Information-Wise – Mid-Term Report

Project start date:	15.02.2019
Project end date:	June 2020 extension date: 31.08.2020
Project length	18 months (including extension of 2 months)
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Date   :   20/12/2019

Version   :   3

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Executive Summary

Vision & Mission Information-Wise

The aim of this mid-term report is to provide an update regarding project 'Information-Wise'. The vision and mission of the project is to support students in developing skills and attitudes that allow them to deal reflectively, critically, and creatively with all formats of sources. The project will help in generating strategies to search, find, evaluate, and communicate information as needed and at the time it is required.

A central deliverable of this project will be the design of an evidence-informed information literacy programme for bachelor students. This programme should be constructively aligned to the intended learning outcomes (ILO's), teaching activities, and assessments of discipline specific curricula at the Maastricht University (UM). Programme coordinators, educational policy advisors, vice-deans of education & management team, members of the board of examiners and information specialists are important stakeholders to realize this endeavour. We therefore need their input and support to disseminate and integrate the project results in their respective faculties (see chapter 1). Furthermore, current projects that address the educational PBL-philosophy (EDview), and other ongoing education innovation initiatives (e.g. Canvas, Study Smart) seem to be important means to disseminate and address information literacy instructions across the UM.

Information Literacy Framework at Maastricht University

This document presents a university-wide Information Literacy Framework. First, a thorough analyses of existing frameworks (SCONUL 7 pillars, ACRL framework, ANCIL, and digital literacy framework of JISC) was conducted (see chapter 2). This information literacy framework at the UM is carefully designed based on the core principles of Problem Based Learning at UM: learning as a constructive, contextual, collaborative, and self-directed process. The framework centres an information-literate student who is able to independently and effectively deal with the changing information landscape in the learning process.

The UM framework entails four dimensions: 1. Resource Discovery, 2. Critical Assessment, 3. Organizing Information, and 4. Creation & Communication. Both attitudes and knowledge practices are described for each dimension. In addition, a developmental rubric was developed, which specifies what students are supposed to learn as regards information literacy in the course of their academic journey, and to support the design of additional teaching and learning activities. The rubric describes ILO's for each dimension and mastery at each stage (e.g. Novice, Intermediate). The rubric was designed based on the constructive alignment model, bloom's taxonomy, and Dreyfus model of skills acquisition (see chapter 2).

Recommendations for improving teaching information literacy practices

Information-Wise includes a research section (WP1) that aims at informing the design and development of information literacy education with qualitative and quantitative evidence. Over 600 bachelor students and about 100 faculty teachers responded to a university-wide survey. Students indicated that they rather learn to pass the exams than to understand the subject matter. It also appeared that they mainly use the mandatory or recommended literature. Faculty teachers often provide a fixed reference list, which means that there is hardly any need for students to search for alternative sources. In addition, a majority of students indicated that they do not use a reference manager to organize and structure literature. Yet they think they quote and refer correctly. Students also indicated that they often critically evaluate sources. In contrast, faculty teachers emphasized that students perform poorly in the critical assessment aspect (see chapter 3).

Based on these findings, amongst others, and the outcomes of guerrilla interviews and two literature reviews on the changing information landscape and analysing informed learning, one general recommendation and 8 specific recommendations are presented in chapter 3:

Overall General Recommendation: Employ constructive alignment approach to integrate information literacy within all curricula.

Recommendation 1: Design a Bachelor pilot to explore scaffolding the use of provided and non-provided literature within a course to stimulate self-directed learning.

Recommendation 2: Diversify the approach to teaching *resource discovery*: make students aware of the difference between (academic) search engines and academic databases and discuss the advantages and disadvantages of each.

Recommendation 3: A larger component of *critical assessment of information* should be developed in each bachelor curriculum.

Recommendation 4: Teach students in *organizing information*. Tools (e.g. reference management tools) could be used to develop this skill. Educating specific tools should not be a goal in itself, but a means in enhancing skills to organize information.

Recommendation 5: Scaffold Information literacy activities that support students in the creation of (academic) output.

Recommendation 6: Teach students how to create and communicate information in a variety of formats (from blogs to academic paper) on multiple digital platforms (e.g. LinkedIn, Facebook).

Recommendation 7: Design a Bachelor pilot to measure *informed learning* with an authentic assessment component within the disciplinary context.

Recommendation 8: Add information literacy training in the teacher professional development programmes and training in teaching in library professional development programmes.

These recommendations provide input for specific pilots linked to the four dimensions of the UM framework and to teacher professionalization programmes at the UM (see chapter 4).

Pilots at the faculties
Chapter 4 shows a visual overview and a sample of pilots currently running at faculties of the UM. The aim of these pilots is to address and test the framework dimensions and rubric in different teaching settings. The content and structure of these pilots follow the above-mentioned recommendations. The pilots cover innovative assessment practices (e.g. learning diaries), new teaching and learning activities (Bullshit lecture, workshop on Finding & Referencing, online module about Critical Assessment) and a workshop for experienced faculty teachers as part of the Continuing Professional Development programme at the UM. Faculty programmes, rubric ILO's, and assessment of pilot effectiveness are described.

Next steps
The final chapter describes the timeline and final deliverables of the project. Most importantly, this includes:
* Visualisation of the WP1 recommendations;
* Evaluation of the pilots for phase 1;
* A blueprint for the professionalization of teaching staff;
* A new online curriculum for information literacy including generic- and discipline-specific modules;
* Set-up of a strategic communication plan;
* A final project report and position paper.

Contents

2. Introduction

2.1. Vision and Mission

This project envisions to support students in developing skills and attitudes that allow them to deal reflectively, critically, and creatively with all formats of sources and to generate strategies to search, find, evaluate, and communicate information as needed and at the time it is required.

The project objective is to design an evidence-based education programme that provides a range of intended learning outcomes, teaching activities, and assessments related to information literacy skills.

The general project objective consists of the following sub-goals:
- Get an in-depth and comprehensive understanding of the challenges students face regarding their information literacy skills from both a student and teaching staff perspective. In addition, we aim to gain insights from teaching staff with regard to teaching of information literacy skills in different curricula. These insights will provide input and recommendations for developing and tailoring (online) information literacy instructions/education.
- Developing a coherent information literacy programme with generic and discipline-specific modules in which students from all faculties will gain knowledge about, practice, and receive feedback on their information literacy skills.
- Piloting and constructively aligning these modules in different faculty courses to evaluate the effectiveness. This means also increasing didactical support and developing training material (e.g. a blueprint) for teaching staff guiding them to integrate information literacy within faculty curricula.

2.1.1. What questions will the project answer?

The project was initiated to answer the following questions:
1. What is the current state of teaching information skills at all faculties? How can we – both qualitatively and quantitatively – collect data to further analyse and improve information literacy skills from the student and teacher perspective?

2. How can we constructively align and integrate information and digital literacy skills into curricula at all faculties and provide state of the art information literacy interventions to enrich and extend information skills education at UM?

To answer these questions, the project builds on two work packages (WP1 and WP2):
- WP1 aims to identify bachelor students' challenges and needs in order to use information in the learning process effectively.

- WP2 targets the creation of a university-wide information literacy skills programme for bachelor students and will deliver relevant instructional material for teaching staff.

This mid-term report aims to summarize the initial results and recommendations of WP1. Furthermore, as part of WP2, this document explains the newly developed UM information literacy framework and rubric (see appendix c, d) that are closely related to the specific PBL-context. Finally, this report describes the current pilot plan and outlines sustainable implementation and monitoring of the project deliverables. We will describe the next steps.

2.2. Who will benefit from this document?

The Programme Coordinator

Programme coordinators are responsible for the design of a coherent academic skills trajectory within their bachelor programmes. This entails the formulation and mapping of information-literacy related intended learning outcomes (ILOs) and assessments within courses and aligning them to the programme ILOs. This document provides a vision for the next steps of information literacy education at UM. The

recommendations will provide guidance and clarity on how to effectively scaffold and embed relevant information literacy skills within the curriculum.

Educational policy advisor

Education policy advisors provide recommendations on how to implement and maintain constructive alignment on a course and programme level. This also includes the monitoring of academic skills trajectories. This report informs about the current state of the Information-Wise project, including recommendations that lead to the (re-) design of information literacy skills within faculty curricula. The content of this document will provide a global overview of where the project stands at this moment and where it will go in the upcoming phase. Since the project is about halfway, educational policy officers have the opportunity to provide input for the upcoming project developments.

Vice-Deans of Education & Management team

Has the final responsibility for the quality assurance of the curriculum. Because the final objective of this project is to incorporate information literacy skills across faculty curricula, it is from utmost importance that the final decision makers take note of the recent developments of the Information-Wise project. The content of this document will provide a global overview of where the project stands at this moment and where it will go in the upcoming phase. Since the project is about halfway, Vice-Deans of Education & Management team have the opportunity to steer future directions of the project.

Boards of Examiners: Are responsible for the quality assurance of assessment in general to reach and to guarantee the accomplishment of institutional/programme/course ILOs. The board of examiners should critically check the revisions of information literacy learning goals.

Information Specialists

This document indicates future direction for information literacy education at UM. The framework, rubric, and recommendations formulate a new roadmap for information literacy education at Maastricht University. The role of the library information specialists is to make use of their content expertise related to information literacy, collaborating with relevant faculty stakeholders to harmonize existing information literacy instructions and build additional teaching content. Given the project scope, information specialists will take a leading position in designing and supporting information literacy education across all faculties within the UM.

Related Projects

The research project of EDview has defined the future direction of Problem Based Learning (PBL) at Maastricht University. The EDview research stressed the necessity to prepare students for the growing complexity and variety of information in a digital age. Future academic skills education should be coherent with the EDview recommendations and closely linked to the UM philosophy of PBL (constructive, collaborative, contextual and self-directed learning). Thus, it is important to define potential overlaps amongst these two projects. Next to EDview, other ongoing projects such as Study Smart (determining effective learning strategies) and the Canvas (new Learning Management System) implementation seem to be important means to disseminate information literacy instructions across the university landscape. We therefore recommend to collaborate closely with these initiatives in the upcoming project phase.

3. UM information literacy framework

3.1. Framework selection

In general, frameworks multiply the chances to improve information literacy education. They enrich the conversations with faculty staff about rethinking the teaching of information literacy. In addition, frameworks provide a platform to inform instructional goals and objectives. Until now, the University Library employed the ACRL standards to develop the learning objectives and content of workshops and online tutorials. In recent years, the prominent conceptual information literacy frameworks undertook a revision to meet the requirements of the changing information landscape. Especially the younger generations are growing up in an environment in which the use of Facebook, Instagram and Twitter seems indispensable. Therefore, the revised frameworks devote more attention to the critical and careful use of digital information and the active and ethical role of its user. To provide skills support that covers the full range of digital and technological developments in the 21st century, the Information-Wise project team decided to adapt and incorporate a new framework that guides the development of an evidence-based information literacy programme.

To ensure a careful selection, we organized a framework 'mini competition' and followed an internal selection procedure within the University Library. The selection group consisted of information specialist who act as faculty liaison - each specialized on the discipline specific components of information literacy education. Three prominent frameworks were identified that suited the educational vision and needs of UM. Additional educational frameworks - that do not explicitly mention information literacy, but closely link to the concept - were also considered during the selection procedure.

SCONUL 7-Pillars

The SCONUL 7-pillars organize information literacy into seven dimensions (e.g. identify and evaluate information). With the development of specific lenses (e.g. digital literacy and graduate employability lenses) on these dimensions, the framework intends to address the varied and holistic nature of information literacy. Within the seven pillar of information literacy, the competencies are divided into understanding and ability, for example, understanding 'what types of information are available' and ability 'to identify any 'information gaps'. [1]

Association of College and Research Libraries (ACRL) Framework

The Association of College and Research Libraries (ACRL) Framework emerged of a need to bring the existing Standards into alignment with modern information creation and use. The ACRL Framework is organized into six frames (e.g. Information has value) and not only considers the level of knowledge but also the attitude of the learner. In addition, the framework includes other concepts such as metaliteracy and threshold concepts.[2] The framework takes constructivist learning approach where the student is not only consumer in the information marketplace but also contributor[3]. In the US, a large community of university libraries and researchers work extensively to translate the rather conceptual framework into educational practices. Besides a number of scholarly paper discussing the implementation and integration of the ACRL framework, a sandbox repository with all kinds of learning material has been launched.

A New Curriculum for Information Literacy (ANCIL)

A New Curriculum for Information Literacy (ANCIL) aims to help undergraduates develop an advanced, reflective level of information literacy which will enable them not just to find information, but to evaluate, analyse and use academic material independently and judiciously. The curriculum/framework is built around 10 strands (e.g. becoming an independent learner). One core strength of the ANCIL is that it places the student at the "centre of a continuum of abilities, behaviours and attitudes that range from functional skills to high-level intellectual operations. At the same time, it presents a broad vision of

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[1] Gwyer et al. 2012

[2] See Pichel, Jongen, and Hospers (2018), for explanation and definition.

[3] Think of research gate, a platform where researcher despite their rank or reputation can share their scholarly papers, and discuss research-related questions. The platform allows everyone to share and exchange knowledge without walking through a, sometimes, tiring peer-reviewing process.

information literacy across ten 'strands', which include the social, ethical and affective dimensions of dealing with information"[4]. It is also important to note that in the past years, there was not much development regarding the ANCIL framework, mainly because the project has ended in 2012.

Other Frameworks
The Joint Information Systems Committee (JISC) framework is designed around 6 digital competencies (e.g. ICT proficiency). The framework aims to encourage discussions and consensus about the capabilities required in a digital organisation. It therefore touches upon curriculum design to foster digital competencies as well as input for professional staff development. The Research development framework (RDF) describes the knowledge, behaviour and attributes of successful researchers in a broader sense.

The selection process consisted of three different phases. Firstly, information specialists from the university library were asked to score the three selected frameworks on a list of carefully defined criteria (see appendix a, b for complete scoring matrix and results):
- General (vision on information literacy, didactical language)
- Problem Based Learning (Constructive, Contextual, Collaborative, Self-directed learning)
- Content (searching, finding, processing, evaluating, presenting)
- Support (available learning & teaching material, empirical evidence)
- Usability (Understandable, integration into curriculum)

Secondly, a discussion round was organized to clarify the scoring and results. Lastly, the proposal for a new framework was presented to the Information-Wise project group. The scoring results and subsequent conversations lead to the decision to synthesize the most valuable parts of each framework and design an UM information literacy framework that matches the PBL educational philosophy. We reached consensus that due to the PBL-specific context and decentralized situation at UM, choosing a standardized framework would imply shortcomings and complicate the development of information literacy education. Nevertheless, the ACRL, SCONUL, ANCIL- and JISC-frameworks serve as suitable guidelines to align the UM framework to global benchmarks to ensure high-quality information literacy education.

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[4] https://www.sconul.ac.uk/sites/default/files/documents/2.pdf, p.1.

3.2. Vision of the framework

In line with the EDview recommendations (EDview, 2018), the framework vision embraces the Problem Based Learning (PBL) principles: learning as a Constructive, Collaborative, Contextual, and Self-directed process. It centers information literacy as part of students' learning process. At the core of this vision stands the UM Bachelor student, who is confronted with a flood of information created by the quick and easy access to a wealth of (online) information sources as a consequence of the changing information landscape. Dealing with this overload of information makes students insecure when to stop searching for and the trustworthiness of information. To support them in this learning process, the framework envisions an upgraded academic skills trajectory that teaches students gradually how to be self-reflective and critically when using information at the university and beyond.

Information literacy as a constructive process
Constructivism entails the idea that knowledge is constructed by learners as they attempt to make sense of their respective experiences. They thus build on their existing information literacy knowledge and skills as they engage with discipline specific learning activities (Salisbury et al. 2012). Not all students will start at the same point: while one first year student might be familiar with the use of different (academic) databases, another might still have to grasp the basics of searching academic literature. The educational design of programmes und courses should thus be planned to allow for different existing knowledge, and for peer learning in the development of relevant information literacy skills throughout the curriculum.

Developing information literacy through collaboration
When students feel part of a social group, their learning can develop and improve greatly. Practicing and developing information literacy skills should thus take place in a collaborative setting. Through peer-assessment, for instance, students can evaluate the quality of each other's research questions and learn from different types and approaches how best to formulate an effective research inquiry. This should also include reflection moments in which students comparatively evaluate their different approaches to searching, selecting, evaluating, and presenting information in one of their (research) assignments.

Learning information literacy through a contextual process
The UM information literacy framework will form the basis for our teaching and learning engagement opportunities, and has been devised to provide a consistent learning experience for students. As the faculty staff (e.g. programme coordinators, course coordinators, and tutors) design and teach the subject content to the students, they need to be able to clearly identify how information literacy advances students' learning about disciplinary content (Jongen, Pichel, Vernimmen, & Hospers, 2018). This is why information literacy competencies intended to be fully embedded in the academic curriculum and closely linked to the context in which students learn. This situated approach of information literacy emphasizes the role of information in specific contexts (e.g. disciplinary or professional settings).

Information literacy education is most effective in a meaningful context. This can be achieved for example through reflection on real-life situations, and by using authentic learning and assessment tasks that relate to the achievement of learning outcomes that are meaningful in the real-world, and to the context of the student. This could be for instance a business scenario where students need to identify, search, and evaluate technological innovations from competitors in the market, or a research assignment of a medical organization to explore and select new forms of treatment.

Information literacy as a vehicle to self-directed learning
The UM framework embraces a holistic view on information literacy, including digital capabilities and data literacy. Information literate students at UM are (self-) reflective and are able to locate, evaluate and assess information and data critically; they develop an overarching set of skills within the context of their academic disciplines enabling them to self-direct their learning. They are willing to identify their knowledge gaps, are aware of the political and social aspects of information, and look beyond the provided sources. They can create, use, synthesize, and share (digital) information while demonstrating awareness of the ethical considerations, such as copyright legislation and licenses, of the environment in which they operate. They understand the conventions of (academic) integrity and abide

by these. Information literate students are critical, evaluative, self–aware, self–confident, skilled and capable in the use of technologies. They work with a broad range of media and embrace the current cultural shift towards a collaborative world, exchanging and sharing ideas in a variety of contexts and across all subjects. In addition, they are responsible and empowered citizens who know how to create positive (digital) identities and who are capable of looking after personal health, safety, relationships and work-life balance in digital settings (Halfpenny, S., n.d.; Cambridge Information Literacy Network (CILN), 2017).

3.3. Framework Content

The four proposed dimension (i.e. Resource Discovery, Critical Assessment, Organizing Information, Communication & Creation) have incorporated content from the SCONUL-7-pillars and ACRL frames. Each dimension has been divided into sub-dimension (e.g. Evaluate) that further specify the content and purpose of each information literacy topic. The SCONUL framework has been chosen because of its relative simplicity and accessibility. The ACRL framework has been included due to its focus on self-directed learning, metacognition, and student centeredness, which is closely linked to the educational PBL philosophy. The Maynooth University Library's Key Competencies and the Cambridge Information Literacy Network Framework already combined these two frameworks and serve as a template for the UM information literacy framework.

The UM information literacy framework includes attitudes and knowledge practices. Knowledge practices are the proficiencies or abilities that students develop as a result of their comprehension of an information literacy component (ACRL, 2016). Generally, attitude is a learned tendency to evaluate objects, subjects or persons in a certain way[5]. According to the UM information literacy framework, the information-literate bachelor student has the following attitudes and knowledge practices:

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[5] Attitude has different components: affective (act or behave in a certain way towards a certain subject), cognitive (knowledge or belief towards a certain subject), and emotional (feelings and emotions towards a certain subject)

Resource Discovery

Definition:
Learners who develop skills and attitudes relating to resource discovery are able to identify their information need and recognize specific formats and types of information appropriate to answer the research question in an academic paper or a problem statement and related learning goals defined in the pre-discussion of a tutorial group. They understand that the search process entails both searching for the sources themselves, as well as the means (e.g. databases) to access those sources. Learners are aware that resource discovery is likely to be a non-linear, iterative process where they will engage regularly with searching, finding and evaluating information from a wide range of sources to solve the problem statement, answering the learning goals, or answering the research question within an assignment. In addition, resource discovery requires flexibility on the part of learners to pursue alternative avenues as comprehension develops (Cambridge Information Literacy Network (CILN), 2017).[6]

Identify & Plan
Attitude:
- Acknowledges that information sources vary greatly in content and format and have varying relevance and value, depending on the needs and nature of the search;
- Seeks guidance from experts, such as librarians, researchers, and professionals.

Knowledge Practices:
- Identifies information need by assessing current knowledge and identify gaps;
- Formulates a clear, focused, concise, complex and arguable (research) question and identifies for each concept correct search terms.

Search
Attitude:
- Seeks multiple perspectives and sources when searching for information;

Knowledge Practices:
- Is able to systematically locate and access information and/or data sources that are appropriate and relevant for the assignment or research need;
- Knows that research is iterative and depends upon asking increasingly complex or new questions whose answers develop additional questions or lines of inquiry in any field.

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[6] https://camiln.org/about/

Critical Assessment

Definition:
Critical assessment is a critical approach towards information that comprises critical thinking about, evaluation, and critical reading of information. Critical assessment implies the evaluation of an information source with the aim of upholding its dominant paradigms or disproving them and suggesting a better alternative view. It is not the same approach as criticising in that any view or conclusions needs a credible backing. Critical assessment is particularly demanded in higher education or research, the kind of environments where the credibility and origin of the source determines its usability.

Critical Thinking
Attitude:
- Views offline/online sources with an attitude of informed scepticism and an openness to new perspectives and diversity of voices.

Knowledge Practices:
- Understands that the authority, purpose, and accuracy impact the quality of a source;
- Demonstrates the ability to spot own and other biases.

Evaluation
Attitude:
- Acknowledges the ethical and social dimensions of information.

Knowledge Practices:
- Evaluates the appropriateness based on the information need and the context in which the information will be used.
- Is able to define different types of authority (subject expertise, societal position, special experience) and critically assesses the argumentation of and evidence used by the author(s);
- Demonstrates the ability to evaluate online tools in any context.

Organizing information

Definition:
Understanding the practices within their discipline, learners engage with relevant information, and develop strategies for managing information of all kinds. Information has value and, as responsible creators and users of information, learners will consider and understand their rights and responsibilities (ethics) when storing and publishing material. Information use requires learners to choose appropriate tools and systems (e.g. a reference manager) to organize their sources; they use and develop practical skills to structure (e.g. concept mapping) the range and variety of information sources they employ (Cambridge Information Literacy Network (CILN), 2017).

Managing
Attitude:
- Values the skills, time, and effort needed to store and organize information;
- Considers accessibility, and the ethical and privacy regulations when storing information.

Knowledge Practices:
- Stores and organizes information sources systematically using, if necessary, digital tools (e.g. citation management software);
- Develops and uses a transparent and accessible system for managing data and files while considering the ethical and privacy regulations;
- Possesses skills to manage the range and variety of information and/or data sources relevant to the topic explored;
- Is able to make effective use of appropriate tools both online (e.g. bookmarking) and offline (note-taking, concept mapping) to structure information.

Creation and Communication

Definition:
Learners should see themselves as being information creators in addition to information users. Information creation, such as presentations, data visualization, writing, maths models, publishing blog posts, etcetera is a iterative process, which entails evaluation, revising, and re-purposing of discovered content. Learners will understand and value the dynamic processes by which material in their discipline is produced, rearranged, and disseminated. Learners consider how they contribute to the body of knowledge through original research work (projects and thesis) and by joining the conversation within their discipline specific community of practice. They create positive (digital) identities and are capable of looking after personal health, safety, relationships and work-life balance in digital settings in a self-directed manner (Cambridge Information Literacy Network (CILN), 2017).

Create
Attitude:
- Recognizes that s/he is a contributor to, as well as a consumer of, (academic) information;
- Values the skills, time, and effort needed to create new types of information and knowledge;

Knowledge Practices:
- Is able to combine and synthesize multiple (sometimes contradictory) sources;
- Demonstrates the ability to create and communicate information in different formats (from blogs to academic paper) on multiple digital platforms (e.g. LinkedIn, Facebook).

Present
Attitude:
- Respects and values the original ideas of others.

Knowledge Practices:
- Identifies that information possesses several dimensions of value, including as a commodity, as a means of education, as a means to influence, and as a means of negotiation and understanding the world;
- Gives credit to the original ideas of others through proper attribution and citation.

Collaboration
Attitude:
- Views (online) collaborative spaces as an opportunity to share, comment, and debate ideas and thoughts.

Knowledge Practices:
- Is able to communicate (e.g. share and exchange) ideas effectively and ethically (e.g. copyright) in collaborative spaces, and in discipline specific communities of practice.

4. Recommendations for UM regarding teaching information literacy in Problem Based Learning
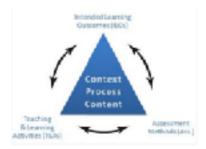
This section of the report, presents parts of the research findings of the Information-Wise project. More specifically, one general recommendation and eight specific recommendations are presented based on the Information-Wise surveys, guerrilla interviews, a quick scan and two literature reviews regarding the changing information landscape and analysing informed learning.

The survey consisted of two parts with both quantitative (i.e. closed) and qualitative (open ended) questions. Both closed and open questions were labelled to either one of the four dimensions of the Information-Wise framework or to a category 'general questions'. The survey was sent out to all current students and staff at Maastricht University and responses were collected in English. It was made explicit that we only asked Bachelor students or teaching staff within Bachelor programmes to respond to the survey.

The guerrilla interviews were conducted to identify possible challenges students face in relation to the four framework dimensions. Complementary to the quantitative data, this research approach was expected to provide more in-depth insights into students' behavior and approach using information to learn. In total, 21 students participated in the interviews representing in total 5 out of 6 faculties.

In the past years, two literature reviews and a quick scan contributed to the scientific evaluation of information literacy education at the UM. The quick scan (Ferguson, 2017) investigated – by means of a survey - the ability of UM students to effectively access and critically assess academic information. The purpose of the second paper (Pichel et al., 2018) was to perform a literature review of articles that address the recent developments of information literacy, focusing in particular on research in a PBL setting. The third paper (Jongen et al., 2019) reviewed several studies, which described how to analyse information as part of the learning process.

Overall General Recommendation: Employ constructive alignment approach to integrate information literacy within all curricula.

Constructive alignment provides a framework for ensuring information literacy efforts could be aligned with subject intended learning outcomes, learning activities, and assessment tasks (Biggs & Tang, 2011). It clarifies what students needs to learn, how to develop information literacy skills further, and how learning these skills will be assessed (Erlinger, 2018; Salisbury et al., 2012). Furthermore, a constructively aligned model for information literacy ensures the alignment between these skills with the subject content. Scholars indicate that information literacy education integrated into the curriculum results in deeper understanding of the subject content because it guides students in how to gather, evaluate, and apply the information needed to complete the coursework (Dodd, 2007; Maybee, Bruce, Lupton, & Rebmann, 2017). Therefore, the next step is to integrate information literacy theory into the constructive alignment framework, which is deployed across faculties at Maastricht University (Pichel, Jongen, & Hospers, 2018).

In order to constructively align and improve information literacy teaching in faculty curricula we propose the following 8 recommendations:

Recommendation 1: Design a Bachelor pilot to explore scaffolding the use of provided and non-provided literature within a course to stimulate self-directed learning.

Recommendation 2: Diversify the approach to teaching *resource discovery*: make students aware of the difference between (academic) search engines and academic databases and discuss the advantages and disadvantages of each.

Recommendation 3: A larger component of *critical assessment of information* should be developed in each bachelor curriculum.

Recommendation 4: Teach students in *organizing information*. Tools (e.g. reference management tools) could be used to develop this skill. Educating specific tools should not be a goal in itself, but a means in enhancing skills to organize information.

Recommendation 5: Scaffold Information literacy activities that support students in the creation of (academic) output.

Recommendation 6: Teach students how to create and communicate information in a variety of formats (from blogs to academic paper) on multiple digital platforms (e.g. LinkedIn, Facebook).

Recommendation 7: Design a Bachelor pilot to measure *informed learning* with an authentic assessment component within the disciplinary context.

Recommendation 8: Add information literacy training in the teacher professional development programmes and training in teaching in library professional development programmes.

Recommendation 1: Design a Bachelor pilot to explore scaffolding the use of provided and non-provided literature within a course to stimulate self-directed learning.

Descriptive analyses of the Information-Wise survey raised concerns about the lack of teaching in self-direct learning. A Wilcoxon Signed-ranks test (a non-parametric test to compare median scores within groups) indicated that students preferred to study for an exam (*Mdn = 4*) compared to study for a deeper understanding (*Mdn = 4*), Z = 6.60, *p* <.001). The results of the survey also supported the concerns regarding the use of provided resources in PBL classes. Students indicated to generally only use the sources provided in the course manual to find information about a topic (*Mdn = 4* 'Most of the time'). In addition, they reported to sometimes extending the search for sources beyond the sources provided in the course manual in order to gain a wider perspective on a topic (*Mdn = 2* 'Sometimes'). Students also indicated that they need to search independently for information on a particular topic about half of the time (*Mdn = 3* 'Half of the time'). In general, they somewhat agreed that they received enough training during the Bachelor's programme, so far (*Mdn = 4* 'Somewhat agree').

A chi-square test of independence was performed to examine the relation between use of resources and bachelor level was examined (detailed analysis in appendix X). We observed no significant differences between the four variables and Bachelor year. This was found with regard to use of sources provided in the course manual (X^2(8, N = 632) = 12.66, *p* =.12)) and the extension of the search for sources beyond the provided sources in the course manual (X^2(8, N = 632) = 13.64, *p* =.09)). It was also shown for the need to search independently in the study programme (X^2(8, N = 632) = 4.62, *p* =.80)), and receiving enough training during the study programme to search independently for answer to a specific topic (X^2(8, N = 632) = 10.13, *p* =.26)). This means that no scaffolding approach is apparent throughout the years, based on the students perception. In other words, no gradual reduction of support and increase of independent self-directed learning is apparent.

This is in line with recent outcomes in project EDview. A high satisfaction of experience was found with the theory of PBL and its underlying learning principles: constructive, collaborative, contextual, and self-directed learning. These principles enhance deep learning, motivation for learning, and lifelong learning skills. However, the UM community was less satisfied with PBL in practice. Two recommendations of project EDview were "do consider that you are designing education for a new generation" and "do guide students carefully to become self-directed learners". Concerning the first recommendation, it was also stated that "students have to be carefully supported in building *information literacy*".

In EDview's focus groups, educational experts mentioned that self-direct learning of students need instructions of teachers. This included making students aware of how they can expand their knowledge networks by searching for new knowledge by means of critical discussion and reflection. Furthermore, it was stated that – in light of the information overload – providing direction in searching and reviewing literature would have to be substantial at first and then gradually decrease. However, teachers indicated that they feel a lack of knowledge and skills to adequately guide this process.

In a quick scan, a similar concern was indicated about fixed literature lists in PBL classes (Ferguson, 2017). In the survey, students indicated receiving mostly fixed literature lists and were not encouraged to look for further resources. This means that students lack the opportunity to develop how to effectively search for and critically assess academic information for the discussion within class (Ferguson, 2017). In an earlier paper, Moust, Van Berkel, and Schmidt (2005) argued that some staff members at Maastricht University do not believe that students are able to cover sufficient subject-content through independent learning. Therefore, they try to steer students' learning activities in various ways. However, providing students with specific references can have negative effects on students' self-studying behaviour and students' abilities to become independent learners. Instead, providing students with fewer fixed reading lists and making the search for literature a more integral part of the regular PBL sessions could encourage students to develop creative and critical approaches when faced with complex questions.

Based on these findings, we recommend to design a pilot for Bachelor students in which the use of provided and non-provided literature should be scaffolded (which means gradually reduced over time) in order to stimulate self-direct learning in students. Preferably, this pilot should run in multiple Bachelor programmes in order to account for faculty-specific differences. It is important to note that the search for additional resources should be considered as beneficial to the learning process of students, because it could become confusing if the search for resources is purely based on curiosity (for example, see quote next page). Support for teaching staff is needed to guide this process [see

recommendation 8]. Library teachers should collaborate to help teachers in guiding the students regarding this process. In addition, assessment of information literacy skills is needed [see recommendation 7].

> "While going beyond assigned sources purely out of curiosity and a passion knowing more than what is necessary to pass the exam is a beautiful think. I find so unproductive, because information surrounding a topic is so vast I end up confused and not getting anything out of what I read. (...) To conclude, I do not think it should encouraged students to look at sources outside the assigned materials in preparation for a tutorial. I do appreciate however, when professors provide a list of materials relevant to a field they are teaching, so that students have the option to delve further if they wish to do so."
> **Student response in survey**

Table 1. "I generally only use the sources provided in the course manual to find information about the topic"

	Year of the study programme			
	Year 1	**Year 2**	**Year 3**	**Total**
1.Never	25	18	15	58
2.Sometimes	61	23	56	140
3.About half of the time	33	27	32	92
4.Most of the time	88	78	85	251
5.Always	34	24	33	91
Total	241	170	221	632

Table 2. "I extend my search for sources beyond the sources provided in the course manual in order to gain a wider perspective on the topic"

	Year of the study programme			
	Year 1	**Year 2**	**Year 3**	**Total**
1.Never	15	9	22	46
2.Sometimes	105	83	86	274
3.About half of the time	43	35	31	109
4.Most of the time	57	33	66	156
5.Always	21	10	16	47
Total	241	170	221	632

Table 3. "In my studies, I need to search independently for information on a particular topic"

	Year of the study programme			
	Year 1	**Year 2**	**Year 3**	**Total**
1.Never	6	2	4	12

2.Sometimes	79	44	70	193
3.About half of the time	50	35	49	134
4.Most of the time	76	65	71	212
5.Always	30	24	27	81
Total	241	170	221	632

Table 4. "So far, I have received enough training during my Bachelor's programme to search independently for answers to a specific topc"

	Year of the study programme			
	Year 1	**Year 2**	**Year 3**	**Total**
1.Never	8	4	3	15
2.Sometimes	20	18	19	57
3.About half of the time	46	24	27	97
4.Most of the time	115	78	104	297
5.Always	52	46	68	166
Total	241	170	221	632

Recommendation 2: Diversify the approach to teaching *resource discovery*: make students aware of the difference between (academic) search engines and academic databases and discuss the advantages and disadvantages of each.

The results in the Information-Wise survey show that Bachelor students 'always' use the sources provided in the course manual to prepare a PBL class (see Table 5). The results also show that Bachelor students use Google 'most of the time', while students use databases (e.g. PubMed, Web of Science, PsyclNFO) of the University Library about 'half of the time'.

The use of Google is in line with previous research. One study showed that Chemistry students start with a broad search using Google before searching in scientific databases and more scholarly sources (Shultz & Zemke, 2019). Tests and interviews showed that that students were aware that they need to use other sources, but perceived Google to provide a more convenient search (Shultz & Zemke, 2019).

Resource discovery taught by University Library information specialists mainly focusses on systematic literature searches, following four steps: defining the search, selecting sources, critically evaluating sources, and documenting sources. This limits the complexity of discovering resources, as it fails to explain the iterative process of searching and finding information. In addition, the impact of these workshops is limited as information literacy skills are mainly taught as a discrete skill (Bruce & Hughes, 2010).
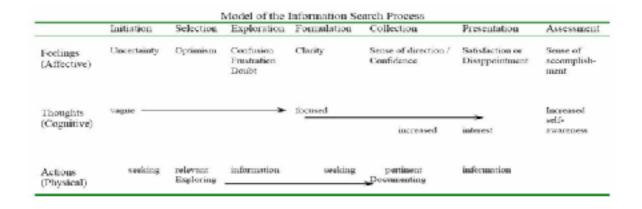
Different search strategies exist, such as backward and forward reference searching. It would be helpful to students to familiarize themselves with several search strategies. In addition, it would be helpful for student to focus on *informed learning* (Maybee, 2018) when discovering resources. One of the principle of informed learning is that it promotes simultaneously learning about disciplinary content and the information using process (Maybee, 2018). This means that it would be helpful to teach resource discovery within the disciplinary context (e.g. economics, law, psychology or engineering).

In addition, many students tend to reach out to peers (friends and fellow students) to discover additional information. Students search for easily digestible and visual information (e.g. YouTube videos or university lectures) to better grasp topics.

"Typically due to limited teaching hours in our short study blocks, some content cannot be discussed in detail. But open courses from renowned universities are good sources for me to learn more in-depth materials. A good example is a computer-science related course (CS 224n) from Stanford"
Student response in survey

Based on these findings, we propose greater focus on resource discovery as a learning process. More specifically, it should be emphasized that resource discovery is an iterative process, which implies going back and forth between the systematic steps of searching (i.e. defining research question and search strategy, selecting sources, evaluating these sources, and documenting the search. One of the models, which could be used, is the Information Search Process (ISP) six stage model of the holistic experience of users in the process of information seeking. This model identifies three realms of experience: affective (feelings), cognitive (thoughts), and the physical (actions) common to each stage (Kuhlthau, 2005). The notion of uncertainty (both affective and cognitive) is central to the model and both increases and decreases in the process of information seeking. Increased uncertainty in the early stages of searching indicates a zone of intervention for teachers.

Model of the Information Search Process

	Initiation	Selection	Exploration	Formulation	Collection	Presentation	Assessment
Feelings (Affective)	Uncertainty	Optimism	Confusion Frustration Doubt	Clarity	Sense of direction / Confidence	Satisfaction or Disappointment	Sense of accomplish-ment
Thoughts (Cognitive)	vague ————————————→			focused ————————————→ increased interest			Increased self-awareness
Actions (Physical)	seeking relevant Exploring		information ——————————→	seeking Documenting	pertinent	information	

Table 5 : Median scores of using sources for preparing a PBL class*				
	Year of study programme			
Sources:	Year 1	Year 2	Year 3	Overall
Sources in course manual (if provided)	5	5	5	5
Google	4	4	4	4
Databases of University Library	3	3	4	3
Google Scholar	2	3	3	3
YouTube	2	2	2	2
Wikipedia	2	2	2	2
Stuvia	1	1	1	1

*5=Always, 4=Most of the time, 3=About half of the time, 2=Sometimes, 1= Never

Recommendation 3: A larger component of *critical assessment of information* should be developed in the bachelor curriculum.

In the Information-Wise survey, students indicated that they critically evaluate the source they read most of the time (*Mdn* = 4, '*Most of the time*'). Students somewhat agree with receiving enough training in the Bachelor programme to critically evaluate resources (*Mdn* = 4 '*Somewhat agree*'). Teaching staff have a different perception, as they indicate that students sometimes critically evaluate the source they read (*Mdn* = 2, '*Sometimes*'). In addition, teaching staff indicates that they generally neither agree nor disagree regarding enough training to critically evaluate resources (*Mdn* = 3).

To follow up on these questions, we asked students with an open-ended text question to indicate which criteria they use in critically evaluating sources. The majority of students tend to look at certain characteristics of the source: author, publication date, type of source (e.g. academic or non-academic). Some students indicate the methodology within the paper (e.g. sample size, research methods, type of research), while others evaluate the citations used by the author and whether these provide similar or opposing findings. Also *relevance* was sometimes mentioned as criteria to evaluate sources. However, it was often unclear what students meant with specific criteria, such as *credibility, reliability, relevance,* and *quality of information*. For example, some students provided an elaborate answer and indicated *relevance to the assignment* as criteria to evaluate a source.

Although students in general provide some criteria to evaluate sources, no systematic evaluation criteria were mentioned, for example using tools like the CRAAP test, which evaluates sources based on Currency, Relevance, Authority, Accuracy, and Purpose (Blakeslee, 2004). The CRAAP test could be a useful tool to critically evaluate academic resources. The Four Moves and a Habit approach could be useful for online resources. This test uses 4 moves (i.e. check for previous work, go upstream to the source, read laterally, and circle back) and a habit (i.e. check your emotions when reading a source). In addition, it was unclear whether students used critical appraisal skills. This was also supported by the guerrilla interviews.

> However, when prompted, they usually explained their implicit reasoning:
>
> A: „*Okay, but do you look at the author or journal?*"
>
> I: „*No.*"
>
> A: „*So you don't check for these things?*"
>
> I: „*No, I trust the course coordinator*"
>
> **Student response in guerrilla interview**

In the EDview project, many participants felt that the PBL approach contributed to students' independency, critical thinking, problem solving skills, communication and research skills. Developing critical thinking skills is an integral part of PBL (Czabanowska, Moust, Meijer, Schroder-Back, & Roebertsen, 2012). For instance, when students define learning goals, they have to collaborate and think about specific goals to find relevant information. During self-study, they should evaluate the validity and relevance of the information found, incorporate the information into their existing knowledge base, and understand which knowledge was lacking.

Based on these findings, we recommend to develop a larger component of *critical assessment of information* in the bachelor curriculum of Maastricht University. The rational should be clear to students why to critically evaluate different types of information according to their information need. In addition, students should be aware of their own cognitive biases in dealing with information (e.g confirmation bias). Specific tools, such as the CRAAP test or the Four Moves and a Habit test, could be helpful to critically evaluate both academic and non-academic information (Lewis, 2018).

Recommendation 4: Teach students in *organizing information*. Tools (e.g. reference managers) could be used to develop this skill. Educating specific tools should not be a goal in itself, but a means in enhancing skills to organize information.

It is important to create awareness for the student that organizing information supports their learning process. More specifically, it is important to show students the rationale of organizing information and to guide students in how to organize information. Why should students organize their information? Why should students use specific tools for doing it appropriately? In that way, students' attitude could change to valuing the skills, time, and effort needed towards organizing information. In addition, they will be able to store and organize information sources systematically using, if necessary, any digital tools such as reference management tools.

In the Information-Wise survey, students indicated a low use of reference management tools. Most students indicated never using a reference manager (for example EndNote, Mendeley, Zotero) to organize information (*Mdn* = 1, 'Never').

However, most Bachelor students indicated having some difficulty to reference properly in their own paper (*Mdn* = 2, 'Sometimes'). This suggests that students find other ways to reference within their assignments.

These results are in line with previous research showing that 31% of Bachelor student respondents used bibliographic management software. (Ferguson, 2017). More than half of these students used EndNote followed by Mendeley and Zotero. In addition, Bachelor students at the UM reported using generic online tool to create references and subsequently import these manually (Ferguson, 2017).

The University Library provides introductory and advanced training in EndNote and provides full support for this specific reference management tool. In addition, an online module 'Managing your citations and references' was developed for students to gain an understanding of reference management. However, the effect and visibility of these trainings and the online module seem limited based on the use of these tools.

Specific instructions should foster the self-directed learning process. Students should be provided with the opportunity to choose which tools (e.g. reference management tool or other tools) suits best for their specific discipline in organizing information. In addition, the benefits of using a reference manager should be made clear at the start of the Bachelor programme. For example, it could be embedded into a course structure: organize the literature in a way that students understand the importance of organizing information. Resources within a Bachelor course could be managed within a reference manager. In that way, students learn how resources as part of specific tasks are connected to other tasks within the course and how the course coordinator organized the literature as part of the instructional design of the course.

Table 1. "I use a reference manager (for example EndNote, Mendeley, Zotero) to organize information"

	Year of the study programme			
	Year 1	Year 2	Year 3	Total
1.Never	134	98	103	335
2.Sometimes	36	29	38	103
3.About half of the time	13	11	18	42
4.Most of the time	19	22	24	65
5.Always	39	10	38	87
Total	241	170	221	632

Table 2. "I find it difficult to reference properly in my own paper"

| | Year of the study programme | | | |
	Year 1	Year 2	Year 3	Total
1.Never	44	53	68	165
2.Sometimes	120	72	113	305
3.About half of the time	43	20	22	85
4.Most of the time	24	15	12	51
5.Always	10	10	6	26
Total	241	170	221	632

Recommendation 5: Scaffold information literacy activities that support students in the creation of (academic) output

In the Information-Wise survey, Bachelor students showed quite some confidence regarding the formulation of a research question (Mdn = 4 , 'Somewhat agree'). The results were mixed regarding whether they knew how to get started with a writing assignment (Mdn = 3, 'Neither agree, nor disagree'). Students felt that they received enough training in writing assignments (Mdn = 4, 'Somewhat agree'). Faculty teachers provided different answers. They did not agree, nor disagree regarding the confidence of students to formulate a research question based on conflicting information in the literature (*Mdn* = 3, 'Neither agree, nor disagree'). In addition, faculty teachers were mixed in whether Bachelor students received enough training to effectively write the kinds of assignments they are required to write (*Mdn* = 3.5, 'Between somewhat agree and neither agree, nor disagree). These results suggest that students might overestimate their ability to formulate a research question and their ability to create (academic) output (e.g. in a writing assignment).

In the answers to the open questions, a smaller (but substantial) group of students indicate that they just start writing the assignment, which appears less systematic. Some respondents even describe severe struggles with research assignments:

> *"I find it hard to come up with a research question when I do not know if I will be able to answer it. (…) Arguing for the relevance of my research is also hard because if something is truly relevant, someone else must have done it before which makes my research irrelevant. I always ask myself the question: Why should I, as a second year bachelor student find out something that has not been discovered yet and is also relevant and useful?"*
> **Student response in survey**

Given that first year students lack research experience and might feel insecure (or overconfident) it is important to provide sufficient guidance for students to master such difficult and complex tasks (e.g. creating a research question, writing a research outline). Breaking down the task into smaller parts that help students begin exploring possible ways to narrow their focus (e.g. finding keywords) likely reduces the cognitive overload of students. This process of reducing support as learners acquire more expertise is called scaffolding. The effectiveness of scaffolding to teach complex skills is indicated by instructional design research (Wopereis, Frerejean, & Brand-Gruwel, 2015) and internal documents at UM (PBL and Research Skills at Maastricht University, 2017). Additional support for such an approach comes back in the answers to the open questions of the survey:

> *"It usually help when the course requires you to provide an outline to your tutor a bit in advance, so then I already start thinking about my paper earlier."*
> **Student response in survey**

Most teachers report 'not knowing how students prepare for a writing assignment'. If they responded to this open, not mandatory question in the survey, they usually do so in terms of problems. They observed that students do not plan, cannot formulate a good research question, feel unprepared and in need of more guidance, or are unable to synthesize different pieces of information. Some blame it on the lack of proper training for students in this domain. This has been reflected in the guerrilla interviews, where students admitted to not having any specific approach to creating and presenting information (they are rather spontaneous or their approach is implicit). Including additional instructions for a writing assignment that also cover information literacy would support students in the process and increase transparency.

Considering the findings above, we suggest a pilot project that will design information literacy tasks (e.g. defining keywords) that slowly build up in complexity (e.g. writing a full research question). Supportive information (e.g. giving examples of well-written or badly written research questions) should be embedded and ideally be developmental over the course of 7-weeks. In addition, right-in-time feedback is provided and offers just-in-time skills training to equip students for the learning challenge of dealing with information.

Recommendation 6: Teach students how to create and communicate information in a variety of formats (from blogs to academic paper) on multiple digital platforms (e.g. LinkedIn, Facebook)

What becomes apparent through the survey is that students often perceive themselves as consumers of information instead of creators. The results of the survey supported the concerns that students take a rather passive role by using the provided resources in PBL classes. Students indicated to generally only use the sources provided in the course manual to find information about a topic (Mdn = 4 'Most of the time').

Students indicate to use online discussion forums, videos, Wikipedia, and other social media channels for accessing, assessing, and sharing sources. This is in line with the findings of Ferguson (2017) who argues that writing and communication competences should be nurtured by discussing online (research) contributions both online and offline. The EDview results reminded us to design education for a new generation and stressed that increasing quality of online open access material raises the question of how we can optimally design education. In an academic environment, it is logical that students have to learn and practice critical thinking and writing academically sound. Letting them mainly write academic papers, however, does not match the possibilities and accessibility of digital media.

In fact, universities could take blogging and social media-connected academic communication (more) seriously (Green, 2015). Existing approach at UM (e.g. Wikimedia, using videos in education) can be seen as good practices in this regard. Wikipedia is a suitable platform to actively create content while making it accessible for a larger audience. Students should be taught the benefits and disadvantages of these platforms. Other approaches to transmit information (such as videos, or blogs) could be implemented on a larger scale. In some courses, videos and Wikipedia are already integrated. The University Library offers trainings on how to make use of videos in the classroom. Combining large research projects, or even thesis with active blogging or vlogging could enrich the diversity of educational practices.

To reflect on their learned content, students could engage in forum discussions, in which the tutor posts prompting questions to retrieve the information learned. A study by Bye, Smith, and Rallis (2009) showed that students reflection in a forum discussion had a greater effect on their study outcomes than offline reflection. Creating digital content (e.g. writing blog posts) help students to move away from only seeing themselves as digital information consumers towards engaging in the activity of digital information creation (Meyers, Erickson, & Small, 2013).

Based on these observations, we propose to teach students how to create and communicate information in a variety of formats (from blogs to academic papers) on multiple digital platforms (e.g. LinkedIn, Facebook?). The UM could also create an own digital platform on which students could write a blog post about their Bachelor or Master thesis or create an open journal (as UCM did). The positive effect of this platform could be that students learn more about the outreach of research and reaching a wider audience (both academic and non-academics).

Recommendation 7: Design a Bachelor pilot to measure *informed learning* with an authentic assessment component within the disciplinary context.

One of the limitations of administering a survey is that it only measures the perception of students or teachers, while it does not measure learning, behavior or long-term effect (Erlinger, 2018) The survey provides no evidence of actual attitude or behavioral changes in learning how to deal with information. In addition, the effects of library workshops are mainly evaluated by surveys, providing only a perception of students about the effectiveness of these workshops. Again, these surveys give limited insights into any attitude or behavioral changes in dealing with information.

   Therefore, we advise to design a Bachelor pilot to measure informed learning with an authentic assessment component within the disciplinary context. The concept of informed learning in a PBL environment was described in a narrative review (Jongen, Pichel, Vernimmen, & Hospers, 2019). Informed learning addresses the situated and critical nature of information during the learning process as compared to the traditional approach of teaching information literacy as a discrete skill (Bruce & Hughes, 2010). The functional approach to information literacy assumes that students will be able to apply information skills within various learning settings. The situated approach emphasized the role of information specific context (e.g. disciplinary or professional setting), while the critical approach aims to increase the awareness of students of the social and political aspects of producing and using information (Lupton & Bruce, 2010).   While the functional approach is most often used in higher education, it does not account for the situated and critical approach (Maybee, 2018).

   After applying the concept of informed learning, it is important to assess attitude and behavior changes of students. As surveys only measure the perception of students, authentic assessments are needed to measure actual behavioral changes in students when dealing with information within the disciplinary context (Gunasekara & Gerts, 2017). Authentic assessment has a high validity of measuring behavioral changes and can be aligned with existing intended learning outcomes, and fosters student's motivation and engagement. In this way, the UM ensures that students are actually learning the skills and knowledge about information for their future careers. The UM framework and rubric help in determining to constructively align intended learning outcomes with assessment.

Recommendation 8: Add information literacy training in the teacher professional development programmes and training in teaching in library professional development programmes

Several teachers indicated that they would like to receive more training in how to teach information literacy. This is in accordance with results from EDview, showing that teaching staff feel a lack of knowledge and skills to adequately guide providing directions in searching and reviewing literature. This was stated in the light of information overload.

In the survey, it was indicated by faculty teachers that they are in need of time, more training, and support (e.g. incorporating information literacy in teaching activities). In addition, they indicated that they would like to have knowledge sharing activities with colleagues, having students with some background in informational literacy, and having the opportunity to have a group of students for longer periods of time to better monitor their progress. Several teachers also indicated that they are in need of autonomy to teach information literacy.

In addition, some concerns were raised about the trends in education and how these impact skills training.

Information literacy is a tremendous problem, including for so-called "digital natives". Finding, evaluating, and identifying information that is reliable (as opposed to just any information) is a challenge for many students.

However, information literacy is problematic in another way, which in my experience is completely overlooked in all discussions relating to skills at UM / teaching innovation / (skills) didactics / curriculum development. [It is] the ability of students to extract information from longer text, especially where this information is complex and requires longer continuous trains of thought (in German we call it "sinnentnehmendes Lesen"), is decreasing by the year. All tutors I know are reporting this, and I am sure the phenomenon is measurable. I assume that its causes are connected to the transformation of how information is consumed by school-age kids; reading is simply not as crucial a skill anymore for a young person as it used to be.

BUT: this skills remains vital in many of the fields of work we educate for, certainly including mine, law. The skill of "sinnentnehmend" reading is absolutely essential (next to others), and if students no longer bring it with them when they enter, we must include it in our skills education. The problem is, however, that it contradicts all "trends" in skills education. It is the opposite of short video clips, gamification, and edutainment. It is NOT a 21st century skill but a 17th century one! But an important one that cannot be missed.

So please mind this in any attempt to modernize or improve skills education at UM.

Teacher response in survey

Currently, a teacher professionalization programme is already being implemented for academic librarians at the UM. In this programme, academic librarians are familiarized with several of the main competences of the University Teaching Qualification: instructional design, teaching delivery, assessment, and knowledge, vision and skills related to teaching.

In addition, as a pilot, a Continuing Professional Development (CPD) workshop will be provided for faculty teachers to discuss and reflect on information literacy skills. In this 2-hour workshop, questions will be addressed such as *what do we consider information literacy as part of problem based learning and what is our university's vision on this topic? How do effective teaching instructions of information literacy look like?* More specifically, teachers will learn about the theory of information literacy and its connection to problem based learning. Teachers will be introduced to informed learning and the landscape of information. From there we will dive into their teaching experiences with information literacy. *How do you see your students applying these competences? What kind of education would facilitate them to further improve these skills?* The newly developed UM information literacy framework and rubric will be used to design information literacy teaching activities and assessments.

5. Pilots

The newly developed framework formulates a UM-wide benchmark and vision on information literacy education. This framework entails four pillars i.e. *Resource discovery*, *Critical Assessment*, *Organization*, and *Creation and Communication*. Furthermore, the Information-Wise team designed a rubric that builds on these four pillars of the framework to clarify what students are supposed to learn as regards information literacy in the course of their academic journey. The rubric consists of four stages (Novice, Intermediate, Competent, Advanced) which describe the level of skills and attitudes a student possesses at a given stage. For each level and framework dimension, multiple intended learning outcomes have been developed which describe what students will be able to do as a result of certain learning activities. The survey results and recommendations indicate challenges of bachelor students regarding their information literacy skills and put forward the types and formats of pilots that are needed to support students. Following the constructive alignment approach, the Information-Wise project team will run generic- and discipline-specific cases that are based on the intended learning outcomes of the rubric, and the recommendations of the survey, and pilot them in selected programmes and courses in the Academic Year 19'20.

We will apply the rapid prototyping approach to design, implement, and evaluate the generic- and discipline specific learning modules. It is a non-linear approach which allows for more instructional flexibility. It can catch problems early in the development stages as learners are able to offer immediate feedback and thereby ensure to achieve a instructional solution that meets their needs. It reduces development time and costs by:

- Using working models early in a project to eliminate time-consuming revisions later on.
- Completing design tasks at the same time, rather than sequentially, throughout the project. (Camm, 2012; Jones & Richey, 2000)

Analyze: The design of the pilots is informed by the insights we gained from the previous research (literature reviews, quick scan) and the recent survey and guerilla interviews. More specifically, we gained a better understanding on the challenges that students face when dealing with information during their studies. Based on the 8 recommendations, we pilot and evaluate instructional interventions that support students and teaching staff to deal with these challenges. These interventions will be informed by evidence-based pedagogical approaches (e.g. constructive alignment) to ensure the application of proven concepts to improve students' information literacy skills. At the same time, we will conduct a few pilots which contain more high-risk experimental elements (e.g. digital detox, and student project to design instructional materials).

Design Phase & Development Phase: This phase starts with a development and exploration of assumption, leading to propositions of how the learning modules will affect students' information literacy skills in the selected pilot courses. In this phase, new materials (e.g. assessments, online tutorials) will be developed in close cooperation with the Information-Wise project members and pilot participants.

Pilot Phase: In this phase, we are testing the pilots in the context of a real classroom and under realistic conditions (e.g. students write a research paper). A mantra of the project is to design education that matters for students. This is why we decided to involve also students in the design and implementation of particular pilots. To ensure representative pilot phases, we will involve a mix of students and teaching staff, and pilot within at least four out of UM's six faculties. The pilots intend to translate all four UM information literacy framework dimensions into faculty courses. In this stage, information specialists collaborate closely with the respective course coordinators to facilitate the pilot implementation.

Evaluation Phase: The Evaluation phase will test the outcomes based on the assumptions we made. This will yield results about the effectiveness of such learning interventions in a course setting. The evaluation phase will lead to improvements of the instructional material and will be used to scale up these learning interventions within the UM community. In the evaluation phase, we will need to work closely with both teachers and students, and gain in-depth insights into their experience. We therefore

will use a mixed method approach using qualitative (e.g. interviews, focus groups) and qualitative (e.g. pre-and posttest) measurements to collect data about the students' learning experience. The collected data should give us indication of how the pilots affected students' knowledge, ability, and attitude towards information literacy. This will allow us to fully grasp the impact of our pilots on the learning of the students and teachers.

Scaling and Sustaining Change: In this phase, the evaluation and experiences with the pilots will be communicated and shared with a broader audience. The instructional materials which were developed for the pilots will be made available for the UM community and can be re-used. In the near future, such material will be also embedded within the Canvas learning environment. The exact planning for the sustainable implementation will be made in close cooperation with the SGEI+ group, related UM projects (e.g. EDview) and other relevant UM stakeholders (Information-Wise Project team, EDLAB, Educational Policy Officers, University Library, programme coordinators etc.).

Sample of Current Pilots (Phase 1)
The first pilot phase is scheduled from August-December 2019. Between December 2019 - February 2020, we will test the pilot's impact on students' learning by collecting both quantitative and qualitative data. The data should provide indication about the effect of these pilots on students' knowledge, ability, and attitude towards information literacy. In addition, we would like to learn from teachers' perspective on whether the piloted learning interventions improved students' information literacy skills. The dissemination of these results and specific action plan for upscaling will be further outlined in the marketing & communication plan (work in progress).

Information-Wise pilots | 2019/2020 Block 1 and 2

ACTIVITY	Learning diaries	Hackathon	Workshops/writing & referencing	Submitted lecture & Assessment Rubric	Online tutorial Critical Assessment	Applying the CRAAP test	Digital escape room
Faculty, course, year	FHML, Antropogenese en Gezondheid, BA YEAR 1	FPN, Social Behaviour, BA YEAR 1	FHML, Skills for writing a Critical Paper, BA YEAR 1	FHS (UCM), Academic Skills 1, BA TASK 1	FHS, LAW, FASoS & FPN, BA YEAR 1	SBE, FHS, Physical Economics, MA YEAR 1	SBE, Conflict in a second, LM Well-being, AFTER
Resource discovery	X	X	X				
Critical assessment	X			X	X	X	
Organizing information	X		X				
Creation & communication							X
Locate resources efficiently	X						
Define the research question		X	X				
Information search process				X	X	X	
Recognize information types and references			X				
Ethical reuse & creation & communicating	X						
Transport various formats							X
Process information	X					X	
Schedule in PF							

5.1. Reflective Learning Diaries

Linked to: Recommendation 5: Scaffold Information literacy activities that support students in the creation of (academic) output

Linked to Recommendation 7: Design a Bachelor pilot to measure informed learning with an authentic assessment component within the disciplinary context

Faculty: *FHML*
Bachelor programme: *Health Sciences / Gezondheidswetenschappen*
Course: *Bedreigingen van Gezondheid*
Year: 1
Framework Dimension: *Resource Discovery, Critical Assessment, Organizing Information*

Rubric ILOs:
The student will…
- *Identify a range of tools and techniques for managing and exporting references (e.g. EndNotes, Mendeley).(Manage, Novice)*
- *Recalls proper attribution and citation (e.g. use of citations and references; choice of paraphrasing, summary, or quoting etc.) (Present, Novice)*
- *Identify at least 2 sources appropriate to the (information) needs of the search (Identify & Plan, Novice).*
- *Carries out a subject search within multiple databases or platforms to find unfamiliar sources (Search, Intermediate).*

- *Identify critical appraisal skills (e.g. judgements on reliability) and tools (e.g. CRAAP test) to select these 2 (or more) sources (Evaluate, Novice).*
- *Recalls proper attribution and citation (e.g. use of citations and references; choice of paraphrasing, summary, or quoting etc.) (Present, Novice).*

Given that first year students lack research experience and might feel insecure (or overconfident) it is important to provide sufficient guidance for students to master such difficult and complex tasks (e.g. creating a research question, writing a research outline). Breaking down the task into smaller parts that help students begin exploring possible ways to narrow their focus (e.g. finding keywords) likely reduces the cognitive overload of students. This process of diminishing support as learners acquire more expertise is called scaffolding.

In this pilot, we let students engage into reflective prompts to put their learnings from the library workshops (systematic searching and EndNote) and assignments into personal perspective. Reflective learning diaries - sometimes called 'learning journals' or 'learning logs' – are personal records about a person's experiences of learning. The students will do 3 diary entries (Week 3-5) answering a set of reflective questions related to their search, evaluation, and organization of sources. In addition, students will perform a pre- and post-test in Week 2 and Week 6. We hypothesized that by employing a reflective diary, students become more critical towards the information they use and will select appropriate sources based on their information need. Overall, this longitudinal approach to information literacy matches recommendation 5 *"Scaffold Information literacy activities that support students in the creation of (academic) output",* since the process of writing a research paper is facilitated by weekly reflection moments and supportive information.

week	voorbereiding	Zelfstudie	Les / activiteit
1	Lees deze handleiding goed door		Introductie college
2	Maken online training en opdrachten (zie par.2.1)	**Reflectie week 2 (Zie assignments StudentPortal)**	Training: systematisch literatuur zoeken
3		**Lezen artikelen, zoeken Reflectie week 3 (Zie assignments StudentPortal)**	Artikel Duvivier in owg
4	Maken online training en opdrachten (zie par.2.1)	**Maak eerste opzet Reflectie week 4 (Zie assignments StudentPortal)**	Training: EndNote
5	Plagiaat training online volgen (zie par 2.3)	**Lezen en schrijven; eerste opzet af Reflectie week 5 (Zie assignments StudentPortal)**	
6		**Opzet verbeteren Reflectie week 6 (Zie assignments StudentPortal)**	
7		**Opzet verbeteren, laatste check**	Inleveren opdracht

Assessment of pilot effectiveness:
Hypothesis: We hypothesize that students become more critical and reflective towards the information they will search for, select, and organize based on their information need.

We are going to test this hypothesis following three steps:
1. First, we will take a random sample (N=25) out of the learning diaries

2. We will interview tutors/mentors whether they experienced a change in students approach to search and select sources
3. We will ask students to perform a pre- and post-test. We will administer a combination of multiple choice questions and open questions, embedded in an authentic assignment.

5.2. Bullshit lectures

Linked to: Recommendation 2: A larger component of critical assessment of information should be developed in the bachelor curriculum.

Faculty: *FSE*
Bachelor Programme: *University College Maastricht*
Course: *Introduction to Academic Skills II,*
Year: *1*
Framework dimension: *Critical Assessment*

Rubric ILOs:
1) The student is able to identify critical appraisal skills (e.g. judgements on reliability) and tools (e.g. CRAAP test) to select sources *(Evaluate, Novice)*.
2) Describes different types of authority (subject expertise, societal position, special experience) *(Evaluate, Novice)*.
3) Describes own and author's biases regarding information (e.g. filter bubbles, confirmation bias) *(Critical Thinking, Novice)*.

Three lectures were provided on the topic *bullshit: how to be critical in a post-truth era* to first year UCM students. The students were introduced to the difference between misinformation and disinformation and practiced their skills to detect bullshit, produced by academic and non-academic sources. Students also learned about several biases that affect our perception on daily news, media, and other sources.
- The course coordinator added a tutorial assignment in which students have to critically assess (including critical reading) an academic paper which encompasses severe flaws.
- The course coordinators added a section on critical assessment to the existing evaluation rubric for the group paper assignment.

Assessment of pilot effectiveness:
- The learning effect of the lecture and assignment will be tested later in a group writing assignment where students have to submit an extended research paper outline. We added critical assessment criteria to the existing rubric.
- We will organize a short interview with the course coordinators, and optional with some tutors, to identify their perceived benefits or pitfalls of the pilot.

5.3. Online tutorial about critical assessment of information

Linked to: Recommendation 2: A larger component of critical assessment of information should be developed in the bachelor curriculum.

Faculty: *FSE*
Bachelor Programme: *Maastricht Science Programme*
Course: Practical 1002
Year: *1*
Framework dimension: *Critical Assessment*

The online module takes approximately two hours and is setup in an interactive way, switching between theory (readings and videos) and short assignments. Students receive the link to the module via EleUM by their course coordinator.

After going through the online module, it will be discussed with their tutor and peers.

Rubric ILOs:

The student...

Evaluation
1. ...summarizes the appropriateness of selected sources based on the information need and the context in which the information will be used *(Evaluation, Intermediate)*
2. ...uses critical appraisal skills (e.g. judgements on reliability) and tools (e.g. CRAAP test) to select sources *(Evaluation, Intermediate)*.
3. ...explains different types of authority (subject expertise, societal position, special experience) *(Evaluation, Intermediate)*.
4. ...explains the influence of authority, purpose, and accuracy on the quality of the source *(Evaluation, Intermediate)*.

Critical Thinking

1. ...uses appropriate criteria to outline the instances of online tools for their relevance to the study context *(Critical Thinking, Intermediate)*.
2. ...clarifies own biases and author's biases regarding information (e.g. filter bubbles, own point of view) *(Critical Thinking, Intermediate)*.
3. ...recognizes contradictory claims by evaluation and/or synthesis.
4. ...uses evidence to support argumentation *(Critical Thinking, Intermediate)*.

Assessment of pilot effectiveness:
- At the end of the online module, students will have to fill in a set of closed and open questions linking to the content and learning experience within the online module.
- At the end of this course, students have to give a presentation in which they will have to reflect on the authority, purpose, and accuracy of at least three sources and its effects on the quality of these sources. Students are also asked to outline possible biases that might affect their own and the author's perspective.

5.4. CRAAP-test & authentic assessment

Linked to: Recommendation 2: A larger component of critical assessment of information should be developed in the bachelor curriculum.

Linked to Recommendation 7: Design a Bachelor pilot to measure informed learning with an authentic assessment component within the disciplinary context.

Faculty: *SBE*
Bachelor Programme: *Fiscal Economics*
Course: *Introduction to Fiscal Economics*
Year: *1*
Framework dimension: *Critical Assessment, Resource Discovery*

Rubric ILOs:

Students…
- create a basic understanding/awareness about the different qualities and relevancies of sources.
- identify critical appraisal skills (e.g. judgements on reliability) and tools (e.g. CRAAP test) to select sources (Evaluate, Novice)

- At the last tutorial meeting, students receive an assignment to employ the CRAAP test to evaluate recommended academic sources that were part of the course manual. The student's task is to evaluate these texts using the CRAAP test. Before attempting this task, the student is asked to read about the CRAAP test using this link: https://tutorials.library.maastrichtuniversity.nl/find-research-information/page176164.html. Evaluate the texts given below, using all letters in the acronym "CRAAP".
- The course coordinators included an authentic assessment in the exam to test students' ability to evaluate sources. This authentic assignment ask students to imagine that they are preparing an in-class presentation on the potential regressive nature of sales taxes.

Assessment of pilot effectiveness:
- *Students' performance regarding the authentic assessment will be discussed with the course coordinators*
- Two pilot-related question were added to the student evaluation:
  - I found it useful to evaluate the academic value of the learning materials using "the CRAAP test".
  - After evaluating the literature, I am better aware of the varying usefulness of different (academic) resources.

5.5. New workshop: Finding & Referencing

Linked to Recommendation 2: Diversify the approach to teaching resource discovery: make students aware of the difference between (academic) search engines and academic databases and discuss the advantages and disadvantages of each.

Linked to Recommendation 4: Teach students in organizing information. Tools (e.g. reference management tools) could be used to develop this skill. Educating specific tools should not be a goal in itself, but a means in enhancing skills to organize information

Faculty: *FPN*
Bachelor Programme: *Psychology*
Course: *Skills IV: Critical review*
Year: 2
Framework dimension: *Resource Discovery, Organizing information*

Rubric ILOs:
- Students select multiple databases (PubMed, PsycINFO, Web of Science, Google Scholar) that somewhat relate to selected concepts or (research) questions
- Students carry out a subject search within databases or platforms to find unfamiliar sources
- Students use EndNote for managing and exporting references
- Students give credit to the ideas of others through proper attribution and citation (e.g. use of citations and references; choice of paraphrasing, summary, or quoting etc.).

During this 2-hour workshop, 2nd year Bachelor students of FPN practice with resource discovery regarding their Skills IV topic. They are required to use a database of their choice (e.g. PsycINFO, PubMed, Web of Science or Google Scholar) to systematically search for academic papers.

As a preparation, students ran through an online module regarding *managing references and citations*. During the second part of the workshop, students practice with exporting the resources from the external databases into EndNote. Finally, students will use CiteWhileYouWrite (an EndNote plug-in in Word) to add in-text citations and a reference list to a mock-up word document in order to practice referencing.

Assessment of pilot effectiveness:
At the end of the Skills IV course, we will send a short questionnaire to students to what extent the workshop helped in writing their individual academic paper. We will ask both quantitative and qualitative questions regarding resource discovery (systematic searching) and organizing information (use of EndNote). In addition, we will try to arrange a student focus group to elaborate on the questionnaire analyses (to be discussed with course coordinator).

5.6. Workshop Continuing Professional Development (CPD)

Title of Workshop: Information-wise: Designing instructions to educate informed learners

Linked to Recommendation 8: Add information literacy training in the teacher professional development programmes and training in teaching in library professional development programmes

Faculty: all teachers (who have a BKO certificate), if free spots available, junior teachers (without a BKO certificate) are encouraged to join
Bachelor Programme: all
Course: all
Year: Bachelor year 1, 2, 3
Framework dimension: *Resource Discovery, Critical Assessment, Organizing Information, Creation & Communication*

ILOs:
You will gain an understanding of the link between information and learning
You will gain an understanding of the UM information literacy framework
You will be able to translate the framework into relevant teaching activities and assessments

Introduction
Information is everywhere around us: from (digital) books and articles to social media notifications and videos. Students should be able to deal effectively and critically with the information jungle to thrive in our problem based learning (or project centred learning) setting at UM. When researching for and writing paper assignments, as well as preparing and studying for classes, students independently find, evaluate, use, and present information – in other words apply information literacy skills. As an university our role is to guide and train students in information skills throughout their academic journey.

Workshop
In this 2-hour workshop, we will address questions such as what do we consider information literacy as part of problem based learning and what is our university's vision on this topic? How do effective teaching instructions of information literacy look like? More specifically, you will learn about the theory of information literacy and its connection to problem based learning. You will be introduced to informed learning and the landscape of information. From there we are going straight into your teaching experiences with information literacy. How do you see your students applying these competences? What kind of education would facilitate them to further improve these skills? We will work with the newly developed UM information literacy framework and rubric to design information literacy teaching activities and assessments.

Assessment of pilot effectiveness
We will administer a short survey which will be filled out by the workshop participants. We will ask about their general feedback on the workshop structure, content, and delivery as well as more specifically about their perception on providing more structural support for teaching information literacy.

Future Pilots (2 Pilot Phase)

The second pilot phase will start as from January 2020. The upcoming Information-Wise project meeting takes place on January 23rd and will be dedicated to the sharing of current pilot activities and recruitment of pilots in the upcoming year. We are going to present the recommendations from WP1, which indicate the direction and content of these pilots, and propose an action plan for pilot phase 2. Project members are held accountable to spread the potential interventions amongst their colleagues and recruit prospective pilot participants in their faculties. Learning interventions (e.g. critical assessment online tutorial, bullshit lectures) that have been developed as part of pilot phase 1 can be further improved in pilot phase 2 by testing them in different contexts (different bachelor years) and faculties.

6. Closing

The mid-term report summarized the initial outcomes from the WP1 research phase, and WP2 educational development phase. Results are, amongst others, I) a visualized UM framework for information literacy, II) a developmental rubric including a set of ILOs, III) an in-depth understanding of the issues students face regarding their information literacy skills from both a student and teaching staff perspective, and IV) evidence-based recommendations for future information literacy education (including pilot interventions) at UM.

As indicated in the visualized timeline below, the following project activities will take place in the upcoming project phase:

- Visualizing WP1 results and recommendations
- Evaluating effectiveness of pilots from phase 1
- Recruitment and delivery of pilots in phase 2
- The delivery of a rubric "how to" manual
- Re-design (online) curriculum for information literacy skills
  - Including a wide range of generic- and discipline-specific online modules
- Delivery of a blueprint for teaching staff professionalization
- Communication & Marketing plan to raise awareness and activate the UM community to make use of the designed instructional materials
- Present initial project outcomes on national and international conferences to stimulate exchange and partnership
- Final project report and position paper

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8. Appendix:

a) Selection Matrix

FRAMEWORK TITLE:					
Criteria	1 – Benchmark	2 - Milestone	3 - Milestone	4 - Capstone	Points
General (25%)					
Perspective on Information literacy (IL)	Does not take a holistic perspective on IL and excludes other literacies (e.g. digital and data literacy)	Takes a holistic perspective on IL and excludes other literacies (e.g. digital and data literacy)	Does take a holistic perspective on IL and includes other literacies (e.g. digital and data literacy)	Does take a holistic perspective on IL and includes other literacies (e.g. digital and data literacy) and views the political, economic and educational dimension of IL	
Didactical language	Does not match with the language of teaching staff (educational and didactical perspective)	Partially matches with the language of teaching staff (educational and didactical perspective)	Matches with the language of teaching staff (educational and didactical perspective)	Matches fully with the language of teaching staff (educational and didactical perspective)	
IL as part of learning	Does not regard information literacy as part of the learning process	Partially regards information literacy as part of the learning process	Regards IL as part of the learning process	Views IL and learning as intertwined	
PBL (15%)					
Contextual	Framework concepts are not translatable to real life context	Framework concepts are partially translatable to real life context	Framework concepts are translatable to real-life context	Framework concepts include effective real-life examples that are easily adaptable	
Constructional	Framework does not invite students to co-construct knowledge and share ideas and knowledge'	Framework provides limited space for students to co-construct knowledge and share ideas and knowledge	Framework invites students to co-construct knowledge and share ideas and knowledge	Framework invites students and educational staff to co-construct knowledge and share ideas and knowledge	
Collaborative	The framework does not different stakeholder to collaborate and create information literacy education that is based on the idea and vision of the framework	The framework considers different stakeholder to collaborate and create information literacy education that is based on the idea and vision of the framework	The framework invites different stakeholders to collaborate and create information literacy education that is based on the idea and vision of the framework	The framework gives guidance how to collaborate with different stakeholders and create information literacy education that is based on the idea and vision of the framework	
Self-directed	Provides exhaustive teaching-centred material	Framework indirectly promotes self-directed learning skills for students	Framework promotes self-directed learning skills for students	Students' self-directed learning skills stand at the core of the framework	

CONTENT (20%)					
Determining Information Need	Not included	Mentioned as a possible intended learning outcome	Clearly defined as intended learning outcome	Clearly defined as intended learning outcome and offers supportive material	
Accessing Information	Not included	Mentioned as a possible intended learning outcome	Clearly defined as intended learning outcome	Clearly defined as intended learning outcome and offers supportive material	
Processing Information	Not included	Mentioned as a possible intended learning outcome	Clearly defined as intended learning outcome	Clearly defined as intended learning outcome and offers supportive material	
Evaluating Information	Not included	Mentioned as a possible intended learning outcome	Clearly defined as intended learning outcome	Clearly defined as intended learning outcome and offers supportive material	
Presenting Information	Not included	Mentioned as a possible intended learning outcome	Clearly defined as intended learning outcome	Clearly defined as intended learning outcome and offers supportive material	
SUPPORT (20%)					
Didactical means	Does not support didactical means (e.g. constructive alignment: assessments, teaching and learning activities, intended learning outcomes etc.) to teach information literacy education	Limited support of didactical means (e.g. constructive alignment: assessments, teaching and learning activities, intended learning outcomes etc.) to teach information literacy education	Supports variety of didactical means (e.g. constructive alignment: assessments, teaching and learning activities, intended learning outcomes etc.) to teach information literacy education	Supports variety and discipline-specific didactical means (e.g. constructive alignment: assessments, teaching and learning activities, intended learning outcomes etc.) to teach information literacy education	
Empirical Evidence	No empirical evidence for the effectivity and educational value of the framework	Some empirical evidence for the effectivity and educational value of the framework	Sufficient empirical evidence for the effectivity and educational value of the framework	Numerous empirical studies for the effectivity and educational value of the framework available	
USABILITY (20%)					
Understandable	Framework is not understandable	Framework requires some effort and time to be grasped	Framework is fully understandable	Framework is understandable on all levels of the educational environment	
Curriculum Integration	Difficult to integrate into curriculum and courses	Requires effort and time to integrate into curriculum and courses	Rather simple to integrate into curriculum and courses	Simple to integrate into curriculum and courses	

b) Results of framework scoring

N=7, 1 lowest, 4 highest

	ACRL	SCONUL	ANCIL
Average	2.70669643	3.05818452	2.67672619
General	3.0125	3.11607143	2.79047619
PBL	3.14285714	2.57142857	2.82142857
Content	2.85714286	3.42857143	2.68571429
Support	2.5	2.5	1.92857143
Usability	2.07142857	3.28571429	2.71428571

c) Generic Information Literacy Rubric (based on UM framework)

The following developmental rubric builds on the four pillars of the framework (i.e. resource discover, critical assessment, organizing information, creation & communication) to clarify what students are supposed to learn as regards information literacy in the course of their academic journey. This will allow curriculum and course designers to constructively align their teaching activities and assessment to the intended learning objectives.

Stages

The rubric is structured into the four levels Novice, Intermediate, Competent and Advanced. These levels demonstrate the contrast in the skills, knowledge, and attitudes between a novice learner and advanced in a specific area (ACRL, 2016).

Scaffolding Approach

Stages tie only very broadly into levels; there may be considerable areas of overlap, and differences in different subject areas. For this reason we recommend flexibility in applying the framework to any educational (re)design. The process of development will be incremental and challenging. Students need sufficient support at first, with greater autonomy later in the curriculum.

Year 1

In year 1, it is recommended that Bachelor students achieve level 1 (Novice). Any students who are already at level 1 should have the opportunity to do self-study activities to reach parts of level 2 (Intermediate) in the respective information literacy dimension.

Year 2

In year 2, Bachelor students should complete their transition to level 2 (Intermediate). Depending on the subject context, some may already progress to level 3 (Competent) in some of the dimensions.

Year 3

In year 3, it is recommended that Bachelor students reach at least level 3 (Competent) in most dimensions. Depending on the subject context, some students might acquire level 4 abilities (Advanced) to succeed in their bachelor thesis assignment.

Intended Learning Outcomes (ILOs)

ILOs define what students will be able to do as a result of learning activities and provide a measure of the success of those activities. A learning outcome for information literacy is phrased in student–centred language and includes verbs. Verbs are the key for effective learning outcomes, because If ILOs do not call for an observable behaviour (e.g. distinguish, recognize) they result in outcomes that are not assessable (Pichel, Jongen, & Hospers, 2018). The quality and success of information literacy teaching is thus dependent on choosing the right wording for describing intended student learning. We used Bloom's revised taxonomy (Krathwohl & Anderson, 2009) to develop and organize the ILOs for this rubric. The new taxonomy adds a very useful and comprehensive list and explanation of verbs which reflect different types and levels of *cognitive processes* (remember, understand, apply, analyse, evaluate, create), and *knowledge* (factual, conceptual, procedural and metacognitive)

d) Rubric matrix divided into the four UM framework pillars and sub-dimensions[7]

		Novice (1)	Intermediate (2)	Competent (3)	Advanced (4)
		The information literate bachelor student:	The information literate bachelor student:	The information literate bachelor student:	The information literate bachelor student:
Resource discovery	Identify & Plan	Identifies different information sources and formats appropriate to the (information) needs of the search.	Explains that information sources vary greatly in content and format and have varying relevance and value, depending on the needs and nature of the search.	Determines the relevance and value of different information sources, depending on the needs and nature of the search.	Designs a systematic search plan which accounts for different information formats and the relevance and value, depending on the needs and nature of the search.
		Recognizes the evolution of questioning within the research process.	Explains the evolution of questioning within the research process.	Deconstructs the evolution of questioning within the research process.	Concludes that research is iterative and depends upon asking increasingly complex or new questions whose answers develop additional questions or lines of inquiry in any field.
		Formulates a topic based on a selection of main themes (related to student's interest and course content) and keywords (connect to selected topic and themes).	Formulates a clear, focused, concise, complex and arguable research question for a paper assignment	Formulates a clear, focused, concise, complex and arguable research question for a bachelor thesis.	Same as "3"
		Identifies information and/or existing data sources that that meet the research need.	Selects information and/or existing data sources that meet the research need.	Selects a variety of information and existing data sources that are generally appropriate and relevant for the assignment or research need.	Creates and evaluates inclusion and exclusion criteria that are relevant for the assignment or research need.
	Search	Explains the relevance of going beyond a regular "google-search".	Explains the benefits of using a variety of academic databases.	Outlines the benefits of using a variety of academic databases.	Reflects on the benefits of using a variety of academic databases.
		Uses basic search techniques (e.g. Boolean operators, search planning form) to carry out a subject search.	Identifies advanced search techniques (e.g. Boolean operators, wildcards) and/or database functionalities (e.g.Thesaurus/MeSH).	Uses advanced search techniques (e.g. Boolean operators, wildcards) and/or database functionalities (e.g.Thesaurus/MeSH).	Reflects on advanced search techniques (e.g. Boolean operators, wildcards) and/or database functionalities (e.g.Thesaurus/MeSH).and refines the search as needed (e.g. broadening and narrowing).
		Selects databases on a pre-defined topic using pre-defined resources.	Selects multiple databases that somewhat relate to selected concepts or (research) questions.	Selects multiple databases appropriate for selected concepts or (research) questions.	Same as "3"

[7] Adapted from Wageningen University, University of Cape Town, and VALUE Rubric, Open University

		Carries out a search to find familiar information sources both online and offline (e.g. a journal article or book from a reference).	Carries out a subject search within multiple databases or platforms to find unfamiliar sources.	Selects familiar and unfamiliar sources independently and confidently, refining the search as needed (e.g. broadening and narrowing).	Searches independently and fluently across a comprehensive range of information sources in any medium, including specialised information such as archives, data sets, special collections, colleagues and contacts in research networks.
Critical Assessment	**Evaluate**	Recognizes the appropriateness of selected sources based on the information need and the context in which the information will be used.	Summarizes the appropriateness of selected sources based on the information need and the context in which the information will be used.	Determines the appropriateness of selected sources based on their appropriateness regarding the information need and the context in which the information will be used.	Same as "3"
		Identifies critical appraisal skills (e.g. judgements on reliability) and tools (e.g. CRAAP test) to select sources.	Uses critical appraisal skills (e.g. judgements on reliability) and tools (e.g. CRAAP test) to select sources.	Chooses the most appropriate critical appraisal skills (e.g. judgements on reliability) and tools (e.g. CRAAP test) to select sources.	Reflects on critical appraisal skills (e.g. judgements on reliability) and tools (e.g. CRAAP test) to select sources.
		Describes different types of authority (subject expertise, societal position, special experience).	Explains different types of authority (subject expertise, societal position, special experience).	Deconstructs different types of authority (subject expertise, societal position, special experience).	Reflects on different types of authority (subject expertise, societal position, special experience).
		Recognizes the influence of authority, purpose, and accuracy on the quality of the source.	Explains the influence of authority, purpose, and accuracy on the quality of the source.	Deconstructs the influence of authority, purpose, and accuracy on the quality of the source.	Generates and reflects on different factors (e.g. authority) which influence the quality of the source.
		Identifies appropriate criteria to evaluate the instances of online tools for their relevance to the study context.	Uses appropriate criteria to outline the instances of online tools for their relevance to the study context.	Chooses appropriate criteria to judge the instances of online tools for their relevance in any context.	Same as "3"

	Critical Thinking	Describes own and author's biases regarding information (e.g. filter bubbles, confirmation bias).	Clarifies own biases and author's biases regarding information (e.g. filter bubbles, own point of view).	Outlines own and author's biases regarding information (e.g. filter bubbles, own point of view).	Reflects on own and author's biases regarding information e.g. Does the author present alternate points of view? What is my own political view?
			Recognizes contradictory claims by evaluation and/or synthesis.	Integrates contradictory claims into own work (e.g. paper assignment) by evaluation and/or synthesis.	Reflects on contradictory claims by evaluation and/or synthesis.
		Clarifies the relevance to support argumentation with evidence	Uses evidence to support argumentation.	Reflects on evidence to support argumentation.	*Same as "3"*

Organizing Information	**Manage**	Identifies a range of tools and techniques for managing and exporting references (e.g. EndNotes, Mendeley).	Uses a range of tools and techniques for managing and exporting references (e.g. EndNotes, Mendeley) and is able to select and use as appropriate.	Differentiates between different tools and techniques available for managing references and sources, e.g. social bookmarking tools, card index, diary, EndNote, Excel.	*Same as "3"*
		Identifies several options to store information and/or data (e.g. in Word, Excel).	Stores and organizes information and/or data sources systematically using citation management software (e.g. EndNote, Mendeley).	Stores and organizes information and/or data sources systematically using citation management software (e.g. EndNote, Mendeley).	*Same as "3"*
Creation and Communication	**Create**	Summarizes information and/or data from different resources to create an information product (e.g. paper, blog post)	Analyses and summarizes information and/or data from different resources to create an information product (e.g. paper, blog post).	Synthesizes information and/or data from different resources to create an information product (e.g. paper, blog post).	Synthesizes information and/or data from different resources and – based on this analysis – he / she formulates insights, hypotheses or applications.
		Indicates that the purpose, message, and delivery of information are acts of creation.	Explains that the purpose, message, and delivery of information are intentional acts of creation.	Outlines the purpose, message, and delivery of information as intentional acts of creation.	Interprets the underlying process of creation as well as the final product to critically evaluate the usefulness of information.
		Identifies the value of a collaborative production of (digital) content related to study activity.	Selects collaborative production of (digital) content appropriate for the study activity.	Reflects on the collaborative production of (digital) content related to a study activities.	Creates a collaborative production of (digital) content related to study activities.
		Describes the ethical and legal requirements (e.g. plagiarism, copyright) surrounding the use and reuse of information.	Explains the ethical and legal requirements (e.g. plagiarism, copyright) surrounding the use and reuse of information.	Integrates ethical and legal requirements (e.g. plagiarism, copyright) into the use and re-use of information and identifies sources of relevant advice (e.g. expert for privacy regulations).	Reflects on the ethical and legal requirements (e.g. plagiarism, copyright) surrounding the use and reuse of information and knows where to seek advice (e.g. expert for privacy regulations).

	Present	Recalls proper attribution and citation (e.g. use of citations and references; choice of paraphrasing, summary, or quoting etc.).	Mostly gives credit to the ideas of others through proper attribution and citation (e.g. use of citations and references; choice of paraphrasing, summary, or quoting etc.).	Consistently gives credit to the original ideas of others through proper attribution and citation (e.g. use of citations and references; choice of paraphrasing, summary, or quoting etc.).	Consistently gives credit to the original ideas of others through proper attribution and citation (e.g. use of citations and references; choice of paraphrasing, summary, or quoting etc.). Applies techniques that nuance the relationship between those ideas and the student's own argument.
		Identifies that information possesses several dimensions of value including as a commodity, as a means of education, as a means to influence, and as a means of negotiation and understanding the world.	Explains that information possesses several dimensions of value including as a commodity, as a means of education, as a means to influence, and as a means of negotiation and understanding the world.	Outlines the different dimensions of information, including as a commodity, as a means of education, as a means to influence, and as a means of negotiation and understanding the world.	Reflects on the different dimensions of information, including as a commodity, as a means of education, as a means to influence, and as a means of negotiation and understanding the world.
		Recognizes that information has several dimensions (e.g. purpose, type) and understands that there is an intention behind the format that is presented.	Identifies several dimensions of information (e.g. purpose, type) and understands that there is an intention behind the format that is presented.	Differentiates between several dimensions of information (e.g. purpose, type) and understands that there is an intention behind the format that is presented.	*Same as "3"*
		Uses multimedia formats (e.g. video, wiki, blog) to comment on subject-related opinions and ideas.	Reflects on the effectiveness of multimedia formats (e.g. video, wiki, blog) to communicate subject-related opinions and ideas.	Creates and publishes content in multimedia formats (e.g. video, wiki, blog) to communicate subject-related opinions and ideas.	*Same as "3"*
			Uses social media platforms such as Facebook, Twitter, ResearchGate, or LinkedIn to present oneself.	Uses social media platforms such as Facebook, Twitter, ResearchGate, or LinkedIn to present oneself and checks the own digital footprint.	Uses social media platforms such as Facebook, Twitter, ResearchGate, or LinkedIn to present him/her and checks the own digital footprint. Reflects on the intended (professional) online presence.

Collabo ration		Responds to online discussions, in a variety of contexts (study, informal, etc.) and on a variety of platforms (e.g. research networks, blogging) to discuss and exchange information.	Uses online discussions, in a variety of contexts (study, informal, etc.) and a variety of platforms (e.g. research networks, social media, blogging) to discuss and exchange information.	Reflects on appropriate and effective communication in online discussions, in a variety of contexts (study, informal, etc.) and variety of platforms (e.g. research networks, social media, blogging) to discuss and exchange information.
	Contributes to an online dialogue with other students on a variety of social media platforms (e.g. Facebook, LinkedIn)	Distinguishes between the different roles and contributions that may be required to produce a piece of work collaboratively online.	Reflects and uses personal strengths to effectively engage in an (online) community e.g. proposing appropriate media and working methods.	Demonstrates leadership in an (online) professional community, e.g. take the initiative in proposing appropriate media and working methods, facilitate the group working through agreed processes, and evaluate group outputs.

e) Additional information about survey

Aim, Design, and Distribution

The aim of the Information-Wise survey was to examine the perception of Bachelor students and staff in relation to information literacy as part of the learning process. In addition, responses within the survey will provide future perspectives of information literacy skills education at the UM. The survey was designed based on literature on information literacy and the monograph on the current state of information literacy (Ferguson, 2017; Jongen et al., 2019; Pichel et al., 2018). In these papers, it was mentioned that a more in-depth quantitative and qualitative analyses was needed regarding the current state of students in dealing with information and teachers in teaching how to deal with information (Ferguson, 2017; Jongen et al., 2019; Pichel et al., 2018) The survey went through several feedback rounds with project members and experts in survey design. The survey was designed in English.

Control variables included questions on which faculty they study, what specific programme do they follow, in which year of the programme, age, gender, and in which country they followed secondary education.

The survey consisted of two parts with both quantitative (i.e. closed) and qualitative (open ended) questions. The first part started with a hypothetical PBL case, followed by several general questions concerning information literacy, use of sources, and use of learning strategies. The second part consisted of a writing assignment scenario. For closed questions, the level of agreement was measured using a five-point Likert scale, with 1 indicating lowest and 5 indicated the highest level of satisfaction (1 was either *strongly disagree* or *never,* 5 was either *strongly agree* or *always*). Both closed and open questions were labelled to either one of the four pillars of the Information-Wise framework or to a category ´general questions'.

The survey was sent out to all current students and staff at Maastricht University and responses were collected in English. It was made explicit that we only asked Bachelor students or teaching staff within Bachelor programmes to respond to the survey. It was open for the entire month of June 2019. The survey was distributed via a Communication email.

GENERAL QUESTIONS: OVERALL ANALYSIS

	Bachelor students (n = 632)			Academic staff (n = 86)		
	Median	Mean	SD	Median	Mean	SD
I read provided literature to gain a deeper understanding of a topic	4	3.89	1.07	4	3.47	0.82
I read provided literature to pass the final exam	4	4.18	1.03	4	4.12	0.71
How frequently do you use the learning strategy listed below to learn about a topic: 1. Elaborative interrogation 2. Self-explanation 3. Summarizing 4. Highlighting / underlying 5. Imagery for text 6. Rereading 7. Practice testing 8. Distributed practice 9. Interleaved practice	3 3 4 4 3 3 3 3 2	3.28 3.04 3.59 3.58 3.08 2.92 2.97 3.33 2.47	1.08 1.12 1.34 1.37 1.22 1.19 1.42 1.17 1.17	3 2 3 4 2 3 2 3 2	2.70 2.50 3.33 3.72 2.42 2.71 2.41 2.78 2.20	0.86 0.70 0.90 0.79 0.73 0.88 1.06 0.79 0.73
I feel that I received enough training in choosing optimal learning strategies	4	3.34	1.09	3	2.76	1.02
I know which learning strategies are most effective for my learning activities	4	3.91	0.98			
How often did you have to do a writing assignment (such as essays, reports, blogs, reviews, Wikipedia pages) so far in your Bachelor's programme)?* *answers: 1= "0", 2="1-2", 3="3-4", 4="5-6", 5="7-8", 6="9-10", 7=">10"	5	5.04	1.74	7	6.31	1.90

GENERAL QUESTIONS PER FACULTY

	FASoS (n = 54)		FHML (n = 228)		FPN (n = 75)		FSE (n = 88)		FL (n = 55)		SBE (n = 132)	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
I read provided literature to gain a deeper understanding of a topic	4.30	0.90	3.67	1.01	4.13	0.92	4.02	1.01	3.69	1.12	3.98	1.08
I read provided literature to pass the final exam	4.43	0.84	3.91	1.04	4.43	0.89	4.16	1.00	4.07	1.20	4.48	0.90
I feel that I received enough training in choosing optimal learning strategies	3.11	1.14	3.31	1.09	3.57	1.11	3.33	1.11	3.09	1.09	3.48	1.00
I know which learning strategies are most effective for my learning activities	3.61	1.07	3.96	0,98	4.08	1,00	3,83	0.96	3,89	1,08	3,91	0,90
How often did you have to do a writing assignment (such as essays, reports, blogs, reviews, Wikipedia pages) so far in your Bachelor's programme)?* *answers: 1= "0", 2="1-2", 3="3-4", 4="5-6", 5="7-8", 6="9-10", 7=">10"	6.09	1.26	5.02	1.76	3.71	1.24	5.84	1.57	5.58	1.72	4.63	1.64

How frequently do you use the learning strategy listed below to learn about a topic:

	FASoS (n = 54)		FHML (n = 228)		FPN (n = 75)		FSE (n = 88)		FL (n = 55)		SBE (n = 132)	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
1. Elaborative interrogation	3.28	1.17	3.21	0.98	3.21	1.03	3.19	1.26	3.36	1.19	3.45	1.03
2. Self-explanation	2.96	1.15	2.94	1.08	2.97	1.00	3.05	1.16	3.36	1.34	3.15	1.09
3. Summarizing	3.76	1.20	3.79	1.26	3.75	1.27	3.42	1.36	3.67	1.38	3.17	1.44
4. Highlighting / underlying	4.07	1.27	3.50	1.30	3.47	1.41	3.10	1.42	4.24	1.00	3.63	1.44
5. Imagery for text	2.80	1.32	3.34	1.15	2.97	1.13	2.82	1.33	3.02	1.37	3.01	1.14
6. Rereading	2.74	1.31	3.11	1.14	2.45	1.08	2.91	1.08	2.91	1.25	2.92	1.15
7. Practice testing	2.17	1.21	2.84	1.37	3.05	1.37	2.63	1.37	3.56	1.39	3.43	1.39
8. Distributed practice	2.93	1.36	3.20	1.10	3.43	1.14	3.19	1.24	3.67	1.14	3.61	1.11
9. Interleaved practice	2.48	1.19	2.36	1.13	2.40	1.09	2.36	1.18	2.64	1.28	2.71	1.20

GENERAL QUESTIONS PER BACHELOR YEAR

	BA Year 1 (n= 241)			BA Year 2 (n = 170)			BA Year 3 (n = 221)		
	Median	Mean	SD	Median	Mean	SD	Median	Mean	SD
I read provided literature to gain a deeper understanding of a topic	4	3.98	1.04	4	3.94	1.02	4	3.76	1.04
I read provided literature to pass the final exam	5	4.25	1.00	5	4.23	1.00	4	4.08	1.04
How frequently do you use the learning strategy listed below to learn about a topic: 1. Elaborative interrogation 2. Self-explanation 3. Summarizing 4. Highlighting / underlying 5. Imagery for text 6. Rereading 7. Practice testing 8. Distributed practice 9. Interleaved practice	3 3 4 4 3 3 3 3 2	3.26 3.07 3.52 3.49 3.15 2.88 3.14 3.41 2.52	1.05 1.13 1.40 1.47 1.21 1.23 1.44 1.19 1.20	3 3 4 4 3 3 2 3 2	3.22 2.99 3.61 3.54 2.99 2.88 2.81 3.43 2.41	1.15 1.15 1.15 1.33 1.30 1.23 1.27 1.47 1.19 1.24	4 3 4 4 3 3 3 3 2	3.34 3.05 3.66 3.71 3.08 2.99 2.90 3.17 2.47	1.10 1.08 1.28 1.30 1.22 1.10 1.33 1.13 1.08
I feel that I received enough training in choosing optimal learning strategies	4	3.56	1.09	3.5	3.31	1,08	3	3.14	1.05
I know which learning strategies are most effective for my learning activities	4	3.95	0.98	4	3.86	1,01	4	3.91	0.97
How often did you have to do a writing assignment (such as essays, reports, blogs, reviews, Wikipedia pages) so far in your Bachelor's programme)?* *answers: 1= "0", 2="1-2", 3="3-4", 4="5-6", 5="7-8", 6="9-10", 7=">10"	3	4.15	1.49	6	5.45	1.68	7	5.69	1.65

DIMENSION 1: Resource Discovery: OVERALL ANALYSIS

	BA students (n = 632)			Academic staff (n=86)		
	Median	Mean	SD	Median	Mean	SD
I identify my lack of knowledge before I start reading the literature of this topic	3	2.78	1.12	3	2.86	1.02
I generally only use the sources provided in the course manual to find information about this topic	4	3.28	1.22	4	3.87	0.84
I extend my search for sources beyond the sources provided in the course manual in order to gain a wider perspective on this topic	2	2.82	1.11	2	2.09	0.84
I know when I have collected enough information about this specific topic	4	3.26	1.04	2.5	2.55	0.90
In my studies, I need to search independently for information on a particular topic	3	3.25	1.08	2	2.80	1.14
So far, I have received enough training during my Bachelor's programme to search independently for answers to a specific topic	4	3.86	0.99	3	3.06	0.12
In the courses I followed so far, I was encouraged to look for additional sources	3	2.91	1.08	3	2.98	1.05
Given that a course had no reference list provided, I would like to spend more time on discussing how we find information for a specific topic	3	2.88	1.24	3	2.76	1.10
I know when I have found a sufficient amount of reliable sources to help me answer my specific questions	4	3.42	1.03	2	2.45	0.89
How often do you use the following sources when preparing for a (PBL) class? 1. Google 2. Google Scholar 3. YouTube 4. Wikipedia 5. Stuvia 6. Databases of University Library (PubMed, Web of Science, PsycINFO, JSTOR, WestLaw) 7. Sources in course manual (if provided)	4 3 2 2 1 3 5	3.77 2.80 2.46 2.38 1.72 3.24 4.31	1.20 1.23 1.05 1.13 1.10 1.29 0.99	4 2 3 3 2 2 4	3.73 2.55 3.00 3.09 2.27 2.18 4.18	1.19 1.21 1.00 0.94 1.42 0.75 0.60
How often do you use the following platforms to gain access to study materials? 1. StudyDrive 2. Google Drive 3. Facebook 4. Sci-Hub 5. Library Genesis 6. Academia.edu 7. ResearchGate 8. WhatsApp 9. Dropbox	2 2 1 1 1 1 1 2 1	2.44 2.35 1.43 1.28 1.35 1.35 1.85 2.19 1.73	1.40 1.22 0.79 0.81 0.85 0.76 1.09 1.15 1.01	2 3 3 1 1 1 2 3 3	2.82 2.82 2.91 1.73 1.73 1.55 2.00 3.00 2.73	1.47 1.17 1.30 1.10 1.10 0.93 1.18 1.18 1.27

CONTINUED TABLE	BA students (n = 632)			Academic staff (n = 86)		
	Median	Mean	SD	Median	Mean	SD
How often do you use the following platforms to gain access to study materials? 10. YouTube 11. Online Discussion Forums	2 1	2.35 1.47	1.16 0.88	**3** **2**	**2.73** **2.18**	**1.27** **1.17**
I have received enough training to construct a proper search strategy for a writing assignment	4	3.40	1.13	**3**	**3.01**	**1.04**
I search for relevant literature before I define my research question	4	3.89	1.07	**3**	**3.13**	**0.89**
I am familiar with multiple academic databases [for example Web of Science]	YES	Yes: 70.3% No: 29,7%		YES	Yes: 58,1% No: 41,9%	
I check multiple academic databases [for example Web of Science]	3	3.05	1.33	**2**	**2.44**	**0.86**
I am familiar with using database-specific tools (for example thesaurus / MeSH terms / filters) to plan my search	YES	Yes: 61,1% No: 38,9%		NO	Yes: 34,9% No: 65,1%	
I use database-specific tools (for example thesaurus / MeSH terms / filters) to aid in my searching	2	2.55	1.36	**2**	**2.03**	**0.87**

DIMENSION 1: Resource Discovery PER FACULTY

	FASoS (n = 54)		FHML (n = 228)		FPN (n = 75)		FSE (n = 88)		FL (n = 55)		SBE (n = 132)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
I identify my lack of knowledge before I start reading the literature of this topic	3.09	1.22	2.77	1.08	2.60	1.04	2.85	1.13	2.85	1.15	2.67	1.13
I generally only use the sources provided in the course manual to find information about this topic	3.54	1.16	3.07	1.20	3.87	1.07	3.01	1.34	3.55	1.14	3.28	1.17
I extend my search for sources beyond the sources provided in the course manual in order to gain a wider perspective on this topic	2.74	1.09	3.13	1.07	2.20	1.03	2.89	1.13	2.51	1.00	2.74	1.10
I know when I have collected enough information about this specific topic	2.91	1.17	3.11	1.06	3.17	1.05	3.25	0.97	3.36	0.94	3.57	0.95
In my studies, I need to search independently for information on a particular topic	3.11	0.98	3.62	1.02	2.36	0.91	3.49	1.08	3.11	0.98	3.07	1.02
So far, I have received enough training during my Bachelor's programme to search independently for answers to a specific topic	4.07	0.95	3.87	1.01	3.64	0.94	3.93	1.06	3.93	1.03	3.79	0.89
In the courses I followed so far, I was encouraged to look for additional sources	2.93	1.23	3.13	1.04	2.36	0.95	3.02	1.09	2.73	1.06	2.86	1.04
Given that a course had no reference list provided, I would like to spend more time on discussing how we find information for a specific topic	3.19	1.20	2.80	1.26	3.08	1.15	2.94	1.17	2.93	1.33	2.74	1.25
I know when I have found a sufficient amount of reliable sources to help me answer my specific questions	3.46	1.02	3.38	1.01	2.92	1.15	3.48	0.93	3.78	0.94	3.59	1.00

CONTINUED TABLE	FASoS (n = 54)		FHML (n = 228)		FPN (n = 75)		FSE (n = 88)		FL (n = 55)		SBE (n = 132)	
	Mean	SD	Mean	SD	Mean	SD	F	p	Mean	SD	Mean	SD
How often do you use the following sources when preparing for a (PBL) class?												
1. Google	3.37	1.34	3.83	1.16	2.95	1.13	3.44	1.25	3.70	1.12	4.38	0.97
2. Google Scholar	3.16	0.75	2.73	1.25	3.14	1.21	3.00	1.18	2.53	1.17	2.72	1.25
3. YouTube	2.00	1.21	2.54	0.97	2.62	1.06	2.52	1.34	1.57	0.57	2.64	1.18
4. Wikipedia	2.68	1.34	2.40	1.10	2.35	1.14	2.30	1.03	1.77	0.97	2.56	1.19
5. Stuvia	1.37	1.01	2.10	1.23	1.22	0.42	1.04	0.19	1.43	0.86	1.31	0.81
6. Databases of University Library (PubMed, Web of Science, PsycINFO, JSTOR, WestLaw)	3.63	1.17	3.55	1.14	3.32	1.27	3.00	1.49	3.17	1.37	2.21	1.16
7. Sources in course manual (if provided)	4.84	0.38	4.25	0.93	4.65	0.89	4.44	0.75	4.50	0.97	3.95	1.27
How often do you use the following platforms to gain access to study materials?												
1. StudyDrive	2.71	1.20	1.67	1.12	2.97	1.31	2.03	1.10	2.17	1.05	3.80	1.04
2. Google Drive	2.25	1.11	2.53	1.20	1.90	1.10	2.30	1.31	1.96	1.20	2.47	1.26
3. Facebook	1.67	1.01	1.22	0.52	1.74	0.94	1.82	0.98	1.33	1.06	1.38	0.85
4. Sci-Hub	1.29	1.09	1.26	0.81	1.41	0.91	1.61	1.14	1.08	0.64	1.13	0.55
5. Library Genesis	1.67	0.93	1.19	0.70	1.56	1.07	1.85	0.97	1.17	0.41	1.20	0.65
6. Academia.edu	1.79	1.23	1.16	0.48	1.21	0.62	1.55	1.30	1.63	0.48	1.42	0.83
7. ResearchGate	2.13	1.16	1.86	1.09	1.69	0.92	2.42	1.33	1.58	1.06	1.61	0.92
8. WhatsApp	1.96	1.06	2.08	1.04	2.21	1.15	2.27	1.08	1.71	0.55	2.59	1.29
9. Dropbox	1.58	0.88	1.92	1.07	2.08	1.11	1.67	1.32	1.42	0.58	1.36	0.70
10. YouTube	2.08	0.65	2.38	1.10	2.51	1.30	2.42	1.30	1.67	0.87	2.50	1.22
11. Online Discussion Forums	1.38		1.28	0.43	1.26	0.50	1.94		1.58	1.10	1.70	1.02
I have received enough training to construct a proper search strategy for a writing assignment	3.59	1.11	3.32	1.20	3.55	0.96	3.55	1.02	3.47	1.26	3.26	1.09
I search for relevant literature before I define my research question	4.26	0.91	3.82	1.05	4.00	1.01	3.85	1.08	3.89	1.23	3.80	1.10

CONTINUED TABLE	FASoS (n = 54)		FHML (n = 228)		FPN (n = 75)		FSE (n = 88)		FL (n = 55)		SBE (n = 132)	
	Mean	SD	Mean	SD	Mean	SD	F	p	Mean	SD	Mean	SD
I am familiar with multiple academic databases [for example Web of Science]	YES: 79.6% NO: 20.4%		YES: 70.2% NO: 29.8%		YES: 77.3% NO: 22.7%		YES: 79.5% NO: 20.5%		YES: 80% NO: 20%		YES: 52.3% NO: 47.7%	
I check multiple academic databases [for example Web of Science]	3.41	1.22	2.90	1.31	3.17	1.30	3.23	1.33	3.58	1.33	2.76	1.31
I am familiar with using database-specific tools (for example thesaurus / MeSH terms / filters) to plan my search	YES: 61.1% NO: 38.9%		YES: 76.3% NO: 23.7%		YES: 70.7% NO: 29.3%		YES: 55.7% NO: 44.3%		YES: 52.7% NO: 47.3%		YES: 36.4% NO: 63.6%	
I use database-specific tools (for example thesaurus / MeSH terms / filters) to aid in my searching	2.70	1.40	2.82	1.32	2.77	1.34	2.31	1.34	2.53	1.46	2.05	1.23

DIMENSION 1: Resource Discovery: PER BACHELOR YEAR

	BA Year 1 (n= 241)			BA Year 2 (n = 170)			BA Year 3 (n= 221)		
	Median	Mean	SD	Median	Mean	SD	Median	Mean	SD
I identify my lack of knowledge before I start reading the literature of this topic	2	2.77	1.12	3	2.94	1.15	2	2.65	1.07
I generally only use the sources provided in the course manual to find information about this topic	4	3.19	1.25	4	3.39	1.20	4	3.29	1.19
I extend my search for sources beyond the sources provided in the course manual in order to gain a wider perspective on this topic	3	2.85	1.12	2	2.72	1.03	3	2.86	1.17
I know when I have collected enough information about this specific topic	4	3.37	1.03	4	3.15	1.09	3	3.21	1.02
In my studies, I need to search independently for information on a particular topic	3	3.19	1.10	4	3.38	1.06	3	3.21	1.08
So far, I have received enough training during my Bachelor's programme to search independently for answers to a specific topic	4	3.76	0.99	4	3.85	1.01	4	3.97	0.94
In the courses I followed so far, I was encouraged to look for additional sources	3	2.90	1.08	3	2.82	1.07	3	3.00	1.09
Given that a course had no reference list provided, I would like to spend more time on discussing how we find information for a specific topic	3	2.93	1.20	3	2.94	1.31	2	2.79	1.23
I know when I have found a sufficient amount of reliable sources to help me answer my specific questions	4	3.43	1.04	4	3.47	1.03	4	3.38	1.02
How often do you use the following sources when preparing for a (PBL) class? 1. Google 2. Google Scholar 3. YouTube 4. Wikipedia 5. Stuvia 6. Databases of University Library (PubMed, Web of Science, PsycINFO, JSTOR, WestLaw) 7. Sources in course manual (if provided)	4 2 2 2 1 3 5	3.78 2.64 2.63 2.40 1.64 3.01 4.29	1.20 1.21 1.16 1.18 1.04 1.33 1.06	4 3 2 2 1 3 5	3.71 2.83 2.34 2.48 1.88 3.19 4.50	1.27 1.24 0.97 1.16 1.26 1.28 0.80	4 3 2 2 1 4 5	3.80 2.91 2.38 2.30 1.69 3.48 4.21	1.16 1.24 0.97 1.06 1.05 1.23 1.01

How often do you use the following platforms to gain access to study materials?									
1. StudyDrive	3	2.85	1.45	2	2.29	1.31	1	2.08	1.27
2. Google Drive	2	2.36	1.32	2	2.23	1.18	2	2.39	1.13
3. Facebook	1	1.18	0.53	1	1.43	1.13	1	1.68	0.91
4. Sci-Hub	1	1.16	0.55	1	1.42	0.83	1	1.32	0.81
5. Library Genesis	1	1.35	0.87	1	1.40	1.13	1	1.31	0.83
6. Academia.edu	1	1.40	0.86	1	1.28	0.88	1	1.33	0.68
7. ResearchGate		1.75	1.10	1	1.78	0.70	2	1.98	1.03
						1.17			

CONTINUED TABLE	BA Year 1 (n= 241)			BA Year 2 (n = 170)			BA Year 3 (n= 221)		
	Median	Mean	SD	Median	Mean	F	Median	Mean	SD
8. WhatsApp	2	2.40	1.21	2	2.28	1.23	2	1.92	0.97
9. Dropbox	1	1.66	1.07	1	1.77	1.13	2	1.78	0.87
10. YouTube	2	2.59	1.23	2	2.11	1.12	2	2.23	1.07
11. Online Discussion Forums	1	1.53	0.97	1	1.52	0.99	1	1.37	0.70
I have received enough training to construct a proper search strategy for a writing assignment	4	3.41	1.07	3.5	3.29	1.18	4	3.48	1.14
I search for relevant literature before I define my research question	4	3.81	1.11	4	3.88	1.13	4	3.97	0.98
I am familiar with multiple academic databases [for example Web of Science]	YES	YES: 69.3% NO: 30.7%		YES	YES: 65.3% NO: 34.7%		YES	YES: 75.1% NO: 24.9%	
I check multiple academic databases [for example Web of Science]	3	3.17	1.33	3	2.92	1.35	3	3.03	1.30
I am familiar with using database-specific tools (for example thesaurus / MeSH terms / filters) to plan my search	YES	YES: 54.4% NO: 45.6%		YES	YES: 60.6% NO: 39.4%		YES	YES: 68.8% NO: 31.2%	
I use database-specific tools (for example thesaurus / MeSH terms / filters) to aid in my searching	2	2.44	1.31	2	2.44	1.38	3	2.75	1.37

DIMENSION II "CRITICAL ASSESSMENT", DIMENSION III "ORGANIZING INFORMATION" and DIMENSION IV "CREATING & COMMUNICATION": OVERALL ANALYSIS

	BA students (n =632)			Academic staff (n = 86)		
DIMENSION II	Median	Mean	SD	Median	Mean	SD
I critically evaluate the sources I read	4	3.50	1.06	2	2.48	0.81
I have received enough training in my Bachelor to critically evaluate sources	4	3.44	1.09	3	2.84	1.06
DIMENSION III						
I construct mind maps to organize information	2	1.99	1.16	2	2.10	0.63
I use a reference manager (for example EndNote, Mendeley, Zotero) to organize information	1	2.16	1.49	2	2.33	0.91
I find it difficult to reference properly in my own paper	2	2.16	1.03	3	3.01	0.89
DIMENSION IV						
I actively share additional information about this topic during the discussion phase of the next tutorial	3	3.23	1.17	2.5	2.69	1.09
I feel confident formulating a research question based on conflicting information (different perspectives) in the literature	4	3.60	0.99	3	2.65	1.04
I worry that my research question is not good enough	4	3.46	1.08	4	3.77	0.85
I am confident I can formulate a research question	4	3.64	0.99	3	2.66	1.08
I usually do not know how to get started with the writing assignment	3	2.88	1.22	3	3.34	0.97
I have received enough training during my Bachelor's programme so far to effectively write the kinds of assignment I am required to write	4	3.62	1.04	3.5	3.28	1.06
I have received enough feedback during my Bachelor's programme to effectively write the kinds of assignments I am required to write	4	3.27	1.14	4	3.33	1.15

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DIMENSION II "CRITICAL ASSESSMENT", DIMENSION III "ORGANIZING INFORMATION" and DIMENSION IV "CREATING & COMMUNICATION": PER FACULTY

	FASoS (n = 54)		FHML (n = 228)		FPN (n = 75)		FSE (n = 88)		FL (n = 55)		SBE (n = 132)	
DIMENSION II	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
I critically evaluate the sources I read	3.83	1.04	3.39	0.98	3.63	1.06	3.36	1.17	3.64	1.18	3.52	1.02
I have received enough training in my Bachelor to critically evaluate sources	3.76	1.10	3.58	1.08	3.35	1.12	3.28	1.08	3.45	1.07	3.20	1.07
DIMENSION III												
I construct mind maps to organize information	2.56	1.28	1.83	1.15	2.13	1.04	1.86	1.11	2.29	1.27	1.92	1.08
I use a reference manager (for example EndNote, Mendeley, Zotero) to organize information	1.93	1.40	2.54	1.61	2.19	1.48	2.33	1.53	1.58	1.20	1.68	1.19
I find it difficult to reference properly in my own paper	2.11	0.95	2.08	0.92	2.24	1.03	2.03	1.10	2.04	0.84	2.40	1.24
DIMENSION IV												
I actively share additional information about this topic during the discussion phase of the next tutorial	3.44	1.33	3.42	1.06	3.20	1.17	3.19	1.20	2.84	1.21	3.02	1.16
I feel confident formulating a research question based on conflicting information (different perspectives) in the literature	3.74	0.99	3.61	0.92	3.53	0.91	3.93	1.02	3.11	1.30	3.56	0.93
I worry that my research question is not good enough	3.81	0.95	3.42	1.08	3.41	0.93	3.33	1.12	3.69	1.22	3.42	1.12
I am confident I can formulate a research question	3.70	1.21	3.67	0.94	3.51	0.89	3.89	0.94	3.49	1.17	3.55	0.94
I usually do not know how to get started with the writing assignment	2.76	1.20	2.95	1.21	3.04	1.21	2.69	1.25	2.56	1.24	2.97	1.20
I have received enough training during my Bachelor's programme so far to effectively write the kinds of assignment I am required to write	3.89	0.97	3.52	1.05	3.43	1.02	3.84	0.99	3.80	1.06	3.55	1.04
I have received enough feedback during my Bachelor's programme to effectively write the kinds of assignments I am required to write	3.39	1.17	3.24	1.11	3.25	1.08	3.48	1.10	3.13	1.40	3.20	1.10

DIMENSION II "CRITICAL ASSESSMENT", DIMENSION III "ORGANIZING INFORMATION" and DIMENSION IV "CREATING & COMMUNICATION": PER BACHELOR YEAR

	BA Year 1 (n= 241)			BA Year 2 (n = 170)			BA Year 3 (n= 221)		
	Median	Mean	SD	Median	Mean	SD	Median	Mean	SD
DIMENSION II									
I critically evaluate the sources I read	4	3.51	1.13	4	3.46	1.07	4	3.51	0.96
I have received enough training in my Bachelor to critically evaluate sources	3	3.28	1.03	4	3.40	1.17	4	3.64	1.07
DIMENSION III									
I construct mind maps to organize information	2	2.07	1.20	2	1.96	1.13	2	1.92	1.14
I use a reference manager (for example EndNote, Mendeley, Zotero) to organize information	1	2.14	1.54	1	1.92	1.30	2	2.35	1.56
I find it difficult to reference properly in my own paper	2	2.32	1.02	2	2.16	1.14	2	1.98	0.93
DIMENSION IV									
I actively share additional information about this topic during the discussion phase of the next tutorial	3	3.17	1.14	3	3.21	1.23	3	3.31	1.14
I feel confident formulating a research question based on conflicting information (different perspectives) in the literature	4	3.43	0.98	4	3.64	1.06	4	3.76	0.92
I worry that my research question is not good enough	4	3.52	1.05	4	3.51	1.12	4	3.37	1.09
I am confident I can formulate a research question	4	3.50	1.00	4	3.67	1.01	4	3.78	0.93
I usually do not know how to get started with the writing assignment	3	2.90	1.22	3	2.89	1.27	3	2,85	1.19
I have received enough training during my Bachelor's programme so far to effectively write the kinds of assignment I am required to write	4	3.58	1.01	4	3.64	1.04	4	3.65	1.06
I have received enough feedback during my Bachelor's programme to effectively write the kinds of assignments I am required to write	4	3.32	1.07	3	3.19	1.20	3	3.28	1.16