Technology Appropriation in Face-to-Face Collaborative Learning

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Abstract. Studies in computer supported collaborative learning frequently under-expose the interaction between students and technology. To gain more insight in the way student groups interact with educational technology, we examine how students 'appropriate' this technology. The notion of technology appropriation implies a process of social construction in which the actions and thoughts of the user are shaped by the technology, while the meaning and effects of the technology are shaped through the users' actions. In this paper, we develop a problem analysis from theoretical findings, and work towards an initial, tentative concept of technology appropriation.

Key words: Collaborative learning, Technology appropriation, Discussion support, Face-to-face discussions.

1. Introduction

The field of computer-supported collaborative learning (CSCL) advocates the deployment of technology to promote specific interactions between learners that lead to collaboration and learning. Software tools that support discussion within student groups, for example, may facilitate a free exchange of ideas, argumentation or critical thinking within the group. These tools influence group behavior by triggering certain actions, and by shaping interactions between the students, in a way that has a positive effect on the discussion.

In addressing how collaborative learning within student groups is influenced through the use of technology, CSCL research frequently under-exposes the interaction between the students and the technology. The technology is predominantly treated as a variable with a stable influence on the thoughts and actions of the students. This influence is assumed – often implicitly – to be independent of the students' actions. There is evidence to doubt the ground of this assumption. Essentially, because the assumption reflects a deterministic view towards technology use, and conflicts with the premises of socio-constructivist theory. Questioning of this deterministic view has led to several 'emergent perspectives', which propose that the use and effects of a technology emerge on the basis of complex social interactions among users [4].

To gain more insight in the way student groups interact with technology, we examine the students 'appropriation' of the technology. We claim that the use and effects of a technological tool emerge from the interaction between user and tool, based on a mutual influence between them. The notion of technology appropriation implies a process of social construction in which the actions and thoughts of the user are shaped by the technology, while the meaning and effects of the technology are shaped through the users' actions.

If we aim to understand the potential of educational technology to enhance certain processes in the collaboration between students, then we need to be informed about the dynamics of student groups interacting with technology. The notion of technology appropriation, as we will point out, has important implications within the LEAD[1] project, and also within the broader context of CSCL research.

2. The LEAD project

Problem solving discussions are common in classrooms where learners work collaboratively on a task. Groupwork, for example, requires that learners discuss in order to make progress and to succeed as a group. Learners have to share their understanding of a problem and explore different directions to solve it. They have to explicate their line of reasoning, provide arguments, and reach conclusions that are sufficiently shared to proceed with the task. While doing all this, they may have to deal with conflicts and differences in opinion. Due to the challenging character of a problem solving discussion, learners do not always succeed in making the most of it.

The objectives of the LEAD project are to develop and evaluate conceptual models, a didactical method, and accompanying network-computing support to enhance problem-solving discussions in face-to-face classroom settings. The project team posits the claim that the quality of group processes and outcomes can be enhanced through the combination of face-to-face and computer-mediated communication.

The pedagogical research of the various project partners can be positioned within one of three interrelated themes: interaction between students, interaction between students and an external artifact, and the evolving situation. The research proposed in this paper can be placed in the second theme, interaction between students and an external artifact. From the perspective of this theme, the goals of the research are: (1) to formulate a conceptual model of technology appropriation, (2) to study empirically the way in which a network-computing technology is appropriated by face-to-face groups during problem-solving discussion, and (3) to inform the technological and didactical design process in the LEAD project.

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2.1 Problem statement

The method and technology that are being developed in LEAD help groups to move forward in their discussion by triggering certain actions, and by shaping interactions among the group members.

The method comprises a designed sequence of activities that fit with certain pedagogical objectives. It specifies certain elements in the educational environment, like the task, instructions, and certain rules and techniques for collaboration. The method furthermore specifies the deployment of the Discussion Support System (DSS), that is, when it is deployed, why, and under which configuration. Part of the method will be reflected in the structures of the technology.

The DSS will present students with two types of tools: a text-based conferencing tool and a graphical, shared workspace tool. The tools trigger certain actions from the students, for example by making a notation system available. The notation system promotes certain communicative acts, like providing arguments or asking questions. Shaping of interactions is achieved through the use of certain techniques or rules that are reflected in the structures of the tool. For example, the tool enables students to participate simultaneously in the discussion. The process structure of the tools guide the content, pattern or timing of the communication [14].

The design of collaborative technology is based on hypothesis about how artifacts shape cognition and collaboration [19]. Similarly, the DSS is designed on basis of theory and hypothesis about how small-group problem-solving discussions between students proceed, and how they could be enhanced through technology. As we point out below, it is a goal of this research to develop and test such hypothesis.

To some extent, the tools reflect a certain intention to the user regarding their capabilities and how they should be used. Intentions about their use and effects are also explicated through the instructional design or 'script' that the tools are a part of when they're presented to the student group. However, we argue that the students not necessarily use the technology in accordance with these intentions.

The effect of any didactical intervention that incorporates technology depends in part on a process of technology appropriation. Having said this, we ask the following research questions: how should we conceptualize technology appropriation; and how does technology appropriation affect the students' discourse?

2.2 Research and development strategy

The research will follow LEADs' research and development strategy [15]. In short, we formulate a descriptive conceptual model based on preliminary theoretical and empirical findings that were obtained through a problem analysis. We then proceed with an empirical evaluation of this model, which we subsequently adapt according to our findings. This results in a prescriptive model that may inform both the didactical and technological design process, that is, the development of the Discussion Support System and the didactical method.

In a general sense, the research may contribute to our understanding of the role of computer technology in face-to-face problem-solving discussions.

Throughout the remainder of this paper we develop a problem analysis from theoretical findings, and work towards an initial, tentative concept of technology appropriation.

3.   Problem analysis

The conceptual part of our research question deals with defining what technology appropriation is, and how we should model it. Literature review brings different aspects of 'appropriation' to the fore that may be of relevance to our study. We focus on the notion as it can be found in socio-cultural theory, and with socio-constructivist perspectives on the use of technology. In our view, these two theoretical strands develop different aspects of the notion, which make up a comprehensive picture when combined. Of central importance herein is our conception of the relation between user and technology.

3.1 Appropriation of cultural tools

The notion of appropriation has been frequently used in socio-cultural learning theory. Rogoff [13] uses the term 'appropriation' to refer to "the process by which individuals transform their understanding of and responsibility for activities through their own participation". What is appropriated in this case are cultural tools, like language, procedures or 'technical tools' (e.g. a technology) that are attached to a particular practice. For Wertsch[18], 'appropriation' of a cultural tool can be distinguished from 'mastery' as a form of internalization. Whereas 'mastery' refers to "knowing how to use a mediational means with facility", 'appropriation' refers "to taking something that belongs to others and making it one's own" [18]. This should not be read as taking ownership of something, but rather as adapting it to ones own use. Both Wertsch and Rogoff refer to Bakthin in their use of the term. According to Bakthin, a speaker appropriates a word when he adapts it to his own semantic and expressive intention [1].

Human thoughts and activities undergo a transformation when they become mediated by cultural tools. The notion of mediation in the socio-cultural approach is to a large extent inspired by cultural-historical psychology [16]. Basically, tools are created and transformed during the development of an activity and carry with them a particular culture - the historical remnants from this development. The use of tools is a means for the accumulation and transmission of cultural knowledge. This developmental process influences the nature of external behavior and also of the mental functioning of individuals [2]. This emphasis urges to go beyond the here-and-now interactions of tool-users; the interaction process should be incorporated in a broader cultural and historical frame of reference. However, a 'technical tool' like a collaborative technology may also evolve 'here and now' over a short period of time.

3.2 Social shaping of technology

In a different strand of theory, the notion of appropriation has been used to explicitate a mechanism trough which technology is socially shaped [5, 9, 3].

Carroll et al. [3] define appropriation as a process in which a technology is explored, evaluated and adopted or rejected by users. According to their view, users make use of certain capabilities of a technology, and reject others, in order to satisfy their needs. They see appropriation of mobile technologies by young people as a result of the interplay between what people desire, the capabilities and implications of the technology, and the situation of use [3].

DeSanctis and Poole [5] use a different concept of appropriation. Their use of the term can be traced back to Ollman, who defines appropriation as constructive utilization [10]. According to them, 'appropriations' of a technology are immediate, visible actions that evidence deeper structuration processes. Agents appropriate rules and resources that become available as groups interact while using advanced information technology [5].

Technology appropriation can be described as a process that takes place on different levels of social organisation, that is, on the level of the individual user, a group of users, or on the level of the larger sociocultural environment. Carroll et al. [3] place appropriation on the level of the individual user. DeSanctis and Poole [5] conduct an institutional analysis, and define appropriation on the level of the organisation.

The socio-constructivist approaches to technology focus on the fact that technologies are socially shaped, and that their use and effects depend on human contingencies. This perspective suggests that a technology gets its form and meaning in-interaction. The technology-in-use is not a stable artifact with fixed characteristics that are independent from practice. In stead, students construct essential characteristics of the tool when they work with it. It follows that technology is not necessarily used in accordance with the designers' intentions. "Technological artifacts, in both their form and their meaning, are socially shaped, as opposed to being the clearly defined products of particular inventors or innovators" [7].

3.3 The relation between user and technology

In previous research we described the mutual influence and dependency between students and technology [11]. Several aspects about their relation remain unresolved.

We can make different assumptions about the relation between the students and the technology. One assumption would be to state that the behavior of the students is directed through features of the technology. Another assumption would be to state that the students need to actively explore the technology and make conscious choices in order to achieve a desired outcome.

The theory of affordances [6] fits with the first assumption. Scholars have argued in favour of the notion of 'affordance' as an analytic tool to analyse the 'effects' and 'constraints' of a technology [7, 8]. The affordance of an object refers to the possibilities for action carried by this object. The concept originates from environmental psychology, and is closely related to theories of perception. Main shortcomings of the theory are that (1) it describes explanations on the level of the individual, and says little about the group level, and (2) leaves little room for a process of mutual shaping, since the affordance is considered invariant. As Gibson states "The affordance of something does *not change* as the need of the observer changes. The observer may or may not perceive or attend to the affordance, according to his needs, but the affordance, being invariant, is always there to be perceived" [6].

The theory of 'adaptive structuration' (AST) fits with the second assumption. DeSanctis and Poole [5] describe how people utilize technology in organizations, and how their interaction with the technology influences their social practice. In AST, agents are knowledgeable, and have a conscious influence on the course of events. "New social structures emerge in group interaction as the rules and resources of the technology are appropriated in a given context and reproduced in group interaction over time" [5]. The concepts they use illustrate a construction process that transcends notions of 'internal' and 'external'. Consequently, any change or transformation that takes place cannot be solely located within a subject, the object – in this case the technology – undergoes changes also.

4   Tentative concept of technology appropriation

Technology appropriation occurs when someone puts into use a technology in a goal-directed activity while the properties of the technology, and the acts required to accomplish the goal by means of the technology, are unacquainted. When someone is presented with a new technology, he or she appropriates this tool by 'adapting' it in a goal-directed activity. That someone has to make sense of the properties of the tool, and find 'a way of doing' to perform the activity. When a group of people is presented with a tool, technology appropriation occurs on the level of the group. In this case, the group has to make sense of the technology, and adapt it in a joint activity.

Technology makes certain rules and resources available, and it provides opportunities for interaction that would be hard to achieve without the technology. However, technology appropriation does not simply refer to acquisition of knowledge about an object, or to 'learning how to' do or apply something with the technology. Appropriation of a technology simultaneously transforms user and technology. It does not only cause change in the knowledge and skill of the user, but it also causes change in the properties of the technology. Central to the concept of appropriation is a mutual shaping. The concept implies a process of social construction in which the actions and thoughts of the technology user are shaped through the use of the technology, while at the same time the meaning and effects of the technology are shaped through the users' actions.

The educational environment in which the students work encompasses more than the technology, the didactical method and the other members of the group. Elements on different levels of social organisation are of influence on the classroom practice. One could think of, for example, the routines of the practice, or norms that prevail on the level of the educational institution, which can be of influence. One could also think of the history of a student group, or the experience of the individual student. Processes that take place on each of these levels of social organisation may influence the way the technology is brought into action, and affects the students' discourse.

5   Technology appropriation and the students' discourse

The empirical part of our research question deals with how technology appropriation affects the students' discourse.

When the students lack an understanding or are confronted with a technology that seems confusing, they may engage in a process of sensemaking [17]. The use and effects of the technology emerge from the interaction between the students and the tool, as a result of interrelated individual and group processes. We make an analytical distinction between the user and the external artifact, and separate between individual and group processes. We focus on the 'here and now' of the interaction process, which may evolve over short time periods.

In previous research [11] we studied technology appropriation by examining basic actions that students performed in a graphical, shared workspace tool. This research indicates that individual students make certain choices during the process of appropriation. The study revealed that students make different choices both within and between groups. The choices they made influenced the effect of the tool, and led to differences in their discourse. In the planned continuation of this research we want to examine how the students make sense of the features of the tool, and find a way of working, as a group.

The specific focus of LEAD, the combination of face-to-face and computer   mediated communication, provides some opportunities to learn more about technology appropriation. This situation enables us to investigate to what extent the students make use of (a) observations; (b) talk; (c) gestures, or (d) actions in the tool during their appropriation of the technology.

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