Activating Thinking Skills with Mash-Up Research Environments: A Proposal

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Abstract: Critical thinking skills are seen as one of the most important skills for researchers. Mash-Up Research Environments have the potential to activate these skills. While these environments already have their own value, this work provides a first step in answering the question of whether or not they activate thinking processes, and as a further step, what quality of thinking is activated. Considering the openness of such ensembles, we sketch a method for researching activation of thinking at web scale applying a field experiment approach. We outline an individual and a prototype of a collaborative research space and describe a thinking skill framework we will use to categorize thinking expressed in written accounts.

Keywords: reflection, critical thinking, mash-up research environment

1 Thinking Skills and Mash-Up Research Environments

The ability to reflect and think critically about information, to rate, and to review it, is one of the key abilities of the modern information society. Recently, the Research 2.0 [1] movement tries to leverage the possibilities of the Web 2.0 for researchers, providing tools for research practice in the open space of the Web. We call this research tools Mash-Up Research Environments (MRE).

This work describes the first step of researching the relation between these environments and thinking skills. The question is: How do Mash-up Research Environments support the activation of thinking processes, especially in critical thinking?

Today's researchers use more and more online tools to support their daily work. For example, they use these tools to inform themselves about new publications and other web resources, to engage in social networks with their peers, to use it for online collaboration and communication, and to share resources. Mash-Up Research Environments are able to incorporate these widespread resources and functionalities in a single environment. They use widgets (mini applications), which usually provide a single functionality of a larger web application. A combination of widgets forms the mash-up environment. Due to its flexibility to select several widgets for an environment, it could be used to examine which combination of widgets help to create an environment beneficial for research practice and to activate thinking processes. We will call these widget ensembles an event space and the time-span of people working with this space the event duration. Furthermore we distinguish between three types of widgets. Activation widgets, which are meant to be thought-provoking as the main

component of the mash-up environment. Account widgets to give possibilities to express thinking, and narrative widgets, which can be used to support the thinking process.

While many key pedagogical outcome variables could have been taken into account, like conation (motivation and volition), or affection (emotions), the focus of this work is on cognition and especially its sub-concept critical thinking. To emphasis critical thinking seems to be a good starting point for a further examination of the other mentioned dimensions, which are seen as highly connected. Thinking is topic of manifold research articles (for overviews see [2][3][4][5]). The bottom line is, that thinking can be classified into more or less independent categories of thinking, including dimensions and depth of thinking. Later we will outline how these classifications will be used to assess the thinking process activated by the MRE.

The term activation is chosen to express the characteristic of events, which are usually seen as a period of higher activity of the participants. We see the activation of research activities and thinking skills as essential for a deeper learning experience, compared to a mere facilitation, which tends to be more a supporting process of actors in the background of an environment. This is in line with meta-studies emphasizing the importance of activation on learning outcome [6].

Research Mash-Up environments are usually not embedded in a controlled educational space. For example, if researchers write about nascent theories [7] on their blogs, then these environments, try to incorporate these writings, instead of forcing the authors to use the tool of the platform. This flexibility adds a new complexity for researching them. While in a controlled environment all artefacts produced by the participants are easy retrievable, this is not necessarily true for these open environments. Methodologies, which try to investigate research environments embedded in the real world with large-scale observations [8], seem to be necessary.

We will now outline the main components of the proposed infrastructure in which this research is embedded. Starting with Mash-Up environments, a thinking skill framework and an individual and collaborative event space. Finally, conclusions highlight strengths and discuss limitations of the approach.

2 Mash-Up Research Environments

Mash-ups are "a combination of pre-existing, integrated units of technology, glued together to achieve new functionality, as opposed to creating that functionality from scratch" [11]. They are seen as software applications that merge together separate APIs and data sources [9][10].

Based on the Mash-Up idea we implemented a research infrastructure upon which the STELLAR Mash-Up Research Environment [1][12] is built. It uses Elgg, an open source networking and publishing software, as showcasing platform for bringing together widgets and services and the legacy systems of the STELLAR partners. The Mash-Up Research Environment consists of a set of widgets, which the users select from a directory. The widgets are packaged according to the Widget 1.0 specification and delivered through the Wookie widget engine. A plugin for Elgg enables to embed the widgets into Elgg (Wordpress, Moodle, LAMS are supported out-of-the-box). See figure 2 (right) as example of the working individual event space of the Stellar Mash-Up Environment. These research environments are per se just a collection of artifacts,

with the goal to help researchers with their practice. While these ensembles of artifacts (widget ensembles) have already its own value, the focus of this work is seen how this Mash-Up Research Environments can activate thinking processes, especially reflective or critical thinking. With reflection, we mean a deeper, critical thinking about artifacts or situations/events.

3 Thinking Frameworks

Thinking processes, as outcomes of the researchers participating in the Mash-Up Research Environment are central for this work. Several definitions and frameworks about thinking exist, with different notions and emphasis of thinking [2]. In the following we outline qualities of thinking and describe a framework, which seems useful to describe thinking and its facets.

Within the stream of thoughts, which the human brain consciously and unconsciously processes, some salient thoughts catch the attention and foster a process of critical thinking. This quality of thinking can be described as an "active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it, and the further conclusion to which it tends" [13]. Thinking in general is seen as a conscious, goal-directed process. Examples are model building, planning of actions, remembering of past events (thinking backward), imagining future events (thinking forward), decision-making, problem solving, reasoning, and so forth. Conscious processes are interrelated with unconscious ones. The latter usually are highly automated processes, which do not involve the consciousness of the actor anymore.

Moseley et al. [14] developed an integrated framework for understanding thinking and learning. They reviewed 35 thinking skill frameworks ranging from all embracing frameworks to specified ones. They conclude, that the current literature on thinking skills can be integrated in a two-factor model, consisting of "cognitive skills" and "strategic and reflective thinking" (see fig. 2).

Strategic and Reflective Thinking		
Engagement with and management of thinking/learning, supported by value-grounded thinking (including critical reflective thinking)		

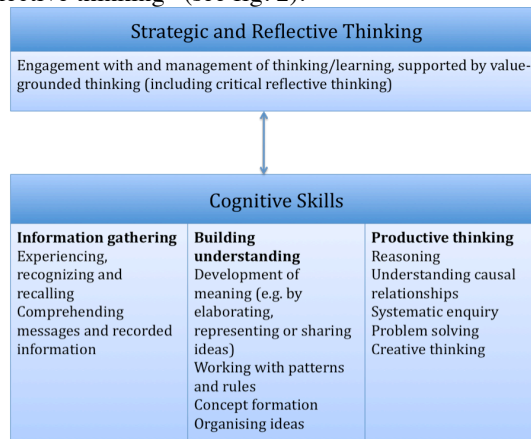| Cognitive Skills		
Information gathering Experiencing, recognizing and recalling Comprehending messages and recorded information	**Building understanding** Development of meaning (e.g. by elaborating, representing or sharing ideas) Working with patterns and rules Concept formation Organising ideas	**Productive thinking** Reasoning Understanding causal relationships Systematic enquiry Problem solving Creative thinking

Figure 1: Framework for thinking [14]

These categories of thinking will help to determine which sort of thinking was activated by an event within a Research Mash-Up Environment. The long-term goal

would be to research the correlations between widget ensembles and thinking. Knowing these could help to construct thinking activating environments.

In our research we limit ourselves to manifested representations of thinking processes on the Web. In most cases thoughts are represented in written form, pictures, audios or videos. Because of our usage of an open Mash-Up Research Environment this representations could be basically found everywhere on the Web. Our research will only take into account public available representations. To research the question whether Mash-Up Research Environments can activate thinking skills we propose an iterative research process starting with the following research design and method.

4 Research Design and Method

The basic idea is to set up an event space for researchers supporting by several widgets. An event could be for example a live stream of a keynote, but also other artifacts, like a visualization, text, etc. These widgets follow the above-mentioned categorization of activation, account, and narrative widgets. We will then investigate whether or not the widget ensemble activates thinking processes captured in the account widgets and elsewhere on the Web. The account widgets can provide the functionality either being connected to a tool, which is in control of the observer, like the TELpedia, or being connected for example to the blog of the participating researcher. Furthermore, and even more interesting, we will observe if the participants write about the event outside the Mash-Up Research Environment. For this we have to find methods to detect these writings and the discussions surrounding these. This will lead to a set or graph structure of writings associated with the event. The outlined framework to categorize thinking will then serve as schema to qualify the written accounts.

The goal of the first experiments is to get to know how many participants actually get activated to write about their experiences during and after the event and what type of thinking is involved. Questionnaires before and after the event will support this research activity, helping to figure out what understanding the participants had before the event, what type of tools they use to write about this event, and where to find them. We will then compare the results of the questionnaire with the detection system we will use to find the writings about the event to gain a better understanding to what extent thinking processes about an event could be detected.

While we already developed an individual event space in the above outlined Stellar Mash-Up Research Environments, we are currently working on a collaborative space, called the collaborative event space. See the mockup in the following figure (left).

The collaborative event space shows as main activation widget a video (this could be the live stream of a keynote). This is meant to be the center of attention for all participants of the event. An additional activation widget is shown below – the social network widget. It shows social network activity for example the Twitter posts of this event, Blog posts, associated videos, etc. Next to this widget you can see two account widgets. A feedback widgets, which is meant to give feedback to the keynote speaker or to send him resources. And a collaborative writing widget, which allows all participants to write down their thoughts. On the right side of the presentation widget,

you can see a narrative widget with reflection fostering questions. Next to it is a widget, providing basic information about the event.
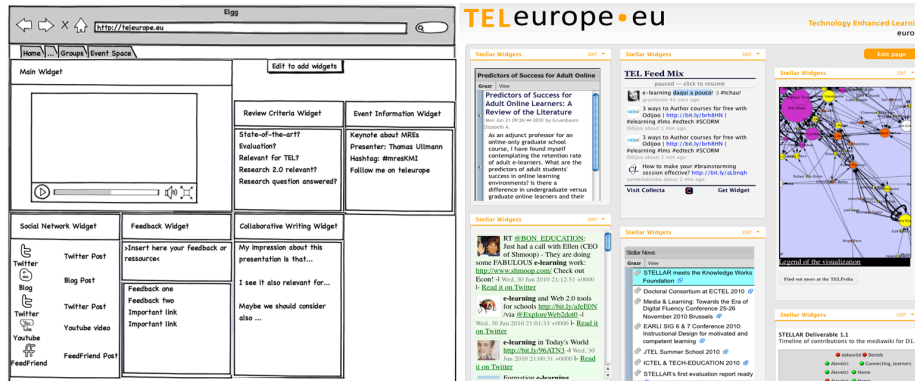

Figure 2: Collaborative Event Space (left) and Individual Event Space (right)

5 Discussion

Thinking, especially critical thinking skills are seen as important, especially for researchers who constantly have to rethink their own work and who need to decide on what work is relevant for their own research. We outlined the Stellar Mash-Up Research Environment, which provides a flexible and open infrastructure for researchers. The Mash-Up approach allows users to use their own tools and arrange them on a space. They can tailor their research space with functionality that is relevant for their own research, while the collaborative research space will allow groups of researchers to work together. One important goal of such environments is to activate the thinking processes of researchers. Considering the variety of tools researchers can use to express them on the Web, a methodology able to detect these seems necessary to study the quality of thinking activated through the events. The first step of this research is to determine if events of the Mash-Up Research environment activate thinking processes. Afterwards, the focus will lie on finding reliable methods to detect thinking accounts associated with an event on the Web. Further examinations will focus on the thinking quality of these accounts. For this we outlined a thinking framework, which will help to categorize manifested thinking processes. In first stance a qualitative research approach will help to categorize the thinking accounts. Using field experiments as approach to observe different widget ensembles, we have to take into account the tradeoff between internal and external validity, weakening internal validity in favor of external one.

We proposed three types of widgets to distinct tasks of widgets. Activations widgets represent the main point of attention for research to think upon. Account widgets will provide an interface to express own thinking. Content generated there could be used by the researcher as a starting point for account writings in the environment of their choice. Narrative widgets can help to initialize the thinking process, providing for example critical questions, standards, or further information. These widgets can be activation points of thinking on their own. For example account widgets could activate to think about ones own account writings or of others,

narrative widgets can activate thinking about the outlined critical questions, etc. The research is drawn on the assumption that the accounts will be publicly available. Researchers publish them on the Web to seek feedback from others or to report about interesting developments. The research data is therefore limited to public accounts.

We see similarities between Mash-Up Learning Environments and Mash-Up Research Environments. Research done in either of the fields could be fruitful for the others. A discussion about the main differences and similarities applying the approach proposed here could encourage new research questions.

Acknowledgment

Reference

1. Wild, F., Ullmann, T.D., Scott, P.: The STELLAR Science 2.0 Mash-Up Infrastructure. Presented at the 10th IEEE International Conference on Advanced Learning Technologies, Sousse, Tunisia (2010).
2. Halpern, D.F.: Thought and Knowledge. An Introduction to Critical Thinking. L. Erlbaum Associates (2003).
3. Facione, P.A.: Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction. Research Findings and Recommendations. (1990).
4. Moon, J.A.: Critical thinking. An exploration of theory and practice. Routledge (2008).
5. Moseley, D., Baumfield, V., Elliott, J., Gregson, M., Higgins, S., Miller, J., Newton, D.P.: Frameworks for Thinking: A Handbook for Teaching and Learning. Cambridge University Press (2005).
6. Hattie, J.: Visible learning: a synthesis of over 800 meta-analyses relating to achievement. Taylor & Francis (2009).
7. Waldrop, M.M.: Science 2.0. Scientific American. 298, 68 (2008).
8. Shneiderman, B.: COMPUTER SCIENCE: Science 2.0. Science. 319, 1349-1350 (2008).
9. Zang, N., Rosson, M.B., Nasser, V.: CHI '08 extended abstracts on Human factors in computing systems. Presented at the , Florence, Italy (2008).
10. Maximilien, E., Ranabahu, A., Gomadam, K.: An Online Platform for Web APIs and Service Mashups. Internet Computing, IEEE. 12, 32-43 (2008).
11. Hartmann, B., Doorley, S., Klemmer, S.R.: Hacking, Mashing, Gluing: A Study of Opportunistic Design and Development. (2006).
12. Wild, F., Ullmann, T.D.: Science 2.0 Mash-Ups, http://www.stellarnet.eu/kmi/deliverables/20100120_stellar___d6-3.pdf, (2009).
13. Dewey, J.: How we think: A restatement of the relation of reflective thinking to the educative process. DC Heath Boston (1933).
14. Moseley, D., Elliott, J., Gregson, M., Higgins, S.: Thinking Skills Frameworks for Use in Education and Training. British Educational Research Journal. 31, 367-390 (2005).