Objects-to-think-with-together

Rethinking Papert's Ideas of Construction Kits for Kids in the Age of Online Sociability

Gunnar Stevens, Alexander Boden, and Thomas von Rekowski

University of Siegen, Human Computer Interaction, Siegen, Germany
{gunnar.stevens,alexander.boden,
thomas.vonrekowski}@uni-siegen.de

Abstract. The spread of the Internet has led to a change from a TV-childhood to a computer-childhood. We investigate how this shift towards networked forms of communication is reflected in constructionist learning environments and elaborate the concept of objects-to-think-with-together in the context of using computers as tool and social medium at the same time. In doing so, we propose four design aspects that should be considered in the context of socially-oriented constructionist learning environments: providing an integrated platform for construction and socializing, supporting re-mixing and re-using as well as self-expression and appreciation, allowing collaborative projects of non-collocated learners, and supporting enculturation and team-building.

Keywords: End User Development, Constructionism, Social learning, Social Media, Scratch, Logo, Constructionist Learning Environments.

1 Introduction

Several representative empirical studies have shown that children's media use has been changing over the last years. For example, in Germany a majority of children's households provide Internet access and 50% of children state that they are using the Internet on a regular basis; furthermore, 31% of the children state to (rather) conduct this activity on their own. This trend has been described by Hammer and Schmitt (2002) as a change from a TV-childhood to a computer-childhood, indicating the replacement of television as the lead medium in favor of computers and the Internet. At the same time, there has been a significant increase of social networks usage in the last years. One out of three children regularly use communication services such as online communities, chats and instant messengers and assert those as their online favorites.

These empirical findings demonstrate that online sociability has become a common part of children's everyday life worlds. Based on this situation, it is important to investigate how this shift towards networked forms of communication and creating/sharing could be integrated into collaborative learning environments for children, especially with regard to artifact-centered approaches of supporting learning such as constructionism.

Y. Dittrich et al. (Eds.): IS-EUD 2013, LNCS 7897, pp. 223–228, 2013.

2 The Social Turn in Constructionist Learning

Constructionism as a learning approach has been developed by Seymour Papert in the 1970ies, adopting ideas from Piaget's constructivism as well as from Activity Theory (Papert 1980). His key thought is that knowledge cannot be exchanged in abstract forms. Instead, knowledge exchange is considered to be dependent on practical and cognitive re-construction on behalf of the learner. Hence, the construction of tangible and personally meaningful artifacts plays a seminal role for the learning process. Against this backdrop, a number of computer based environments for supporting constructionist learning have been developed, called constructionist learning environments (CLE, see for example Figure 1b, left).

The initial focus of Papert's work lay on the domain of technical sciences and individual learning approaches, where the computer serves as an "object-to-think-with" (Papert 1980) that allows learners to realize their personal objectives. At that time, it was a common necessity to edit the source code in one tool, then use another tool for compiling the code, and afterwards execute it manually. This cycle created a "gulf" between code and behavior analog to the gulf of evaluation and execution as outlined by Norman (1986). The seminal innovation of Papert's Logo environment was to bridge that gulf, by making the effects of coding directly visible for the learner.

Beyond the individual focus, recent research has a stronger focus on communities and social aspects of constructionist learning (Bruckman 1997; Chapman 2004; Shaw 1995). One example of this second generation approaches the concept of distributed constructionism elaborated by Resnick (1996) as a socially oriented enhancement of Papert's work. Intellectually, this second generation of constructionism is shaped by learning theories that emphasize the social and distributed nature of learning in practice (Wenger 1998; Salomon 1997). They are typically focused on collaborative learning efforts in communities, where the constructionist learning activities include several participants. In such settings, learning becomes richer and more effective, as

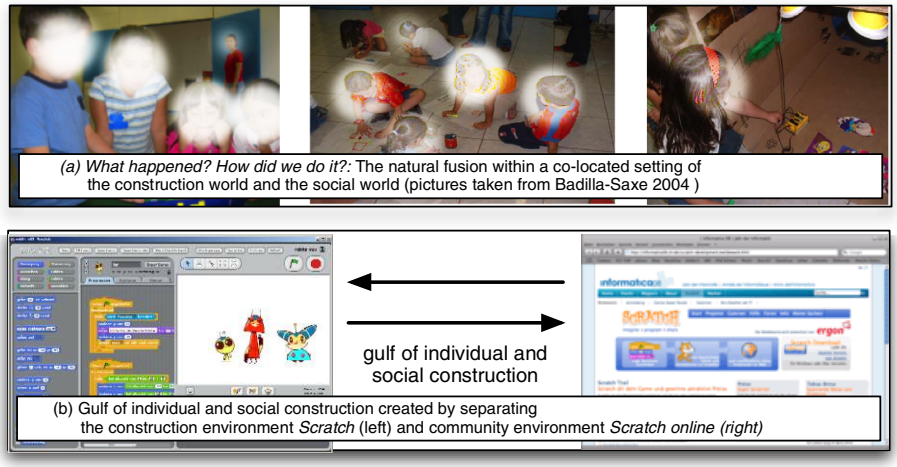

Fig. 1. Social learning in (a) co-located learning environments and (b) computer mediated environments

affective, social and cognitive development is fostered reciprocally through the interaction with one's social environment (see Badilla-Saxe 2004 and Figure 1a).

Within settings such as schools, a shared social context is naturally given. The question of how to establish and support constructionist learning environments beyond this context, for instance on a local community level, has been a recent topic in research. Institutions like the Intel Computer Clubhouses (Resnick and Rusk 1996) or the Come_IN Computer Clubs (Stevens et al. 2005) in Germany demonstrate that by providing local, publicly accessible places to use computers, the participation of educationally deprived groups of society can be improved. In addition, several constructionist learning systems (e.g. Barricelli et al. 2011; Bruckman 1997; Shaw 1995) have been designed following the concept of distributed constructionism (Resnick 1996). The aim of these systems is to enhance computer based learning environments by incorporating social and cultural aspects (see also Figure 1b, right).

2.1 Providing Objects-to-think-with-together

So far we have outlined two topics that are mainly studied independently: the increased online sociability of children and the new insights about the social contexts of constructive learning. Bringing these topics together, we believe that it is time to reconsider Papert's influential idea in the light of the mentioned developments.

Given the potentials of the collaborative web, we think that it is time to extend this principle with regard to the mentioned social turn of education science represented e.g. by Wenger (1988). According to this view, social constructionism should be fostered by making the social relations that are conciliated by the artifacts visible in the learner's use context, embedding the children's online sociability into the context of the construction activities (much similar to the upheaval of initial constructionist approaches resolving the detachment between the design and use of learning artifacts). The integration of the social context is meant to transform the objects-to-think-with of individual community members to objects-to-think-with-together for the whole community, addressing both individual and community-contexts of learning in a unified approach where the computer serves as a medium and tool at the same time.

This thought is also related to recent threads in Activity Theory (Engeström 2005) which consider artifacts as boundary objects which have to be sufficiently tangible in order to be adoptable by users of various backgrounds, and at the same time robust enough to establish a common identity among social worlds. In this regard, digital construction kits as computational boundary objects can serve two major purposes, as noted by Fischer (2001): "(1) they can serve as objects to support the interaction and collaboration between different communities of practice, and (2) they can support the interaction between users and (computational) environments".

2.2 Bridging the Gulf between the Individual and the Social Construction

In the following, we want to elaborate the concept of "objects-to-think-with-together" in terms of design by using the concept as an analytic lens to study existing approaches discussed in the literature. Based on our considerations outlined above, we propose four design aspects that illustrate how the social dimension of artifacts could be supported.

Integrated Platform for Construction and Socializing

At a basic level, there is a need for an integrated platform that supports socializing between different learners and fosters the sharing of ideas and artifacts in a project based learning environment. In this platform, the construction editor and social tools should be tightly integrated with each other to avoid a gap between the social activities and the construction activities (see also the gap mentioned in Fig 1b). In the literature, we find game-oriented approaches that extend multi-player games by integrating collaborative game construction kits like MOOSE Crossing (Bruckman 1997) or that discuss multi-player construction games like Minecraft (Zuzanna 2011) as collaborative learning environments. Such approaches illustrate how construction and social interaction can be integrated with each other. However, existing work in this area is usually limited to games and does only support highly specific kinds of design projects.

Concerning this topic, the evolution of Scratch and Scratch online (Resnick et al. 2009) to Scratch 2.0 (see http://beta.scratch.mit.edu/) is highly interesting. Like Scratch, the new approaches rest on traditional programming ways of sharing projects that group code blocks and additional resources. However, Scratch 2.0 aims at developing this idea further by integrating Web 2.0 features, most notably by integrating an online code editor into their social platform. Other notable examples from outside the domain of CLE are Mash-up platforms such as Yahoo Pipes that combines mash-up editors with community services, thus minimizing the divide between editing and sharing of mash-ups (Grammel und Storey 2010).

Re-mixing, Re-using, Self-expression and Appreciation

Kids learn from observing and mimicking actions of others. In this context, artifacts of others typically serve as inspiration and blueprints for one's own project. This "monkey see-monkey do" style of construction (Gamma and Beck 2004) implies a need for supporting re-using and re-mixing of digital artifacts as well as a need for supporting their appropriation. In addition, the created artifacts also have an emotional side as these artifacts serve kids as a way for self-expression. Hence, in becoming an object of discourse, artifacts are used to share common interests, perspectives and ideas. In particular, they allow appreciating each other by appreciating each other's work. With regard to design, this implies a need for reusing artifacts made by others as well as commenting and rating them.

The first solutions that explicitly support the "monkey see monkey do" were the mentioned mash-up platforms, which allow users to re-use and -assemble existing web services to create their own solutions. In addition, users can tag and receive recommendations during construction activities based on the tagging information (Grammel und Storey 2010). With regard to CLE, Scratch online (Resnick et al. 2009) was maybe the first to provide tagging as well as re-mixing support. In addition, the system allows kids to comment and rate projects as well as inspect which project was re-mixed by whom in order to support the promote mutual appreciation among the community.

However, in a further step to realize the vision of objects-to-think-with-together, these features should also be embedded into the context of the construction activities (in order to provide for instance awareness about expertise and artifacts that fit the situated context). Regarding this aspect, CLE design might learn from newer Software

Engineering approaches. For instance, the tool STeP_IN (Nishinaka et al. 2007) uses existing recommendation algorithms to make software developers aware about local experts and documentation to Java components that are used in the actual context.

Collaborative Projects

Creating artifacts is a common goal and motivation for joint projects, in which the artifact will be constructed in a collaborative manner. This implies a need for synchronous and/or asynchronous environments for collaborative construction. There is a long vast body of work on supporting collaboration in synchronous and asynchronous contexts (for example in environments such as Wikipedia or Google Docs). Because of this, we were quite surprised that most of the existing project-oriented solutions like Scratch 2.0 or Mash-up editors do not support this social dimension of artifacts. Instead, projects are still owned by one person and collaboration can only be organized by sharing copies which each other.

However, quite interestingly, the situation is totally different in the case of game oriented CLE like MOOSE Crossing or construction-oriented games such as Minecraft. In these environments, kids can create virtual objects, spaces, and characters while interacting with one another e.g. through chats. Therefore, ethnographical studies would be highly interesting, how kids appropriate these systems and use them to work together.

Enculturation and Team Building

Last but not least, CLE 2.0 platforms should support enculturation and team building, as well as further aspects of social learning in the sense of Communities of Practice (Wenger 1998). For example, CLE should allow legitimate peripheral participation, enable gentle transitions from being a lurker to becoming a core team member, and allow scaffolding as well as seeking and offering help within the community. This topic is sporadically discussed in the literature, for example by Bruckman (1997) who notes that such ideas inspired her. In addition, Korn and Veith (2009) outline how Scratch could be extended through scaffolding mechanisms into that direction. Yet, what is missing is a systematic investigation of the design patterns that support enculturation and team building in online communities for kids as well as empirical studies about how such features are used in practice.

3 Discussion and Conclusion

In this paper, we have outlined that computational constructions are social artifacts that can serve as boundary objects between the self and the computational environment and the social world. Yet, this quality is hardly covered by the current CLE designs. In order to bridge the gulf between individual and social constructionist learning in communities, we have outlined the concept of objects-to-think-with-together that rethinks Papert's original idea in the age of online sociability and brings together the different facets of computational boundary objects by means of an integrated collaboration infrastructure within the application (Stevens 2009). We further

identified a number of interesting examples that show steps towards how the concept could be realized. In our future work, we have to study how the different design concepts could be integrated in a coherent framework to improve the boundary object quality of artifacts mediating social relations. In particular, we plan on conducting ethnographical studies on how these features are being appropriated to understand the concept from within the construction and learning practices of the children.

References

Barricelli, B.R., von Rekowski, T., Sprenger, M.A., Weibert, A.: Supporting Collaborative Project Work in Intercultural Computer Clubs (2011)

Badilla-Saxe, E.: Constructionism, Complex Thinking and Emergent Learning. Constructionism 2010, Paris (2004)

Bruckman, A.S.: MOOSE Crossing. PhD Thesis, MIT, USA (1997)

Chapman, R.: Pearls of wisdom. In: Social Capital and Information Technology, pp. 301–331 (2004)

Engeström, Y.: Developmental work research. Bd. 12. Lehmanns Media (2005)

Fischer, G.: External and shareable artifacts as opportunities for social creativity in communities of interest. In: Computational and Cognitive Models of Creative Design (2001)

Gamma, E., Beck, K.: Contributing to Eclipse. Add.-Wesley (2004)

Grammel, L., Storey, M.-A.: A survey of mashup development environments. In: Chignell, M., Cordy, J., Ng, J., Yesha, Y. (eds.) The Smart Internet. LNCS, vol. 6400, pp. 137–151. Springer, Heidelberg (2010)

Korn, M., Veith, M.: Learning support through scaffolding collaborative project work. In: Proc. of CSCL 2009 (2009)

Hammer, V., Schmitt, C.: Computer in der Familie. Staatsinst. für Familienforschung an der Univ., Bamberg (2002)

Nishinaka, Y., Asada, M., Yamamoto, Y., Ye, Y.: Please STeP_IN: A Socio-Technical Platform for in situ Networking. In: Proc. of APSEC 2005 (2005)

Norman, D.A.: Cognitive engineering. In: User Centered System Design, pp. 31–61 (1986)

Papert, S.: Mindstorms: Children, computers, and powerful ideas. Basic Books (1980)

Resnick, M.: Distributed constructionism. In: Proc. of the 1996 International Conference on Learning Sciences, pp. 280–284 (1996)

Resnick, M., et al.: Scratch: programming for all. CACM 52(11), 60–67 (2009)

Resnick, M., Rusk, N.: The Computer Clubhouse: Preparing for life in a digital world. IBM Systems Journal 35(3.4), 431–439 (1996)

Salomon, G.: Distributed cognitions. Cambridge Univ. Pr. (1997)

Shaw, A.: Social constructionism and the inner city. Ph.D. Thesis, MIT (1995)

Stevens, G.: Understanding and Designing Appropriation Infrastructures. PhD Thesis, Universität Siegen, Germany (2009)

Stevens, G., Veith, M., Wulf, V.: Bridging among ethnic communities by cross-cultural communities of practice. In: Proc. of C&T 2005, pp. 377–396 (2005)

Wenger, E.: Communities of practice. Cambridge Univ. Pr. (1998)

Zuzanna, M.: Constructing identity in games: a case study of Minecraft on YouTube, University of York