Scaffolding Collaborative Project Work in End-User Development

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Abstract. In a long term case study, we have analyzed learning practices in a German Computer Club House (CCH) setting. Observing children and their parents creating artifacts 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 in communities of end-user development.

Introduction

Today's children grow up in a highly computerized world already being exposed to various media technologies. They consume and even produce YouTube videos, Wikipedia articles and other forms of user created content every day. 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. Accordingly, we base our research on project work with active production and consumption of collaboratively created, personally meaningful artifacts. We concentrate on children as a special group of end-users. While we also observed their parents, we think some of these insights will be helpful for this user group as well.

In this paper, we investigate how we can use Vygotsky's concept of scaffolding in a collaborative project setting to support end-user development 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.

1 Theoretical Considerations and Motivation

Overcoming Paperts (1980) focus on subjective concepts in constructing artifacts, Bruner recognizes Vygotsky's social constructivist concept of scaffolding (Wood et al., 1976; Vygotsky, 1978). 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. The tutor then begins with

the gradual removal of the scaffolding, which now allows the learner to work independently (Wood et al., 1976). Scaffolding is based on Vygotsky's (1978) previous idea of the *Zone of Proximal Development* (ZPD). The ZPD is "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). The ZPD shifts as the learner has expanded her knowledge and the scaffolding must constantly be adapted to address this change.

Too little attention has yet been drawn to the sustainable long-term support of end-user development processes by scaffolding collaboration in project work. We propose a transition from designing single artifact construction kits to whole frameworks supporting project work over time.

2 Settings and Methodological Approach

The computer club 'come_IN' provides opportunities for elementary school kids, parents, and tutors to engage in group-oriented project work (Stevens et al., 2005; Veith et al., 2007). 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 German context. The project work within the club stems from the participants' maps of experience. Projects normally last for several months and encompass the programmatic creation of varied multi-media artifacts.

Ideally, all participants take part in all steps of the project work, i.e. brainstorming, planning, execution, wrapping-up, presentation, and reflection. In regard to scaffolding, ICT support should be available in all project phases. Re-use of projects or parts of it in following projects should be a common practice.

Our results stem from an evaluation study in the computer club house. Over the course of six months, we conducted participatory action research by implementing ourselves as tutors in the club collecting information through field notes, observations, interviews, and video and artifact analysis. This mix of methods allows us to collect as much information as possible in order to evaluate a pre-defined goal.

3 Empirical Findings

The identified practice reveals a picture that is different from the ideal situation described above. 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.

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 table in the club or sket-

ching broader project layouts on the blackboard (Figure 1a). Children do normally lack the patience for longer discussions, but more importantly, they, as many parents, do not always have the insights into the general workings of the club.

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.

The *execution* work 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. But they often have problems finding files on the network drive or other recently created artifacts to continue their work and stay focused. Parents are often much less involved in the actual project execution. Due to poor integration and personal disinterest, they only sit behind their kids, from time to time giving hints or advice (Figure 1b) or 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 the progress 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 and overview the activities of everyone. The poor monitoring creates additional work in the following *wrapping-up* of artifacts and re-organization, which is also mainly achieved by tutors. They collect the scattered sub-projects and fragmented material and combine and arrange 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.

This lack of direction in project work and collaboration motivates a need for scaffolding of collaborative 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 into the planning process and the following phases of the work flow. 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 to the members giving them contextual support in those tasks that are initially beyond their individual capabilities or knowledge.

4 Conclusion and Outlook

In this paper, we investigated Vygotsky's concept of scaffolding to support collaborative project work in end-user development. We proposed that sustainability (in terms of a growing information space) by providing end-users support in collaborative project work over time is more important than the tools themselves (i.e. construction kits). In our analysis we showed how fostering collaboration by scaffolding orientation and cognitive mapping can be achieved through visualization of artifact and expertise distribution.

Based on our experiences, we showed 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, we proposed a scaffolding technique to support collaborative 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.

5 References

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