# Learning Support through Scaffolding Collaborative Project Work

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**Abstract:** A Computer Club House (CCH) can be understood as a community of prosumers in which members are producing and consuming personally meaningful artifacts of each other. In a long term case study, we have analyzed learning practices in a German CCH setting. Observing children and their parents working with construction kits, we found that they had problems in maintaining the flow of their project work over time. Therefore, we develop concepts for a project management tool which support CCH settings to scaffold their growing information space in terms of artifact re-use and expertise development over time. Scaffolding in this regard is understood to support collaborative processes of learning communities.

## Introduction

Today's children grow up in a highly computerized world already being exposed to various media technologies. We strive to support children in their cognitive and social development, i.e. to enable them to understand the world they live in and empower them to form it according to their own conviction. A social phenomenon described by futurologist Alvin Toffler (1980), which he coined 'prosumption', describes a development, where users produce and consume at once. Today, his observations are even more valid – especially with the notion of user created content that emerged recently within the Web 2.0 context (e.g. Wikipedia or Flickr). Similarly, von Hippel's (2005) concept of user innovation shows that innovations are often developed by end-users instead of the manufacturer triggered by their very own unsolved issues. Accordingly, we base our research on learning by the active production and consumption of collaboratively created, personally meaningful artifacts.

Not much research has been done on using the power of prosumption in collaborative project settings. In this paper, we therefore investigate how we can use Vygotsky's concept of scaffolding to support learning through prosumption during all phases of project work and in multiple projects over time. By conducting a qualitative field study we hope to shed some light on this area.

## Theoretical Considerations and Motivation

Overcoming Papert's (1980) focus on subjective concepts in constructing artifacts, Bruner recognizes Vygotsky's social constructivist concept of scaffolding (Wood, Bruner, & Ross, 1976). With scaffolding, the tutor would offer assistance only with those skills that are beyond the learner's capability to help her master a task that she is initially unable to grasp independently. Quintana et al. (2004) lay out a scaffolding design framework and suggest twenty specific strategies for designing scaffolds in computer-based learning environments. Similarly, Puntambekar and Hübscher (2005) point out problems with the notion of scaffolding in the design of tools to support student learning in project-based classrooms. They argue that some of the critical elements, like ongoing diagnosis, calibrated support, and fading, are missing in many scaffolding tools.

By introducing the notion of prosumption, we are able to describe observed phenomena in communities from a new perspective (Toffler, 1980). Artifacts as collective goods are produced and consumed by 1) creator(s) of the artifact and 2) other community members (i.e. creators of other artifacts). Typically, these products are components, macros, snippets or other sub-parts of an underlying system. Consumption of products may include the orchestration of components or the inclusion into the underlying system. Sharing is a main force within the community. It needs description and meta-data of the products in order to guarantee a sufficient distribution to consumers (by retrieval strategies, etc.). Based on the concept of Communities of Practice (Lave & Wenger, 1991; Wenger, 1998), a *Community of Prosumption*, where members share a common practice, by producing and consuming personally meaningful artifacts of each other, is further characterized by an evolutionary growing repository of shared goods and information about expertise distribution. Learning within communities of prosumption is achieved through deep engagement with own artifacts and with those of others.

Too little attention has yet been drawn to the sustainable long-term support of learning processes by scaffolding collaboration and project work and the design of appropriate tools for community of prosumption use. We propose a transition from designing single artifact construction kits to whole frameworks, supporting project work and learning over time.

## Setting and Methodological Approach

The computer club 'come_IN' provides opportunities for elementary school kids, their parents, and tutors to engage in group-oriented project work (Stevens, Veith, & Wulf, 2005; Veith, Schubert, von Rekowski, & Wulf, 2007). They meet two hours per week every Monday from 5pm to 7pm. There is some fluctuation in attendance,

as some participants do not come to every session. As described in more detail in Stevens et al. (2005), come_IN is inspired by the Computer Clubhouse concept by Resnick & Rusk (1996), adapted specifically to the context in Germany. The project work within the club stems from the participants maps of experience and motivation. Projects normally last for several months and can encompass the creation of varied multi-media artifacts (e.g. texts, videos, animations and games). The computer club is regarded in this paper as a community of prosumption, implementing computer-supported collaborative project work.

Learning in this setting is seen as an unavoidable, subtle by-product, but indeed a very productive and important one. Children (and parents) in the club experience more intensive learning situations due to active participation by dealing with the chosen topics of their projects and by investigating how to solve the problems at hand. Children are further endorsed in their actions by people close to them, i.e. their parents, grand-parents or older siblings, who also pursue activities in the club. By scaffolding, the community can achieve much more than one individual participant could achieve: experts help novices by constructing and slowly reduce scaffolding as the novice becomes more acquainted with the task.

Our results stem from an evaluation study in the computer club house. Over the course of six months, we conducted participatory action research. One or more research assistants acted as tutors in the club collecting information through field notes, observations, interviews, and video and artifact analyses. Another researcher acted as an external observer not being directly involved in the club activities themselves. With the collected material, monthly reflection sessions were held between the both parties. Our goal is to identify practices in the club, how participants engage in project work and how this can be further supported for their learning progress.

## Empirical Findings

Due to the project-based nature of the activities in the club, a vast amount of artifacts is created and used by the participants (e.g. photos, videos, reports and stories). They are gathered during field trips, investigations in the neighborhood or topic-related research on the internet among other. During the initial collective *brainstorming* phase re-use is rarely occurring. When beginning new projects, participants normally start from scratch building solely upon their prior experience but do not consider previously created artifacts or implemented ideas directly.

(a)  (b) 

Figure 1. (a) Tutors are planning alone while children go about their own business.
(b) Mother sitting next to her son, nearly uninvolved throughout the whole session.

*Planning* is only done by experts, i.e. tutors and some 'old-timer' parents. While children go about their own business, the experts are left alone discussing about the necessary tasks and task distribution at the big round table in the center of the club or sketching broader project layouts on the blackboard (see Figure 1a). Children do normally lack the patience for longer discussions, but more importantly, they, as well as many parents, do not always have the insights into the general workings of the club.

The *execution* work, then, is mainly done by children. They voluntarily commit themselves to realize their ideas within the project's scope as they have chosen the topics on their own or share a common experience. But they often have problems finding files on the network drive or other recently created artifacts to continue their work and stay focused. They lack an overview due to the unstructured storage of the many files. Parents are often much less involved in the actual project execution. Due to poor integration and personal disinterest, they only sit behind their own kids, from time to time giving hints or advice (see Figure 1b) – or: they are not present at all. Much less do they show initiative in using computers themselves in activities deeply connected with their child's activities. In general, parents barely take interest in other community members and their activities, only thinking about their own progress or that of their child.

Due to the lack of parents' involvement, tutors are also very much occupied during execution, helping all of the children (and also some parents) at the same time. The ICT expertise and club experience of the parents is too limited to help in some cases. In contrast, tutors have a relatively clear picture of the whole project structure, because they are heavily involved in all phases of the project workflow. Due to their high workload,

 

*monitoring* of the overall project progress is hardly ever possible. Tutors do not have the time to coordinate the activities of everyone. The poor monitoring creates additional work in the following *wrapping-up* of artifacts. They collect the scattered sub-projects and fragmented material to combine it into the superordinate framework.

*Collaboration* is mainly initiated without ICT support by the tutors. It is mostly them, who point participants to other members to collaborate on similar issues or projects, or to exchange experience, ideas and help, which one party might have already acquired. Though participants collaboratively choose a common topic or share a common experience, they deal with it independently.

Projects often remaining incomplete and the need for intensive tutoring, as well as the participants' lack of direction in project work and collaboration motivate a need for scaffolding of collaborative learning and project work in the community, beyond the scaffolding of the individual mind. To support this scaffolding and enable the participants' involvement in all phases of the project workflow, we aim for a transparent visualization of the network of other participants' related previous work, of their expertise and generally supportive artifacts (e.g. tutorials, related tools). This may help to engage more community members in the planning process and the following phases of the workflow. These additional tools could be seen as a kind of project management software, used as the working environment by all participants. It acts as a scaffold for the members, giving them contextual help in those tasks that are initially beyond their individual capabilities or knowledge.

## Conclusion and Outlook

Based on Vygotsky's concept of scaffolding, we investigated learning in *Communities of Prosumption* supported by scaffolding of collaborative project work. We propose that sustainability by providing learning support in collaborative project work over time is more important than the tools themselves (i.e. artifact construction kits). In our analysis we show how fostering collaboration by scaffolding orientation and cognitive mapping can be achieved through visualization of artifact and expertise distribution. Special attention needs to be drawn to *Communities of Prosumption*, giving them a stronger theoretical and empirical foundation. Based on the theory of *Communities of Practice*, they bring together production and consumption in a shared project environment.

Based on our experience, we show the Janus-faced nature of scaffolding. On the one side, scaffolding is seen to support the individual mind and thoughts, as constructionists use it in artifact construction kits. On the other side, similar to Kolodner et al. (2003), we propose a scaffolding technique to support collaborative learning processes of whole communities. Both sides of the Janus face need to be embraced, as they can lead to different design implications. Currently, architectural design decisions have been made and the system is being implemented and needs evaluation afterwards.

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