

The learning potential of an asynchronous discussion tool in informal learning settings

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Research question and goals of the dissertation project

The focus of my dissertation project will be on the learning potential of an asynchronous discussion tool in informal learning settings like museums. The aim is to identify cognitive processes that contain potential for learning when engaging in discussion about a current controversy elicited by the exhibition content. Active participation in discourse, awareness of controversy, reading other's statements and typing one's own statement is expected to result in deeper elaboration of content and thus higher degrees of learning.

In a second step, cognitive processes which have been identified as core processes in such a setting will be enhanced by technology to promote learning via awareness tools (e.g. regarding controversy to elicit cognitive conflicts).

This dissertation project is realized in the context of a German research project of the IWM - Institut für Wissensmedien (Knowledge Media Research Center, Tuebingen), the research department of Deutsches Museum, Munich, and the IPN – Institute for Science Education at the University of Kiel.

Theoretical background

Informal learning at the museum and the role of new media is a relatively new area of psychological research (Falk, 2004). Thus, informal learning is an important field of learning sciences, especially due to the fact that "lifelong learning" is an omnipresent buzzword today. Informal learning settings are characterised by e.g. high internal motivation, free-choice learning, absence of external goal-setting or assessment of learning (Ash & Klein, 1999). These qualities complicate psychological and experimental research. Learning in the workplace and learning in leisure time (e.g. learning at the museum) are therefore rarely (experimentally) explored issues. Visitor studies and museum learning are an active field of qualitative research: Museum visits have been described at different levels of detail in the 1980s and brought out that social interaction and conversational engagement are a matter of special importance for knowledge acquisition (Ellenbogen, Luke, & Dierking, 2004; Falk & Dierking, 1992; Leinhardt & Crowley, 1998; Leinhardt, Tittle, & Knutson, 2002; Vom Lehn, Heath, & Hindmarsh, 2002). Explicit dialogue and discussion between visitors (versus implicit dialogue between exhibit and visitor) can foster reconsideration and hypothesising about the exhibit (Overwien, 2000). A possible explanation is offered by collaborative learning theories: Individual cognition is mediated through social processes as socio-constructivist and socio-cultural learning theories state (Piaget, 1985; Vygotsky, 1986). These theories consider learning and conceptual changes to be the result of social interaction.

The belief that engaging in discussion supports learning is one of the great untested assumptions of current educational practice (Laurillard, 1993). In this dissertation project, the role of articulating one's opinion and the role of other's beliefs for learning is addressed and empirically tested. This study will focus on the cognitive processes underlying discursive activity in informal learning settings to highlight what constitutes potential for learning.

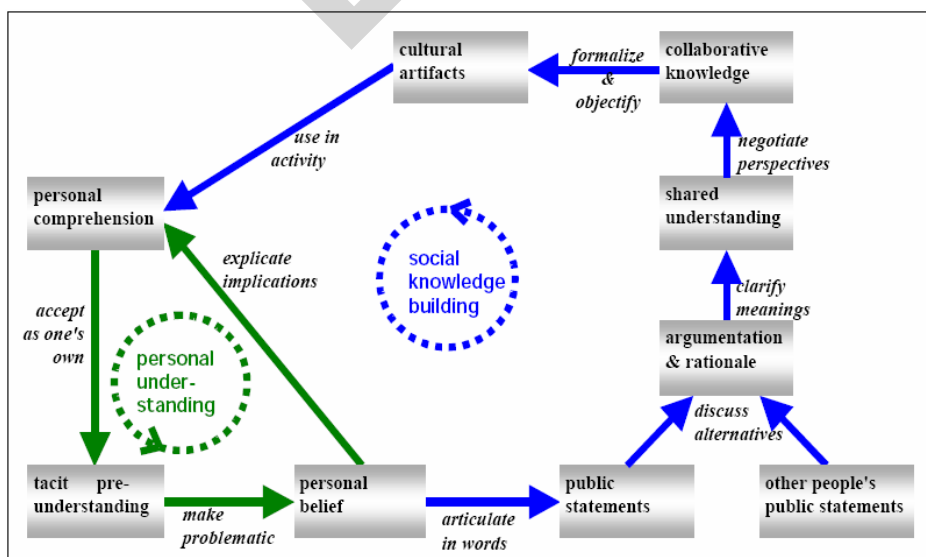


Figure 1: a model of collaborative knowledge building (Stahl, 2000)

Stahl (2000) presents a model of collaborative knowledge building that identifies processes and products of learning (see figure 1). The knowledge building process starts at the individual pre-understanding of a problem. By reinterpreting the own meaning structure the learner arrives at new comprehension. This process typically involves some feedback from the social surrounding. Articulating personal beliefs and discussing alternatives with others are the next steps if the individual could not resolve the problematic character of personal understanding. Knowledge is collaboratively built through negotiation and discourse. For the learning setting that is used in this dissertation project, especially the first (individual) steps are relevant: Through exploration of the exhibition at the museum, the learner acquires first pre-understanding about content and, perhaps, already about implications for society and daily life. The discussion tool will then provide opportunity to articulate this personal belief in a public statement. Articulation itself could foster elaboration as stated above. The possibility to make aware other's understanding and attitudes towards a certain topic by means of the discussion tool and the opportunity to discuss alternatives should lead to a deeper learning of content (Dysthe, 2002; Stahl, 2000). Salomon (1993) emphasizes that "there is no way to get around the role played by individuals' representations" (p. 134) while considering collaborative learning and collaborative knowledge building. He suggests a reciprocal, spiral-like relation between distributed cognition within a group and the individual cognition, and states that communication affects thought (Salomon, 1993, p.122). Therefore, this dissertation project will focus on individual cognitive processes and individual knowledge acquisition and its relation to the communication situation and the social context.

The second central aspect of the dissertation project is application of technology to enhance the knowledge building processes during the museum visit (Frost, 2002; Grinter et al., 2002). Technology plays an important role in support of individual and collaborative learning in various formal learning settings. But how can technology foster learning in *informal* settings like the museum? Some researchers also highlighted the role of the social context for informal learning at the museum (e.g. Falk & Dierking, 2000). But how to support learning by means of new media with regard to *social forms of knowledge construction*? This dissertation project aims to clear up some aspects of these fundamental questions: To get a deeper understanding of cognitive learning processes which occur in asynchronous discussion, a computer-mediated asynchronous discussion tool is utilized to mediate and encourage social communication that should lead to individual learning. The Subjects (Ss) have the opportunity to engage in asynchronous discourse with other persons. There will be expert and other visitors' opinions available, and additionally, the Ss can type their own statements regarding to a current and controversial question which is elicited by the exhibition (e.g. "Would you support use of embryonic material for stem-cell research? Why?"). Object of research is mainly knowledge acquisition about the exhibition object (e.g. facts about stem cell research and embryonic growth) and cognitive theories of learning are drawn on to explain the effects of the discussion tool (information processing theory, Gagné, 1985; levels of processing, Craik & Lockhart, 1972 etc.).

There are some aspects of the described discussion situation that could create potential for learning: The controversial question that is posed via the discussion tool for itself should foster deeper elaboration, articulating one's personal opinion results in higher motivation and involvement and, thus, supports reflection and abstraction (Berlyne, 1960; Litwak, 1996; Lowry & Johnson, 1981). Reading other's statements makes controversy more salient, and multiple perspectives should give rise to knowledge acquisition through resolving cognitive conflict (Piaget, 1985). The availability of the tool itself should heighten the attraction and holding power of the exhibit (Davis, Trant, & van der Starre, 1996). An overview of the functionalities of the discussion tool and expected effects on individual learning is presented in table 1.

Table 1: possible functionalities of the discussion tool and their assumed learning potential

Controversial question	Makes aware of (potentially) problematic character of the exhibition content Induces personal involvement Fosters deeper elaboration of the exhibition
Expert statements	Make aware of multiple perspectives Inform about different arguments (pro & con) Facilitate collaborative knowledge building via clarification of meaning and negotiating different perspectives
Typing in one's own opinion	Motivates cognitive elaboration Induces personal involvement Triggers reflection and abstraction of personal pre-understanding
Other's opinions	Make aware of multiple perspectives Inform about different arguments (pro & con) Facilitate collaborative knowledge building via clarification of meaning and negotiating different perspectives Fosters social comparison processes because they are more comparable to the individual in contrast to experts

Awareness information	Makes controversial perspectives more salient Fosters cognitive conflicts which can support deeper learning Facilitates social comparison processes
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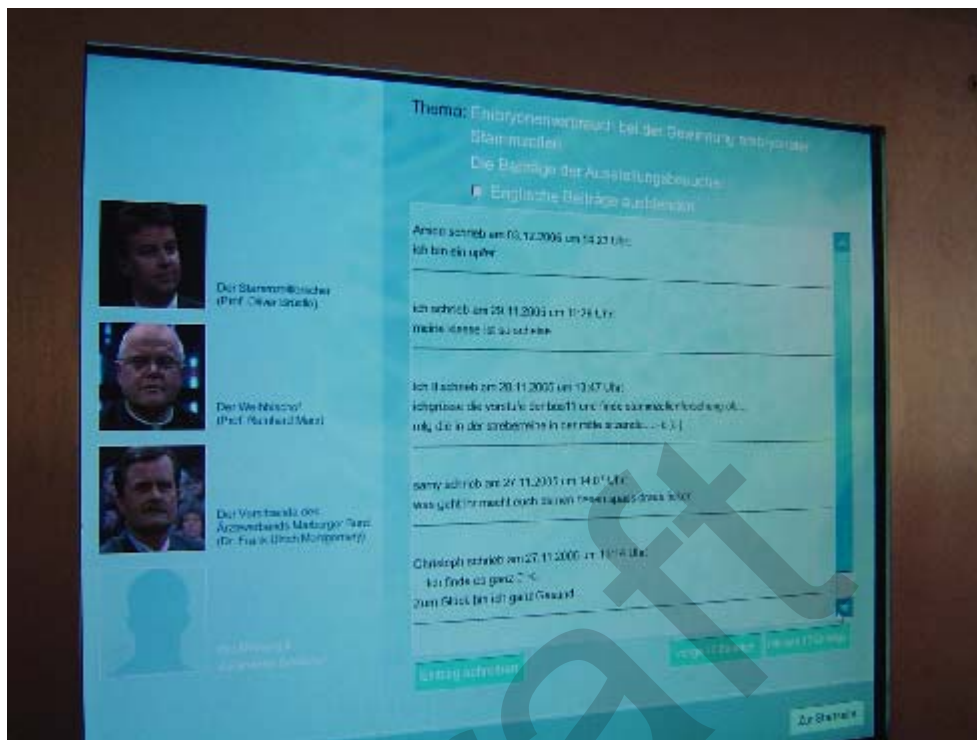


Figure 2: The current discussion tool at “Deutsches Museum”, Munich

Furthermore, theories of attitude formation and change could be relevant as explanation of the relation between attitudes towards and knowledge about an object. E.g. a relation of attitude importance and accumulation of attitude-relevant knowledge by selective exposure to and elaboration on relevant information was found (Holbrook, Berent, Krosnick, Visser, & Boninger, 2005). Other empirical findings about the persuasive impact of group opinions on individual need for cognition also are of relevance (Areni, Ferrel, & Wilcox, 2000). Therefore, object of research will be attitude formation and attitude change and how these are linked to the exploration of an exhibit and knowledge acquisition. Theories like the Elaboration Likelihood Model could throw light on the individual cognitive processes that took place (Petty, & Cacioppo, 1986): Richard E. Petty and John T. Cacioppo (1986) created the Elaboration Likelihood Model of Persuasion to explain, in detail, how a persuasive message worked to change the attitude of the receiver. They proposed that a message was transmitted and received through one of two routes of persuasion: the central route (extensively elaborating on a message) and the peripheral route (focusing on issues or themes that are not directly related to the subject matter).

As one can read other’s statements and expert opinions the discussion situation constitutes a setting for social comparison processes (Festinger, 1954). Especially due to the fact that a controversial question is posed and therefore, a situation of uncertainty is elicited, one has to consider the impact of others’ opinions. People don’t tend to evaluate themselves against others that are too different than themselves. In fact, given a range of people they will choose people most like themselves for comparison. Thus, it is expected that expert opinions would have just a slight impact on visitors’ opinions compared to other visitors’ statements.

To sum up, the aim of the dissertation project is to identify the core processes that underlie different functionalities of the discussion tool. In a second step the question is focused how to support these processes by optimized functionalities of an asynchronous discussion tool, e.g. ‘awareness tools’ to highlight controversy in discourse. Awareness usually refers to situational awareness (spatial orientation, presence, etc.) or activity awareness, e.g. presence of others, product history, group activity etc. (Barros & Verdejo, 2000; Gutwin & Greenberg, 1995). In this dissertation, the effect of awareness tools that provide information with no physical equivalent will be tested. One could imagine an awareness tool that summarizes others’ opinions as percentage

quotations or displays only opinions which are conflicting with one's own opinion. Thus, cognitive conflicts could be elicited or become salient, and resolving these conflicts should foster deeper elaboration of the content (Piaget, 1985; Buchs, Butera, Mugny, & Darnon, 2004).

Methodology

Planned studies

In my pilot work which will start in spring 2006, I will collect first descriptive data about the use of discussion tools and data about the relation between discussion tool and exhibit exploration behaviour. In addition, first variations of the functionalities of the discussion tool will take place. I will explore the impact of different functionalities on exploration and information selection, discussion behaviour, attitude formation and change, and knowledge acquisition. The exhibition object will be from loan of "Deutsches Museum" to reach a preferably real museum setting within a lab experiment. Results of this first study can then be used to refine the research design of the main study. Especially aspects of awareness information that can constitute further potential of learning are of interest.

The main study will be conducted in autumn 2006. Variations concern 1) availability of the discussion tool and 2) functionalities of the discussion tool: availability of expert statements, possibility to type own statements and to read other's statements, and 3) availability of awareness tools to foster learning. The aim of this study is to test whether this asynchronous discussion tool embodies potential of learning, to explore underlying cognitive core processes, and to identify how to foster learning by awareness tools. According to this, relevant dependent variables will be data about information selection and exploration within the exhibition, use of the discussion tool and content of public statements, knowledge acquisition about the exhibition object and attitude formation/attitude change through discussion. Interesting mediating variables concern prior knowledge, interest and motivation, pre-attitudes, attitudes towards new media, and need for cognition.

A third study is planned for autumn 2007 and will be conducted in the context of a planned exhibition of "Deutsches Museum" in Munich where dialogue and discussion tools will be installed (see figure 3). In this study, especially the question of external validity can be addressed in a real, natural setting, and I hope to be able to contribute to the design of dialogue and discussion tools through my main study described above



Figure 3: proposal of a dialogue station for the exhibition in autumn 2007 at "Deutsches Museum", Munich

Research Design of the main study

To ensure external and internal validity, in this dissertation project a laboratory museum study will be realised: A real exhibition by the “Deutsches Museum” will be used in a laboratory setting (topic: stemcell research and gene technology), where most of the external influences can be controlled. This topic is The Ss explore exhibits which are a loan from “Deutsches Museum” in Munich. At the same time they have the opportunity to engage in asynchronous discussion with other Ss. The discussion tool is integrated in the exhibition and consists of a touch screen with integrated key board. There will be three expert opinions available and the Ss can type a statement regarding a current and controversial question which is elicited by the exhibition (e.g. “Would you support use of embryonic material for stem-cell research? Why?”). Statements of other persons can be read (listed in blog-format upon entry).

For an overview of the experimental conditions, see table 2. It is expected, that the availability of the discussion tool fosters individual cognition independently of the functionalities of the discussion tool (comparison with/without discussion tool). To identify which qualities of the discussion tool address the cognitive core processes, the functionalities are varied within three experimental groups:

1. The controversial question plus expert opinions should foster elaboration on the exhibition content via eliciting further reflection of presented information and a multi-perspective view (experimental group 1). The exploration behaviour should be more pronounced and should therefore result in higher levels of knowledge acquisition (concerning quantity and quality of learning).
2. Active engagement and externalisation of individual understanding in experimental group 2 is expected to deepen individual knowledge acquisition because it further triggers elaboration on and reflection about the exhibition object. Social comparison processes should be stimulated and attitude formation and change should be pronounced.
3. The availability of an awareness tool that summarizes or structures the different statements (experimental group 3) should further support learning compared to experimental group 2. Further exploration of and reflection on relevant information should be stimulated. The awareness information should facilitate social comparison processes and stimulate cognitive conflicts about the posed question and the adherent decision of the individual and other Ss.

The effect of interesting mediating variables like prior knowledge, attitudes, interest and motivation on knowledge acquisition will be accounted for.

Table 2: Research Design of the main study

without discussion tool	(control group)		
with discussion tool	Controversial question plus expert opinions (experimental group 1)	plus typing statements and reading others' opinions (experimental group 2)	plus awareness tool (experimental group 3)

Subjects

Ss of pilot work will be 20 students. They will be recruited at the University of Tuebingen.

In the main study in autumn, each condition of the research design consists of 30 Ss, thus, data of 120 Ss will be collected (see table 2).

Dependent Variables

Dependent variables will be: knowledge acquisition via pre-post-visit comparison, attitudes towards the exhibition object and its implications, and exploration behaviour and information selection in relation to the discussion behaviour.

Another question will concern the relation between the computer-mediated discussion via the described discussion tool and the “real” communication situation. Of course, it should be positive that subjects have the opportunity to discuss their understandings independently from time or their real exploration situation (alone versus in a group), but one could imagine that the discussion tool subtracts attention from the real communication situation. Does the discussion tool have negative effects on communication within a group or does it even foster (controversial) discourse? Results could contribute to the decision under what specific conditions to install such dialogue tools in informal learning settings.

Current status

Preliminary theory work is finished and the research design for the first study that will be conducted in April is presently being developed. Descriptive data of the use of the tool and its relation to the exhibit will be collected in spring 2006 and first variations on the design of the discussion tool should highlight the learning potential of this tool. This first study focuses on questions concerning the research design of the main study in autumn.

Preliminary results

First results of pilot work (will be conducted in spring) can be expected at the ICLS 2006.

Issues for discussion at the doctoral consortium

Because of the broad theory field that is addressed in this dissertation project, it would be helpful to discuss whether so far unaccounted theories could explain the (possible) learning potential of asynchronous discussion tools in informal learning settings. Which cognitive processes are concerned in my learning setting? What role plays the (para-) social situation in this setting?

In principle, it is difficult to bring informal learning settings into lab. I was wondering about the external validity of results in such a controlled and some rather artificial situation when you try to catch informal learning. It seems critical to get valid results when trying to catch informal learning. Although a second study will be conducted in spring 2007 in a real museum setting where dialogue and discussion stations play an important role (see figure 3), the issue of external validity could be interesting also to other participants.

A possible issue for discussion would concern measurement of learning: How to assess learning in informal learning settings? Could one achieve to assess learning with a knowledge test? Or are there other factors which are more relevant?

References

- Areni, C., Ferrell, M., & Wilcox, J. (2000). The persuasive impact of reported opinions on individuals low versus high in need for cognition: Rationalization versus biased elaboration? *Psychology & Marketing*, 17 (10), 855-887.
- Ash, D. & Klein, C (1999). Inquiry in the informal learning environment. In J. Minstrell & E. Van Zee (Eds.), *Teaching and Learning in an Inquiry-based Classroom*. Washington, D. C.: American Association for the Advancement of Science.
- Barros, B. & Verdejo, M. F. (2000). Analysing student interaction processes in order to improve collaboration. The DEGREE approach. *International Journal of Artificial Intelligence in Education*, 11, 221-241.
- Berlyne, D. E. (1960). *Conflict, Arousal, and Curiosity*. New York: McGraw Hill.
- Buchs, C., Butera, F., Mugny, G., & Darnon, C. (2004). Conflict elaboration and cognitive outcomes. *Theory Into Practice*, 43 (1), 23-30.
- Craik, F. & Lockhart, R. (1972). Levels of processing: A framework for memory research. *Journal of Verbal Learning & Verbal Behavior*, 11, 671-684.
- Davis, B., Trant, J. & van der Starre, J. (1996). *Introduction to multimedia in museums*. The Hague: ICOM. Available at: <http://www.willpowerinfo.myby.co.uk/cidoc/introtomultimediamuseums.pdf> [29-11-05]
- Dysthe, O. (2002). The learning potential of a web-mediated discussion in a university course. *Studies in Higher Education*, 25, 339-352.
- Ellenbogen, K., Luke, J., & Dierking, L. (2004). Family learning research in museums: An emerging disciplinary matrix? *Science Education*, 88, 48-58.
- Falk, J. (2004). The director's cut: Toward an improved understanding of learning from museums. *Science Education*, 88, 83-96.
- Falk, J. & Dierking, L. (1992). *The museum experience*. Washington DC: Whalesback Books.
- Falk, J. H. & Dierking, L. D. (2000). *Learning from museums*. Walnut Creek: Altamira Press.
- Festinger, L. (1954). A theory of social comparison processes. *Human Relations* 7, 117-40.
- Frost, C. (2002). When the object is digital: Properties of digital surrogate objects and implications for learning. In S. Paris (Ed.), *Perspectives on object-centered learning in museums* (pp. 79-94). Mahwah, N.J.: Lawrence Erlbaum.
- Gagne, R. (1985). *The Conditions of Learning* (4th ed.). New York: Holt, Rinehart & Winston.
- Grinter, R., Aoki, P., Hurst, A., Szymanski, M., Thornton, J. & Woodruff, A. (2002). Revisiting the visit: Understanding how technology can shape the museum visit. *Proceedings of CSCW 2002*.
- Gutwin, C. & Greenberg, S. (1995). Support for group awareness in real-time desktop conferences. In *Proceedings of the Second New Zealand Computer Science Research Students' Conference* (Apr. 18-21, Waikato, Hamilton, NZ).
- Holbrook, A., Berent, M., Krosnick, J., Visser, P. & Boninger, D. (2005). Attitude importance and the accumulation of attitude-relevant knowledge in memory. *Journal of Personality and Social Psychology*, 88 (5), 749-769.
- Laurillard, D. M. (1993). *Rethinking university teaching: A Framework for the effective use of educational technology*. London: Routledge.
- Leinhardt, G. & Crowley, K. (1998). *Museum learning as conversational elaboration: A proposal to capture code and analyze museum talk*. Museum Learning Collaborative Technical Report [MLC-01], Learning Research & Development Center, University of Pittsburgh, PA. Retrieved 24-02-2006 from <http://mlc.lrdc.pitt.edu/mlc>.
- Leinhardt, G., Tittle, C. & Knutson, K. (2002). Talking to oneself: Diaries of museum visits. In G. Leinhardt, K. Crowley, & K. Knutson (Eds.), *Learning conversations in museums* (pp. 103-132). Mahwah: Erlbaum.
- Litwak, J.M. (1996). Using questions as titles on museum exhibit labels to direct visitor attention and increase learning. *Dissertation Abstracts International Section A: Humanities and Social Sciences*, 57 (6-A), 2356.
- Lowry, N., & Johnson, D. W. (1981). Effects of controversy on epistemic curiosity, achievement, and attitudes. *Journal of Social Psychology*, 115, 31-43.
- Overwien, B. (2000). Befreiungspädagogik und informelles Lernen – eine Verbindung für globales Lernen? In A. Scheunpflug & K. Hirsch (Eds.), *Globalisierung als Herausforderung für die Pädagogik* (S. 137-155). Frankfurt/Main.
- Petty, R.E. & Cacioppo, J.T. (1986). *Communication and persuasion. Central and peripheral routes to attitude change*. New York: Springer-Verlag.
- Piaget, J. (1985). *The equilibrium of cognitive structures: The central problem of intellectual development*. Chicago: University of Chicago Press.
- Salomon, G. (1993). No distribution without individuals' cognition: a dynamic interactional view. In G. Salomon (Ed.) *Distributed cognitions: psychological and educational considerations* (pp. 111-138). Cambridge: University Press.

- Stahl, G. (2000). A model of collaborative knowledge-building. In B. Fishman & S. O'Connor-Divelbiss (Eds.), *Fourth International Conference of the Learning Sciences* (pp. 70-77). Mahwah, NJ: Erlbaum.
- Vygotsky, L. (1986). *Thought and language*. Boston: MIT Press.
- Vom Lehn, D., Heath, C. & Hindmarsh, J. (2002). Video based field studies in museums and galleries. *Visitor Studies Today*, 5 (3), 15-23.

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