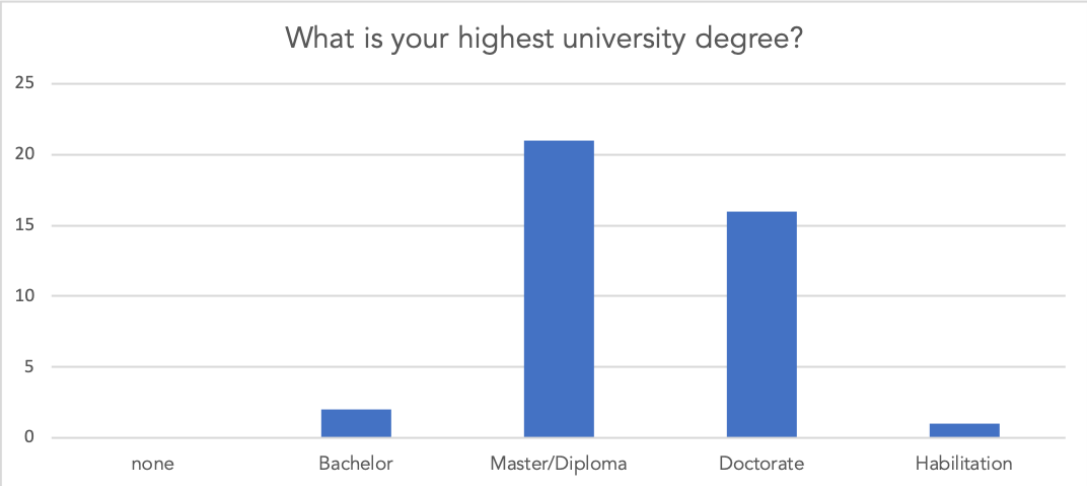

Figure 20: MOOC participants' highest university degree

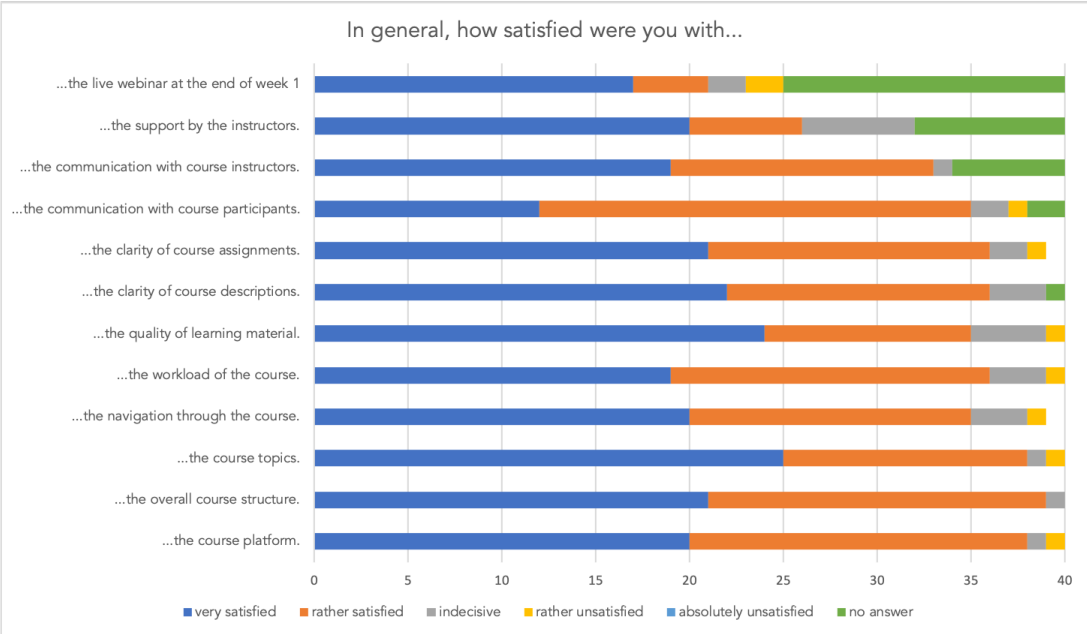

Figure 21: Overall satisfaction with the MOOC

5 Adaptive Training Support

5.1 Learning-how-to-search widget

5.1.1 Goal, challenges and research questions

The goal of the Learning-how-to-search widget is to support users on **learning how to search with the MOVING platform** to become an experienced searcher.

The Learning-how-to-search widget focuses on **providing guidance for training** MOVING users on how to **efficiently and effectively use the MOVING platform**, including all its search functionalities. The goal of the Learning-how-to-search widget is to make MOVING users aware of the available MOVING functionalities in order to be able to exploit the complete potential of the MOVING platform later on. This exploitation enables users to quickly retrieve the desired and relevant information and finally enhance the user's search expertise and search satisfaction.

Reflective learning, which we used as underlying learning strategy, is a viable mean to re-evaluate past (search) behaviour or (search) experiences in order to learn from them for improving future (search) behaviour. In order to provide guidance for initiating reflective learning, the Learning-how-to-search widget adapts to the search behaviour of the MOVING user in relation to the used features. It mirrors back feature usage and behaviour, and suggests features and reflective prompts aiming at improving the user's search behaviour. The major challenge of the Learning-how-to-search widget is ensuring that the widget really supports the users on learning how to search with the MOVING platform to become an experienced searcher. Thus, the major sub-challenges are defined as follows:

- Challenge 1. Visualizing the usage behaviour to support the development of search expertise by allowing the user to visualize their past and potential future search behaviour.
- Challenge 2. Implementation of a reflection guidance concept to motivate people to reflect about their search behaviour with the goal to improve.

According to these challenges, we have defined the following three research questions:

- Do study participants use and accept the Learning-how-to-search widget?
- Do study participants change their search behaviour and use new/different search functionalities available on the MOVING platform?
- Do study participants reflect on their search behaviour and improve their search expertise?

A detailed related work section and background literature was presented in D2.1 as well as in D2.2 and will not be repeated in this deliverable. Instead, we will shortly summarize the final implemented widget and then present the results of one of the evaluations conducted in detail, while the second evaluation conducted together with UMAN will be reported in D1.4.

5.1.2 Learning-how-search widget: concept and implementation update

During Y3 of MOVING, we finalized the development of the "Learning-how-to-search" widget by focusing on its integration and combination with the "Curriculum Reflection" widget, by adding responsive design and improving the visual appeal and stability of the widget.

Figure 22 presents the final version of the "Learning-how-to-search" widget in the MOVING platform. The implementation of the widget follows the concept that was developed within the first two years of the project.

The basic idea of the widget is to mirror back the user's own search behaviour based on the user's activities with regard to the feature usage on the MOVING platform. By presenting the user in a bar chart how often she uses which MOVING feature based on the work of Malacria et al. (Malacria, Scarr, Cockburn, Gutwin, & Grossman, 2013), we make her aware of her search behaviour, motivate to think about it and give her an opportunity to reflect about it on order to derive insights for improving her search expertise. During Y3, we updated the presented features accordingly now consisting of three functionalities to initiate a search, namely "Simple Search", "Advanced Search", "Faceted Search", and five functionalities of presenting the results, namely "Result List", "Concept Graph", "uRank", "Tag Cloud" and "Top Properties".

Besides visualizing the feature usage per user, we also implemented a reflection guidance concept to show reflective prompts adapted to the user's needs. Such a prompt could be either a reflective question or sentence starter to stimulate reflection on the feature usage so far or provide a suggestion to use another rarely used feature. For example, a reflective question is *"Do you think that using the "Concept Graph" can improve*

your search performance search skills...? And if yes how?". Which prompt is presented to the user depends on the user's experience with the search features on the MOVING platform. A newbie receives 1st level reflection questions and reflection amplifiers that will make her/him aware of not used features of the platform (reflection interventions) and ask questions to think about the first experiences while using them. The goal of these prompts is to make the user familiar with the MOVING functionalities. An intermediate user will get 2nd level reflection interventions and reflection amplifiers that will make the user aware of his/her feature usage behaviour (reflection intervention) and motivate him/her to reflect on why different features are perceived as useful (reflection amplifier). An expert user will get 3rd level prompts to stimulate reflection about the user's perceived benefit and learning on the MOVING platform as well as to motivate users to think about whether a subjectively perceived behaviour change or an individual performance improvement has taken place. A detailed description about the prompts can be found in D2.2.

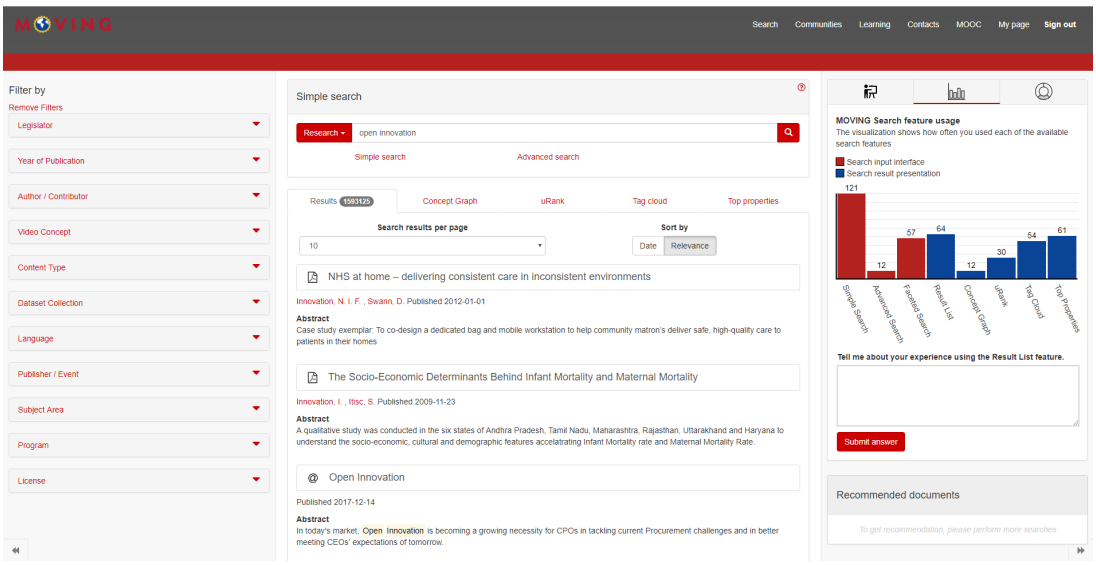

Figure 22: Final version of the "Learning-how-to-search" widget in the MOVING platform.

One of the tasks that we needed to cope with in Y3 was how to combine the "Learning-how-to-search" widget with the newly developed "Curriculum Reflection" widget (see Section 3.2). In order to be able to easily switch between the widgets, we implemented a solution with "tabs" as depicted in Figure 23.

Figure 23: Tabs for switching between the widgets.

The tabs are marked with icons referring to the corresponding widget. The tab in the middle, that presents a small bar chart and is underlined with a red line is the active "Learning-how-to-search" widget tab. When clicking on the tab on the left with the blackboard on it, it changes the view to the "Curriculum Reflection" widget. And the tab on the right with the pie chart, changes the view to the overall learning progress.

Regarding the presentation of the widget, we made the widget also responsive, so that it automatically adjusts to the different sizes of displays it is viewed with. Additionally, we improved the reliability and stability of the widget.

5.1.3 Evaluation of the Learning-how-to-search widget

The major focus in Y3 with regard to the "learning-how-to-search" widget was put on the evaluation. The learning-how-to-search widget was evaluated twice, the first evaluation took place in June 2018 where 15 knowledge workers and students participated in a 2 weeks study. The detailed results of the study are reported in D1.4.

The second study was conducted together with WP3. In this study the learning-how-to-search widget was evaluated together with the evaluation of the visualizations "Concept Graph" and "uRank". The study setup, study procedure and study participants are presented in detail in D3.3. section 5.4, thus, this deliverable will only shortly summarize them here. The results of the visualizations are reported in D3.3, section 5.4 while the results regarding the learning-how-to-search widget will be presented below.

Methodology:
Two target groups were addressed in the study, which were determined from the two use cases specified in deliverable D1.1: User requirements and specification of the use cases (Bienia et al., 2017). Therefore, researchers were the target group for the first use case and auditors the target group for the second use case.

Research Goal: In addition to the two target groups, the study aimed at stimulating reflection on own search behaviour with the goal to motivate users to explore different functionalities and search strategies on the MOVING platform. Our research approach including the research questions, evaluation plan and tools follow Kirkpatrick's model (Kirkpatrick & Kirkpatrick, 2006) for assessing training effectiveness in organizations. Kirkpatrick argues that learning should be evaluated at four levels that build up on each other in the sense of one level needing to be evaluated "positively" before success can be achieved at the next level. The levels are: reaction (how users react to technology), learning (whether and what learning occurs), behaviour (how behaviour of people is changed) and results (work performance). Second, we used the Technology Acceptance Model (TAM) proposed by (F. D. Davis, 1989) and extended by (Venkatesh & Davis, 2000), called TAM2, which is an information systems theory that helps to explain and predict user behaviour of information technology. While the original TAM focused on the perceived usefulness and perceived ease-of-use as factors for technology of being accepted by users, the TAM2 was extended and includes also social influence (subjective norm, voluntariness, and image), cognitive instrumental processes (job relevance, output quality, and result demonstrability and experience.

Thus, in our evaluation, we concentrated on the first two levels of Kirkpatrick's model, Level 1: Reaction and Level 2: Learning in combination with several topics and items of the TAM model, and stated the following research questions:

- RQ1: How do participants perceive the widget in the search environment? (Level 1: reaction)
- RQ2: To what extent did the widget motivate participants to think about their own search behaviour or try out other visualizations (Level 2: learning)
- RQ3: To what depth does reflective learning occur? (Level 2: learning).

Participants: The participants consisted of master students from the Graz University of Technology and of employees from Ernst & Young in Essen, Germany. The participants were divided into "Researchers" (Use Case 1) and "Auditors" (Use Case 2), based on the target groups from the two use cases from D1.1. All of the employees of Ernst & Young were assigned to the "Auditor" use case, while the students were assigned to the "Researcher" use case. Since there were many more participants in the "Researcher" use case, the students with an economy background were moved from the "Researcher" use case to the "Auditor" use case. Additionally, the two groups were divided in two subgroups, so that we had the following four groups: Use Case 1F and Use Case 1V for the researchers and Use Case 2F and Use Case 2V for the auditors. While the groups with "F" had to deal with faceted search, the groups with "V" were asked to use the visualizations. More details can be found in D3.3, section 5.4.1.

Procedure: The study was conducted by using four different Google Forms, one form for each group. All four forms followed the same structure, only the tasks given to them were different. The study started by first introducing the MOVING Platform and details about procedure of the study (see D3.3., Appendix 8). After reading the participant information sheet according to the General Data Protection Regulation (see D3.3, Appendix 11), the participants had to consent to the terms of the study before continuing. Then, the participants were asked to answer some demographic questions, questions regarding their preferences, and questions regarding their skill set (see D3.3, Appendix 9). Thereafter, the participants were walked through the process of registration on the MOVING Platform (see D3.3., Appendix 10). After a successful registration and account activation, they were asked to read a document that explained all the relevant features that are used in the study (see D3.3, Appendix 12 and Appendix 13). Before starting the tasks, the participants were requested to familiarize with the MOVING Platform by logging in and exploring it on their own for 5 minutes.

Task Structure and Questionnaire: The overall user study consisted of three different tasks. The first two tasks were designed to compare the visual interface uRank and the Concept Graph with the faceted search interface, while the third task asked participants to interpret the Learning-how-to-search widget. The details about the first two tasks are reported in D3.3., thus in this deliverable the focus will be put on the third task with regard to the learning-how-to-search widget.

Task 3: The whole task description as well as all posed questions can be found in Appendix 10.1.

At the beginning of Task 3, the participants were introduced to the "Learning-how-to-search" widget by being linked to a detailed description . After they have read the instructions, the participants of each user group were asked to open a given link and to have a look at the widget. The widget was prepared according to the tasks which the related use case groups had to perform.

Use Case 1F (researchers) and Use Case 2F (auditors): the participants of these groups were asked to perform a search task and afterwards to use the faceted search interface to find the desired results. The Learning-how-to-search widget was adapted accordingly to this task. For Use Case 1F we related the faceted search to the simple search – as presented in Figure24 – thus the widget showed them that the simple search was the mostly used search interface. For Use Case 2F we related the faceted search to the advanced search – as presented in Figure25. Additionally, in both cases a reflective question tailored to the content of the chart was presented below.

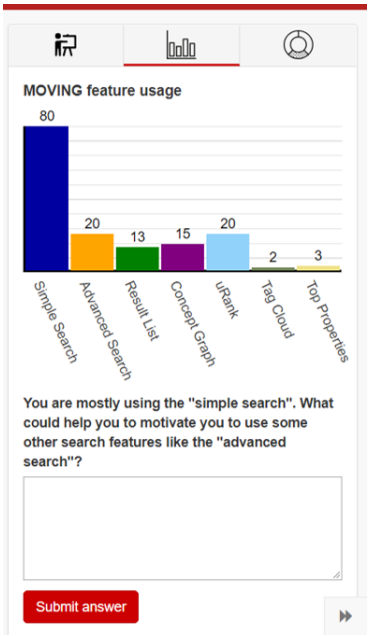

Figure 24: Learning-how-to-search widget prepared for use case 1F.

Use Case 1V (researchers) and Use Case 2V (auditors): the participants of these two groups were asked to use in one task the uRank visualization and in the second task the Concept Graph visualization. Based on this, we again prepared for Use Case 1V the widget showing the uRank visualization with the highest bar as depicted in Figure 26 and in the use case 2V we made the Concept Graph bar the highest one as presented in Figure 27. Again, for each of them a reflective question was posed below.

After the participants have had a look at the widget and the reflective question, we posed them four open questions in the questionnaire. Two of the questions referred to reflective learning, while the other two questions asked about the interpretation of the widget and the motivation about trying out other functionalities.

Furthermore, the following analysis and metrics have been used during the study:

- *Analysis of the widget*: We thematically analyzed the open question posed and the answers are then clustered according the topic that emerged.
- *Subjective Workload*: After Task 3 has been completed, the participants were asked to fill out a questionnaire that inquired about the perceived difficulty of the task and how the participants thought they performed. The questionnaire was based on the NASA Task Load Index (NASA-TLX) (Hart & Staveland, 1988) and asked the participants for their perceived "Mental Demand", "Physical Demand",

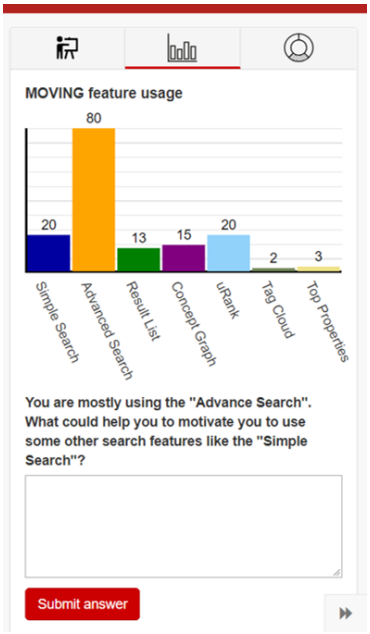

Figure 25: Learning-how-to-search widget prepared for use case 2F.

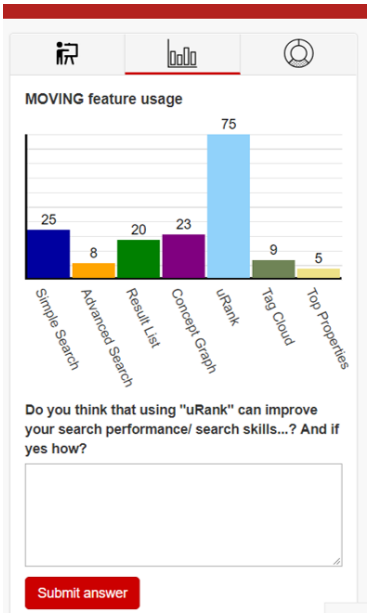

Figure 26: Learning-how-to-search widget prepared for use case 1V.

"Temporal Demand", "Performance" and "Frustration". The participants could rate each of the asked questions on a Likert scale from 1 - 7. In addition to the NASA-TLX questions, a comment field was added, where the participants could give feedback for this particular sub-task. The used questions are presented in Appendix 10.1

– *Kirkpatrick and TAM questions*: At the end of the questionnaire, we prepared a set of questions per topic along the model of Kirkpatrick and the technology acceptance model (TAM) covering the following topics: "Loyalty Metric" (1 item), "Ease of use" (5 items), "Perceived Usefulness" (7 items), "Attitude towards the widget" (2 items), "Widgets specific questions" (6 items), "Learning Outcome" (2 items), "Behaviour Intention" (2 items), "Technological Self-Efficacy" (3 items), "Subjective Norm" (3 items), "System Accessibility" (1 item) as well as some additional open questions (2 items). The used questions are presented in Appendix 10.1

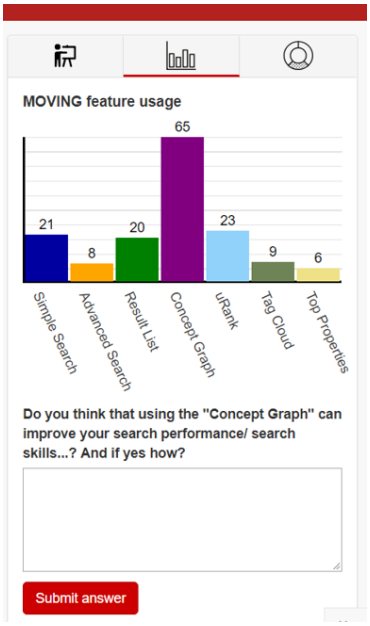

Figure 27: Learning-how-to-search widget prepared for use case 2V.

Results

PARTICIPANTS: Altogether 76 participants (61 male, 15 female) took part in the study, out of these were 42 participants in the research group (35 male, 7 female) and 34 participants in the auditor group (16 male, 8 female). 80% of the participants were aged between 18-27, 18.5% between 28-37 and 1.5% was aged between 48-57. More detailed information about the participants' English level, their usage of search platforms, visualizations tools and data analysis tools as well as their education can be found in D3.3, section 5.4.2.

ANALYSIS OF THE WIDGET: We will analyze the answers given to the four open questions related to the widget and according to each group. Additionally, we always added the number of how many participants have given similar answers in brackets. In order to not keep the readability of the deliverable and to not make this deliverable too long, all tables presenting the detailed answers given to the open questions are inserted in Appendix 12.

Question 1: The reflective question which was posed depended on the search task assigned to each group. Thus, we will analyze the answers per question and group:

Use Case 1F: You are mostly using the "simple search". What could help you to motivate you to use some other search features like the "advanced search"?

The answer to this question could be clustered into five different topics that would lead to motivate them to use the advanced search more than the simple search. The researchers stated that if short comings of the simple search are detected they would use the advanced search (4). Second, they would use the advanced search in order to find more specific knowledge (5) or if they have some deeper knowledge about what they are searching for (2). They also stated that they would like to have some tips or hints to be more efficient (2) and also stated that they would use it if the advanced search has more search functionalities (2). The detailed answers are presented in Table 20 in Appendix 12.

Use Case 1V: Do you think that using the "uRank" can improve your search performance/ search skills...? And if yes how?

The participants from the researcher group reflected about the uRank visualizations and many of them stated that uRank can enhance the search performance and additionally helps to easier find relevant documents (17). Additionally, uRank can also impact on the identification of keywords. Only some participants stated that uRank cannot improve the search performance or they were not sure about it (4). The detailed answers are presented in Table 21 in Appendix 12.

Use Case 2F: You are mostly using the "Advance Search". What could help you to motivate you to use some other search features like the "Simple Search"?

The answers of this reflective question are ambivalent. One participant from the auditor group stated the s/he uses the advanced search because s/he has a kind of result set in mind. Other participants stated that they would like to have further information about the differences between the simple search and the advanced search (2). Furthermore, several participants mentioned that they would use the simple search if they will receive as good results as with the advanced search (5) and others mentioned that they have not used the advanced search at all (2). The detailed answers are presented in Table 22 in Appendix 12.

Use Case 2V: Do you think that using the "Concept Graph" can improve your search performance/ search skills...? And if yes how?

When reflecting about the "Concept Graph" and its opportunities regarding performance or search skill improvement, the answers were again very different. Most of the participants (8) answered the questions with yes and stated several reasons why the Concept Graph increases the search performance like for example a faster exploration of similar topics, it is very useful to get the big picture about a topic or it is easier to find related papers. In contrast, other participants (6) stated that the concept graph could not improve the performance. In addition, some participants could not decide if yes or no (2). The detailed answers are presented in Table 23 in Appendix 12.

Question 2: Did the reflective question you have answered motivate you to reflect about your search behaviour?

This question was posed to all use case groups and is answered according to the reflective question that was posed per group.

Use Case 1F: The majority of the participants agreed to have reflected about their search behaviour. While some of them (8) just stated yes, others gave some further insights of their thoughts like that they would like to try out different methods to optimize their search results or that such a tool like the widget could motivate you to do more than usually. On the other hand, some participants (7) did not reflect about their search behaviour at all. The detailed answers are presented in Table 24 in Appendix 12.

Use Case 1V: In this use case some participants (8) confirmed that they reflected about their search behaviour. They stated for example that in real life they have not time to try out other visualization, that they are quite happy with their search behaviour or that they search about their search skills. However, the majority in this group (11) stated that they did not reflect about their search behaviour. The detailed answers are presented in Table 25 in Appendix 12.

Use Case 2F: In this group, the answers were very balanced. Half of the participants (8) confirmed that they reflected about the search behaviour. For example, they mentioned that it is good to try out new methods, thought about how to improve their own search skills or that they prefer text -based searchers. The other half (7) did not reflect about their search behaviour. They stated that they need to be efficient when searching for information, or that they perform their searches pretty well. The detailed answers are presented in Table 24 in Appendix 12.

Use Case 2V: In this use case again, the majority of the participants confirm that they reflected about their search behaviour. For example, they stated that they just use Google or that they better understand which things characterize a document to find similar ones. The other participants (8) mentioned not to be motivated to reflect about their search behaviour. The detailed answers are presented in Table 25 in Appendix 12.

Summing up the results from the question if reflective learning has taken place, we can say that in 3 out of four use case groups, the widget and the reflective question motivated the people to reflect. Only the majority of participants of Use Case 1V did not reflect, which can be seen in Figure 28.

Question 3: When you look at the "learning-how-to-search" widget, what does the visualization tell you about your usage behaviour?

This question was intended to be posed to all participants, however, unfortunately, we did not pose this question to the use case group 2F as there was an error in the corresponding Google form. The results will be represented for the three remaining use cases.

Use Case 1F: Overall the visualization was understood by all participants. Some participants (6) responded

Figure 28: Overview per use case of how many participants reflected about their search behaviour.

that the visualisation shows that they use most of the time the simple search. While mostly all refer the bar chart to the own platform usage, one of the participants referred it to the overall users of the platform. Other participants (9) stated that they not only use the simple search the most but mentioned also their usage of other functionalities, like the advanced search. The rest (4) mentioned it as a summary of their own search behaviour and that they should try out the not so often used functionalities too. The detailed answers are presented in Table 28 in Appendix 12.

Use Case 1V: Again, the visualisation was understood by most of the participants. The majority of the participants (11) stated that uRank was the most used functionality used. Some others (7) included not only the uRank in their interpretation, but also mentioned the other functionalities and how they were used. Interestingly, 2 participants gave an answer that did not fit to the presented bar chart in the widget at all. From the description it seems that they opened the wrong link, however, it is not clear how this could have happened because the link to the widget was the same for all participants. The detailed answers are presented in Table 29 in Appendix 12.

Use Case 2V: In general, mostly all participants understood the visualization of the widget. Most of them (7) stated that the Concept Graph was the functionality mostly used while others also mentioned other functionalities (5). Some participants (4) only mentioned the purpose of the widget without going into much detail. And only few of them (2) gave some unrelated answers – it is not clear if they really did not understand it or if they did not take the time to look at it in more detail. The detailed answers are presented in Table 30 in Appendix 12.

Question 4: When you look at the "learning-how-to-search" widget, would it motivate you to use an other visualization? And if yes, which one? And if not, why not?

This question was posed to all four user groups and the results will be again reported accordingly depending on the content of the widget presented to them.

Use Case 1F: Some of the participants (8) confirmed to be motivated to try out another visualization. They mentioned the widget to be helpful to raise awareness of other visualizations, they liked the approach or mentioned for example the tag cloud being a candidate for trying. In contrast, other participants (11) stated that it is not motivating them to try out other functionalities. Reasons mentioned are that they like the statistical overview of the widget as it is simple and easy to use and understand, however some also mentioned that they missed some kind of explicit hint why to try out something else. One participant would like to have a pie chart instead of a bar chart. The detailed answers are presented in Table 31 in Appendix 12.

Use Case 1V: In this use case the answers are balanced. Half of the participants (10) stated that they

would be motivated to try out other functionalities based on what the widget is presenting to them. And the other half of the participants (10) would not try out other visualizations motivated by the widget. Some of them stated to stay with uRank, some of them stated to use only one visualization that fits best for them and some of them refer to be a creature of habit who does not want to change something. The detailed answers are presented in Table 32 in Appendix 12.

Use Case 2F: In this use case, most participants (11) stated that they would be motivated to try out other visualizations. They mentioned especially the uRank visualization as well as the concept graph and the tag cloud. Some of them stated as a reason that they are curious to try out other functionalities. Only few participants (3) mentioned not wanting to try out other functionalities. Others (2) gave some general comments, one about that s/he likes the widget and the other a wish to compare with others. The detailed answers are presented in Table 33 in Appendix 12.

Use Case 2V: Again, the answers are nearly balanced. Some of the (8) stated that the widget would motivate them to try out other functionalities especially those that were rarely used. In contrast, the other participants (10) are not motivated to try out other visualizations arguing that they prefer searching the way they are doing it and do not see a reason for changing their search behaviour. The detailed answers are presented in Table 34 in Appendix 12.

To the question if the widget motivates the participants to try out other visualizations on the MOVING platform, the answers for Use Case 1F, 1V, 2V were in summary very balanced – half of the participants of each group confirmed that the widget motivated them to try out other visualizations, while the other half of the participants were not motivated. Interestingly in Use Case 2F, a clear majority of the participants stated that the widget motivated them to use different visualizations as depicted in Figure 29.

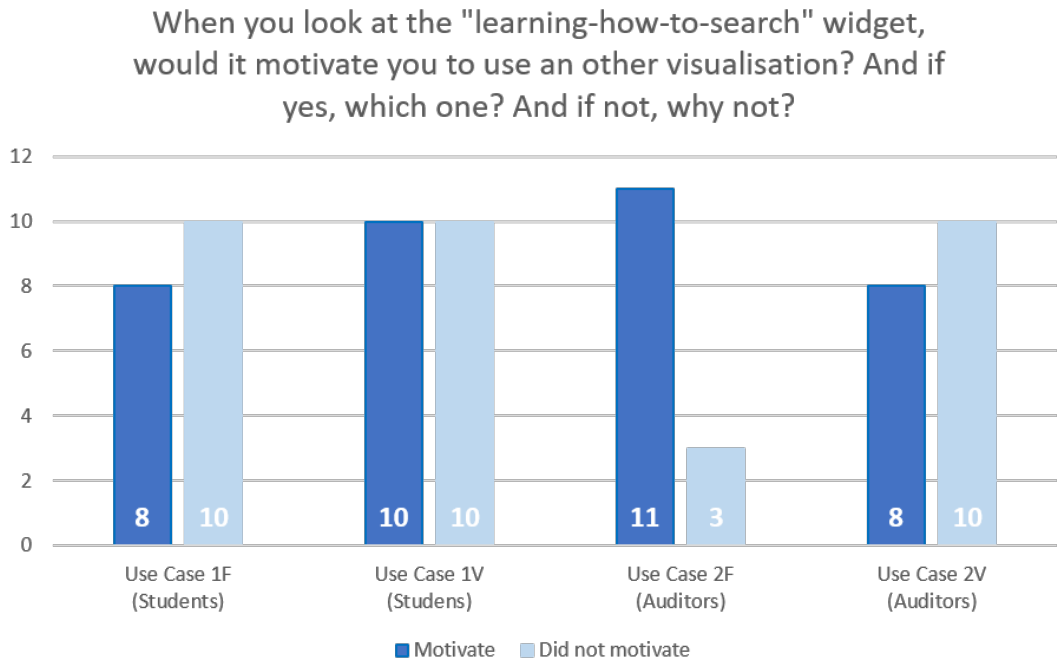

Figure 29: Overview per use case of how many participants are motivated to try out other visualizations.

Subjective Workload: The participants in the study used the learning-how-to-search widget either prepared for the visual or the faceted search interface, thus, we had two groups to compare for each use case. For each of them we calculated the workload as presented in Table 9. Additionally, the number of participants for each use case differed from each other and the gathered data from the subjective workload questionnaire was not normally distributed, as confirmed by a Shapiro-Wilk with $p < 0.01$ for all five NASA-TLX Variables. We used a Kruskal-Wallis test (Kruskal & Wallis, 1952) to compare all four groups. The p-value of the asymptotic significance is p = .325, which is used for samples greater than 30. This means that we cannot reject the null hypotheses, thus, there is no difference between the four groups regarding the workload.

Table 9: NASA-TLX Workload per User Case Group

Group	Workload for Task 3
Use Case 1F	32.54%
Use Case 1V	26.35%
USe Case 2F	29.17%
Use Case 2V	30.93%

TAM Questions: The *loyalty metric* describes how likely it is that the participants would recommend the learning-how-to-search widget to others, with a scale from 10 (absolutely) to 0 (not at all).

The learning-how-to-search widget would be actively promoted by 1.32% (promoters scale: 9 – 10), passively recommended by another 19.74% (passives scale: 7-8) and not recommended by $78,95\%$ (distractors scale: 0-6). The net promoter score (NPS) is $-77,63\%$ (percentage of promoters minus the percentage of distractors). Table 18 presents the results for all users and both use cases. The results show, that it is unlikely that the participants would recommend the widget to colleagues and friends. Table 10 presents the loylty metric per participant group.

Table 10: Loyalty Metric: Results presented for all and the two use case groups

Loyalty Metric	All participants	Participants from researchers group	Participants from auditors group
Promoters Scale	1.32%	1.32%	0.00%
Passives Scale	19.74%	10.53%	9.21%
Distractors Scale	78.95%	43.42%	35.53%
Net Promotor Score	−77.63%	−42.11%	−35.53%

The final questions in the Google Form consisted of a questionnaire related to the *Technology Acceptance Model* (TAM). The TAM questions consisted of the following topics: "Ease of use" (6 items), "Perceived Usefulness" (7 items), "Attitude towards the widget" (2 items), "Widgets specific questions" (6 items), "Learning Outcome" (2 items), "Behaviour Intention" (2 items), "Subjective Norm" (3 items), "System Accessibility" (1 item) as well as some open questions (2 items). All Items were rated on a 7-point Likert scale form 1 – strongly disagree to 7 strongly agree.

In order to detect significant differences between all four use cases and between the two user groups we conducted a one-way Anova for each of the topics, however, no significant results were found. This means that there were no significant differences between the ratings of the different use cases and groups regarding the different topics. Therefore, we will only report the average values per topic and group.

As follows, we will shortly report the interesting results regarding the ratings of the TAM items. The average ratings of the *ease-of-use* for both groups were very similar(Researchers: $M = 4.80$ $(SD = 1.11)$; Auditors: $M = 4.84$ $(SD = 1.07)$), thus, they agreed that the widget is easy to use. With respect to the *technological self-efficacy*, both user groups agreed to have necessary technical skills and are confident to use such a widget. The participants from the researcher group rated it with $M = 5.12$ $(SD = 1.34)$ and the participants from the auditor group with $M = 5.23$ $(SD = 1.41)$. The participants from the researcher group $M = 5.93$ $(SD = 1.30)$ as well as the participants from the auditor group $M = 5.71$ (SD $= 1.43$) agreed that there were no difficulties regarding the *system accessibility*. The *behavioural intention* of how and if to use the widget in the future were rated from both slightly negative, participants from the researcher group rated it with $M = 2.58$ $(SD = 1.66)$ and participants from the auditor group with $M = 2.69$ $(SD = 1.68)$. The participants slightly disagreed to use the widget in the future. The *perceived usefulness*, *attitude towards the widget*, *widget specific quesiotns* and *learning outcomes* were rated neutral form both groups.

It is remarkable that for all ratings and independent of the user groups the standard deviations are > 1, meaning that the opinion of all user groups is very polarized over all topics. Figure 30 presents the mean values and standard deviations per user group.

At the end of the TAM questions, we added two open questions about what the participants liked about the widget and what the participants did not like.

Additional question 1: What did you like about the "Learning-how-to-search" widget?

After having analyzed the answers, we were able to cluster them into the following four topics: "Ease of use", "Visualization", "Search Behaviour & Reflection" and "Others".

Use Case 1F: The participants (4) confirmed that the widget is easy to use and that they (4) liked the graphical representation of information as well as the design. Really important is here that the majority of

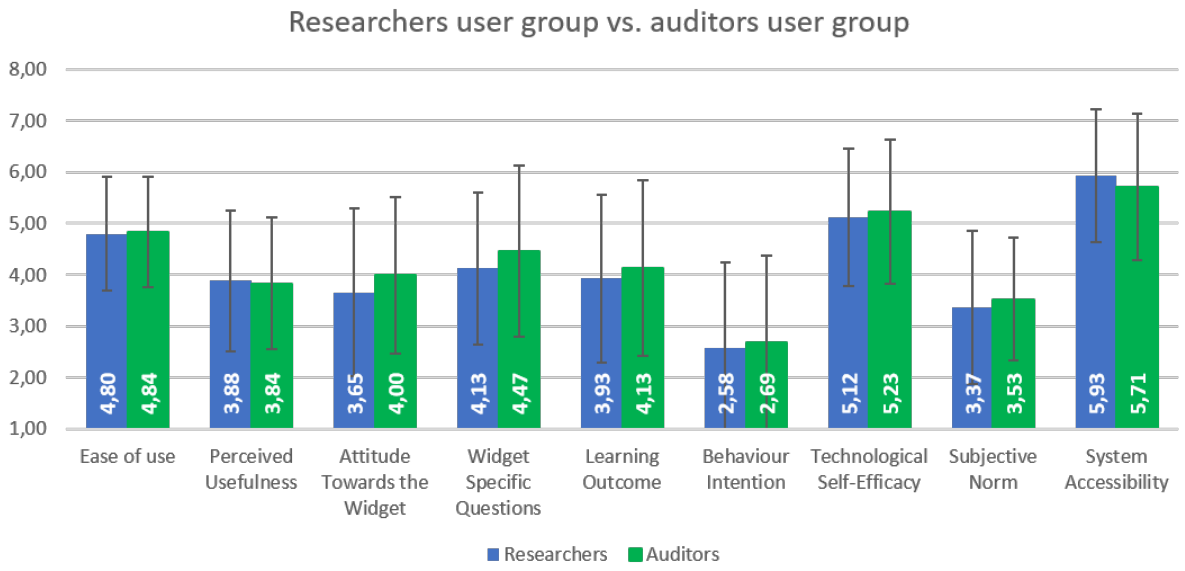

Figure 30: Mean values and STD for researchers and auditors for the TAM items.

the participants (11) stated that they become aware of their search behaviour as well as which type of search functionalities are available on the MOVING platform. Furthermore, they mentioned that they are motivated to try out other search functionalities, to improve the own search behaviour and that they become aware of not completely the full potential of the platform. The detailed answers are presented in Table 35 in Appendix 12.

Use Case 1V: The participants (4) stated again that the widget is easy to use, especially the design, the way it works and that is clear and simple. Other participants (4) liked the visualizations especially the nice statistics and the way it presents the information in the chart. The majority of the participants (8) stated that after they see their search preferences, that they become aware of which other search functionalities are available and that they are motivated to improve their own search behaviour. Other comments (5) covered feedback that the widget provides information, the most used search functionality, as well as that it was funny to use. The detailed answers are presented in Table 36 in Appendix 12.

Use Case 2F: One participant liked that the widget is easy to use, and some participants (3) liked the visualization to present nice-to-have information. The majority of the participants (7) liked getting an overview of their own search behaviour and to become aware of which other features are available, so that they can use them if the search results received are bad. One participant stated that something new is always good while another does not want to give any feedback after having only shortly used it. The detailed answers are presented in Table 37 in Appendix 12.

Use Case 2V: Some participants (4) stated that the widget is clear, easy to understand and very simple. Additionally, they (4) mentioned that it presents statistics in form of a graph with their used functionalities. Some participants (5) stated that it gives an overview about their own search behaviour. Other answers (4) given called it innovative, a kind of history tracking and a nice try but not useful. The detailed answers are presented in Table 38 in Appendix 12.

Additional question 2: What did you dislike about the "Learning-how-to-search" widget?

Again, we tried to analyze the given answers according to the same topics emerging from them, however, the answers given were that diverse that we were not able to derive common topics so that we will report them per use case.

Use Case 1F: The participants (2) of this group criticized the design as boring and that the statistics only are too few. Furthermore, they (4) mentioned that they did not like the reflective question or that it could be difficult to answer, and that such a visualization does not affect their search behaviour. Some participants (5) also mentioned that the usage of the widget is limited, some missing descriptions of terms like uRank or also

a missing description of the y-axes. One participant complained that his/her data is collected, however, this was mentioned in the consent form and will only be used for this evaluation. Finally, some participants (3) did not find it interesting and not very motivating. The detailed answers are presented in Table 39 in Appendix 12.

Use Case 1V: Some participants (3) complained again about the design, mentioning that it is difficult to understand how the widget works, that the chart could be a bit bigger, or questioning the visualization at all. Other participants (6) thought that the widget would not motivate them to think about their search behaviour or to reflect. One participant requested more or other information to be displayed, like the usage per week or month. Other statements of the participants (5) mentioned that they do not find the widget useful, that it recommends irrelevant options, or reported some errors while using it. The detailed answers are presented in Table 40 in Appendix 12.

Use Case 2F: The participants (3) complained about the design, that it is not appealing, old-school and suggest to remove the numbers on the bars. They (4) mentioned also some shortcomings regarding the usability, namely that they have to use the platform sometimes before something is shown in the widget, that it takes time to learn, or that they did not understand the purpose of the widget. The detailed answers are presented in Table 41 in Appendix 12.

Use Case 2V: Again, the second group of the participants from the auditor group (3) did not like the design as it seems to be too complex or the look and feel. One participant was not sure if she understood the purpose of the widget correctly. Furthermore, some participants (3) mentioned that they see no value for themselves in using the widget although it is a nice to have. The majority of the participants (9) mentioned very different shortcomings from not understanding the purpose of the widget, that it takes work to get used to it, and that it is not clear why one has to change their own search behaviour. Furthermore, the missing description of the y-axis was mentioned as well as some technical errors. The detailed answers are presented in Table 42 in Appendix 12.

Summarizing the answers of how the participants liked the learning how to search widget, one can see that most of the participants liked the widget, found it easy to use, and liked the visualizations. An interesting difference regarding the search behaviour and reflection topic is, that the widget makes the participants from both groups aware of their search behaviour, and that the participants from the researcher group mentioned more often that the widget motivates them to improve their search behaviour, or to try out new functionalities.

Shortcomings that were reported over all four use case groups concerned on the one hand the design and the user-interface of the platform as well as the widget. On the other hand, the participants mentioned that they do not really understand the widget or did not find it very interesting or unnecessary and not motivating to change their search behaviour. Again here, there was not much difference between the answers given by the participants from both the researcher and auditor groups.

Discussion

We will now shortly discuss the results according to the three research questions and distinguish between each of the use cases or researchers and auditors where necessary.

RQ1: How do participants perceive the widget in the search environment? (Level 1: reaction)

The subjective workload measured with the NASA-TLX was rated rather low and no significant differences were detected between the four user groups. This led us to the conclusion that the widget is easy to use, which was also confirmed by the corresponding TAM rating as well as with the open questions about what the participants liked – especially the ease of use was positively mentioned here by several participants.

We also have evidence that mostly all participants in three out of four use case groups understood the presentation within the widget. Most of the participants interpreted the diagram correctly and mentioned either the most often used feature or also referred to all features presented in the widget. Only in use case 1F the participants mentioned that they should also try out the functionalities that were less used than others. Thus, we can conclude that the widget is easy to understand for both target groups.

Although the widget was easy to use, we were made also aware that we need to improve the design of the widget. Here the goal would be to make it fancier and more interactive in order to be more attractive to the users.

Regarding the usefulness of the widget, the opinions were very diverse. While some of the participants did not understand the purpose of the widget, others understood it and did not perceive it as useful for them. In contrast, others found it useful and helpful for them to see how they search and which further functionalities are available. Furthermore, the low value about recommending the widget to others, as well as the lack of a clear benefit for the individuals shows that there is room for improvement with regard to the widget's usefulness. To overcome the problem of not being perceived as useful or not- or misunderstanding the purpose of the widget, a possible solution might be to introduce such an approach face-to-face or in a virtual meeting, and not in a written form. This would have given the participants the chance to understand right from the beginning what the goal of the widget is, and what we wanted to achieve. Thus, the participants would have then been more focused on using the widget than to struggle with the purpose.

RQ2: To what extend does the widget motivate participants to think about their own search behaviour or try out other visualizations? (Level 2: learning)

The widget is aiming at motivating participants to think about their own search behaviour with the goal to improve it if necessary and also to try out new functionalities that have not been used or only rarely used.

From the feedback given to some open questions, we could show that the participants confirmed to become aware of their own search behaviour. However, while some of them confirmed to think about the search behaviour and perhaps improve it, others stated that just presenting the behaviour is not enough to improve, or change it. Additionally, some stated that they do not want to change their search behaviour as they find what they want to have with their current search strategy.

The question about the motivation to try out or not to try out other visualizations is for three use cases namely use case 1F, 1V and 2V very balanced. Around half of the participants per group are motivated by the widget to try out other visualizations, while others would not be motivated to try out other visualizations independent of being in the researcher or auditor group. Only the participants from the auditor group of the use case 2F confirmed that they are motivated to try out new functionalities, thus by only presenting the usage behaviour. It is very interesting to compare these answers with the answers given to the question of what the participants from the auditor group in use case 2V did not like about the widget, namely exactly the opposite, that the widget is not interesting or motivating at all. Having these two very divers answers from those two use groups in mind, it is not so easy to interpret these results in a correct and meaningful way. However, from our point of view and from our experience, it seems that students, which were the exclusive participants for the researcher group might be more motivated to try out other and new search functionalities or to improve own search behaviour. This could be the case because students are still in the phase of learning in order to find out what they like and what they do not like with regard to to searching, or are still open and adventurous, and are motivated to try out new things. This could also be true for the participants from the auditor group, consisting to a great part of employees from Ernst & Young, however, working in finance means also to be performant and to deliver results in time, thus, not having time for trying new things out. And typically, working in finance seems to have already developed their routinized search behaviour that works for efficiently and effectively conducting their work and it seems to be difficult to motivate them to leave routinized work behaviour, thus to leave their comfort zone, especially if they have a well-working and established own search behaviour.

RQ3: To what depth does reflective learning occur? (Level 2: learning).

By letting the participants answer a reflective question in the Google Form, we could show that they at least thought about the visualization. For both use cases 1F and 2F, the participants had more difficulties in answering questions about the simple and advanced search - this could be due to the fact that their task was related to the filter search interface and not directly to the simple or advanced search. Additionally, an explanation was missed in the task description which could have clarified that the filter search interface counts as functionality for the one or the other search. For both use cases 1V and 2V, reflective questions on the uRank and the Concept Graph were answered mostly in a more reflective way, thus, some participants really confirmed that when thinking about the visualization, the use of these visualizations could have a positive impact on their search performance or search skills – and this is what we wanted to achieve. We could show that in three out of the four use cases reflective learning was initiated and motivated by a reflective question, unfortunately explicit insights gained, lessons learned or other learning outcomes were not inserted into the answers.

Conclusion

With this evaluation we could show that half of the participants liked the widget, perceived it as easy to use and useful while the other half of the participants mentioned some opportunities for improvement. However, we could show that the purpose of the widget, namely to become aware and reflect about the own search behaviour, as well as to motivate to try out other search functionalities were fulfilled for both target groups. Although we only had this very short-term evaluation using only some mock-ups for evaluating the widget, the results indicate that using the widget over a longer period of time could lead to learning and as a consequence to improve the own search behaviour.

5.2 Curriculum Reflection widget

The second major focus with regard to the adaptive training support was the implementation of the "Curriculum Reflection" widget. In Y2, we developed a first idea and a first draft of a concept for it, we updated the concept in close collaboration with TUD, and finished the complete development and implementation of the widget in the platform.

5.2.1 Goal, challenges and research questions

The goal of the Curriculum Reflection widget is to support users to become information-savvy professionals by **providing automatic learning guidance to raise the learner's competence level for each competence in the curriculum to the expert level**. Furthermore, we base our work on micro learning in combination with reflective learning, which we both see as two complementary learning strategies that support learning on the fly while using the MOVING platform. The main contribution of this widget is to

- a newly developed learning approach by combining micro learning with reflective learning based on open learner modelling.
- a newly developed concept that automatically tracks the learner's learning progress in order to provide guidance adapted to the learner's competence level and learning needs with regard to the curriculum.

Thus, the major challenge of the widget is to provide and visualize the correct competence status and learning progress with regard to the curriculum by analyzing and inferring automatically captured activity tracking data.

The sub-challenges are defined as follows:

- Challenge 1: Correct inferring of the competence status of a user from automatically tracked activity data.
- Challenge 2: Visualizing the learning progress in an understandable and meaningful way.
- Challenge 3: Motivating learners with learning and reflective prompts to continue their learning progress and deepen their knowledge.

According to these challenges, we have defined the following three research questions:

- RQ1: How needs the interplay between micro learning and reflective learning be designed in order to effectively support the accommodation and assimilation of the learning content?
- RQ2: How needs the reflective prompts be formulated that they are strongly related to the micro learning content and that they can be understood, are perceived as appropriate with regard to the user's expertise, and lead to reflection?
- RQ3: Does the presented competence status derived from activity tracking data correctly reflect the real competence status of the user?

Additionally, we got accepted a full paper about the Curriculum Reflection Widget at the Conference on Learning Information Literacy(Fessl, Simic, Barthold, & Pammer-Schindler, 2019).

5.2.2 The Curriculum Reflection widget concept

Based on the first concept developed in Y2 and described in D2.2, we further developed and improved the concept for the curriculum reflection widget in order to implement it in the MOVING platform.

In Figure 31, we shortly present the updated concept the widget is based upon. The widget consists of two parts, the *curriculum learning and reflection part* that provides automatic learning guidance through the curriculum, and the *overall progress part* that presents the overall learning progress of the current user.

In order to initialize the widget, the learner's competence status with regard to the modules of the curriculum, including different competence levels per module, is extracted with the prior knowledge assessment (see Section 5.3). This status is stored in the user's user model that is created when a user is registering on the MOVING platform. The status can be beginner, intermediate and expert, and these levels are also used to prepare the micro learning cards in the curriculum. According to this status, the *curriculum learning and reflection part* of the widget automatically recommends the user a learning prompt referring to a micro learning card covering a topic to further develop the user's learning competence with regard to the curriculum.

In order to automatically track if a user is opening the recommended learning card and deals with the learning content, we have implemented an activity logging mechanism that automatically tracks the user's activities with the learning card (e.g. opening the card, clicking on the next button when having learned the topic). These activities are then used to automatically infer the further development of the learner's competences and are added into the user model again. To strengthen the learned content, the widget presents a reflective question according to the learned content. After having answered this (open) question, the widget shows automatically the next content to learn.

The *overall progress part* of the widget, visualizes the overall progress of the user with regard to the curriculum, thus the learner can see his/her progress at one glance. This visualization uses the current learning progress status stored in the user model of the current user and presents it in a sophisticated way.

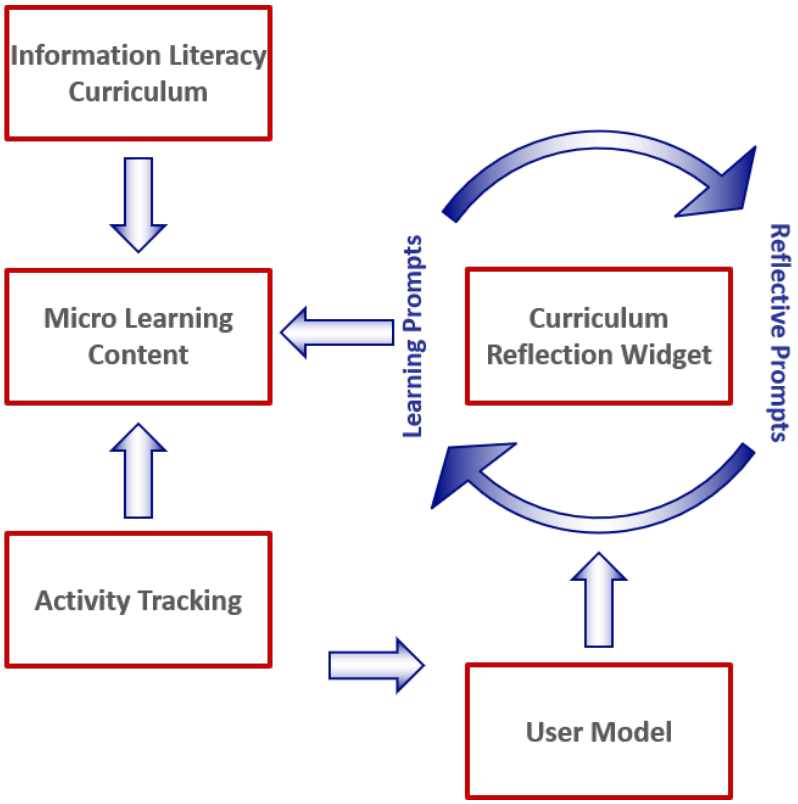

Figure 31: Curriculum Reflection widget: Updated concept for automatically providing learner guidance to the user

In order to cover both MOVING use cases, the researchers use case and the auditors use case, the widget does not only present the three modules of the Information Literacy curriculum, namely "Information & Data Literacy", "Communication & Collaboration" and "Content Creation", that are available for all users. In addition, a fourth curriculum module called "Digital Audit" was developed especially for auditors, which covers general information about the conduction of audits. This fourth curriculum module is only available for EY auditors that are recognized by their EY email address.

5.2.3 Implementation of the Curriculum Reflection widget

As already mentioned in Section above, the Curriculum Reflection Widget and the Learning-how-to-search widget are implemented in the same area of the platform and can be switched by using the appropriate tabs. The Curriculum Reflection widget consists of two parts, the curriculum learning and reflection part and the

overall progress part. The curriculum learning and reflection part, is divided into two areas. The upper area contains either a learning prompt, suggesting to learn more about the next topic that would be the next in the current sub-module of their curriculum, and a button which opens the respective learning unit in a new tab (see Figure 32), or it presents a reflective question that motivates the user to think about the currently learned topic (see Figure 33). Below the prompts, a progress indicator shows the user the progress of the curriculum's current sub-module. The progress is defined by the amount of completed learning units in comparison to the available ones for this particular sub-module, and matches with the progress in the overall progress widget for this specific sub-module.

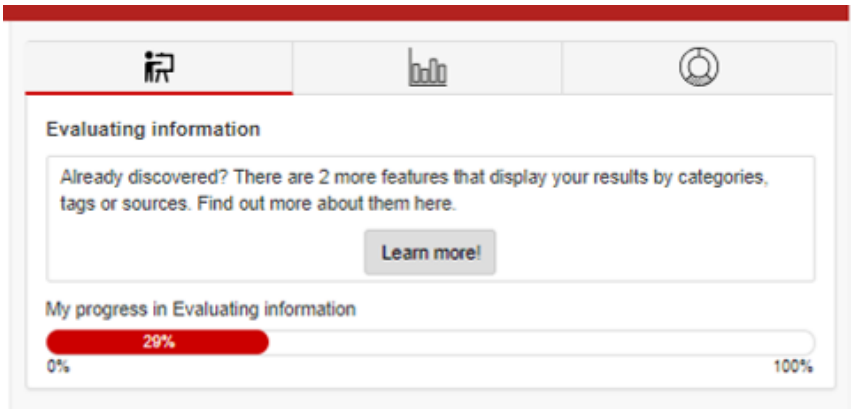

Figure 32: Learning prompt in the Curriculum Reflection widget

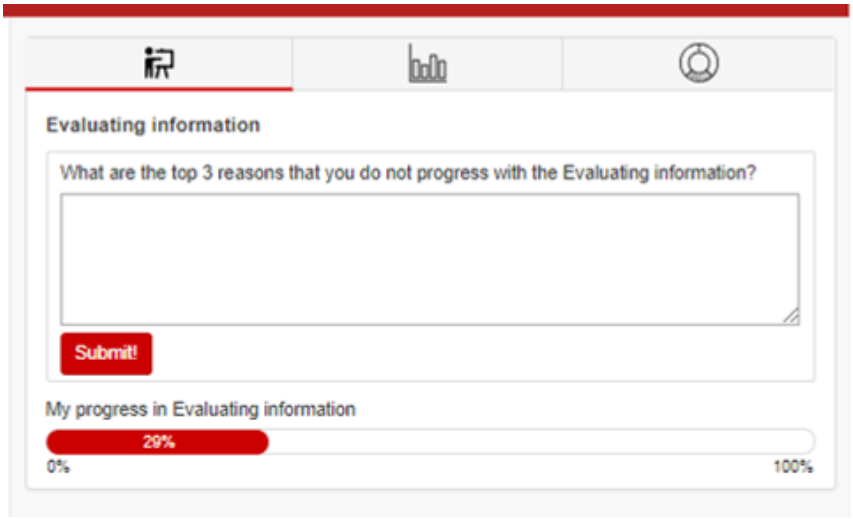

Figure 33: Reflective prompt in the Curriculum Reflection widget

Regarding the prompts in more detail, both types of prompts are divided into prompts supporting three different expertise levels of users. Thus, depending on the competence status of a user(beginner, intermediate or expert), a corresponding prompt will be displayed.

Learning activity prompts always consist of a short text message that should make the users curious about the micro learning content in order to motivate them to learn. For example, Table 11 shows three prompts for the sub-module "Finding Information" within the module "Information and Data Literacy" on three expertise levels. All available learning prompts with regard to all four modules of the curriculum can be found in Appendix 11.1.

On one hand, the reflective prompts are strongly related to the topic of the micro learning content by referring to the content a learner has just learned. On the other hand, the reflective prompts were developed according to the model of Kirkpatrick (Kirkpatrick & Kirkpatrick, 2006) and follows a specific goal depending on the learner's learning progress. Reflective prompts for the beginners' level should make users aware of how they react to the learned topic, e.g. if it was helpful for them. Prompts at the intermediate level make users

Table 11: Example of micro learning prompts for the sub-module "Finding Information" in the module "Information and Data Literacy"

Level	Prompt
Beginner	- Search tools are the various sources from which you can obtain information. Find out which there are and what you can use them for.
Intermediate	- Would you like to know which strategies and tools you can use for your search? Click here for more information.
Expert	- Do you know what search engines do if you search for information in a digital database? Find out more here!

aware to what degree learners acquire knowledge, skills, attitudes, confidence, and commitment and apply it in practice. Prompts on an expert level should motivate learners to think about if they perceived a change or improvement in their work or study behaviour. Table 12 gives two examples for each level.

All available reflective prompts with corresponding placeholders for being used with different sub-modules can be found in Appendix 11.2.

Table 12: Examples of reflective prompts for all three levels.

Level	Prompt
Beginner	- What do you think about the progress of your finding information skills? - What could help you to improve the finding information skills faster?
Intermediate	- Could you already apply your newly gained knowledge about finding information and if yes, how? If no, why not? - What actions/motivators lead you to increase your learning about finding information this week?
Expert	- How did your newly developed skill find information help you to improve your work/study? - How can you encourage yourself to continuously improve your finding of information?

The overall progress part of the widget shows the user's learning progress with regard to the curriculum using a sunburst visualization. In Figure 34, it can be seen that the curriculum is divided into three modules, in Figure 35 it can be seen that a fourth module is added that is only available for auditors of EY. Each module is represented as section in the inner circle of the visualization and each module is additionally divided into three sub-modules (outer circle). Every time a user completes a new learning unit, the percentage in the respective section in the sunburst diagram gets updated. Furthermore, the progress in each sub-module is encoded by colour. If the user has not completed any learning units in a sub-module (0%) the respective section will be red. Making progress in a sub-module will turn the section to yellow (50%) and finally, by completing a sub-module, the section will turn green (100%). This is also explained by the legend below the visualization. Moreover, the sections in the sunburst diagram are ordered to mirror the structure of the curriculum. Starting from the top, the sub-modules get completed clock-wise, slowly turning the visualization green.

5.2.4 Discussion

We will shortly discuss challenges and shortcomings according to our three research questions.

RQ1: Interplay between micro learning and reflective learning:

The advantages of a micro learning approach initiated through learning prompts are twofold: first, the content which should be learned is broken down into very small pieces and second, the cognitive load in our setting is still on searching and not on learning. However, it can be easily integrated in search activities (Bruck, Motiwalla, & Foerster, 2012). Second, automatically guiding the learner through the curriculum according to the learners' learning progress and learning level ensures that the learner will cover all topics automatically and at the same time takes away the workload from the learner to the next learning content, in order to progress in the curriculum. Third, presenting the overall learning progress in one visualization can motivate the learner to continue. Although reflective learning has been proved to be a very successful learning strategy, we are aware that the initiation of reflective learning with reflective learning technologies like prompts is still challenging. First, reflective learning is a cognitive process based on the individual's intrinsic motivation and cannot be directly enforced. However, external impulses such as automatically provided reflective prompts can

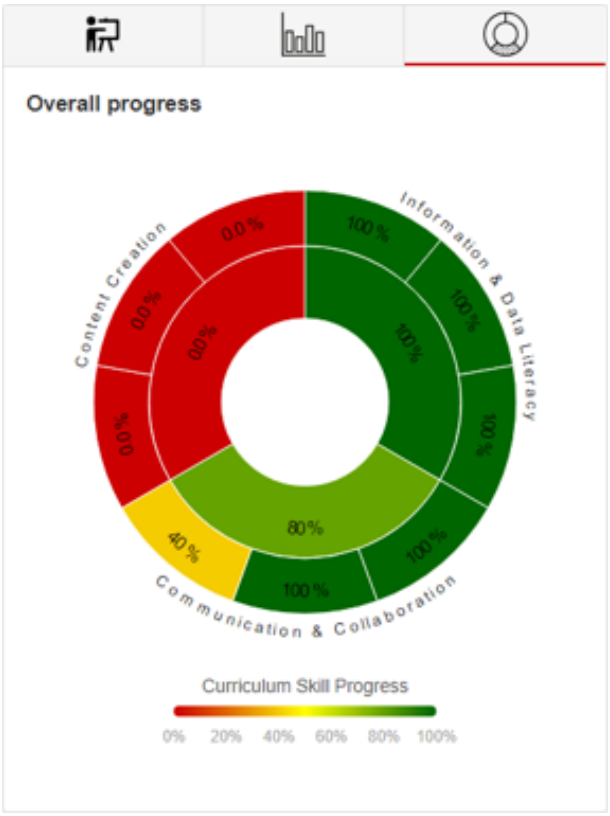

Figure 34: Overall learning progress with 3 modules of the curriculum.

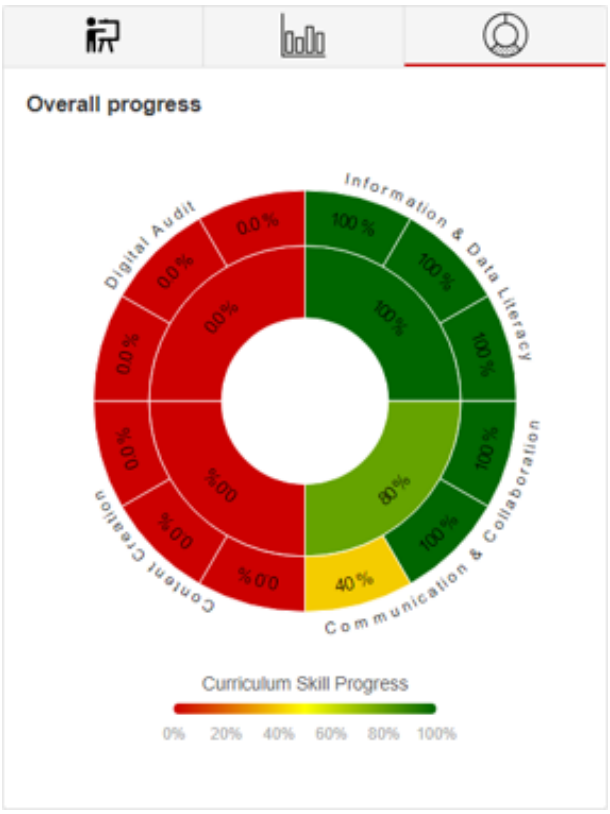

Figure 35: Overall learning progress with 4 modules of the curriculum.

be given to stimulate learner's motivation (E. A. Davis, 2000; E. Davis, 2003; Ifenthaler, 2012) . Second, the timing of reflection is very challenging, thus, if a learner is disrupted by performing a search and perceives a prompt rather as disturbing than as useful s/he will not use it (Fessl, Blunk, Prilla, & Pammer, 2017) Third, the content of a prompt needs to be carefully considered, thus, it should be related to the user's context, in our case the learner's learning activities (Kocielnik, Xiao, Avrahami, & Hsieh, 2018) in order to motivate for reflection. By combining the two learning strategies, we try on one hand to use the advantages that micro learning brings along with the use of reflective learning prompts to deepen the assimilation and accommodation of knowledge, such as that we strongly relate the reflective question to the currently learned micro learning content.

RQ2: Design of reflection prompts:

The design and formulation of the reflective prompts was motivated by the question on how to provide learner's a clear benefit for themselves as this is often difficult to achieve (Rivera-Pelayo, Fessl, Müller, & Pammer, 2017). First, we strongly relate the topic of the reflective question to the content of the micro learning content in order to have a visible relation to current learning activities of the learner. Second, we built our question upon the model of Kirkpatrick (Kirkpatrick & Kirkpatrick, 2006), which is originally a model used for assessing training effectiveness in organizations using a 4-level approach for evaluating learning. By formulating the reflective questions according to the first three steps of the model ("Reaction", "Learning" and "Behaviour") we are aiming at improving the learner's self-reflection by starting with low-level reflective questions followed by questions to deepen the reflective learning. We think that our approach is legitimate and well founded, however, only a well-planned evaluation will give us insights if this approach works.

RQ3: Inferring correct competence status from activity tracking:

It is really difficult to reliably answer the third research question. We are aware that only tracking the opening of the micro learning card via the Curriculum Reflection widget and clicking the "Next" button at the end of the micro learning card might not be the perfect solution. However, we have discussed several other heuristics that could make sense, but they were soon discarded for several reasons, e.g. which activities to track in order to get to know if a user has at least seen the learning content. Other heuristics like the dwell time on a micro learning page or scrolling down to the end of the micro learning page did not fit because computing a reliable dwell time is difficult (e.g. a learner opens the micro learning card and goes for a coffee), and as the content of a micro learning card is that short, it is not an option to check if the user has scrolled down to the bottom of the page. More advanced techniques like eye-tracking to see if a learner is in front of the computer and reading the content, or mouse movements of tracking how concentrated a user is would go beyond the scope of the project. Thus, to really show if a learner has learned the IL content could only be achieved by conducting an evaluation over a longer period of time in order to see if the learning of the learners progresses. To really track if the progress is correct can only by shown by testing the learner's knowledge status after having learned the content of the curriculum.

5.2.5 Outlook

Overall, we have reached our objectives and goals to design and implement a widget that educates searchers to become data-savvy professionals with regard to information literacy and digital competences while conducting a search on the MOVING platform. We based our concept on the combination of micro learning and reflective learning, as we see these two learning strategies are perfectly complementing each other so that they support the acquisition of knowledge, and deepening the assimilation of it at the same time. Furthermore, we discussed challenges and shortcomings of our concept.

5.3 Prior knowledge assessment

The prior knowledge assessment was already implemented in the platform in Y2. The goal of this assessment was to estimate the learner's previous knowledge on information literacy and digital competences to be able to initialize the Curriculum Reflection widget and establish individual learning paths for each user. Therefore, while registering on the platform, every new user is asked to determine his or her skills and competences in a short self-assessment survey that is based on the learning goals described above and is informed by the digital competence assessment standards of DigComp 2.0 (Vuorikari, Punie, Gomez, Van Den Brande, et al., 2016). Details of the questionnaire can be found in D2.2.

In Y3, we adapted the prior knowledge assessment in the following way:

First, after having implemented the first version of the prior knowledge assessment, filling in the questionnaires was mandatory for all participants during the on-boarding process. In order to simplify the on-boarding process and to lower the inhibition threshold to provide too much information about oneself (with regard to GDPR), we made the prior knowledge assessment optional. As a consequence, if someone skipped filling in the assessment, we could not use the results of the questionnaires to initiate the widget anymore. In this case, the widget starts as if the current user has no prior knowledge about the information literacy and digital competence. In addition, we added at the top of the widget a reminder and a link for filling in the prior knowledge assessment afterwards, as depicted in Figure 15.

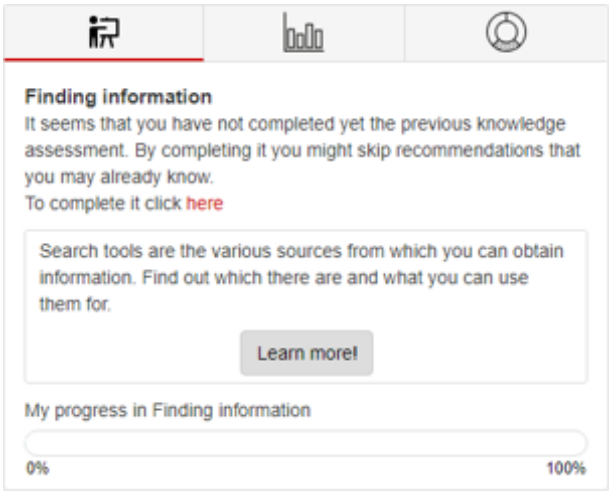

Figure 36: Curriculum Reflection widget with hint to go through the prior knowledge assessment.

For the newly added module called "Digital Audit", there is no prior knowledge assessment implemented, as all auditors need to complete the whole curriculum.

6 Semantic profiling and recommender system

In the previous deliverables D2.1 (Fessl, Thalmann, et al., 2017) and D2.2 (Günther et al., 2018), we introduced the MOVING semantic profiling and recommender system, which suggests documents to users to help them to discover interesting knowledge. In this deliverable, we show how a new technique, based on adversarial autoencoders (Makhzani, Shlens, Jaitly, & Goodfellow, 2015), can improve the system.

6.1 Problem statement

Recent advances in autoencoders on images have shown that adversarial regularization can improve the performance of autoencoders (Makhzani et al., 2015). The so-called adversarial autoencoders (Makhzani et al., 2015) are not only trained to reconstruct the input, but also to match the code with a selected prior distribution. We analyze whether adversarial autoencoders can be applied to highly sparse recommendation tasks. We evaluate the effect of adversarial regularization with respect to the degree of sparsity and different input modalities on two exemplary tasks: citation and subject label recommendation.

Citation Recommendation More and more publishers decide to contribute to the Initiative for Open Citations[17], which aims to make citation metadata publicly available. This motivates us to consider the following scenario as a recommendation task. When writing a new paper, it is essential that the authors reference other publications which are key in the respective field of study or relevant to the paper being written. Failing to do so can be rated negatively by reviewers in a peer-reviewing process. However, due to increasing volume of scientific literature, even some critical papers may be overlooked. Hence, in this paper we study the problem of recommending publications to consider as citation candidates, given that the authors have already selected some other references and assuming that the paper is close to completion, i. e., information such as the title (or a tentative title) of the paper is available.

Subject Indexing Apart from citation data, also subject labels, or tags, are publicly available for numerous domains, such as MeSH[18] for medicine or EconBiz[19] for economics. Subject indexing is a common task in scientific libraries to make documents accessible for search. New documents are annotated with a set of subjects by professional subject indexers. Fully-automated multi-label classification approaches to subject indexing are promising (Nam, Loza Mencía, Kim, & Fürnkranz, 2017), even when merely the metadata of the publications is used (Galke, Mai, Schelten, Brunsch, & Scherp, 2017). Professional subject indexers, however, typically use the result of these approaches only as recommendations, so that the human-level quality can still be guaranteed. This circumstance motivates us to build a subject label recommender system that explicitly takes the partial list of already assigned subjects into account.

To unify these two scenarios, we take either the citations or the assigned subjects as implicit feedback for a considered recommendation task. In the former case, citations are known to resemble credit assignment (Wouters et al., 1999), whereas in the latter case the subject labels are selected by respective professionals such that their relevance to the paper is guaranteed by human supervision.

Traditionally, the recommendation problem is modeled as the prediction of missing ratings in a $U \times I$ matrix with set of users U and set of items I (matrix completion). In our case, following (McNee et al., 2002), we view research papers themselves as users over their authors or the responsible subject indexers. The rationale is that one author may be involved in multiple papers of different domains but that all authors for a given paper should receive the same recommendations. Analogously, a given paper should receive the same recommendations for candidate subjects, independently of the current subject indexer in charge of annotating it.

We have transferred the approach of (Makhzani et al., 2015), which was applied to images, and extended it to our problem of a general recommendation task. By developing a novel interpretation of the adversarial autoencoder, we show how it can be applied to recommendation tasks and how multiple input modalities can be incorporated. We make use of this capability in our experiments by considering besides the ratings also additional metadata, namely the documents' title, as content-based features. We performed 408 experiments for our two recommendation tasks to study how adversarial autoencoders perform while exploiting titles along with the partial list of citations or the already assigned subjects, respectively. For a close investigation of the adversarial autoencoders' performance, we not only consider the adversarial autoencoder as a whole but also individually assess its components.

[17] https://i4oc.org
[18] https://www.nlm.nih.gov/mesh/
[19] https://www.econbiz.de/

We further evaluate to which degree these models are robust to sparsity in the dataset. When conducting citation or research paper recommendation, it is not desirable that only already frequently cited papers get recommended and less frequently cited papers are ignored. Common pruning strategies comprise removing rarely cited documents and documents that cite too few other works (Beel, Gipp, Langer, & Breitinger, 2016). This pruning step affects the number of considered items, and thus, the degree of sparsity. To gain a better understanding of how the pruning threshold affects the models' performance, we conduct experiments, in which the pruning threshold is a controlled variable.

Our results show that the partial list of items is more important for the citation recommendation task than it is for the subject labeling task. This is interesting because an inspection of the semantics of item co-occurrence may help researchers or practitioners to tackle new recommendation tasks, specifically to decide whether to supply the partial list of items as input. For citation recommendation, item co-occurrence implied relatedness, i. e., it is of high relevance which other works have been cited so far. For subject labels, in contrast, co-occurrence implies diversity: similar subjects are rarely used together for annotation of a single document. Thus, the title is more relevant than the already assigned subjects. All of the evaluated methods appeared similarly sensitive to data sparsity despite the differences in the number of parameters.

Due to the use of the titles, the adversarial autoencoders yields competitive performance to the baselines. On the subject label recommendation task, they outperform the baselines. A closer look at the individual components of the adversarial autoencoder revealed that the sole MLP decoder achieved better performance than the whole model on the subject labelling task, while its performance fell behind the whole model on the citation recommendation task.

6.2 Literature review

Research paper and subject label recommendation An extensive survey (Beel et al., 2016) shows that research paper recommendation is a well-known topic. In this context, BibTip (Geyer-Schulz, Hahsler, & Jahn, 2002) and bX (Bollen & de Sompel, 2006) are well-known recommender systems, which operate on the basis of citations harvested by CiteSeer (Giles, Bollacker, & Lawrence, 1998). Docear is a more recent research paper recommender system, which takes user profiles into account (Beel, Langer, Gipp, & Nürnberger, 2014). For citation recommendation specifically, Huang et al. distinguish between recommendations based on a partial list of references and recommendations based on the content of a manuscript (Huang et al., 2012). While the former is suited for finding matching citations for a given statement during writing, the latter strives to identify missing citations on the broader, document level. Citation recommendation recently focuses on context-sensitive applications, in which concrete sentences are mapped to, preferably relevant, citations (Beel et al., 2016; Huang et al., 2012; Ebesu & Fang, 2017). Instead, we revisit the reference list completion problem and we do not take into account the context of the citation, as the full text of a papers is rarely available in large-scale metadata sources. In 1973, Small started the field of co-citation analysis (Small, 1973). Co-citation analysis assumes that two papers are more related to each other, the more they are co-cited. Following that idea, Caragea et al. relied on singular value decomposition as a more efficient and extendable approach (Caragea, Silvescu, Mitra, & Giles, 2013). We recognise the need for new methods that are not only based on item co-occurrence but also take supplementary metadata into account for these partial list completion problems.

Subject label recommendation is similar to tag recommendation, as in both cases the goal is to suggest a descriptive label for some content. Sen et al. propose algorithms that predict users' preferences for items based on their inferred preferences for tags (Sen, Vig, & Riedl, 2009). Montañés et al. exploit probabilistic regression for collaborative tag recommendation (Montañés, Quevedo, Díaz, & Ranilla, 2009), while Krestel et al. relied on Latent Dirichlet allocation (Krestel, Fankhauser, & Nejdl, 2009). Similarly, Sigurbjörnsson and van Zwol propose a tag recommender for Flickr to support the user in the photo annotation task (Sigurbjörnsson & van Zwol, 2008), whereas Posh et al. predict hashtag categories on Twitter (Posch, Wagner, Singer, & Strohmaier, 2013). Dellschaft and Staab measure the influence of tag recommender systems on the indexing quality in collaborative tagging systems (Dellschaft & Staab, 2012). These works, however, focus on tags for social media, while we consider subject labels from a standardised thesaurus for scientific documents.

Recommendation and Link Prediction based on Deep Learning Multiple recommender systems based on deep learning have been proposed. Wang et al. used deep learning for collaborative filtering (Wang, Wang, & Yeung, 2015). Another recent collaborative-filtering approach explicitly takes side information into account for autoencoders (Barbieri, Alvim, Braida, & Zimbrão, 2017). We include a similar model in our comparison, as it is one component of the adversarial autoencoder. Additional techniques employ recurrent neural networks to provide session-based recommendations (Quadrana, Karatzoglou, Hidasi, & Cremonesi, 2017) or combine

knowledge graphs with deep learning (Palumbo, Rizzo, & Troncy, 2017; Rosati, Ristoski, Noia, Leone, & Paulheim, 2016). To the best of our knowledge, only two approaches makes use of deep learning techniques for citation recommendation (Huang, Wu, Chen, Mitra, & Giles, 2015; Ebesu & Fang, 2017). However, both of them focus on context-sensitive scenarios,i. e., exploit the text close to the citation. In the MOVING platform, the full-text is not always available, e. g., due to licenses.

Citation networks are also considered in many studies on link prediction. By making use of the network structure, dedicated architectures learn representations of its nodes. One of the most prominent approaches is DeepWalk (Perozzi, Al-Rfou, & Skiena, 2014), together with its extension Node2vec (Grover & Leskovec, 2016). These methods perform a random walk over the graph and feed the generated sequence into skip-gram negative sampling methods (Mikolov, Sutskever, Chen, Corrado, & Dean, 2013). Kipf and Welling recently proposed Graph Auto-Encoders (Kipf & Welling, 2016b) and Graph Convolutional Networks (Kipf & Welling, 2016a). However, all of these graph-based approaches assume that all nodes (research papers) are known during training. Hence, they are unable to deal with unknown nodes (new, unseen citing documents) at test time. Instead, we focus on a more realistic application scenario, where we need to predict citations for a paper which is being written and thus yet unknown. To simulate such practical settings, we ensure that all documents of the test set are unknown to the system during training. Such a scenario is challenging due to a cold-start problems.

6.3 Method description

In the following, we describe the employed models. We start with two baselines based on item co-occurrence. Subsequently, we briefly introduce the multi-layer perceptron as a building block for the two autoencoder variants. We show how title information can be incorporated in undercomplete and adversarial autoencoders. We provide information on hyperparameters in the final paragraph of this section.

Item Co-Occurrence As a non-parametric yet strong baseline we consider the co-citation score (Small, 1973) that is purely based on item co-occurrence. The rationale is that two papers, which have been cited more often together in the past, are more likely to be cited together in the future than papers that were less often cited together. Given training data X_{train}, we compute the full item co-occurrence matrix $C = {X_{train}}^T \cdot X_{train} \in R^{n \times n}$. At prediction time, we obtain the scores by aggregating the co-occurrence values via matrix multiplication $X_{test} \cdot C$. On the diagonal of C, the (squared) occurrence count of each item is retained to model the prior probability.

Singular Value Decomposition Singular value decomposition (SVD) is an approach that factorises the co-occurrence matrix of items $X^T \cdot X$. Caragea et al. showed that SVD can be successfully used for citation recommendation (Caragea et al., 2013). We therefore include SVD in our comparison and extend it by the capability of incorporating title information, which has already been proposed as future work by (Caragea et al., 2013). We concatenate the textual features as TF-IDF weighted bag-of-words with the items and perform singular value decomposition on the resulting matrix. To obtain predictions, we only use those indices of the reconstructed matrix that are associated with items.

Multi-Layer Perceptron A multi-layer perceptron (MLP) is a fully-connected feed-forward neural network with one or multiple hidden layers. The output is computed by consecutive applications of $h^{(i)} = f(h^{(i-1)} \cdot W^{(i)} + b^{(i)})$ with f being a nonlinear activation function. In the description of the following models, we abbreviate a two hidden-layer perceptron module by MLP-2. This MLP-2 module is not only used as a building block for subsequent architectures, but also as a full model that only operates on the documents' titles. In this case, we optimise binary cross-entropy $BCE(x, MLP-2(s))$, where the titles s are used as input and citations or subject labels x as target outputs. We chose to operate on an TF-IDF weighted embedded bag-of-words representation (Galke, Saleh, & Scherp, 2017) for a fair comparison with the autoencoder variants, which are described below.

Undercomplete Autoencoders The general concept of an autoencoder (AE) involves two components: the encoder `enc` and the decoder `dec`. The encoder transforms the input into a hidden representation (the code) $z = enc(x)$. Then the decoder reconstructs the input from the code $r = dec(z)$. The two components are jointly trained to minimise the loss function $BCE(x, r)$. To avoid learning to merely copy the input x to the output r, autoencoders need to be regularised. The most common way to regularise autoencoders is by imposing a lower dimensionality on the code (undercomplete). In short, autoencoders are trained to capture the most important explanatory factors of variation for reconstruction (Bengio, Courville, & Vincent, 2012).

For both the encoder and the decoder we chose an MLP-2 module, such that the model function becomes $r = MLP-2_{dec}(MLP-2_{enc}(x))$. When the documents' title is available, we supply it as additional input to the decoder $r = MLP-2_{dec}([MLP-2_{enc}(x);s])$. We embed the textual features into a lower dimensional space by using pre-trained word embeddings (Mikolov et al., 2013). The rationale here is that the rather low code dimension is not overwhelmed by the high amount of vocabulary terms. For a fair comparison of the models, also the MLP described above is supplied the same text representation as input. More precisely, we employ a TF-IDF weighted bag of embedded words representation which has proven to be useful for information retrieval (Galke, Saleh, & Scherp, 2017). The usage of title information in an undercomplete autoencoder is comparable to the approach by (Barbieri et al., 2017). A minor difference is that we supply the side information (titles) only to the decoder, yet use two hidden layers for both the encoder and the decoder to enable a fair comparison to the adversarial variant, which is described below.

Adversarial Autoencoders We extend the work of Makhzani et al. on adversarial autoencoders (AAE) (Makhzani et al., 2015), who combine generative adversarial networks (Goodfellow et al., 2014) with autoencoders. The autoencoder component reconstructs the sparse item vectors, while the discriminator distinguishes between the generated codes and samples from a selected prior distribution (see Figure 37). Hence, the distribution of the latent code is shaped to match the prior distribution. We hypothesise that the latent representations learned by distinguishing the code from a smooth prior lead to a model that is more robust to sparse input vectors than undercomplete autoencoders. The rationale is that smoothness is a main criterion for good representations that disentangle the explanatory factors of variation (Bengio et al., 2012).

Formally, we first compute $h = MLP-2_{enc}(x)$ and $r = MLP-2_{dec}(h)$ and then update the parameters of the encoder and the decoder with respect to binary cross-entropy $BCE(x,r)$. Hence, in the regularization phase, we draw samples $z \sim \mathcal{N}(0,I)$ from independent Gaussian distributions matching the size of h. The parameters of the discriminator $MLP-2_{disc}$ are then updated, to minimise $\log MLP-2_{disc}(z) + \log(1 - MLP-2_{disc}(h))$ (Goodfellow et al., 2014). Finally, the parameters of the encoder are updated to maximise $\log MLP-2_{disc}(h)$, such that the encoder is trained to fool the discriminator. As a result, the encoder is jointly optimised for matching the prior distribution and for reconstruction of the input (Makhzani et al., 2015).

To incorporate the documents' title, we once again concatenate on the code level. This scenario corresponds to the supervised case from the original work of Makhzani et al. on images, in which the purpose was to separate the style from the class. All information that cannot be reconstructed from the class is drawn from the style (the code) (Makhzani et al., 2015). We adapt this interpretation by supplying title information as additional input to the decoder. Hence, the model is optimised to exploit the title information when it is helpful for reconstruction but also take the partial item set into account. At prediction time, we perform one reconstruction step by applying one encoding and one decoding step.

Hyperparameters The hyperparameters are selected by conducting pre-experiments on the citation recommendation dataset by considering only items that appear 50 or more times in the whole corpus. We chose this scenario because this aggressive pruning results in numbers of distinct items and documents that are similar to the ones of the subject label recommendation dataset. Considering the MLP-modules, we conducted a grid search with hidden layer sizes between 50 and 1,000, initial learning rates between 0.01 and 0.00005, activation functions Tanh, ReLU (Nair & Hinton, 2010), SELU (Klambauer, Unterthiner, Mayr, & Hochreiter, 2017) along with dropout (Srivastava, Hinton, Krizhevsky, Sutskever, & Salakhutdinov, 2014), or alpha-dropout in case of SELUs, probabilities between .1 and .5 and as optimization algorithms stochastic gradient descent and Adam (Kingma & Ba, 2014). For the autoencoder-based models, we considered code sizes between 10 and 500, but only if the size was smaller than the hidden layer sizes of the MLP modules. In case of adversarial autoencoders, we experimented with Gaussian, Bernoulli, and Multinomial prior distributions, and with linear, sigmoid, and softmax activation on the code layer, respectively.

While we do not exclude that a certain set of hyperparameters may perform better in a specific scenario, we select the following, most robust, hyperparameters: hidden layer sizes of 100 with ReLU (Nair & Hinton, 2010) nonlinearities and drop probabilities of .2 after each hidden layer. The optimization is carried out by Adam (Kingma & Ba, 2014) with initial learning rate 0.001. The two autoencoder variants use a code size of 50. We further select a Gaussian prior distribution for the adversarial autoencoder. For SVD, we consecutively increased the number of singular values up to 1,000. Using higher amounts of singular values decreased the performance. We keep this set of hyperparameters fixed across all models and across all subsequent experiments to ensure a reliable comparison of the models' quality.

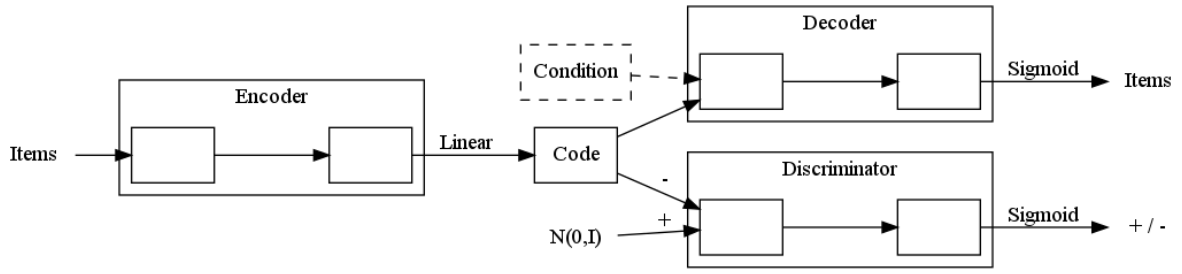

Figure 37: Adversarial autoencoder for item-based recommendations. Each edge resembles a parametrized mapping $f(Wx+b)$ with activation function f and parameters W, b. When not labeled differently, the activation function is rectified linear followed by dropout.

6.4 Experimental evaluation and comparison

To evaluate adversarial autoencoders for recommendation tasks on scientific documents, we conduct a citation recommendation experiment as presented in section 6.5 and a subject label recommendation experiment as presented in section 6.6. Adversarial autoencoders are not only evaluated against the two baselines (item co-occurrence and SVD), but also against its own components: undercomplete autoencoders and multi-layer perceptrons.

6.5 Citation Recommendation

In this section, we describe our experimental setup which is designed to resemble a real-world application of missing citation recommendation.

Dataset The CITREC[20] PubMed citation dataset (Gipp, Meuschke, & Lipinski, 2015) consists of 7,546,982 citations. The dataset comprises 224,092 distinct citing documents published between 1928 and 2011 and 2,896,764 distinct cited documents. The documents are cited between 1 and 3,247 times with a median of 1 and a mean of 2.61 (SD: 6.71). The citing documents hold on average 33.68 (SD: 27.49) citations to other documents (minimum: 1, maximum 2,242) with a median of 29.

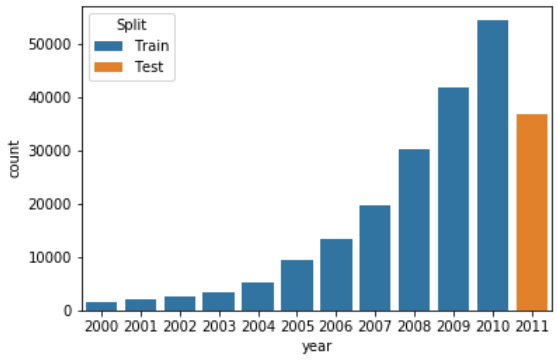

Figure 38: Count of documents by publication year starting with 2000 along with the split in training and test set for the PubMed citation dataset.

Split on Time Axis To simulate a real-world citation prediction setting, we split the data on the time axis of the citing documents. This resembles the natural constraint that publications cannot cite other publications that do not exist yet. Given a specific publication year T, we ensure that the training set D_{train} consists of all documents that were published earlier than year T and use the remaining documents as test data D_{test}. Figure 38 shows the distribution of documents over the years along with the split into training and test set. We select the year 2011 for evaluation to obtain a 90:10 ratio between training and test documents.

[20] https://www.isg.uni-konstanz.de/projects/citrec/

Table 13: Dataset characteristics with respect to pruning thresholds on minimum item occurrence for the PubMed citation recommendation task.

pruning	cited documents	citations	documents	density
15	35,664	1,173,568	136,911	0.000240
20	20,270	878,359	121,374	0.000357
25	12,881	692,037	105,170	0.000511
30	8,906	568,563	96,980	0.000658
35	6,469	478,693	87,498	0.000846
40	4,939	413,746	79,830	0.001049
45	3,904	363,870	73,200	0.001273
50	3,185	324,693	67,703	0.001506
55	2,643	292,791	62,647	0.001768

Preprocessing and Dataset Pruning as Controlled Variable For preprocessing the datasets, we conduct the following three steps:

1. Build a vocabulary on the training set with items that received implicit feedback more than α times.
2. Filter both the training and test set and retain only items from the vocabulary.
3. Remove documents that are assigned to fewer than two of the vocabulary items.

The pruning threshold α is crucial since it affects both the number of considered items as well as the number of documents. Thus, we identify α as a controllable parameter and evaluate the models' performance with respect to different values for α. Table 13 shows the dataset characteristics with respect to the pruning threshold.

Evaluation Metric For evaluation, certain items were omitted on purpose in the test set. For each document, the models ought to predict the omitted item as good as possible. Thus, we choose mean reciprocal rank as our evaluation metric. We are given a set of predictions X_{pred} for the test set $\tilde{X}_{test}$. Hence for each row, we compute the reciprocal rank (Craswell, 2009) of the missing element from $x_{test} - \tilde{x}_{test}$. The reciprocal rank corresponds to one divided by the position of the omitted item in the sorted list of predictions x_{pred}. We then average over all documents of the test set to obtain the mean reciprocal rank. To alleviate random effects of model initialization, training data shuffling, and selecting the elements to omit, we conduct three runs for each of the experiments. To allow a fair comparison, the removed items in the test set remain the same for all models during one run with a fixed pruning parameter.

Results Figure 39 shows the results for the models with respect to the pruning parameter that controls the number of considered items as well as the sparsity (see Table 13). We observe a trend that a more aggressive pruning threshold leads to higher scores among all models. When no title information is given, the item co-occurrence approach consistently yields the highest scores. When title information is available, adversarial autoencoders become competitive to the item co-occurrence approach and yield higher scores than all of their components.

6.6 Subject Label Recommendation

On the basis of our experience in multi-label classification (Große-Bölting, Nishioka, & Scherp, 2015; Galke, Mai, et al., 2017), we now consider a subject label recommendation task, which is close to how professional subject indexers work.

Dataset The EconBiz dataset provided by ZBW — Leibniz Information Centre for Economics consists of 61,619 documents with label annotations from professional subject indexers (Große-Bölting et al., 2015; Galke, Mai, et al., 2017). The 4,669 assigned labels are a subset of the controlled vocabulary Standardthesaurus Wirtschaft[21]. The number of documents to which a label is assigned ranges between 1 and 13,925 with mean 69 (SD: 316) and median 14. The label annotations of a document ranges between 1 and 23 with mean 5.24 (SD: 1.83) and median 5 labels.

[21] http://zbw.eu/stw/version/latest/about

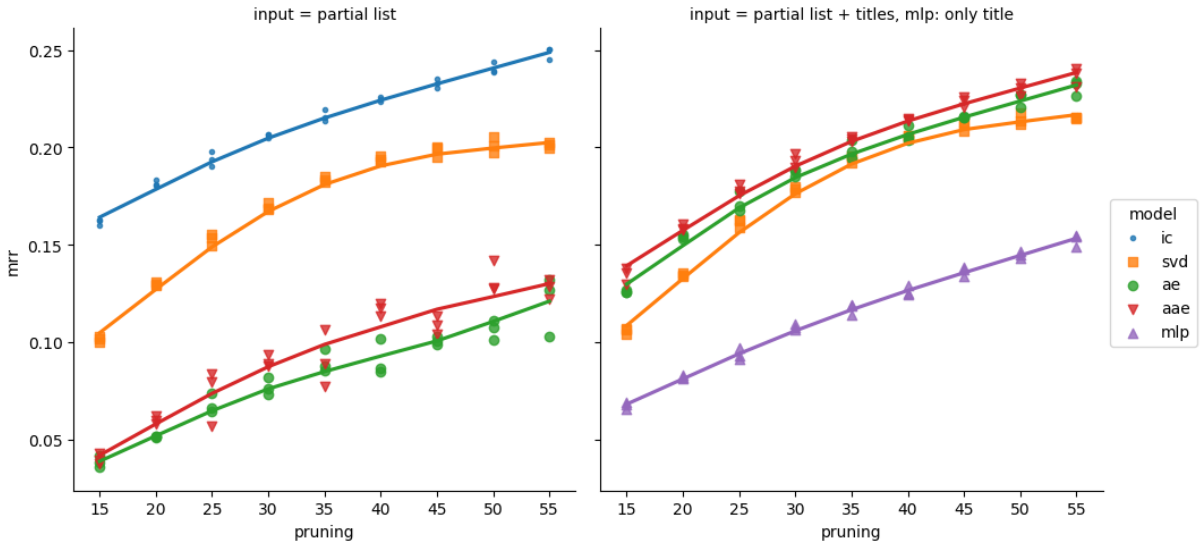

Figure 39: Mean reciprocal rank of missing citation on the test set with varying minimum item occurence (pruning) thresholds. Left: Only the partial list of items is given. Right: The partial list of items along with the document title is given, except for the MLP, which can only make use of the title.

Table 14: Dataset characteristics with respect to pruning thresholds on minimum item occurrence for the EconBiz subject label recommendation task.

pruning	labels	assigned labels	documents	density
1	4,568	323,670	61,104	0.001160
2	4,103	323,060	61,090	0.001289
3	3,760	322,199	61,060	0.001403
4	3,497	321,213	61,039	0.001505
5	3,259	320,048	60,983	0.001610
10	2,597	314,738	60,778	0.001994
15	2,192	309,101	60,524	0.002330
20	1,924	303,693	60,272	0.002619

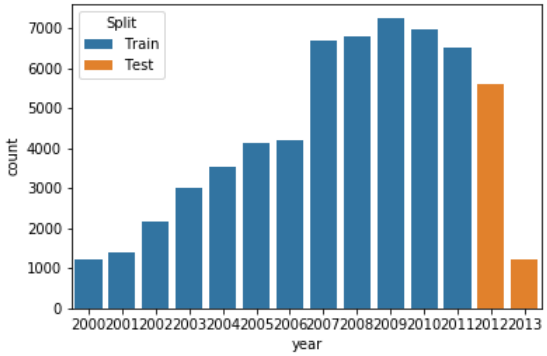

Figure 40: Count of documents by publication year starting with 2000 along with the split in training and test set for the Economics subject label dataset.

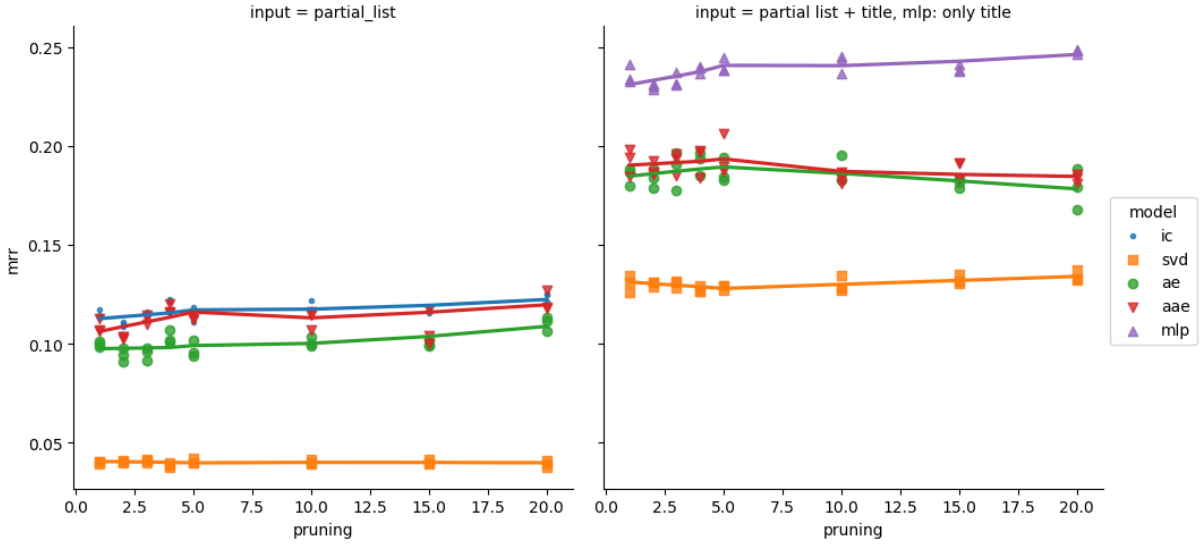

Figure 41: Mean reciprocal rank of missing subject label on the test set with varying minimum item occurence thresholds. Left: Only the partial list of items is given. Right: The partial list of items along with the document title is given, except for the MLP, which can only make use of the title.

Evaluation The preprocessing steps and evaluation procedure for the subject label recommendation task is the same as in section 6.5. We also conduct the split between training set and test set on the time axis (see Figure 40). This is challenging because label annotations suffer from concept drift over time (Toepfer & Seifert, 2017). We use the years 2012 and 2013 as test documents to obtain a train-test ratio similar to the scenario in section 6.5. The dataset characteristics affected by dataset pruning are given in Table 14.

Results Figure 41 shows the results for the models with respect to the pruning parameter that controls the number of considered items and therefore also the sparsity (see Table 14). When no title information is available, the adversarial autoencoder is competitive to the item co-occurrence approach. When title information is given, the adversarial autoencoder yields considerably higher scores than all models operating without this information. The sole decoder part (an MLP-2 module) of the adversarial autoencoder yields, however, consistently higher scores than the model as a whole.

7 Conclusion and outlook

This deliverable gives a final report of all achievements that have been completed in WP2 of the MOVING project. Overarching goal of the MOVING project is to provide a combined work and training platform for the general public that helps people from all societal sectors to significantly improve their information and data literacy and digital competences. The MOVING concept included a wide range of learning offers and training features for different use cases with the goal to foster open innovation and open leadership and train data-savvy professionals in different work contexts. The competent search for and use of information as well as competences in digital communication and collaboration are preconditions for innovations in all kinds of professional sectors.

With the MOVING Curriculum for Information Literacy 2.0 we addressed this general demand for information-savvy professionals in knowledge societies of the 21st century and provide information and data literacy training for digital environments. The Adaptive Training Support widgets support users in technology enhanced learning while they are using the data mining and information discovery features of the platform and offers microlearning sessions coupled with reflective guidance based on the Information Literacy 2.0 curriculum. The recommender system helps users in information discovery by providing user-specific document suggestions based on their interests that users might find significant and helpful while searching the MOVING database and using the data visualisation technologies.

The two use cases that guided the platform design and development process were taken as a basis to develop specific training offers in the Learning environment of the MOVING platform. Use case 1, training public administrators, was implemented in the Digital Audit curriculum developed by EY and was included in the both the ATS and the Learning Tracks in the Learning Environment. Use case 2, training young scholars, was implemented in the open science curriculum of the MOVING MOOC *Science 2.0 and open research methods*. The MOOC was designed as collaborative learning experience and attracted young researchers from around the world that established a community of practice of open science scholars on the MOVING platform.

The evaluation of the learning and training features of MOVING showed that the didactic concepts and curricula were matching the expectations and training needs of the targeted audiences and helped platform users improve their information and data competences in different aspects of their daily work tasks. The MOVING project is thereby actively contributing to foster open innovation and open science by laying the foundations for users to be able to consciously and competently handle information and digital tools in professional contexts.

References

Abramovich, S. (2016). Understanding digital badges in higher education through assessment. *On the Horizon*, *24*(1), 126-131. Retrieved from https://doi.org/10.1108/OTH-08-2015-0044 doi: 10.1108/OTH-08-2015-0044

Barbieri, J., Alvim, L. G. M., Braida, F., & Zimbrão, G. (2017). Autoencoders and recommender systems: COFILS approach. *Expert Syst. Appl.*, *89*, 81–90.

Beel, J., Gipp, B., Langer, S., & Breitinger, C. (2016). paper recommender systems: a literature survey. *International Journal on Digital Libraries*, *17*(4), 305–338.

Beel, J., Langer, S., Gipp, B., & Nürnberger, A. (2014). The architecture and datasets of docear's research paper recommender system. *D-Lib Magazine*, *20*(11/12).

Bengio, Y., Courville, A. C., & Vincent, P. (2012). Unsupervised feature learning and deep learning: A review and new perspectives. *CoRR*, *abs/1206.5538*.

Bienia, I., Fessl, A., Günther, F., Herbst, S., Maas, A., & Wiese, M. (2017). *Deliverable 1.1: User requirements and specification of the use cases (tech. rep.). moving.* (Tech. Rep.). Retrieved from http://moving-project.eu/wp-content/uploads/2017/04/moving_d1.1_v1.0.pdf

Blümel, C., Fecher, B., & Leimüller, G. (2018). *Was gewinnen wir durch open science und open innovation?* (Tech. Rep.). Essen. Retrieved 2019-03-04, from http://{DOI}:10.5281/zenodo.1880055

Bollen, J., & de Sompel, H. V. (2006). An architecture for the aggregation and analysis of scholarly usage data. In *JCDL* (pp. 298–307). ACM.

Bruck, P. A., Motiwalla, L., & Foerster, F. (2012). Mobile learning with micro-content: A framework and evaluation. *Bled eConference*, *25*.

Caragea, C., Silvescu, A., Mitra, P., & Giles, C. L. (2013). Can't see the forest for the trees?: a citation recommendation system. In *JCDL* (pp. 111–114). ACM.

Carretero, S., Vuorikari, R., Punie, Y., et al. (2017). *Digcomp 2.1: The digital competence framework for citizens with eight proficiency levels and examples of use* (Tech. Rep.). Joint Research Centre (Seville site).

Craswell, N. (2009). Mean reciprocal rank. In L. LIU & M. T. ÖZSU (Eds.), *Encyclopedia of database systems* (pp. 1703–1703). Boston, MA: Springer US.

Davis, E. (2003). Prompting middle school science students for productive reflection: Generic and directed prompts. *J. of the Learning Sciences*, *12*(1), 91-142.

Davis, E. A. (2000). Scaffolding students' knowledge integration: prompts for reflection in KIE. *Int. J. of Science Education*, *22*(8), 819-837. doi: 10.1080/095006900412293

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS quarterly*, 319–340.

Dellschaft, K., & Staab, S. (2012). Measuring the influence of tag recommenders on the indexing quality in tagging systems. In *HT* (pp. 73–82). ACM.

Ebesu, T., & Fang, Y. (2017). Neural citation network for context-aware citation recommendation. In *SIGIR* (pp. 1093–1096). ACM.

Fessl, A., Blunk, O., Prilla, M., & Pammer, V. (2017). The known universe of reflection guidance: A literature review. *International journal of technology enhanced learning*, *9*(2-3), 103–125.

Fessl, A., Simic, I., Barthold, S., & Pammer-Schindler, V. (2019). Concept and development of an information literacy curriculum widget. In *Proceedings of the conference on learning information literacy across the globe. (to appear).*

Fessl, A., Thalmann, S., Pammer-Schindler, V., Saleh, A., Nishioka, C., Scherp, A., ... Günther, F. (2017). *Deliverable 2.1: Initial conceptual framework-curricula and technical prototypes for adaptive training support* (Tech. Rep.). MOVING. Retrieved from http://moving-project.eu/wp-content/uploads/2017/04/moving_d2.1_v1.0.pdf

Galke, L., Mai, F., Schelten, A., Brunsch, D., & Scherp, A. (2017). Using titles vs. full-text as source for automated semantic document annotation. In *K-CAP* (pp. 20:1–20:4). ACM.

Galke, L., Saleh, A., & Scherp, A. (2017). Word embeddings for practical information retrieval. In *Gi-jahrestagung* (Vol. P-275, pp. 2155–2167). GI.

Geyer-Schulz, A., Hahsler, M., & Jahn, M. (2002). Recommendations for virtual universities from observed user behavior. In *Classification, automation, and new media* (pp. 273–280). Springer.

Giles, C. L., Bollacker, K. D., & Lawrence, S. (1998). Citeseer: An automatic citation indexing system. In *ACM DL* (pp. 89–98). ACM.

Gipp, B., Meuschke, N., & Lipinski, M. (2015, March 24-27). CITREC: An Evaluation Framework for Citation-Based Similarity Measures based on TREC Genomics and PubMed Central. In *Proceedings*

of the iConference 2015. Newport Beach, California. Retrieved from http://ischools.org/the-iconference/

Goodfellow, I. J., Pouget-Abadie, J., Mirza, M., Xu, B., Warde-Farley, D., Ozair, S., ... Bengio, Y. (2014). Generative adversarial nets. In *NIPS* (pp. 2672–2680).

Große-Bölting, G., Nishioka, C., & Scherp, A. (2015). A comparison of different strategies for automated semantic document annotation. In *K-CAP* (pp. 8:1–8:8). ACM.

Grover, A., & Leskovec, J. (2016). node2vec: Scalable feature learning for networks. In *KDD* (pp. 855–864). ACM.

Günther, F., Barthold, S., Bienia, I., Maas, A., Wiese, M., Fessl, A., ... (JSI, T. Z. D. (2018). *Deliverable 2.2: Updated curricula and prototypes for adaptive training support and introductory moving mooc for community building* (Tech. Rep.). MOVING. Retrieved from http://moving-project.eu/wp-content/uploads/2018/03/moving_d2.2_v1.0.pdf

Hart, S. G., & Staveland, L. E. (1988). Development of nasa-tlx (task load index): Results of empirical and theoretical research. In *Advances in psychology* (Vol. 52, pp. 139–183). Elsevier.

Haug, S., & Wedekind, J. (2013). cmooc – ein alternatives lehr-/lernszenarium? In *Moocs massive open online courses - offene bildung oder geschäftsmodell?* (p. 161-206). Münster: Waxmann. Retrieved from https://www.waxmann.com/fileadmin/media/zusatztexte/2960Volltext.pdf

Huang, W., Kataria, S., Caragea, C., Mitra, P., Giles, C. L., & Rokach, L. (2012). Recommending citations: translating papers into references. In *CIKM* (pp. 1910–1914). ACM.

Huang, W., Wu, Z., Chen, L., Mitra, P., & Giles, C. L. (2015). A neural probabilistic model for context based citation recommendation. In *AAAI* (pp. 2404–2410). AAAI Press.

Ifenthaler, D. (2012). Determining the effectiveness of prompts for self-regulated learning in problem-solving scenarios. *Educational Technology & Society*, *15*(1), 38–52.

Kingma, D. P., & Ba, J. (2014). Adam: A method for stochastic optimization. *CoRR*, *abs/1412.6980*.

Kipf, T. N., & Welling, M. (2016a). Semi-supervised classification with graph convolutional networks. *CoRR*, *abs/1609.02907*.

Kipf, T. N., & Welling, M. (2016b). Variational graph auto-encoders. *CoRR*, *abs/1611.07308*. Retrieved from http://arxiv.org/abs/1611.07308

Kirkpatrick, D. L., & Kirkpatrick, J. D. (2006). *Evaluating trainings programs: The four levels. 3rd ed.* Berrett-Koehler Publ., Inc.

Klambauer, G., Unterthiner, T., Mayr, A., & Hochreiter, S. (2017). Self-normalizing neural networks. In *NIPS* (pp. 972–981).

Kocielnik, R., Xiao, L., Avrahami, D., & Hsieh, G. (2018). Reflection companion: A conversational system for engaging users in reflection on physical activity. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies*, *2*(2), 70.

Krestel, R., Fankhauser, P., & Nejdl, W. (2009). Latent dirichlet allocation for tag recommendation. In *Recsys* (pp. 61–68). ACM.

Kruskal, W. H., & Wallis, W. A. (1952). Use of ranks in one-criterion variance analysis. *Journal of the American statistical Association*, *47*(260), 583–621.

Makhzani, A., Shlens, J., Jaitly, N., & Goodfellow, I. J. (2015). Adversarial autoencoders. *CoRR*, *abs/1511.05644*.

Malacria, S., Scarr, J., Cockburn, A., Gutwin, C., & Grossman, T. (2013). Skillometers: reflective widgets that motivate and help users to improve performance. In *Proceedings of the 26th annual acm symposium on user interface software and technology* (pp. 321–330).

McNee, S. M., Albert, I., Cosley, D., Gopalkrishnan, P., Lam, S. K., Rashid, A. M., ... Riedl, J. (2002). On the recommending of citations for research papers. In *CSCW* (pp. 116–125). ACM.

Mikolov, T., Sutskever, I., Chen, K., Corrado, G. S., & Dean, J. (2013). Distributed representations of words and phrases and their compositionality. In *NIPS* (pp. 3111–3119).

Montañés, E., Quevedo, J. R., Díaz, I., & Ranilla, J. (2009). Collaborative tag recommendation system based on logistic regression. In *Dc@pkdd/ecml* (Vol. 497). CEUR-WS.org.

Nair, V., & Hinton, G. E. (2010). Rectified linear units improve restricted boltzmann machines. In *ICML* (pp. 807–814). Omnipress.

Nam, J., Loza Mencía, E., Kim, H. J., & Fürnkranz, J. (2017). Maximizing subset accuracy with recurrent neural networks in multi-label classification. In *NIPS* (pp. 5419–5429).

Palumbo, E., Rizzo, G., & Troncy, R. (2017). entity2rec: Learning user-item relatedness from knowledge graphs for top-n item recommendation. In *Recsys* (pp. 32–36). ACM.

Perozzi, B., Al-Rfou, R., & Skiena, S. (2014). Deepwalk: online learning of social representations. In *KDD* (pp. 701–710). ACM.

Posch, L., Wagner, C., Singer, P., & Strohmaier, M. (2013). Meaning as collective use: predicting semantic hashtag categories on twitter. In *WWW (companion volume)* (pp. 621–628). International World Wide Web Conferences Steering Committee / ACM.

Quadrana, M., Karatzoglou, A., Hidasi, B., & Cremonesi, P. (2017). Personalizing session-based recommendations with hierarchical recurrent neural networks. In *Recsys* (pp. 130–137). ACM.

Rivera-Pelayo, V., Fessl, A., Müller, L., & Pammer, V. (2017). Introducing mood self-tracking at work: Empirical insights from call centers. *ACM Transactions on Computer-Human Interaction (TOCHI)*, *24*(1), 3.

Rosati, J., Ristoski, P., Noia, T. D., Leone, R. D., & Paulheim, H. (2016). RDF graph embeddings for content-based recommender systems. In *Cbrecsys@recsys* (Vol. 1673, pp. 23–30). CEUR-WS.org.

Roy, S., & Clark, D. (n.d.). Digital badges, do they live up to the hype? *British Journal of Educational Technology*, *0*(0). Retrieved from `https://onlinelibrary.wiley.com/doi/abs/10.1111/bjet.12709` doi: 10.1111/bjet.12709

Sen, S., Vig, J., & Riedl, J. (2009). Tagommenders: connecting users to items through tags. In *WWW* (pp. 671–680). ACM.

Shields, R., & Chugh, R. (2017, Jul 01). Digital badges – rewards for learning? *Education and Information Technologies*, *22*(4), 1817–1824. Retrieved from `https://doi.org/10.1007/s10639-016-9521-x` doi: 10.1007/s10639-016-9521-x

Sigurbjörnsson, B., & van Zwol, R. (2008). Flickr tag recommendation based on collective knowledge. In *WWW* (pp. 327–336). ACM.

Small, H. (1973). Co-citation in the scientific literature: A new measure of the relationship between two documents. *JASIS*, *24*(4), 265–269.

Srivastava, N., Hinton, G. E., Krizhevsky, A., Sutskever, I., & Salakhutdinov, R. (2014). Dropout: a simple way to prevent neural networks from overfitting. *Journal of Machine Learning Research*, *15*(1), 1929–1958.

Toepfer, M., & Seifert, C. (2017). Descriptor-invariant fusion architectures for automatic subject indexing. In *JCDL* (pp. 31–40). IEEE Computer Society.

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management science*, *46*(2), 186–204.

Voogt, L., Dow, L., & Dobson, S. (2016, July). Open badges: A best-practice framework. In *2016 sai computing conference (sai)* (p. 796-804). doi: 10.1109/SAI.2016.7556070

Vuorikari, R., & Punie, Y. (2016). *Digcomp 2.0: The digital competence framework for citizens* (Tech. Rep.). Joint Research Centre (Seville site).

Vuorikari, R., Punie, Y., Gomez, S. C., Van Den Brande, G., et al. (2016). *Digcomp 2.0: The digital competence framework for citizens. update phase 1: The conceptual reference model* (Tech. Rep.). Joint Research Centre (Seville site).

Wang, H., Wang, N., & Yeung, D. (2015). Collaborative deep learning for recommender systems. In *KDD* (pp. 1235–1244). ACM.

Wouters, P. F., et al. (1999). *The citation culture* (Doctoral dissertation, Universiteit van Amsterdam). Retrieved from `https://pure.uva.nl/ws/files/3164315/8231_13.pdf`

8 Appendix A: MOVING MOOC Evaluation Questionnaire

Participants of the MOVING MOOC Science 2.0 and open research methods were asked via email to fill in this online questionnaire after the course was completed for the purpose of course evaluation. 8 participants completed the survey after the first round of the MOOC in December 2018. 40 participants of the second round of the MOOC in February 2019 responded to the survey. The survey was anonymous and inquired demographic characteristics of the participants, personal expectations and satisfaction with the course. It also assessed the clarity of learning goals, course instructions, assessments and learning materials.

Survey

1 Welcome

Welcome to the survey.
Please take a few minutes and answer the following questions to help us improve the MOOC!

2 Demographics

What's your gender?

- Male
- Female
- Other
- Not specified

How old are you?

- 20-24 years
- 25-29 years
- 30-34 years
- 35-39 years
- 40-44 years
- 45-49 years
- 50-54 years
- 55-59 years
- 60+ years

Please select your country of origin:

What is your highest university degree?

- ○ non
- ○ Bachelor
- ○ Master/Diploma
- ○ Doctorate
- ○ Other, please specify:

What is your professional background?

please check one

- ○ University student
- ○ University researcher
- ○ Non-university researcher
- ○ University teacher/lecturer
- ○ Non-university teacher/lecturer
- ○ Librarian
- ○ Other, please specify:

What is your disciplinary background?

please check one

- ○ Natural Sciences
- ○ Social Sciences and Humanities
- ○ Engineering and Technology
- ○ Architecture, Arts & Design
- ○ Environmental Science, Agriculture & Forestry
- ○ Medicine
- ○ Education
- ○ Law
- ○ Journalism & Media
- ○ other

3 Participation_MOOC

What motivated you to take part in the MOVING MOOC?

multiple answers are possible

- ☐ I am interested in the exchange with others.
- ☐ I am interested in the topic.
- ☐ The course is relevant for my professional development.
- ☐ The course is relevant for my personal development.
- ☐ I am interested in the course format.

- [ ] Other, please specify:

How did you become aware of the MOVING MOOC?

multiple answers are possible

- [ ] Through Twitter announcement.
- [ ] Through mailing list.
- [ ] I saw a poster/flyer.
- [ ] Through friends/colleagues.
- [ ] On the MOVING platform.
- [ ] Other, please specify.

How familiar were you with the concept of Open Science prior to the MOOC?

- ○ I had never heard of it.
- ○ I've heard of it, but never practiced.
- ○ I knew it and practiced it somehow.
- ○ I was already familiar and practiced it regularly.

Did the MOVING MOOC meet the overall expectations that you had about the course?

please choose one answer

- ○ fully met my expectations
- ○ met most of my expectations
- ○ met part of my expectations
- ○ met only few of my expectations
- ○ was absolutely not was I expected
- ○ no answer

In general, how satisfied were you with...

	very satisfied	rather satisfied	indecisive	rather unsatisfied	absolutely unsatisfied	no answer
...the course platform.	○	○	○	○	○	○
...the overall course structure.	○	○	○	○	○	○
...the course topics.	○	○	○	○	○	○
...the navigation through the course.	○	○	○	○	○	○
...the workload of the course.	○	○	○	○	○	○
...the quality of learning material.	○	○	○	○	○	○
...the clarity of course descriptions.	○	○	○	○	○	○
...the clarity of course assignments.	○	○	○	○	○	○
...the communication with course participants.	○	○	○	○	○	○
...the communication with course instructors.	○	○	○	○	○	○
...the support by the instructors.	○	○	○	○	○	○

...the live webinar at the end of week 1	○	○	○	○	○	○

Is there anything else that you would like to describe in more detail or that you particularly liked or did not like?

After completing the MOOC: Do you plan to use open research methods in your research workflow/your daily work routines?

A click activates the slider and you can move it back and forth.

- ○ I don't plan using open research methods
- ○
- ○ I change parts of my workflow
- ○
- ○ I will fundamentally change my workflow

4 Statements

To what extend do you agree to the following statements?

	agree	rather agree	indecisive	rather disagree	disagree	don't know
I have learned something new.	○	○	○	○	○	○
I was able to operate the course platform without problems.	○	○	○	○	○	○
I was able to access the platform via Smartphone, tablet, etc.	○	○	○	○	○	○
The workload was as I expected.	○	○	○	○	○	○
The workload was too high.	○	○	○	○	○	○
The workload was too low.	○	○	○	○	○	○
There was too much learning material provided in the MOOC.	○	○	○	○	○	○
There was not enough learning material provided in the MOOC.	○	○	○	○	○	○
I liked the learning material.	○	○	○	○	○	○
I liked the assignments.	○	○	○	○	○	○
I liked the live webinar.	○	○	○	○	○	○
I would recommend this MOOC to friends/colleagues.	○	○	○	○	○	○

If you dropped out of the course: what were the reasons for the drop-out?

multiple answers are possible

- [ ] I've lost interest in the subject.
- [ ] I didn't have time to keep attending the course.
- [ ] The topics were not relevant for me.
- [ ] The tasks were unclear.
- [ ] I was dissatisfied with support.
- [ ] I was not not getting enough feedback.
- [ ] I was dissatisfied with the engagement of the participants.
- [ ] I had problems with operating the platform.
- [ ] Other, please specify:

5 4 week program

The MOVING-MOOC was a 4-week program. What weeks did you attend?

- [ ] Week 1
- [ ] Week 2
- [ ] Week 3
- [ ] Week 4
- [ ] none

6.1 Week 1

How satisfied are you with the provided material in week 1 "Introduction to Science 2.0 and open research methods"?

- ○ Very satisfied
- ○ Satisfied
- ○ Neutral
- ○ Less satisfied
- ○ Unsatisfied

How useful were the provided material in week 1 for your learning success?

	very useful	useful	indecisive	less useful	useless
videos and movies	○	○	○	○	○
graphical illustrations	○	○	○	○	○
articles	○	○	○	○	○
forum discussions	○	○	○	○	○
webinar	○	○	○	○	○

How many hours did you invest for completing week 1?

Please insert a value between 0 and 10 hours.

The workload for week 1 was ...

- ...too little
- ...just right
- ...too heavy

7.1 Week 2

How satisfied are you with the provided material in week 2 "Understand the Web 2.0 information landscape"?

- Very satisfied
- Satisfied
- Neutral
- Less satisfied
- Unsatisfied

How useful were the provided material in week 2 for your learning success?

	very useful	useful	indecisive	less useful	useless
videos					
graphical illustrations					
articles					
forum discussions					
practical tasks					

How many hours did you invest for completing week 2?

Please insert a value between 0 and 10 hours.

The workload for week 2 was ...

- ...too little
- ...just right
- ...too heavy

8.1 Week 3

How satisfied are you with the provided material in week 3 "Communication&Collaboration: Become and active voice in the conversation"?

- Very satisfied
- Satisfied
- Neutral
- Less satisfied
- Unsatisfied

How useful were the provided material in week 3 for your learning success?

	very useful	useful	indecisive	less useful	useless
videos					

graphical illustrations	○	○	○	○	○
articles	○	○	○	○	○
forum discussions	○	○	○	○	○
practical tasks	○	○	○	○	○

How many hours did you invest for completing week 3?

Please insert a value between 0 and 10 hours.

The workload for week 3 was ...

- ○ ...too little
- ○ ...just right
- ○ ...too heavy

9.1 Week 4

How satisfied are you with the provided material in week 4 "Make your research open"?

- ○ Very satisfied
- ○ Satisfied
- ○ Neutral
- ○ Less satisfied
- ○ Unsatisfied

How useful were the provided material in week 4 for your learning success?

	very useful	useful	indecisive	less useful	useless
videos	○	○	○	○	○
graphical illustrations	○	○	○	○	○
articles	○	○	○	○	○
forum discussions	○	○	○	○	○
podcast	○	○	○	○	○

How many hours did you invest for completing week 4?

Please insert a value between 0 and 10 hours.

The workload for week 4 was ...

- ○ ...too little
- ○ ...just right
- ○ ...too heavy

10 Standardseite

Do you have any other comments or suggestions?

11 Endseite

Thank you for your participation!

Impressum

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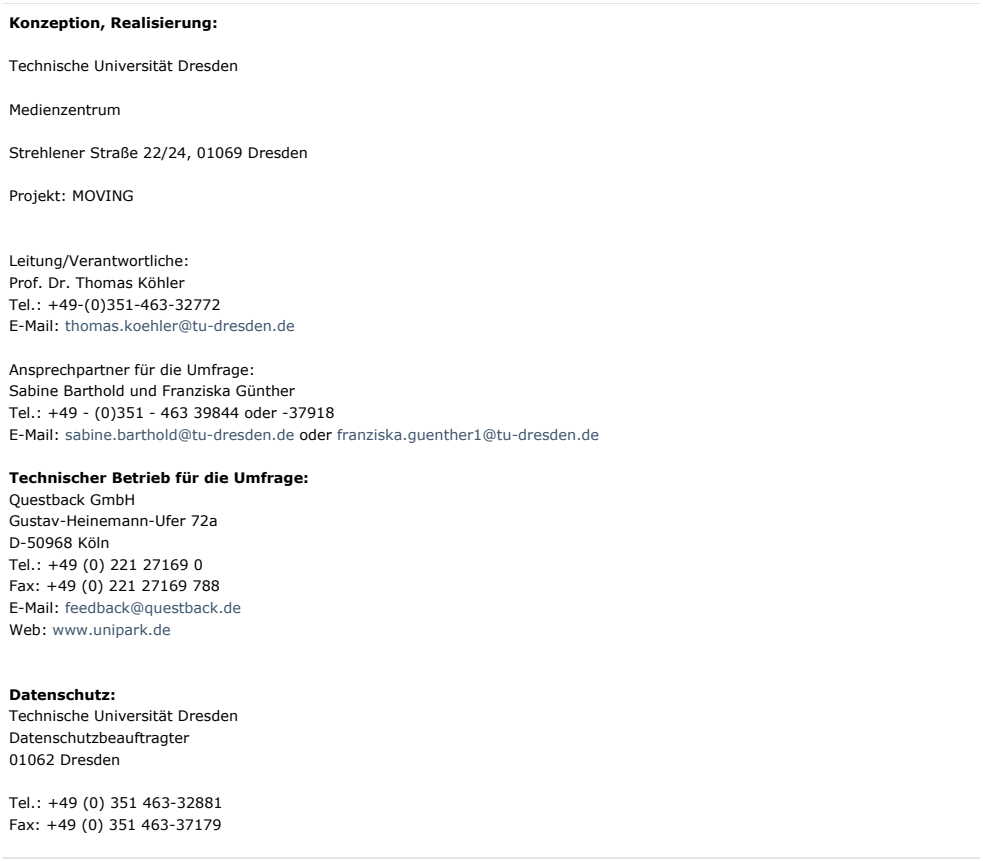

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Figure 42: MOOC Evaluation Survey

9 Appendix B: MOOC materials

Figure 43: MOOC Certificate Of Participation

Registration for the MOVING MOOC "Science 2.0 and open research methods" is open!

In the MOVING MOOC young scholars will learn to use web-based social technologies and online communities not just as objects of study, but as way of conducting research: to build networks, discuss findings, and collaborate (globally) with scholars across disciplinary, cultural and geographical boundaries. Movements like Open Data, Open Access, and Open Educational Resources that advocate the free access to knowledge for everyone have broad implications for the excellence of research – its creativity, productivity, reliability, and validity and require a new set of competences and attitudes for young researchers to thrive in this environment.

Participants of the MOOC will learn that the use of social technologies together with movements like Creative Commons offer entirely new ways to publish, share, discuss and reproduce scientific findings and data. Mastering these social technologies and web-based tools will provide them with the opportunity to create scholarly innovations and make scientific findings accessible to a broader public.

The MOOC starts **November 12th, 2018** on the MOVING platform. For more information watch the video below, visit the MOVING website and follow us on Twitter @MoMoSci20. You can register now for the MOOC.

The MOOC will be held on the MOVING platform, a combined space for research, collaboration and training for a wider public to improve information and data literacy. The aim of the MOVING project is to foster open research and innovation processes.

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Figure 44: MOOC Press release

Figure 45: MOOC Flyer

10 Appendix C: ATS Evaluation - Task 3 questionnaire

10.1 Learning-how-to-search widget questionnaire

Below we present the description of Task 3 and the corresponding questionnaire. Where different questions per use case were posed, we added them accordingly. All ratings were done on a 7-point Likert Scale. Other scales used or open questions are marked accordingly.

10.1.1 Task 3 - Learning-how-to-search widget

Before starting with the third task please read the following short description about the widget: https://drive.google.com/open?id=1o1Lsrt31tojcMiDBBMIR5j2F3MtQis6_

Now after you have read what the "Learning-how-to-search" widget does, please open the link below. Afterwards have a look at the widget, answer the posed reflective question that you see below the widget on the screen. As you cannot answer the reflective question in the presented view, please answer it directly below as well as some further questions regarding the widget.

- Use Case 1F: https://drive.google.com/open?id=1itM4d5ZJ8silXosJDH16Aohqcpk40vCU
- Use Case 1V: https://drive.google.com/open?id=1sjtVcxxjVH1fFRKcHodKRK8AU7n3gU8V
- Use Case 2F: https://drive.google.com/open?id=1cXoCEOPIFWkfxOnwr2li0IZajx3UgAZe
- Use Case 2V: https://drive.google.com/open?id=1nx9nbrT2LGavui1loGIKtedfDlGhkCOA

10.1.2 Open questions

- [Question 1] Reflective question per use case [freetext]:
  - Use Case 1F: You are mostly using the "simple search". What could help you to motivate you to use some other search features like the "advanced search"?
  - Use Case 1V: Do you think that using the "uRank" can improve your search performance/ search skills...? And if yes how?
  - Use Case 2F: You are mostly using the "Advance Search". What could help you to motivate you to use some other search features like the "Simple Search"?
  - Use Case 2V: Do you think that using the "Concept Graph" can improve your search performance/ search skills...? And if yes how?
- [Question 2] When you look at the "learning-how-to-search" widget, what does the visualisation tell you about your usage behaviour? [freetext]
- [Question 3] When you look at the "learning-how-to-search" widget, would it motivate you to use an other visualisation? And if yes, which one? And if not, why not? [freetext]
- [Question 4] Did the reflective question you have answered motivate you to reflect about your search behaviour? [freetext]

10.1.3 Task 3 - How did it go (NASA TLX)

The following assessment is used to measure your personal opinion on how much workload was required of you during the task you just completed. There is no right or wrong answer.

- [NASA TLX 1] Mental Demand: How mentally demanding was the task?
- [NASA TLX 2] Physical Demand: How physically demanding was the task?
- [NASA TLX 3] Temporal Demand: How hurried or rushed was the pace of the task?
- [NASA TLX 4] Performance: How successful were you in accomplishing what you were asked to do?
- [NASA TLX 5] Frustration: How insecure, discouraged, irritated, stressed, and annoyed were you?
- [NASA TLX 6] Task 3: Any comments? What was good / bad / unexpected / difficult? [freetext]

10.1.4 Task 3 – Final questions (Loyalty Metric, TAM questions)

Loyalty Metric

- [LM1] How likely is it that you would recommend "learning-how-to-search" widget to a friend or colleague? [0 – 10]

Ease of use

- [EOU1] I find the "learning-how-to-search" widget easy to use.
- [EOU2] I like the look & feel of the widget.
- [EOU3] The widget was fun to use.
- [EOU4] The user experience with the widget was very comfortable.
- [EOU5] The widget was free of bugs and errors.

Perceived Usefulness

- [PU1] I am satisfied to use the widget.
- [PU2] I think the widget is useful for exploring different functionalities on the MOVING platform.
- [PU3] Using the "learning-how-to-search" widget would increase my search performance.
- [PU4] Using the "learning-how-to-search" widget would increase my search productivity.
- [PU5] I would like to use the widget continuously as part of my student's/work life.
- [PU6] It is useful for me to continue using the widget in my student's/work life.
- [PU7] It is beneficial for me to continue using the widget in my student's/work life.

Attitude towards the widget

- [AT1] Using the "learning-how-to-search" widget is a good idea.
- [AT2] I am in favour of using the "learning-how-to-search" widget for my Fessl with regard to 51 search activities.

Widget specific questions

- [WSQ1] The widget visualizes relevant information to reconstruct my search behaviour.
- [WSQ2] The widget motivates me to think about my search behaviour.
- [WSQ3] The widget motivates me to change my typical search behaviour.
- [WSQ4] The widget motivates me to try out different search interfaces and visualisations (ConceptGraph, uRank, TagCloud, Top Concepts, Top Sources).
- [WSQ5] The widget motivates me to try out other functionalities like the advanced search or the available filters.
- [WSQ6] The widget raised my engagement with the usage of the platform's functionality.

Learning Outcome

- [LO1] I made a conscious decision on how to search in the future.
- [LO2] I did gain a deeper understanding of my search behaviour. Behaviour Intention
- [BI1] I intend to use the "learning-how-to-search" widget in the future.
- [BI2] I intend to become a heavy user of the "learning-how-to-search" widget.

Technological Self-Efficacy

- [TSE1] I feel confident in using software like this "learning-how-to-search" widget.
- [TSE2] I have the necessary skills for using such widget.
- [TSE3] I know quite a lot about the web and search engines.

Subjective Norm

- [SN1] Feedback on my search activities from such widget corresponds to my values in life.
- [SN2] Becoming familiar with this kind of widget is important for my studies / my professional career.
- [SN3] I agree with the values and ideas underlying this kind of technology.

System Accessibility

- [SA1] I think I will have no technical or other difficulties in accessing and using the widget in the future if I decide to use it.

Additional Questions

- [AQ1] What did you like about the "Learning-how-to-search" widget? [freetext]
- [AQ2] What did you dislike about the "Learning-how-to-search" widget? [freetext]

11 Appendix D: Curriculum Reflection widget

11.1 Learning prompts

The following tables present for each curriculum module all learning prompts per submodule and level that are implemented in the MOVING platform. Table 15 presents all learning prompts for the module "Information and Data Literacy".

Table 15: Learning prompts on three levels for the module "Information and Data Literacy

Submodule	Level	Prompt
Finding Information	Beginner	• Search tools are the various sources from which you can obtain information. Find out which there are and what you can use them for. • Did you know you can also use social media as source of up-to-date information? Find out more here. • Do you want to know how the MOVING Search works? Watch this tutorial video! • Would you like to know which strategies and tools you can use for your search? Click here for more information.
	Intermediate	• Would you like to specify your search query? Search Operators will help you. Find out more here. • Did you know? With the advanced search mask and various filter settings you can specify your search query. Click here to learn more. • Want to make your search even more efficient? Then activate Adaptive Training Support and get helpful tips! See how it works here. • Did you know you can also use social media as source of up-to-date information? Find out more here.
	Expert	• Did you know? You can find videos on specific topics via the content categories of lecture videos. You can find out how it works here. • Do you know what search engines do if you search for information in a digital database? Find out more here! • Did you know? You can automatically detect visual concepts in videos using ITIs online video analysis service. Find out more here.
Evaluate Information	Beginner	• Do you know which sources of information there are and how you can evaluate the reliability of their content? Find out more here.
	Intermediate	• Do you know how you can evaluate the seriosity and reliability of websites and social media content? Find out more here. • You can find out how to get an overview of the most important keywords in your search results here. • Would you like to know how data visualization can help you find patterns in large datasets? Then click here.
	Expert	• Already discovered? There are 2 more features that display your results by categories, tags or sources. Find out more about them here. • Explore the most important results of your search query via the Concept Graph. You can find out how to use it here. • With uRank you can reorder the list of search results according to the relevance of your keywords. Click here for more information.
Managing Information and Digital Content	Beginner	• Would you like to know how you can save and process the results and information of your search query? See how it works here!
	Intermediate	• Discover and use digital learning opportunities! Find out more here. • Do you want to know about MOOCs as a way of digital learning? Then click here. • RDF is a widely used standard for providing metadata on the web. You want to learn how it works? Click here.
	Expert	• MOVING is using LODatio+ to search and index documents so that you can find them in our database. Would you like to know how this works? Click here! • Do you know what data mining is and what it is used for? Learn more here!

Table 16 presents all learning prompts for the module "Communication and Collaboration".
Table 17 presents all learning prompts for the module "Content Creation".
Table 18 presents all learning prompts for the module "Digital Audit".

11.2 Reflective prompts

The Table 19 present all reflective prompts on all three levels along the model of Kirkpatrick (Kirkpatrick & Kirkpatrick, 2006). The phrase "{{sub_competence }}" is a placeholder that is replaced with the name of the sub-competence w.r.t. the learning context of the user.

Table 16: Learning prompts on three levels for the module "Communication and Collaboration"

Submodule	Level	Prompt
Interacting through digital technologies	Beginner	• Do you know what Netiquette means? Find out more here.
	Intermediate	• Want to know how to interact with others online? Click here to learn more. • Are you wondering what technological possibilities there are to communicate and exchange content online? Then take a look at this now! • Would you like to know how you can present information to others with the help of digital tools? Then have a look here.
	Expert	• Would you like to know which tools you can use to start online polls, e.g. to coordinate with others dates or ideas? Click here to find out more. • Do you know how to build a network and contact people on the MOVING platform? This is how.
Sharing through digital technologies	Beginner	• Do you know what possibilities you have to share information and distribute content online? Find out here.
	Intermediate	• Do you know how to share information and knowledge online? Find out more here. • Do you know that you can organize notes and share ideas using digital tools? Click here and find out more. • You want to know how to share presentations online? Here are some tools that might help you.
	Expert	• Do you know what open data is and how you can use and share it? Find out more here! • Have you used wikis to create, share and manage content collaboratively? Find out more here.
Collaborating through digital technologies	Beginner	• Want to know what tools you can use to collaborate with others online? Click here to learn more.
	Intermediate	• Would you like to work with others simply and simultaneously? You can find out how to do this here. • Virtual Whiteboards and Etherpads help you brainstorm ideas with others. Find out how it works here. • You can use digital tools for collaboratively working on texts and other documents. Find out more here. • Kanban Boards are a way to organize collaboration online. Find out how you can use them here.
	Expert	• Do you know what virtual research environments are? Click here! • Do you know that you can crowdsource your research engaging both with researchers and with non-scientists? Find out how it works here. • Have you ever heard of research crowdfunding and citizen science? Find out what it is here.

Table 17: Learning prompts on three levels for the module "Content Creation"

Submodule	Level	Prompt
Developing digital content	Beginner	• Want to know what formats and media you can use to create digital content? Then take a look at this here!
	Intermediate	• Do you want to create videos or animations? Find out what you need here! • You can create images and infographics using digital tools. Want to know how? Click here.
	Expert	• Would you like to create a website or blog yourself? You can find out what you need here.
Integrating and re-elaborating digital content	Beginner	• Do you know what hyperlinks are and how you can use them? Look here.
	Intermediate	• You have a website or a blog and want to share news with others? Use RSS or ATOM. This is how it works. • Do you know how the MOVING editor works and what kinds of digital content you can integrate in a community post? Have a look. • Want to know what pre-prints are and what advantage pre-print repositories offer you in finding information? Find out here.
	Expert	• Do you know what free software and open source means? Then take a look at the short information video here! • Do you want to find out what open content is and how you can use it? Then click here.
Copyright and licenses	Beginner	• Did you know that you can use, remix and share Open Educational Resources freely. Find out more!
	Intermediate	• Did you know? Even freely shared content is copyrighted and has several licenses. To find out what these are and what you can add to your content, click here. • Do you want to learn about Creative Commons licenses and how to use them? Look here. • Have you ever wondered what open access is and how it helps organize the access to information and knowledge online? Then check this out!
	Expert	• Do you want to know what open source means and how you can use open source licenses? Then have a look at this! • Do you want to know what open data is? How it is formatted and who provides it? Then take a look at the short information video here! • Would you like to test your hypotheses about web-based user behavior without much effort? Then find out more about WevQuery here.

Table 18: Learning prompts on three levels for the module "Digital Audit"

Submodule	Prompt
ISA 550: Understand and evaluate related parties disclosed by the entity	• The MOVING platform can support assessing the completeness of related parties disclosed by the entity as required by ISA 550. Click to learn more about the ISA's objectives. • With MOVING, you can extract entities contained in documents prepared by the entity. This may assist in understanding the related parties disclosed by the client and evaluating their relationships. Click to learn more! • Entities extracted from the databases connected to MOVING can be matched to entities contained in a document prepared by the client. Click to learn how this may assist in assessing the completeness of related parties disclosed in the client's financial statements. • Learn how to use MOVING's different visualization features to support assessing the completeness of related parties disclosed by the client.
ISA 315: Understand the entity and the environment	• The MOVING platform can support obtaining an understanding of the entity and the environment as required by ISA 315. Click to learn more about the ISA's objectives. • ISA 315 requires the financial auditor to obtain an understanding of the nature of the entity. Click to learn more about how the MOVING platform can support with this task. • The search algorithms of the MOVING platform are designed to return the most relevant results based on the search query entered. Click to learn how this can support identifying industry, regulatory and other external factors that are relevant to the entity.
ISA 250: Identify applicable laws and regulations and changes therein	• The MOVING platform can support identifying laws and regulations relevant to the client and evaluating changes therein, as required by ISA 250. Click to learn more about the ISA's objectives. • Applicable laws and regulations are usually referred to in the annual report of an entity. The MOVING platform supports the auditor in identifying and assessing (1) laws and regulations included in the entity's financial statements and (2) additional laws and regulations that may be applicable to the client. Click to learn more! • Due to the high complexity and speed of change of laws and regulations as well as their inter-relationships, staying up-to-date with the regulatory environment can be a challenge in the auditor's daily work. Learn more about how the MOVING platform can support identifying and evaluating changes within laws and regulations.

Table 19: Reflective prompts on different levels for the Curriculum Reflection Widget.

Level	Prompt
Beginner	• How did the learning content help you to improve {{sub_competence}}? • What does the learning content need to contain in order to be helpful for you to gain more knowledge about the topic of {{sub_competence}}? • What do you think about the progress of your competence about {{sub_competence}}? • What would help you to progress faster in the competence of {{sub_competence}}? • How many times do you use the platform to progress your {{sub_competence}} competence? • What could help you to improve your {{sub_competence}} competence faster? • Did you notice any motivating moments during this week for progressing with the {{sub_competence}} competence? • On which days, during the last week, did you progress the {{sub_competence}} competence the most? And why? • What were the discrepancies between your plans to continue your {{sub_competence}} competence progress in the curriculum and your actual working/learning activities? • What did surprise you when continuing with the {{sub_competence}} competence?
Intermediate	• Which activities you performed on the platform helped you to understand/apply the {{sub_competence}} competence? • Could you already apply your newly gained {{sub_competence}} competence and if yes, how? If no, why not? • What are the top 3 reasons that you do not progress with the {{sub_competence}} competence? • What actions/motivators lead you to increase your learning about the topic of {{sub_competence}} this week? • What has happened in your last MOVING session? Is there already something you learned from it? • When using the learning environment in the MOVING Platform, what kind of learning material do you appreciate most and why? • When looking at the learning environment in the MOVING Platform, what kind of learning material do you not like at all and why? • How useful were the learning resources you used for learning the {{sub_competence}} competence? • What have you learned regarding the {{sub_competence}} competence so far? • What is your personal outcome of learning {{sub_competence}} competence? • If you think about the competences your already acquired on the topic of {{sub_competence}}, which insights did you gain for yourself?
Expert	• How have you applied your newly gained competence about the topic of {{sub_competence}} at work or during your study. • Did your new developed competence on {{sub_competence}} help you to improve your work/study? • How did you change your behaviour with regards to the {{sub_competence}} competence? • Did the acquirement of the {{sub_competence}} competence impact your behaviour? If yes, how, if not, why not? • Did the acquirement of {{sub_competence}} competence improve your work/study performance? • How can you encourage yourself to learn regularly? • How can you encourage yourself to continuously improve your {{sub_competence}} competence? • How can you avoid low learning activities in the future? • What events could affect your learning activities in the future? • What could help you to motivate your learning activities in the future?

12 Appendix E: ATS Evaluation - Analysis of the open questions

To enhance the readability of this deliverable, all tables that present the detailed analysis of the open answers given have been moved to the appendix.

Table 20: Use Case 1F: Detailed answers to the reflective question.

Topic	Answers
Short comings of the simple search results	- Search results not being found by simple search - If the results provided by simple search don't satisfy my needs anymore. - Maybe if I'm not fully satisfied with results from simple search and I need more restricted search. - If there is a field which can't be filtered on with the filter by bar on the side I would expect it in the advanced search.
More specific information needs	- The need for a more granular search - Only needing it for specific purposes like finding an author's papers. Not much because the filters and simple search are already powerful enough - Accessing more specific content, ease to use - If I need to find more specific information about the topic that I am looking for. - Introducing me more benefits of this search compare to simple search.
Deeper knowledge is available	- When I know the person and the title - If I would know more specific details about the topic or document I am searching
Tips/Hints	- A hint/highlighting on the other features - Some extra tips on how to search more efficiently
Further functionality of the advanced search	- If the advances search has an option to filter out results, which are not relevant to my search. For example, if the advances search shows me results which are mostly clicked by other users, that have same or similar search inputs. - I would be motivated to use advanced search if using it was easy and did not require a lot of time.

Table 21: Use Case 1V: Detailed answers to the reflective question

Topic	Answers
Enhancement of search performance	- Search performance yes, because I can filter for important keywords which are already laid out by the software itself. Search skills no, I'm not a text processor, that's what the software is doing for generating the keywords. I can't really improve something I'm doing during the search process as the most effective approach would be to pick the most relevant keywords and the documents most relevant to those keywords, which are presented to me by the system itself. - Yes. You get faster since u can select the important tags. - The search performance yes, but not so much the search skills as i think that subject is a different thing. - I think it can, using key words makes a huge difference. - Yes, by suggestion other relevant keywords - Yes, because you get a nice overview. - I don't think that uRank can improve my search skills, but it can improve my search performance, since it makes it easy to see at a glance the importance of a search term in a given document - Yes, cause it provides a different approach to retrieve information.
Easier to find relevant documents	- Yes. It makes things a whole lot easier for the user to find if they have a certain search or keyword they would like to search by. The colours and tags keep the layout simple and concise. - Yes, because i have an overview of documents that are related to my keywords. Searching for a specific document is far easier than searching for a keyword to find an appropriate document - Yes, easier to properly select the relevant documents - Yes. I find it quite intuitive to use. It provides some keywords that i don't have to think about. - Yes, it provides easier access to learning materials - If I know for what keywords I'm looking for, I'm quite sure to find relevant papers very quickly. - I think it can help me with searching because it simplifies finding the right results for some more complicated queries
Impact on keywords	- uRank can be used to identify keywords connected to the documents in the search results. I could see myself using it to find out how much impact does a keyword have on a search result.
Visualization	- uRank is the best view for searching for documents in my opinion.

Table 22: Use Case 1V: Detailed answers to the reflective question

Topic	Answers
Expert searcher	- I use advanced search because I already have a very specific result-set in mind, if i could get that same result-set with simple search i would use it.
Differences between search types	- A clear description of the differences between advanced and simple search. - An explanation of the advantages of the other features
Good results with simple search	- If simple search gives me good results with less effort - Have the simple search give the results I was looking for - If I would need to search for simple things - If the system ranks the most important item among the top three items. Otherwise I have to specify more concrete information what exactly I want to find. - Maybe getting better and more tailored (for my need) results

Table 23: Use Case 2V: Detailed answers to the reflective question

Topic	Answers
Improvement of search performance	- Yes, by quickly drill down to a specific node. - Yes, for faster exploration of similar topics. - Yes, with more insights and depth into the information provided by the concept graph. - Yes of course, with this function it is easier to search for documents that have a similar content or the author. I only used Google before and this tool make it much easier. - Yes, but it has to be faster and easier. It is very useful, if the task at hand requires such "overview" look and big picture search. Otherwise, just Google it. - Yes, by providing me with connections between keywords/authors/documents etc - It makes it easier to find related papers to a given paper by traversing through the papers of an author of the given paper and so on and so forth. - Yes, my performance.
No improvement of search performance	- I find it rather clunky. So no. - I don't think so. - At the moment I don't think so, maybe if I get more experience with this feature it could help me - No I don't think that using the Concept Graph will really improve the my search skills. - Probably not. - No
No decision	- I think, it is always better to have more options. Consequently, it makes my searches better. - Yes and no. I think usually we do not need this approach. But if you are searching for particular information you can find it.I still believe Google does this for us :) So here we actually see how we get to the solution. - I think it can by characterize each document based on its properties and finding other documents with the same characteristics (e.g. if I found an article from Black, I can easy find other articles from Black)

Table 24: Use Case 1F: Detailed answer if reflective learning has taken place

Topic	Answers
Yes – Answers	- Yes (8) - Yes. People like to get things done without any effort, even when that's not feasible. They would rather type more things into a simple search bar instead learning a new search tool, because they think learning the new tool would be more effort than just to keep using simpler less efficient tools. - Yes, I would try different methods for optimized search results. - You realize the tool can be pushed much more than what you are doing - Yes, because it wouldn't be my way of searching things. I use most of the time "Advanced Search", when it's available, because with the correct options I can limit the results to show the things, I'm looking for - Yeah kind of
No – Answers	- If I have to be honest, it does not motivate me so much. - No (2) - Not really (3) - No not really

Table 25: Use Case 1V: Detailed answer if reflective learning has taken place

Topic	Answers
Yes – Answers	- Yes, It helps but in real life I might not have time to try out other visualizations and just use the one I am most comfortable with. - Not really. It only made me thought about my searching skills. - A bit, but it just showed me some usage statistics and did not give me a reason to use another feature - I'm currently quite happy with my search behaviour - Inevitably, yes. - Yes, they did. (2) - Yes
No – Answers	- Not really (2) - no (7) - No, because I'm happy with my current way of searching. - It didn't
Further Comments	- I'd rather be happy for a hint on which feature could help me with my current search - e.g. many results, broad by terms -¿ use concept graph to see intersections... - I cannot say anything about that now

Table 26: Use Case 2F: Detailed answer if reflective learning has taken place

Topic	Answers
Yes – Answers	- Yes, it's good to try out new methods - A bit yes, I never thought how I can improve my searching skills and it is a valuable asset. - A little bit, maybe. But I still prefer text based searches due to my habit. - Yes (4) - Yes, it does
No – Answers	- Not really, because normally when I search I get the results that I'm looking for in a fast way, changing my behavior therefore would cost time for doing something that is already efficient for me - Not really reflect but wanting to try out other features. - Not much, I think do search pretty well when I need to retrieve information. - No (3) Not really

Table 27: Use Case 2V: Detailed answer if reflective learning has taken place

Topic	Answers
Yes – Answers	- Yes it makes you think about your behaviour - Yes, I realized I am mostly a 1 trick pony. I just Google. Natural language search it seems is superior, as I am craving it, as soon as I needed to play around with clouds and bubbles here. - Yes, it helps me to understand with thinks characterize a document and how I can find similar ones. - Yes definitely. - Yes (3) - Yes, it did. - I guess, yes. - Could be, if I use these tools regular
No – Answers	- No. I already got that from looking at the bar charts and felt not motivated to type in any comments. It also was no question but a statement. - No (5) - No, it is more like a test for me - Not really.

Table 28: Use Case 1F: Detailed answers give to the questions of how to interpret the widget

Topic	Answers
Simple search	- That I mostly use simple search - Simple search is mostly preferred, but other options have also been tried out - Simple search is mostly used and it seems it was sufficient therefore the high number. - That I mostly used simple search - That I have used only the simple search - That i use mostly the simple search
Simple search and other functionalities	- I mostly use the simple search and uRank - Most users use the simple search. Not even half of the users use the advanced search. - It tells me what things I used the most which is in this case the simple search and other things like uRank and tag cloud but i don't know what that means - 50% is simple search and visualization stuff does not really get used that much - That I often use the simple search (80) and sometimes the advanced search (20) - That after the simple search, advanced search and result list are used almost the same - That I primarily use "simple search" and that I'm not focused on the "result list" all the time and rather check the "uRank" and the "concept graph" of my search - That I use simple search 4 times more than advanced one. - For me, it says after using it several times, I can see something interesting for the included view, it tells how frequently the user uses each search type - That I am using the simple search more often than other methods. Also I have barely touched Tag Clouds and Top Priorities
Search behaviour	- It tells me what way of searching I use how often. - Helps you to discover more about your usage behavior and how you use tools for searching. - It tells me that a lot of my searches are simple searches and that maybe I should use other types of searches. - You can see the individualized display of the functionalities used

Table 29: Use Case 1V: Detailed answers give to the questions of how to interpret the widget

Topic	Answers
uRank	- It tells me that I have used uRank the most. - I'm not sure whether I understand that widget properly but I think it says I use "uRank" most regularly - There is a peak in using uRank. So the user liked using it. - I use uRank a lot, though I'm not sure how much as the values are not presented in percentage. - that uRank is the preferred visualization to search - mostly uRank - That I use mostly uRank - The usage of uRank equals the use of all other tools together. - uRank is most used - uRank was used most often - That I mostly use uRank
uRank and other functionalities	- It basically tells me which feature I like the most to explore the data. - according to the visualization I'm a big fan of uRank and use it quite extensively, but that there are also other features - It tells me that I use uRank feature the most, and Top Properties the least. - It shows my searches and how often I have used which feature - It tells me what widget I used how often. - mainly used uRank and tried out a bit simple search, concept graph, and result list - That I have tried out everything and that I like uRank the most I guess.
Unrelated answers	- That people most usually use "simple search" and "concept graph". - The number of uses of the specific tools. Here the simple search was used the most.

Table 30: Use Case 2V: Detailed answers give to the questions of how to interpret the widget

Topic	Answers
Concept Graph	- The concept Graph was the function I used most frequently. - I used concept graph the most. - I mostly used Concept Graph? - That I use the Concept Graph frequently - That I used Concept Graph very often, because it was not still clear for me how it works - What I use most - I most often used the "Concept Graph".
Concept Graph and other functionalities	- That you use the visualization tools more often. The high-runner, the favourite toll you use, is the concept graph. and at the second position the uRank - That I use the concept graph way to much compared to the other types of visualizations. - The widget shows my searching behavior in terms of the frequency of using the features of the platform. - That I'm mostly using the concept graph tool (65 times). But also I used uRank, Simple search and Result list about 20 times each. Less for the other methods. - How often I used simple/advanced search and which method to display the results.
Frequency of tool usage	- It tells me the frequency of the tools I use. - how often I use a tool - It tells me which features I use - What is most suitable tool
Unrelated answers	- It tells me it will show me some graphs and math. Not friendly. - Probably that I lean on a lot of keywords.

Table 31: Use Case 1F: Detailed answers give to the question about how motivating the widget is to try out other visualizations.

Topic	Answers
Motivate	- It depends on how satisfied I am with the results I got with the usual methods. For some searches it could be useful to use other tools and the widget suggests them. As for which one: I would try them all to see which one could be useful. - It could, because there are some that I didn't know about - Yes, because visuals on first sight give more information than the pure text. - I like it the way it is, it can stay like this - Yes, the tag cloud - It would motivate me to see the success rate of simple searches versus the success rate of advanced searches. - Maybe I like the simple search because it is simple and fulfills my needs perfectly as I don't need other forms of visualization. - Yes I would because I would know better how to search for my data.
Does not motivate	- I don't think it motivates any other visualizations, it simply shows what's been used earlier and does nothing to motivate the user to try other functions. - No, it is just presenting me the previous usage statistics, but no hints why some other form of visualization might be useful to take into account for my current search. - There probably is a reason why the other visualizations aren't used that often. If I've had bad experiences with them; or usually don't find anything useful using them; telling me that I've not used them much won't change my mind in not using them. - No this is already a good overview. - No, because it only shows me what other features exist and does not tell why they should be useful - I don't think so because it worked well without changing anything - No because I do not find interesting to know what kind of searches I usually do. - Probably not, because this one is good enough...simple, easy to see what I need...but it's hard to answer this without really trying it out - No, bar charts are simple and expressive for the end users - Not, because it is really simple and very intuitive and easy to interpret. - How should this graph be motivating? so no, its just an ordinary graph. But it's nice to see how often I would have used which feature of the website
Further suggestions	- I personally think, pie charts are better suited...It would be also better to separate some things there...for example should "simple/advanced search" are one pie chart and the other pie chart shows my usage of the 5 tabs of showing my results "result list, concept graph, uRank, tag cloud, top properties"

Table 32: Use Case 1V: Detailed answers give to the question about how motivating the widget is to try out other visualizations.

Topic	Answers
Motivate	- It helps let me know that there ARE other visualizations I can use. It would motivate me to try at least one other out. - Yes tag cloud, maybe that one is interesting. - Yes, maybe. It seems I haven't tried the advanced search that often. - It would motivate me, because I could see which different visualization tools are there. I could also show me if I lean onto one visualization technique to much. - Since uRank was also ranked pretty high (3rd place), I would maybe look into this one (even though I preferred Concept graph.) - It displays other options which i would explore randomly - It displays other options which i would explore randomly - Yes. e.g Tag Cloud, because I seem to not have used it often and might give it a try - Yes, because if this one is so simple and useful, the other should be as well so I would use them - Maybe, if I see that I never used one visualization I could imaging that I would give that one a try. - Maybe to try it out once, but probably not more
Does not motivate	- In the screen-shot provided no, since it seems like I have used everything but stuck with uRank. I would guess that would mean it brings the most success. - I'd probably switch to what works best depending on the results I need - the widget does not provide me any hints on how to improve. - Since every type of visualization has been used, uRank must be the best one for that case and therefore there is no the motivation to use another visualization - Probably not, if the widgets I use resulted in proper results - No, because if i use uRank so much is because it really helps me. In the widget we can see that we have try also the other visualizations, so i see that the best one that fits me is the uRank - No, I would stay with urank. - I guess I'd not use one of the other features. I'm a creature of habit, why should I use something else when I get my stuff done with the tools I have (or the tools I'm used to) - No. Because with one good visual hint i think is more than enough. - I think it wouldn't, I would still use the visualization I mostly use and prefer - I would probably try out tag cloud (since it sounds interesting)

Table 33: Use Case 2F: Detailed answers give to the question about how motivating the widget is to try out other visualizations.

Topic	Answers
Motivate	- Maybe, I'd at least get reminded that I could give the other tools a chance. - uRank because you can get results based on weighted features - The concept graph and the uRank. - It depends, if my results with advanced search would have been satisfying, I don't think that I would change my searching behaviour; otherwise I would try out uRank because there I can use weights to tailor the results for my need - Yes, it can be also interesting to try out new methods - Only those which can analyze what I'm doing wrong in my search habits. - maybe i would try the rest out if not yet tried - yes, tag cloud and uRank because I do not know what those are yet - All of them to try them. - Curiosity for testing out those other features - It would only motivate me if I am not able to find the desired documents.
Does not motivate	- No, it seems like "nice to know" information, but nothing I needed - Not really. - Probably would have tested it. But usually I am satisfied with my information retrieval process.
Further comments	- I think widget is really nice I would just do more modern and user-friendly design - How other users search

Table 34: Use Case 2V: Detailed answers give to the question about how motivating the widget is to try out other visualizations.

Topic	Answers
Motivate	- Yes, I could try out the others. - Yes, uRank and Tag Cloud - Yes, I should use the tag cloud, top concepts, top sources more often. - Yes. If I see that I'm only using one of the tool suggested, I will try the other ones just to "well balanced" the graph. So especially those less used. - Maybe I would try one that I didn't use as much, but I the long term I would stick with what I learned that works for me. - Maybe Top Properties because I used it quite rarely - Maybe. If my search would not be successful, I'd try some lesser used methods of mine. - Yes
Does not motivate	- It would not. I think the bar chart shows all information - No, because probably there is a reason that my searching behaviour is as it is. - Just a histogram of my usages doesn't bring me to use another tool. If I'm frustrated with the usage of one tool, I will use a other feature maybe. - No, because I want to use the tool I want. - Yes, if it displays a visualization method I haven't used for a while but used very often back in time. But that's not the case. So for me it is a not, as it would motivate me to use my favourite visualization method more often. - No, because this chart shows that the user can find the most of the searching with the concept graph - Not really, I prefer normal ways of searching. - No. I don't really know any other tools. - no, it is only an indicator for me what i use most - I am not sure. I guess no but it is interesting to see it. If yes, it visualizes my options

Table 35: Use Case 1F: Detailed answers given to the question of what the participants liked about the "learning-how-to-search widget".

Topic	Answers
Ease of use	- It's simple to understand and easy to use - It's simple and uncomplicated. - It is easy to use - It is easy to see what's happening.
Visualization	- Graphical representation of information - I really liked the usage statistic visualization - The design - The visual representation.
Search Behaviour & Reflection	- The way to represent the data of my searches and the different colours. - I didn't look into the other functionalities of the platform and it is interesting to see how you behave when searching. - It asks for feedback and what could make me use specific things more - Feedback from the platform to the user to improve performance of user's tasks - I liked that it shows you in a simple form how to improve the way i search information. - It is easy to use, at least for me and that it helps me to think more about my search behaviour and how to improve it. - It motivates to try out other search interfaces. - It made me think of how I don't use the full potential of advanced search and filters - Those reflective questions. - Reflects my search behaviour - The visualization of my search behavior

Table 36: Use Case 1V: Detailed answers given to the question of what the participants liked about the "learning-how-to-search widget".

Topic	Answers
Ease of use	- The bar graph makes it easy to read. - I liked the design and the way it works. Simple. - Design, clear and meaningful positioning of the things. - Visualization is easy to understand
Visualization	- The colours in the chart are distinguishable. - The charts - Nice statistics - The way it represents the information in charts and colours.
Search Behaviour & Reflection	- That I can see what are my search preferences and that there are other tools - It shows that there are other possibilities to search for information - There is an improvement/suggestions text field that can be submitted - It forces me to think about different way to find information, and it helps me in different areas of searching, depending on which feature I use. - That you can clearly see what search mechanisms you are using how frequently - It is practical and helped me improve my searches - Nice statistics about my search behaviour - It shows me some important information about which search techniques I prefer.
Others	- Urank for the win. - Gives recommendations what else to use - That I couldn't look at it myself but had to use a screen-shot instead. That was really funny. - Nothing in particular - After only seeing a screen-shot i cannot really say something about it

Table 37: Use Case 2F: Detailed answers given to the question of what the participants liked about the "learning-how-to-search widget".

Topic	Answers
Ease of use	- Ease of use
Visualization	- Different visualization options - Good visualization of nice-to-have information - Clean presentation
Search Behaviour & Reflection	- Showed a nice overview of my behaviour and 'suggested' other search alternatives - To get an overview of my search behaviour - It gave me an idea about what my searching skills are - Shows what features I could try to use - It makes one aware of other options on the platform - That it shows other functionalities of the site. - Analysis and visualization of search behaviour; in case of bad results: motivation for using other techniques
Others	- It is definitely something new which is always good - I don't think I can fairly answer that question after just a few minutes of usage.

Table 38: Use Case 2V: Detailed answers given to the question of what the participants liked about the "learning-how-to-search widget".

Topic	Answers
Ease of use	- Very clear, easy understandable - Easy to understand - Really simple - Clear indicator
Visualization	- It showed how often I used with functionalities - The presented statistics - The presentation of the results. - The graph.
Search Behaviour & Reflection	- Gives a good overview of behaviour - That you can see your searching behaviour - Getting an overview of the search behaviour (feature usage) at once glance. - Get a quick overview of your search behaviour - I like how it explores different ways to search.
Others	- Nice gadget, but not very useful to me. - It's a nice try. - Innovation - Tracking history.

Table 39: Use Case 1F: Detailed answers given to the question of what the participants did not like about the "learning-how-to-search widget".

Topic	Answers
Design	- Just the statistics on feature usage seem to be a little too little. The question also didn't feel like a very thought-provoking question. - A little insipid design
Search Behaviour & Reflection	- At some point the user behaviour can be biased - I think it could be difficult to answer to reflective questions - The reflective answers seem unnecessary. - The displayed data didn't affect my searching behaviour
Less Information	- It's usage seems limited, it's nice to see statistics about what search methods you've used and all but I feel like it doesn't really provide that much useful information - There are no definitions what the terms uRank etc mean - My graph is empty even after some searches except the ones from the tasks. - The graph shows too things, that should be separated. It asks for my feedback, but it doesn't motivate me with examples to try out other things. - Not very much information is displayed, just a simple graphical representation.
Data Collection	- They collect my data!!! I have to turn on javascript and also to disable the adblocker that is a disaster.
Others	- Not very responsive - Not that I dislike it but I am not motivated to use it in the future, even though there are a lot of benefits, I think i do not need it that much for my searches. - I do not find it really interesting

Table 40: Use Case 1V: Detailed answers given to the question of what the participants did not like about the "learning-how-to-search widget".

Topic	Answers
Design	- It just shows how often I used which feature, but there is no additional insight like "you used uRank 75 times, but according to our data in 35 times you'd have performed better when using concept graph because ..."another question is: why do these visualizations compete against each other? uRank shows me the importance of keywords, concept graph shows me connections between different nodes (documents, authors..) - Sometimes is hard to understand how the widget works. - Maybe I would make chart bigger.
Search Behaviour & Reflection	- Instead of asking me a question how it can improve search, it should tell me. - The point at which the display of the functionalities takes place. Do I have to use every functionality once to get the display. - I think it won't change my way of searching - I don't see the need for this. It is "nice to have" but I am not sure if this really influences people to rethink their way of searching. - The reflective question part of the widget - There isn't anything I don't like, but I'm not sure whether it would motivate me to try out different search techniques
Less Information	- I would probably add more details about feature usage for example, per month, per week etc.
Others	- It suggests options which are not relevant for me - I don't really think it is necessary - Don't see any usefulness - The fact that I actually tried to open it on the website but failed to do so. - That you had to click on the button first, that you want to get started. so no data got tracked at the beginning.

Table 41: Use Case 2F: Detailed answers given to the question of what the participants did not like about the "learning-how-to-search widget".

Topic	Answers
Design	- The design of the website as a whole is off-putting and reminds of old high-school websites that are hastily made. However, it is obviously that design is not priority here so not really much to dislike. - Not so appealing design. - The numbers aren't really needed, they just add noise to a widget that aims to make a user use different features of a platform. I think it would be better to point to or show features the user hasn't tried yet so as to not make the user feel dumb.
Usability	- Very simple visualization; no interactive opportunities like previews for other search techniques; no explanation regarding pro and contra of the search techniques. - I don't like that i have to use the features very often to get something displayed - Confusing filtering - Takes pretty long to learn - I did not quite get the purpose of the widget

Table 42: Use Case 2V: Detailed answers given to the question of what the participants did not like about the "learning-how-to-search widget".

Topic	Answers
Design	- Design and might be too complex. - The look and feel - UX
Usability	- I am not sure if I understand it correctly. But for me the widget "Learning-how-to-search" was just a bar chart that shows which functionalities of I used how often and sometimes a question about my user behavior. I do not thing that it is very helpful for my work.
Value	- I do not see any value using the widget. - I don't see the value of such a widget and don't know why I should use the depicted information. - Nice to have but not really relevant
Others	- It did not actually work for me on my interface - The whole idea I cannot identify with. - I do not think that it is actually necessary. - It is at first empty which is kind of weird. To me, it would have made more sense that it uses my previous data. - I did not really try it so it's quite impossible to make a relevant judgment - It's not as simple as using natural language. Takes work. - Why do i need to change my search behaviour? - That it wasn't motivating for me. And the y-axis was not labeled. - Missing graph y-axis labels. I don't like filling out the free text form.