# Concept and Development of an Information Literacy Curriculum Widget

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**Abstract.** Information literacy, the access to knowledge and use of it
are becoming a precondition for individuals to actively take part in so-
cial, economic, cultural and political life. Information literacy must be
considered as a fundamental competency like the ability to read, write
and calculate. Therefore, we are working on automatic learning guidance
with respect to three modules of the information literacy curriculum de-
veloped by the EU (DigComp 2.1 Framework). In prior work, we have
laid out the essential research questions from a technical side. In this
work, we follow-up by specifying the concept to micro learning, and mi-
cro learning content units. This means, that the overall intervention that
we design is concretized to: The widget is initialized by assessing the
learners competence with the help of a knowledge test. This is the basis
for recommending suitable micro learning content, adapted to the iden-
tified competence level. After the learner has read/worked through the
content, the widget asks a reflective question to the learner. The goal of
the reflective question is to deepen the learning. In this paper we present
the concept of the widget and its integration in a search platform.

**Keywords:** Information Literacy · Micro Learning · Reflective Learn-
ing.

## 1   Introduction

Information literacy and the access to and use of knowledge are becoming a
precondition for individuals to actively take part in social, economic, cultural
and political life in societies of the 21st century and must be considered as a
fundamental competency in our digital lives. The UNESCO considers it a basic
human right [9] while the American Library Association (ALA) [1] calls it a
survival skill in the information age.

In general, the concept of information literacy is widely unknown outside the
information science community, although, there is a need in society to educate
citizens to become digitally competent. The European Commission deems the
gain of skills and competences w.r.t. information literacy necessary and offers a

tool to assess and improve citizens' digital competence by developing the European Digital Competence Framework for Citizens (DigComp 2.1) [8]. Therefore, the education of professionals to become data-savvy with regard to information literacy becomes more and more important.

In this work, we will present a concept of a widget and its implementation in a newly developed search platform that provides automatic learning guidance with respect to three modules of the DigComp 2.1. framework. The goal of the automatic learning guidance widget is to raise the learners competence level for each competence to the expert level. Furthermore, we base our work on micro learning in combination with reflective learning, which we both see as two complementary learning strategies that support learning on the fly while using the search platform.

The main contribution of this work is to provide

- a newly developed learning approach by combining micro learning with reflective learning based on open learner modelling.
- a newly developed concept that automatically tracks the learner's learning progress in order to provide guidance adapted to the learner's competence level and learning needs w.r.t. the curriculum.

As this work presented here is currently work in progress, there was no evaluation conducted so far. However, a previous work discussion challenges on providing automatic learning guidance can be found in  [13].

## 2   Related Work

In this paper, we are interested in technology implemented in a newly developed search platform that provides automatic learning guidance with regard to an information literacy curriculum. As the cognitive load while searching is typically very high and is concentrated on the information need, we will follow a micro-learning approach that offers the learning content bit-by-bit. For guiding learners through the curriculum and motivating learners to reflect about the micro learning content of the curriculum, we use prompts as proactive interventions and challenges. Additionally, we also relate to open learner modelling literature in the sense that micro learning content and reflection guidance technology is embedded in a search environment; thus all activities conducted on the platform with regard to these learning activities will be tracked, collected and stored in order to keep the skill and competence acquisition of the learner updated, and to store insights gained through reflection (if entered in the system). Finally, we conclude the related work section with a re-statement of this papers contribution in the context of such related work, and a statement of research questions.

### 2.1   Information Literacy

In societies of the 21st century information literacy and the access and use of knowledge are becoming a precondition for individuals to actively take part in social, economic, cultural and political life. Information literacy (IL) today, rather

than being a specialized skill-set, must be considered a fundamental competency like the ability to read, write and calculate. IL is so important for social development that UNESCO even regards the acquisition of this competence as a *a basic human right* [9]. Likewise, the American Library Association (ALA) (2006) [1] calls information literacy a *survival skill in the information age*. Digital competence, the confident and critical use of ICT tools, is equally vital for social and economic participation [27]. Today, when information is available primarily in digital and web-based environments, information literacy and digital literacy necessarily complement each other. Therefore, the European Commission developed the European Digital Competence Framework for Citizens, also known as DigComp [27]. DigComp 2.0 encompasses the main components of Information Literacy and parts of Media Literacy and was in version 2.1 extended to eight proficiency levels and use examples applied to the learning and employment field.

## 2.2   Micro-Learning

Within the area of mobile devices and new web technologies, new ways of learning and knowledge acquiring emerge. Typically, people use the web to enhance their learning in a formal learning setting like for example looking for further learning material or resources. In addition, the technological development of mobile applications offers new learning opportunities in a ubiquitous way, thus learning will be possible anytime and anywhere. Therefore, novel informal learning methods like micro learning become more and more convenient. The cognitive load of learners as well as professionals is typically very high, thus, we will follow a micro-learning approach, because *"micro-learning does not demand separate learning sessions"* [4], but it can be easily integrated into other activities of a learner, like for example searching. Micro learning *has been defined as small units of learning intended for application and paired with a learning objective as a step toward a larger goal, easily accessed by learners, therefore, often associated with device learning, and retrieved through tags and keywords* [22]. *"Micro-learning refers originally to taking short-term-focused learning activities on small learning content units"* as stated by Kovache et al. [21]. Both definitions are in line with our plans to use the micro-learning while conducting a search. By transferring micro learning into a search platform, *learning becomes more accessible anytime and anywhere, ubiquitous, just-in-time and on-demand, adaptive and learner-centric* [23]. Therefore, the content of the information literacy curriculum will be split into small bits that can be consumed bit-by-bit by using micro learning cards.

## 2.3   Reflective Learning and Reflective Prompts

Reflective learning is the conscious re-evaluation of past experiences with the goal to learn from them. This is in line with the definition of Boud et al. [3], who define reflective learning as *those intellectual and affective activities in which individuals engage to explore their experiences in order to lead to new understandings and appreciations.* Beside other technologies that can initiate reflective learning,

so-called reflective prompts have been shown to be a good way to technologically initiate reflective learning [12, 14, 11, 10]. We understand a reflective prompt as an intervention that motivates a user to reflect by presenting a small text message. These prompts often consist of a question, sentence starter (e.g."What I am thinking about now is...") or a direct instruction strongly connected to the users activities or context. The goal of prompts is to focus user attention on relevant aspects or experiences of their learning and working activities. In learning management systems, prompts emerged to be a viable and appropriate approach for guiding and initiating reflective learning  [11, 16]. Here, prompts are used very often to organize, retrieve, monitor or evaluate knowledge as well as to reflect on students learning [16, 2, 18, 28]. Another approach that is presented in Kocielnik et al. [20], who use a conversational system that stimulates reflective learning on personal sensed activity data tracked with a fitness tracking application. Their approach was to send daily messages consisting of a visualization regarding the tracked fitness data in combination with a two-step mini-dialogue structure to make the reflective conversation engaging and to encourage a deeper level of reflection. Important to note is that all approaches presented can be seen as data-driven reflective learning approaches which leads to the idea to also use learning activities conducted in a search environment as a baseline for reflective learning. One major challenge that needs to be considered with regard to prompts is the right timing in the sense of not interrupting the user, as the right timing of a prompt affects the learning outcome [26]. To reduce the stress of interruptions through prompts on mobile devices, Ho and Intille [15] presented prompts directly after the completion of actions, while Pejovic and Musolesi [24] identify opportune moments for interruption by classifying relevant sensor data for context recognition.

### 2.4   User Models

User models are models that computer systems have about their users. In learning systems, user models often contain information about users like *knowledge, interests, goals, background and individual traits* [5]. Learning management systems typically use such models to adapt their behaviour or information representation to the user. In this case the user model need not be accessible by the user. In contrast, if users are allowed to access their user model in a learning management system, then they are called open learner models. Providing this access allows the users to see what the learning systems knows about their knowledge, and use this as basis for reflecting on their learning status and progress, and to plan further learning activities [6, 7, 17]. Relating such open learner modelling to Boud et al. [3], the learner models content represents the learning experience. In learning settings, the learning experience is the object of reflection, i.e. what the learners reflect on. In this sense, open learner models are similar to what the applications do, when reflection guidance technology is embedded: they collect information about a user activity, and represent it to users as a basis for reflection.

### 2.5   Contribution and Research Questions

Based on the literature presented above, we have designed a concept for a widget to provide automatic learning guidance w.r.t. the information literacy curriculum. The widget itself is implemented in a newly developed search platform aiming at increasing the learner's competence level to an expert level w.r.t. three modules of the curriculum.

As the cognitive load while performing a search is rather high, we have used a micro learning approach as underlying learning strategy. From reflective learning prompts we know that the timing when to motivate to reflect plays an important role, thus we coupled the timing of the reflective prompts to the learning activities of the learner on the platform. All learning activities, that are related to the curriculum like for example reading a micro learning content for pursuing the curriculum or answering a reflective question are stored in a learner model to keep track of the learner's learning progress.

Thus, the contribution of our work is to combine two different learning strategies: micro learning and reflective learning. We use micro learning to help users to learn small and feasible bytes in order to smoothly deal with complex content. We amplify this micro learning to support and deepen the assimilation and accommodation through reflective learning. In order to be able to apply this approach we need to be able to automatically infer the learning progress of the user in order to be able to present the right information w.r.t. learning to the user. While this challenge was already discussed in our previous paper [13], in this work we focus on the combination of micro learning and reflective learning.

Thus, we have defined the following research questions as further guidance for our work.

- RQ1: How need the interplay between micro learning and reflective learning be designed in order to effectively support the accommodation and assimilation of the learning content?
- RQ2: How need the reflective prompts be formulated that they are strongly related to the micro learning content and that they can be understood, are perceived as appropriate w.r.t. the users expertise, and lead to reflection;

These are the research questions that we would like to have answered within our approach, however, we have not conducted any evaluation with regard to the widget so far.

## 3   Concept

In figure 1, we shortly present the concept the widget is based upon. In order to initialize the widget, the learner's competence status w.r.t the modules of the curriculum, including different competence levels per module, is extracted with a questionnaire. This status is stored in the user's user model. According to this status, the widget automatically recommends the user a learning prompt referring to a micro learning card covering a topic to further develop the user's

learning competence. In order to automatically track if a user is opening the recommended learning card and deals with the learning content, we have implemented an activity logging mechanism that automatically tracks the user's activities with the learning card (e.g. opening the card, clicking on the next button when having learned the topic). These activities are then used to automatically infer the further development of the learner's competences and are added into the user model again. To strengthen the learned content, the widget presents a reflective question according to the learned content. After having answered this (open) question, the widget presents the next content to learn. Furthermore, beside presenting the learning and reflective prompts mutually, the widget visualizes also the overall progress of the user w.r.t. curriculum, thus the learner can see his/her progress at one glance.
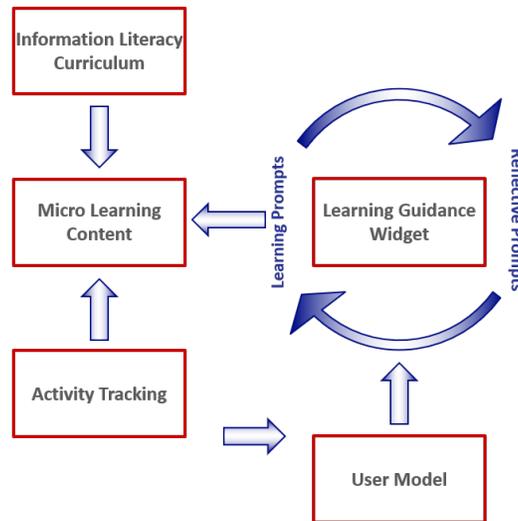


**Fig. 1.** Overall concept of the widget

## 4   Implementation of the Widget

In general the widget is implemented in the user interface of a search platform. It supports the acquiring of the following three modules of the DigComp 2.1 framework on three levels, namely, "Information and Data Literacy", "Communication and Collaboration" and "Content Creation".

The learning guidance widget consists of two parts, the *curriculum learning and reflection* part and the *overall progress part*. The curriculum learning and reflection part, figure 2 is divided into two areas. The upper area contains either a learning prompt suggesting to learn more about the next topic that would be the next in the current sub-module of their curriculum, and a button which

opens the respective learning unit in a new tab (see Figure2, a), or it presents a reflective question that motivates to think about the currently learned topic (see Figure2, b).

Regarding the prompts in more detail, both types of prompts are divided into prompts supporting three different expertise levels of users. Thus, depending on the competence status a user has like beginner, intermediate or expert, a corresponding prompt will be displayed. Thus, we have prompts for beginners, prompts for intermediates and prompts for experts. For example, table 1 shows three prompts for the sub-module "Finding Information" within the module "Information and Data Literacy" on three expertise levels.

**Table 1.** Example of micro learning prompts for the sub-module "Finding Information" in the module "Information and Data Literacy"

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

On one hand, the reflective prompts are strongly related to the topic of the micro learning content by taking up the content a learner has just learned. On the other hand, the reflective prompts were developed according the model of Kirkpatrick [19] and follows a specific goal depending on the learner's learning progress. Reflective prompts for the beginners level should make users aware of how they react to the learned topic e.g. if it was helpful for them. Prompts at the intermediate level make users aware to what degree learners acquire knowledge, skills, attitudes, confidence, and commitment and apply it in practice. Prompts on an expert level should motivate learner's to think about if they perceived a change or improvement in their work or study behaviour. Table 2 gives two examples for each level.

Below the prompts, a progress indicator shows the user the current progress for the curriculum's current sub-module. The progress is defined by the amount of completed learning units in comparison to the available ones for this particular sub-module, and matches with the progress in the overall progress widget for this specific sub-module.

The overall progress widget shows the user's learning progress with regard to the curriculum. In figure 3, it can be seen that the curriculum is divided into three modules, represented as sections in the inner circle of the visualization. Each module is additionally divided into three sub-modules (outer circle). Every time a user completes a new learning unit, the percentage in the respective section in the sunburst diagram gets updated. Furthermore, the progress in each sub-module is encoded by color. If the user has not completed any learning units

**Table 2.** Example of reflective learning prompts on three expertise levels

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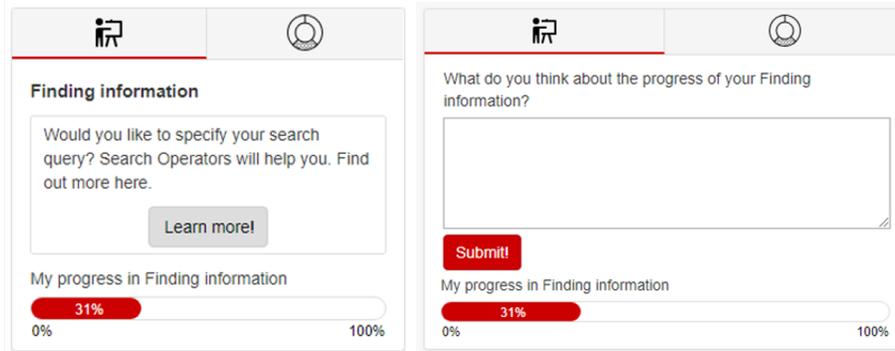


a) Learning prompt to micro learning card          b) Reflective prompt

**Fig. 2.** Learning prompt on the left side and reflective prompt on the right side.

in a sub-module (0%) the respective section will be red. Making progress in a sub-module will turn the section to yellow (50%) and finally, by completing a sub-module, the section will turn green (100%). This is also explained by the legend below the visualization. Moreover, the sections in the sunburst diagram are ordered to mirror the structure of the curriculum. Starting from the top, the sub-modules get completed clock-wise, slowly turning the visualization green.
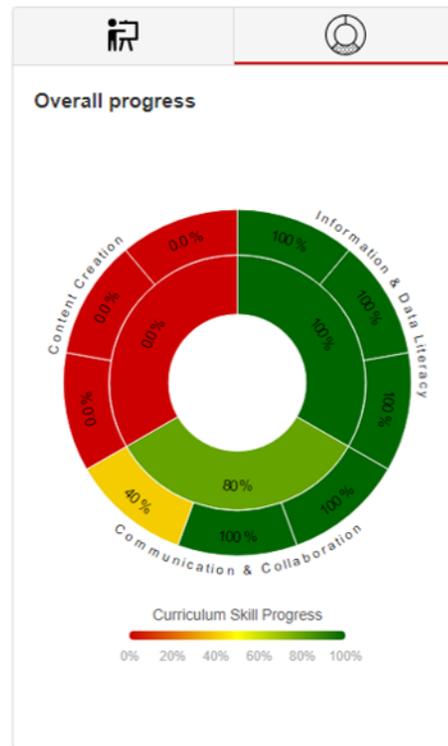
**Fig. 3.** Overall progress of the learner w.r.t. the curriculum.

## 5   Discussion

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

**RQ1: Interplay between micro learning and reflective learning** The advantage of a micro learning approach initiated through learning prompts are twofold: first, the content which should be learned is broken down into very small pieces and second, the cognitive load in our setting is still on searching and not on learning, however, it can be easily integrated in search activities [4]. Second, automatically guiding the learner through the curriculum according to the learners' learning progress and learning level ensures that the learner will cover all topics automatically and at the same time takes away the workload from the learner to find the next learning content to progress in the curriculum. Third, presenting the overall learning progress in one visualization can motivate the learner to continue.

Although reflective learning has been proved to be a very successful learning strategy, we are aware that the initiation of reflective learning with reflective learning technologies like prompts is still challenging. First, reflective learning is

a cognitive process based on the individuals intrinsic motivation and cannot be directly enforced. However, external impulses can be given to stimulate learners motivation [11, 10, 16]. Second, the timing of reflection is very challenging, thus, if a learner is disrupted by performing a search and perceives a prompt rather as disturbing than as useful s/he will not use it [14]. Third, the content of a prompt needs to be carefully considered, thus, it should be related to the user's context, in our case the learner's learning activities [20] in order to motivate for reflection.

By combining the two learning strategies, we try on one hand to use the advantages that micro learning brings along with the use of reflective learning prompts to deepen the assimilation and accommodation of knowledge, such as that we strongly relate the reflective question to the currently learned micro learning content.

**RQ2: Design of reflection prompts:** The design and formulation of the reflective prompts was motivated by the question on how to provide learner's a clear benefit for themselves as this is often difficult to achieve [25]. First, we strongly relate the topic of the reflective question to the content of the micro learning content in order to have a visible relation to current learning activities of the learner. Second, we built our question upon the model of Kirkpatrick [19], which is originally a model used for assessing training effectiveness in organizations using a 4-level approach for evaluating learning. By formulating the reflective questions according to the first three steps of the model ("Reaction", "Learning" and "Behaviour") we are aiming at improving the learner's self-reflection by starting with low-level reflective questions followed by questions to deepen the reflective learning.

We think that our approach is legitimate and well founded, however, only a well-planned evaluation will give us insights if this approach works.

## 6    Conclusion

In this work we have presented a widget for providing learning guidance along an information literacy curriculum based on the EU DigComp 2.1 framework that has been implemented in a newly developed search platform. We based our concept on the combination of micro learning and reflective learning, as we see these two learning strategies are perfectly complementing each other so that they support the acquiring of knowledge, and deepening the assimilation of it at the same time. Furthermore, we discussed challenges and shortcomings of our concept. As the next step, we aim to set up experimental field studies with university students in order to answer the above stated research questions.

## 7    Acknowledgement

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