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Supporting Reflection in Informal Learning

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Abstract: This paper analyzes how different visualisations of interaction information can be used to indicate user activity and support informal learning. The question for research is how to support learners in unstructured and emerging environments to become aware of their often unconscious learning processes. Based on this question, two design studies and three experiments were conducted, to analyze the effects of indicators on informal learning. From the findings of the research we identified that the reception of interaction information is dependent on the context of the learners. “Relatedness” seems to be important for designing indicators that support learning.

Keywords: personal learning environments, adaptive instructions, learner support, context awareness

Introduction

People need to communicate their knowledge and competences in many situations of daily life. In formal educational settings, this communication is supported through specially trained staff and the application of fine grained assessment methods. Such assessment is not limited to formally strict testing, but includes (among other approaches) observing learners on their learning course, stimulating group work, apprenticing, analysing a learner’s contributions in discussions and problem solving approaches. In this broad and qualitative understanding assessment does not only allow the expression but also the comparison of knowledge and competences among groups of learners. In this sense “assessment” is assisting learners to communicate their knowledge and competences. Furthermore is assessment integral to the curricula of formal education. One of the key qualities of formal education is to make learning processes accessible for communication in such a way that forms of assessment results – the certificates – can serve as proof of the acquired knowledge and competences. As a result have the former learners a rather explicit understanding of the meaning and quality of their certificates with respect to the knowledge and competences they have (or have not) acquired while obtaining it.

Formal education allows several assumptions about the learning process. First the learning domain is defined. Second, the learning objectives are defined. Third, the learning results can be defined. Fourth, the prior knowledge of the learners might be available. Fifth, the learning material is well defined and known. Sixth, the learning

process is pre-structured. Seventh, well tested assessment methods are available. Eighth, participants intend to learn something. Even if some of these assumptions cannot be made in one particular setting, learning processes in formal education are almost always well structured and *contextualized* within a given environment. An enormous number of educational and educational technology research publications deal with these assumptions, assessment methods, and instructional design in formal education. The baseline of the related research is the explicit and structured learning process.

The explicit and structured learning processes of formal education take less and less time once a person has finished compulsory education. However, this does not mean that people stop learning. It has been reported that the knowledge and competences, which were acquired independently from formal education play an important role for the individual professional development [4]. This implies that people also need to be able communicating the knowledge and competences, which they acquired informally. It appears that learners are often unaware about their informal learning processes [16] as well as about the quality and value of related outcomes [7, 15].

The problem for our research is to support informal learning processes that are lacking of pre-defined structure. The lack of structure implies that the underlying assumptions of formal education cannot be made in these cases. This does not mean that learning support is “de-contextualised”. Instead, informal learning takes place in a range of highly complex, uncertain, and unstable situations [16], which require different approaches of contextualisation to support learning.

This paper reports on the progress and findings of the research on supporting engagement and reflection in informal learning. The approach for supporting learning is by providing contextual information visualisations of learning actions, which we call indicators. The results include the outcomes of two design studies and two experimental studies, from which we drew the concept of peripheral information. Based on this concept we outlined and prepared a third experimental study, in order to verify our findings.

Background and Motivation

This research was motivated by from Schön’s [16] analysis of professionals’ reasoning and learning. The author notes that today’s professionals are confronted with a range of situations that are highly complex, uncertain, and unstable. In these situations it is not always possible to apply deterministic and hard empirically grounded methods as they are often taught in schools or universities. In other words, professionals have to manage “messes” and make sense of these in order to provide services to their clients [16].

Our research is based on three pillars.

The first pillar is context in situated learning and communities of practice [14, 17]. At large, this research provides a framework of supporting learning in communities of practice through technology. Nevertheless, the applications of social software reported in these settings do not tackle the problem of engagement and motivation for

learning processes that are part of the professional “artistry” [16] and professional competence development [3, 4].

The second pillar is self-regulated learning and motivation in learning [1]. The key finding for this research is that people need various types of external information in order to monitor and regulate their actions in an environment. However, the related research in this field has not yet focused on contextual factors in using external information for self-regulation and how this affects motivation and engagement.

The third pillar is the research on interaction *indicators* [5, 13] of interaction footprints [2, 8]. Indicators provide simplified representations of complex information, contexts, and processes. The related research applies techniques of information visualisation for making social activity accessible to the actors. Although the special indicators used in prior research [5, 13] provide good examples for supporting self-regulated actions of learners in online environments through activity visualizations, they are limited to a single context, which contrasts the underpinnings of the first pillar.

From the viewpoint of these pillars context has been identified as an important factor for supporting learning processes, which is likely to be supported by visualizing social dynamics to the actors in informal learning. However, both, the theoretical models of self-regulation and the applied visualizations have not yet considered context as a dimension for supporting learning.

Grounded on these pillars our research objective is to analyze if and how indicators can support informal learning in different contexts. For this reason the concept of a *smart indicator* has been introduced. A smart indicator is defined as *a context aware indicator system, which dynamically aligns data sources, data aggregation, and data presentation to the current context of a learner* [8].

Question of Research

Considering this, our research seeks to answer the following question: how to support learners in unstructured and emerging environments to become aware of their often unconscious learning processes? The objective of our research is to identify contextual dimensions for learner support in unstructured environments, in which no predefined curriculum and explicit educational guidance is available, and users might be at very different stages on their learning course.

Our particular interest is the application of interaction footprints for both determining appropriate support strategies and as a source of information that is suitable for stimulating learning in unstructured settings.

Reviews, Designs, and Experiments

In order to develop a better understanding of supporting strategies in informal learning, a literature review [10], two design studies [8, 12], and three experiments [9, 11] have been conducted. By the time of this writing, one experiment is still in progress.

The literature review [10] shows that there are various approaches of visualizing social dynamics by using interaction footprints of the users of online systems. The review also showed that the focus of research was on aggregating and visualizing information, mostly at the level of design studies or functional prototypes. The review had three important findings. The first finding is the lack of empirical grounding for the benefits of the different types of visualizations for the learning process. The second finding is that data for visualization is mostly randomly selected. The third finding of the review is the visualization is not analyzed regarding the context, in which the information is presented to the users.

The first design study [8] implemented a smart indicator on top of a community information system. Based on the general findings of prior literature research an adaptation strategy has been proposed for the indicator. This adaptation strategy was based on two abstract information visualizations. Both visualizations were personal bar charts of the user's activity. For contextualizing the presented information we choose "participation" as the key context dimension.

We analyzed in the first experimental study [9], if the assumptions for adapting the indicator to the participation level could be verified. For this purpose we used the system with the two visualizations of the earlier design study. Different to the proposed design, the indicator was non-adaptive. This way it we analyzed if the assumed contextual differences of "reading" the visualizations could be found in practice. Through this experiment we were able to partially verify our assumptions for one of the visualizations, whereas the other visualization appeared to be of little benefit for informal learning.

While the first experiment focused on the visualization of general user activity, the second experiment [11] analyzed if more specific information of user activity might be used to stimulate reflection. This experiment focused at the differences between the explicit uses of tagged resources in comparison with their implicit uses while reading. The purpose of this experiment was to understand if explicit interest expressions provide different information than implicit interest expressions, and if the reading habits are comparable for users at different levels of participation. The key findings of this experiment confirmed both assumptions. This means that visualizing implicit interest expressions to the users can help to unveil information to the users, of which they were not aware of.

The second design study [12] focused on visualizing different types of tagging information in a "tag cloud" for stimulating reflection. This design study encoded different information of the personal uses of a user's tags in social bookmarking. From an educational perspective this study helped to identify three types of reflecting on web readings. First, *relating* browsing and tagging habits to external tasks; second, *controlling* and directing their web readings towards interests or tasks; and third, *linking* topics and tags on a conceptual level.

A third experiment is currently running. It analyses if the findings of the second design study could be verified for a larger user group and if these findings refer to more general principles.

Discussion

The presented research identified that the visualization of interaction footprints can change the learners' perspective on the learning activities independently from the actual resources. Additionally, we found that visualized information has contextual meaning to the participants. From the design of the indicators we found that those visualizations that create a relational tension in the perception of the learners helped to translate the visualization into meaningful information and stimulated reflection. We call the visualized information "*peripheral information*", because it is mostly independent from the core application logic.

The important aspect of peripheral information is the relation to the learners' context. I.e. this information needs to allow the learners to contextualize the information and to allow meaningful interpretations that are relevant to the learners' context. From the perspective of technology enhanced learning, peripheral information is interesting because it can be used to support awareness and stimulate reflection of learners by providing referral hooks that are independent from explicit learning objectives, contents or didactics.

Conclusions

This paper focused on supporting reflection in unstructured and emerging learning settings. Because concepts and structures are moving targets in these settings, we decided to utilize support strategies that are independent from the actual concepts, structures, or processes. Instead, we designed an environment that visualizes interaction footprints of the learners for stimulating their reflection. Our research has shown that the visualisations can be designed independently from the pre-defined concepts, structures, and processes, but that they have to allow the learners to relate themselves to the information. The latter appears to be dependent on the learner's context. Given to our findings the idea of "peripheral information" is the design principle for information visualisation for supporting informal learning.

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