Participation in Knowledge Building "Revisited": Reflective Discussion and Information Design with Advanced Digital Video Technology

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Abstract: Advanced tools in the realm of Web 2.0 applications have pushed forward a new paradigm for using (audio)visual media. This paradigm shift marks a starting point for theoretical reflections and empirical research on the changing nature of participation in modern knowledge building communities involving digital video. We propose a simplified model of collaborative dual-space problem solving, distinguishing online *discussion* from online *design*. Directions for future research and the educational implications of this perspective are discussed.

Introduction

Advanced tools and developments in the realm of Web 2.0 / Web 3.0 Internet technology have pushed forward a new paradigm for using (audio)visual media in computer-supported collaborative learning (CSCL). As a result, the ways in which people "watch" video information are in the process of being reshaped (Cha, Kwak, Rodriguez, Ahn & Moon, 2007): Users or learners can actively participate in knowledge building by creating and broad-/pod-casting their own digital videos (Alby, 2007), by designing complex information structures based on video, and by posting comments and 'video responses' (Benevenuto, et al., 2007). In other words: They can create entirely new patterns of video-based knowledge building in modern online-communities.

We previously investigated similar types of active video usage within the more focused context of CSCL research in formal education. For example, we have introduced digital video technologies in relation to 'rhetorical problems' for school-based education (Zahn, Pea, Hesse, Finke & Rosen, 2005) and as cognitive/collaborative tools for the support of teacher education, advanced arts and literature studies and natural science learning (e.g. the *Diver/WebDiver* project, Pea, Mills, Rosen, Dauber & Effelsberg, 2004; *hypervideo and dynamic information spaces*, Zahn & Finke, 2003; Chambel, Zahn & Finke, 2006). In our research studies we specified several functions of digital environments for video collaboration: For instance, WebDIVER™ developed by the Stanford Center for Innovations in Learning (SCIL) enables a user to direct the attention of other users to what he or she is referring to (*guided noticing*, Pea, 2006) and how technology affordances can help to structure and coordinate the joint efforts (Zhang & Norman, 1994), support a more complete and reflective elaboration than a purely oral discussion and – by making information permanent – act as a kind of group memory (Gassner & Hoppe, 2000). We also explained how advanced activities of video production or designing video-based information structures supported by digital technologies or other advanced activities of video production differ from more traditional forms of video usage in educational settings. In sum, our research demonstrates how active usage of video creates new potential for advanced knowledge building.

Here we take a more general perspective. We consider the paradigm shift associated with web-based digital video technologies as a starting point for theoretical reflections and empirical research on the changing *nature of participation in modern knowledge building communities.* Our claim is that the paradigm shift in the handling of audiovisual media requires refinements in constructivist theory approaches. Central to constructivist theory is the concept of encouraging learners to express their own knowledge in (media) artifacts rather than 'receiving' the knowledge from others. Scardamalia, for example, has long emphasized in her research the importance of establishing knowledge communities with equal rights for all learners to contribute, thus enabling participation in the communities' knowledge building processes and in the development of open information environments (as exemplified in the CSILE/Knowledge Forum project, Scardamalia & Bereiter, 2006). Likewise, Jenkins et al. (2007) have stressed the need to establish new media literacies (including social skills) needed for access to new technologies and participatory cultures for youth. While we fully agree with these theoretical perspectives, we think it necessary to shift our research focus to include empirical comparisons of contrasting types of active participation, because here contrasts are becoming more pronounced.

Generally, two major types of participation in knowledge building are well known and established (see also Alby, 2007):

- Participation in *reflective discussion and critical debate*
- Participation in *processes of information design*

While both types usually include analyses and interpretations of specific content by participants, as well as social interaction, the main difference between the two is that those participating in reflective online-discussions focus on externalizing their content knowledge in a (*text based) dialogue with discussion partners*, while those participating in design focus on expressing their knowledge by creating (multi)media elements and *structuring content for an anticipated audience according to given aesthetic standards (form) of the design environment*. This difference between discussion and design, which might be rather subtle in text-based media, becomes more pronounced in the light of the rapid advancement of technology tools reflecting the latest Web 2.0 'visions': Creating a video as opposed to merely writing a contribution to a discussion requires complex visual design activities. Thus, for example, the new usage pattern of creating video responses in the video platform *YouTube* (now the third most trafficked website in the world) clearly challenges our theoretical understanding of what it means to participate in an online community. Is a video response like a contribution to a discussion? Or is it more like visual information design? Is discussing a video the same as restructuring a video? How can we conceptualize participation in collaborative visual design with complex digital video information? Which (socio-)cognitive processes are involved in collaboratively designing audio-visual communication? How do these differ from established types of participation, such as making commentaries and contributions to a discussion? The answers to such questions can have important implications for educational practice, too. For the emergent usage patterns and types of participation, which have specific socio-cognitive effects on the learners, different theoretical models might apply to explain and predict potential benefits in educational practice. Interesting topics arise for examination into how students construct knowledge by not only viewing and exploring video, but also by responding and building knowledge with their own video-based products.

In the remainder of this contribution, by transferring the difference between participation in discussion and participation in design to complex audio-visual software environments (web-based advanced digital video technologies), we will outline a tentative model based on the assumption of dual-space problem solving processes in design. We consider this model suitable for distinguishing emerging usage patterns made possible by advanced web-based video technology. We address the related question "How can we conceive of participation in collaborative visual design with complex digital video information?" in order to gain further insights into the new paradigm of using audio-visual media for CSCL.

Online-collaboration in relation to "rhetorical problem spaces"

As mentioned above, participation in the information design processes in online communities differs from participation in discussions, because the associated collaborative activities pursue different goals: discussion focuses on dialogue with partners while design focuses on creating and structuring content for an anticipated audience according to the rhetorical or aesthetic standards of a given environment. This difference implies: When participating in a discussion, learners have to consider the content of their discussion as their problem. When participating in designing an information environment (such as a video-based web-page), learners have to take into conscious consideration *both* content *and* the audience of their knowledge product as their dual problem. The problem space they have to establish and maintain is thus a 'rhetorical' one.

The idea of writing and design as a dual space problem-solving process – a viewpoint we adopt here – was suggested earlier by research in cognitive psychology and in the learning sciences.Three major lines of research are important precedents: First, we note the cognitive approach to writing (Hayes, 1996; Bereiter & Scardamalia, 1987), which explains writing for an audience as a complex (dual space) problem-solving process, where intensive interactions between a *content problem space* and a *rhetorical problem space* lead to knowledge transformation. Second, the cognitive approach to design by Goel & Pirolli, (1992), which defines design processes as *problem solving* for an ill-defined and complex problem that needs to be defined and structured by the designer. In extending this problem-solving approach, models of design as dual space search were also proposed, for example by Seitamaa-Hakkarainen (2000). Third, constructivist/constructionist approaches to learning by designing (Erickson & Lehrer, 1998; Lehrer, Erickson, & Connel, 1994) define hypertext writing as a complex problem-solving process consisting of planning, transformation, evaluation and revision. These problem-solving approaches, including their underlying assumptions about associated cognitive processes, have been investigated and approved by much applied research in pedagogy. These approaches have also inspired a vast number of educational applications and research ranging from 'writing to learn' (Klein, 1999), to 'hypertext / hypervideo design' (Stahl & Bromme, 2004), to 'computer programming' and software design (Harel, 1991; Kafai & Ching 2001), from K-12 education to university and adult education levels. In an attempt to integrate these earlier research studies and apply them to participation in collaborative visual design in knowledge-building communities, we propose a model of collaborative dual-space problem solving (see *Figure 1*). The model certainly simplifies the complex nature of design, but can also explain how participation in discussion may differ from participation in design activities.

We assume that collaborative design in modern online communities is a collaborative process of *dual space problem solving involving intensive interactions between content and form (audience-related goals) –*

whereas discussion is usually focused on one problem space, usually the topic content. Based on this model, we assume joint *rhetorical problem spaces* in collaborative design versus joint content problem spaces in discussion (*joint problem spaces*, see Roschelle & Teasley, 1995). In contrast to participants in a discussion, who only have to establish a content space, 'designers' have to establish an additional joint rhetorical problem space and structure it according to the specific rhetorical goals, style features and rules of the media at hand. In the case of creating digital video or video-based content, these refer to the conventions of film and video, as well as the specific technologies in use.

With this simple model can find answers to the other questions posed above: Which socio-cognitive processes are involved in collaboratively *designing* visual communication? How do these differ from established types of participation, such as contributing comments to a discussion?

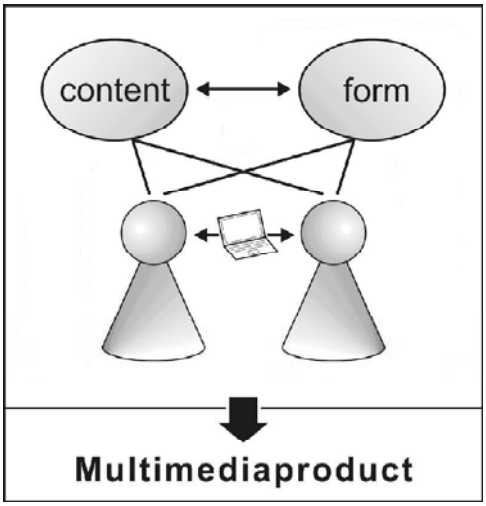

Figure 1. Integrative model of collaborative design activities as problem solving involving dual 'rhetorical' problem spaces.

To find answers to such questions, we started with conducting empirical research using WebDIVER™ as a collaborative tool for analyzing video as data (Pea, et al., 2004; Pea, Lindgren and Rosen, 2006). For example, we studied the influences of WebDIVER technology affordances on socio-cognitive processes during knowledge building (in the domain of history). Here, qualitative analyses revealed how joint rhetorical problem spaces are established. In another experimental study we tested the validity of our theoretical assumptions by asking users/learners to participate either in collaborative visual design or participating in a discussion. Precisely, the participants either discussed a historical video source, or they were asked to integrate video selections from the historical video source into a multimedia product for a hypothetical student audience. We expected the 'designers' to pay more attention and consideration to both content *and* visual style of video messages than users/learners participating in a discussion, *even if they work with exactly the same materials, with exactly the same tools and in the same information environment*. The results of this study indicate that participants from both conditions (discussion and design) were similarly satisfied with the task and participants did not differ with regard to their factual knowledge in the post-test or general use of the digital tool. This proves the general effectiveness of participation in knowledge building. However, significant differences emerged with regard to participants' handling of the audio-visual source material and their collaborative strategies on a deeper level: In the design task condition, participants displayed a tendency to better recall visual information from the source material and to consider visual information in more detail. More importantly, there was a strong effect indicating that participants in the design condition integrated *both* problem spaces–the rhetorical and the content space–during their analysis of the video material, as opposed to participants in the discussion conditions. The study – despite some limitations – yielded results that are in line with a theoretical model of video based design as dual space problem solving. In particular, the findings point to extended validity of the dual space writing model of Bereiter & Scardamalia (1987) for video-based design.

Conclusion

We started our paper with the claim that newly emerging usage patterns of audiovisual communication in modern knowledge building communities (originating from advanced digital video technologies) require reflection on constructivist theory and educational practice. Particular emphasis was put on the necessity of distinguishing between contrasting types of active participation, with respect to their possible socio-cognitive effects on both theoretical and empirical learning. We proposed a simplified model of dual space problem solving distinguishing reflective discussion from (visual) design. Precisely, we hypothesized collaborative

design in modern online communities to be a *collaborative problem solving process involving intensive interactions between content and form (audience-related goals) in a rhetorical problem space* – while discussion to be focused on only one problem space (content). In experimental studies, we investigated specific questions empirically and found preliminary evidence supporting these ideas. We hope that this theoretical framework stimulates future empirical research that will further refine the assumptions. There are also some educational implications important to mention in the context of CSCL: As our model suggests, different types of participation and collaborative activities (discussion and design) supported by advanced digital video technology should have different socio-cognitive effects. Without evaluating these effects as either better or worse, they apply to different educational settings depending upon different educational goals. Imagine a history lesson, for example, where a teacher asks students to analyze and interpret video as data and uses digital video technology at the computer to support collaborative learning. If the teacher's educational goal is that students learn about the historical context of video through knowledge exchange among her students, then she should probably ask students to engage in a video-based online discussion. However, if the teacher's goal is both content learning and media education (or: critical reflection of video and film as a visual information source, e.g., with videos showing historic propaganda materials), then she should probably ask the students to collaboratively design a video-based web page or something similar to be published e.g., for younger peers. Likewise, in more informal e-learning scenarios or in the realm of Web 2.0, the same technologies, the same materials but different opportunities and forms of participatory cultures (Jenkins, et al. 2007) may make a difference in the socio-cognitive processes of the users and in their (joint) focus of attention when they actively participate in knowledge building.

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Acknowledgments

We sincerely thank Verena Seibold who was greatly involved in all stages of the reported research and Joe Rosen for technical support in relation to the study.