The teacher’s balance between structure and flexibility in the technology-enhanced collaborative inquiry setting

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Abstract: The focus of this paper arises from the dilemma created by the promises and demands of students’ technology-enhanced collaborative inquiry learning on the one hand and lack of competencies in carrying the collective cognitive responsibility of inquiry on the other hand. In this study, we analyze the teacher’s balancing between structure and flexibility when aiming towards supporting students in taking their own responsibility for collaborative technology-enhanced inquiry practices in an ordinary Finnish elementary-level school. The aim of the ‘Artifact project - the Past, the Present, and the Future’ was to support students’ understanding of the diversity of artifacts. For our analysis, we selected all the video-recorded episodes that represented teacher’s and students’ joint whole class activities. It is concluded that in the joint activities, the responsibility for directing the inquiry varied from collectively developed to teacher directed.

Introduction

The studies from the successful knowledge creation and inquiry-based classrooms have been reporting promising results for the purpose of education in the knowledge age (Chang, Scardamalia, Reeve & Messina, 2009; Hmelo-Silver et al. 2000). In inquiry and knowledge creation based learning approaches the aim is to engage classroom community in tackling with open-ended complex problems and exploiting collaboration. The aim is to support handling the ideas and knowledge continually improvable and raise the students’ own ideas and questions at the center of working (Scardamalia 2002). This could be promoted by getting community to define their own learning goals and get them engaged in collective cognitive responsibility of their own process (Scardamalia 2002; Chang, Scardamalia, Reeve & Messina, 2009).

However, if the local classroom culture is colored with traditions or passive voices, and the students are expecting the teacher to lead their knowledge acquisition, the implementation of totally new kind of working practices is evident in order to reach collective cognitive responsibility for the advancement of collective knowledge and inquiry. Challenge for the teacher, when directing the classroom from traditional teacher-driven approaches towards shared inquiry aims, is to tolerate openness. When the process and the object of inquiry are designed in collaboration with students, the outcome of the inquiry cannot be fully known beforehand – neither the phases of the process nor the content to be studied. In addition, although aiming towards collective responsibility and shared aims, the students should be offered enough support (Hmelo-Silver, Duncan, & Chinn, 2000).

The role of the teacher in the classroom is often portrayed either as a transmitter of knowledge or facilitator of learning. Instead of just using dichotomies, we need to understand the diversity of roles that teachers play within the variety of day-to-day activities in a classroom. Simultaneously with expecting students to take responsibility for their own work, they have to be deliberately guided to follow certain rules and standards, such as setting up productive research questions and making plans of inquiry (Olson, 2000). In progressively implementing inquiry-learning practices and facilitating self-regulative and collaborative learning activities, the teachers still need to set requirements for the students in their inquiry and set up some procedures and rules how to proceed. According to Olson (2000), only when the students are familiar with the aims and have undertaken the responsibility for the teacher-set inquiry obligations, are they able to set requirements for themselves and then adapt and reshape the rules if needed.

Supporting students’ generation of their own ideas and promoting collaboration within a classroom community is not possible without supporting routines and structures that channel the students’ activities in a way that elicits participation in inquiry. Having too rigid structures may, however, undermine inquiry efforts altogether. If the teachers prepare or follow strongly scripted curricula or fixed routines, their own creativity and ability to respond to the specific needs of certain classroom are limited (Roth, 2002; Sawyer, 2004). A scripted approach clearly specifies tasks and learning activities, the order and form they should take. In scripted teaching, the teacher is the one who controls the flow of the class, limiting when students can talk and how much impact their statements can have on the collective encounters (Sawyer, 2004). To continue, there are serious concerns that too-strong structuring undermines higher-level objective of inquiry learning because it
makes peripheral the pursuit of advancement of the students’ own ideas (Lakkala, Muukkonen, Aavola, Hakkarainen, 2008).

Several researchers emphasize (Sawyer 2004; Lakkala, al., 2008) that the most effective classroom interaction will balance structure with flexibility and improvisation. Cazden (2001) advocated eschewing an either-or approach and emphasized that teachers should have a repertoire of lesson structures and teaching styles. Thus, effective teaching gives students freedom to construct their own knowledge, while providing and shifting between carefully chosen elements of structure; these include scaffolds, activity formats or pedagogical frameworks that support the co-constructive process (Sawyer, 2004). The shifts themselves are the teacher’s improvisational responses to the unique needs of that class and those students (Sawyer, 2004).

Consequently, the challenge for the teacher is to orchestrate the inquiry process and practices where the students are utilizing their own ideas and strengthening their own community, and promote sustained, collective, pedagogical settings in which idea improvement is the central focus rather, than specific learning tasks or activities (Chang, Hong, Scardamalia, Teo, Morley, 2011).

**ims and scope of the study**

This paper focuses on the dilemma created by the promises and demands of students’ collaborative inquiry learning on the one hand and lack of competencies in carrying the collective cognitive responsibility of inquiry on the other hand. In this study, we analyze the teacher’s balancing between structure and flexibility when aiming towards supporting students in taking their own responsibility for collaborative technology-enhanced inquiry practices in an ordinary elementary-level school. The research question is: How was the responsibility of directing inquiry distributed between the teacher and students within the different collective activities?

**Data collection and analysis**

The context for the study was “The Artifact Project – The Past, the Present and the Future” at Laajasalo Comprehensive School, Helsinki, Finland (Seitamaa-Hakkaronen, Ililo, Hakkarainen, 2010). This intervention has been inspired by the knowledge-building and progressive inquiry approaches which aim at engaging both teachers and pupils in building new knowledge and understanding (Scardamalia, 2002; Hakkarainen, 2003). The project was designed together with the researchers and class teacher, who is familiar with previous approaches and have been implementing them in her class. In the project, 32 students participated. The project started in the beginning of the second term of fourth grade and ended at the end of the fifth grade. The teacher had begun working with this particular class only in the first term of their fourth grade. The students had learned in their earlier school years the teaching and learning activities, where they followed traditional schooling culture with teacher-directed activities and pre-given problems. The aim of the Artifact project was to support students’ understanding of the diversity of artifacts in their cultural context. The students were asked to analyze artifacts within a cultural context. The students were asked to analyze artifacts within a cultural context, to study physical phenomena (such as electricity) related to artifacts, and to design future artifacts. In the project, the collaborative learning environment, Knowledge Forum, provided tools for visualizing and building knowledge (http: \www.knowledgeforum.com\). During the longitudinal project, we collected 56 lessons of video data (i.e., one lesson lasted 45 minutes).

The project activities were concentrating on continuous elaboration of ideas and themes within the project frames. The organization of the project broke down the lesson limits so that the project’s themes and activities were often continuing through several lessons. In addition, the teacher did not follow basic lesson structures (i.e., teacher’s lesson introduction, lesson body, and closing), even in several occasions the teacher needed to take care of lesson transitions with introducing the continuing theme or closing the working time. Thus, for the analysis, the video data from past and present phase were divided into distinguishable episodes. An episode was considered distinguishable when the aim, the social organization, or the supporting tools (for example use of F) changed during the activity, or the break recessed the activity. Each collective episode lasted approximately 11 minutes. The Future phase was excluded from the analysis, because the teacher remained background and the professional designer guided the students’ design process. For the present analysis, we selected all those collective episodes (N:34) where both, the teacher and students, were present.

The collective episodes were analyzed from the two perspectives: (1) Responsibility for directing the inquiry, and (2) Type of activity. In the responsibility for directing the inquiry, the episode was classified as a) teacher directed, when the teacher alone directed the strategy and the students were listening, b) teacher promoted when the teacher carried the responsibility for maintaining the inquiry but the whole class participated, and c) collectively developed when the whole class community developed the strategy together. We also analyzed the type of activity in the episode to understand when the collective activities involved either a) planning, or b) reflecting on strategy; or, alternatively when the activity concentrated on c) improving ideas.

All the episodes were further divided in events (N:116) according to topics of discussion in the activity. These topics served different functions for advancing the activity and were categorized for a) Discussing content, b) Discussing strategy and deepening inquiry, c) Discussing previous phase, d) Inquiry management and summarizing, e) Teacher guidance, or f) Teacher organization.
Results

The results indicate (see Figure 1) that most of the cases where the teacher alone took the responsibility for directing the inquiry were idea improvement episodes. In those episodes the teacher either took care of the lesson transitions or structured the project activities, such as provided short guidelines regarding what they were supposed to be doing or requested to deepen their thinking. In addition, these included a couple of teacher-extended questions that the students would not have been able to consider themselves, but the teacher thought would provide a good opportunity to connect. In the teacher directed episodes the topics of discussion were in general concentrating around short teacher organization functions.

![Figure 1. Different types of activity (planning, reflecting strategy, and idea improvement) in video recorded episodes according to responsibility for directing inquiry](image)

The teacher-promoted collective episodes occurred when the students were not able to take the cognitive responsibility or carry on the strategic directing of the process. In those episodes, the students did not always have tools to participate although the teacher’s aim was to turn the strategic activity to the students. In some cases, the teacher had a preliminary idea what they could achieve and chose to promote the inquiry further. When planning or reflecting strategy, the teacher, for example, assisted students in implementing the suitable strategy to plan their inquiry (i.e., determine how to use the collected information), or then she promoted students in reflecting the used strategy at meta-level (i.e., what kind of research questions are valuable). It is noteworthy that the teacher needed to promote the discussions when the used strategy was reflected. She needed to socialize the students understanding of how to observe, create questions, or use KF for building on knowledge. In teacher-promoted idea-improvement episodes, they were developing the inquiry ideas further, but the teacher needed to promote the discussion. The teacher’s support and inducement was, on the one hand, essential for creating discussion; on the other hand, she often had some background idea what they could consider.

In the teacher promoted idea improvement episodes, the functions of the different events were concentrating on developing and discussing content together. The talk about content was often preceded with discussions of previous phase represented by knowledge Forum. The following excerpt is from the longer event where they thought back the issues about how they had made the lamp light. In the excerpt, the teacher creates ground for deepening the inquiry about electricity towards explaining what happens inside the electricity cable. The teacher had a background idea herself how they could continue, and wanted to connect the students’ present wonderings to the current. Students have not been able to deepen their inquiry themselves, thus the teacher promoted it based on the students’ KF wonderings:

**Excerpt 1, “Discussing previous phase”**

**Teacher:** [searching Theo’s note from KF and opening it] So what was it about the system that, like over here Theo said that the power is conducted. And Theo already talks about how the power circuit doesn’t conduct energy if the power circuit isn’t closed. What does it mean? What do you mean by that?

**Theo:** It means that plus and minus go into one another.

**Teacher:** Yeah, but where does it go and how?

**Theo:** It goes so that there goes a cable from the minus end to the lamp and from the lamp a cable goes to the plus end.

**Teacher:** So you mean that something happens inside the lamp? Well, what happens in the lamp?

**Theo:** Well, the current goes through it.

**Teacher:** Well how can it go through? What transports it?

**Theo:** Well it’s there. It’s trying to get to the minus end all the time.

**Teacher:** What does it transmit along? What’s inside the cable?
Theo: Copper wires.
Teacher: Good, now we’re at the heart of the issue. So there’s something inside the wire.

The analysis revealed [see figure] further, that whole class collectively took responsibility for directing the inquiry when the process needed planning, i.e., they planned how to conduct the project activities, such as creating research plan, or own research questions. These episodes took place usually in the beginning of the new phase of the project. However, there were no collective episodes of idea improvement or reflecting strategy that would have involved collectively shared responsibility for directing inquiry. Idea improvement mainly took place in episodes of team-based and individual working, where the students were carrying the inquiry further by themselves. The topics of discussion in these episodes served discussing strategy and deepening inquiry three times more often than in other episodes. During these discussions, the collective tried to plan how to continue like in the following extract where they were collectively developing the inquiry and planning how to study artifacts:

Teacher: “Discussing strategy and deepening inquiry”
Teacher: …So these are the ways, for example, how to continue the study further and further. Do we have any other ways to study things? Something else than these that we have already earlier used. Ind?
Teacher: We could go some place out and study them.
Teacher: We can go out to some place and study. Where? Cut the thing away, please. Where? What did you mean? If we think about the artifact?
Teacher: Well.
Teacher: If it is the question about some concrete artifact, well, where one could go? Where would you go? Amy?
Teacher: To the museum.
Teacher: Oh, cut it costs.
Teacher: It costs. For example, to the museum. Didn’t we went to Eureka science museum when wondering about flying and space. Area.
Teacher: Well then, for example, the artifact project… We could look at where they are made, those equ…
Teacher: Cut that could be interesting! To go some place, yes, where they are made. Different types of artifacts. Eedi.
Teacher: To the library.
Teacher: yes, what else? Ane?
Teacher: If we study some artifact, if someone would have the artifact herself, it could be brought here, to the classroom.
Teacher: mm, We could study our own depositories as well. Artifacts that we own, that is also possible. Do you have more ideas? Michael.
Teacher: Well, I had approximately the same idea, that if there would exist some old stuff that could be asked about from grandparents or others… that would they have some similar artifacts, if they would know, or some other friends could be asked about if they would have the artifact. If they would know?
Teacher: Do you know what it is called about? What are we doing then? What are they doing when asking about something? Well, Michael?
Teacher: Is it some gallup?
Teacher: Well, nearly so, gallup yes, maybe the concept do not support the very idea, but what are they called about? We are doing what? When you are asking about something… I am just searching the concept, we will learn new concepts at the same time. Well, isn’t it an interview? We’ll make an interview, we’ll interview some expert. Good idea. Good idea, very good ideas you have. I save quickly your ideas here that they won’t run away anywhere. Let’s put them here. What would be the good title for these? Ane?
Teacher: Studying artifact.

Conclusion
Three types of collective working episodes were distinguished regarding responsibility of directing inquiry in practice. Firstly, we identified episodes in which the teacher and students were equally involved in developing the inquiry. In these episodes, the strategic plans and goals of the project were determined jointly between the teacher and students although the teacher sometimes needed to facilitate and nourish the discussion from her part. Secondly, it was distinguished episodes in which the teacher deliberately either promoted discussions towards suitable strategy for further inquiry, or carried idea improvement towards understanding that the students would not have been able to reach themselves. Such teacher promoting was needed when students’
were not able to express their own ideas or spontaneously emerged patterns of classroom discourse did not lead the community to a direction that would have assisted in obtaining higher level objectives of the project.

Thirdly, there occurred episodes where the teacher controlled joint activities so as to reach deeper level of explanation. In these cases the teacher considered it necessary to directly lead the community to using appropriate inquiry strategies.

The present project was a collective object oriented process in nature and intended to support students in appropriating in inquiry practices that resemble those that experts functioning in knowledge-creation communities enact. Based on the results, the teacher guided students to bring up ideas relying on their own experiences and background knowledge, and her aim was to support students’ knowledge building and taking of responsibility for idea improvement. Yet, there were no whole class episodes, where students made most of the initiations regarding advancement of inquiry and the teacher only chaired the session. However, it still is very typical to Finnish school that students are not oriented toward sharing their spontaneously generated ideas in the social space of the classroom. Moreover, the student-driven collaborative activities took frequently place in the context of team work.

On the other hand, the present teacher was students’ co-research in the project she was responsible to its strategic guidance together with students. The present type of investigative study project does not simply represent the teachers’ world because of being co-figured with students and their interest. Neither did the project represent students’ world; it constitute a collective space that emerged through joint efforts of the participants. Cazden’s (2001) claim that differences between learning in teacher-led lessons and learning in peer groups are becoming less marked, when the work in progress can be shared for whole classroom community through technology, is supported in the project at hand. Differently constructed episodes created all common ground and took productively part in the collective inquiry.

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