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Shared Epistemic Agency: An Empirical Study of an Emergent Construct

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Shared Epistemic Agency: An Empirical Study of an Emergent Construct

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This article reports on a qualitative study of the construct of shared epistemic agency, investigated in the context of collaborative instructional design activities of university students. The aim of the study is to shed light on the notion of shared epistemic agency and to create empirical grounding for its theoretical description. The current study provides an account of the construct, based on a review of several theoretical conceptualizations and on the analysis of empirical material from 2 case studies from university education. We investigate shared epistemic agency within the specific framework of the knowledge creation perspective on learning, viewing it as the capacity that enables deliberate collaborative efforts of groups to create shared knowledge objects. Our study identifies and describes 2 core dimensions of shared epistemic agency: the epistemic and the regulative dimensions. We identify actions within each dimension that indicate the manifestation of shared epistemic

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agency in the practice of collaborative creation of shared knowledge objects. This study also distinguishes patterns of action that provide indications of how shared epistemic agency is differently articulated in the 2 groups' collaborative object-oriented activities.

INTRODUCTION

Val: … but then I would want to have this question answered: "How to involve someone in volunteer work?"

Sam: Yes, that's indeed very explicit.

Val: That is how we summarize the goal of the client; then, we have to operationalize it in learning goals.

Mel: Then, we could tell the pupils: We'll provide you with an assignment to help someone else to get involved. But our underlying, hidden aim is that the pupils learn something from that and they become more involved themselves.

(Group A discussion, fifth project week)

Val: Let's focus on the learning goals and content … But let's take care that it makes sense to the pupils … and that it stimulates them to become involved. We talked about it last time.

Alex: Oh, yes, we were thinking about what information was needed and how to present it to the pupils …

Mel: As I suggested, I think a day in the life of a child from Africa or Malawi. Maybe Africa is too general?

Val: I'd suggest general instruction about Africa, then "a day in the life of a child from one of the countries." […]

Mel: Let's make a plan for how to continue developing these sections. We had such good ideas now, but if we don't concretize them, this is a waste of time …

(Group A discussion, sixth project week)

Mel, on documenting ideas discussed during the group meetings: "We decided to do it because the design caused us some headaches. Some things were thought through thoroughly, and if that wasn't written down, we forgot it straight away. […] Therefore, it was necessary to write down those ideas, not only to make notes and plans of what we will do next week."

(Group A, excerpt from the final interview)

These excerpts show instances of collaboration between four university students working on a long-term group project in the context of an instructional design course. The design task was complex and ill structured. An external client requested the group to design new Web site material for primary

school pupils to help them learn about the lives of their peers in developing countries.

The students collected information about the topic and the learning needs of the target group. Now they could decide on the structure and the content of the design product. The excerpts shown concern the learning goals and what is important when designing instructional material. The group seems to agree on the importance of stimulating pupils to understand the circumstances of their peers in developing countries (first excerpt). In the second excerpt, the group members come up with ideas on how to present the topic in an attractive, structured manner. The group members succeed in jointly producing a new idea to be applied in the design product. The final excerpt shows students' decision to document the discussions because they find it important to keep track of ideas proposed and choices made during the 10-week period.

The discussion fragments illustrate the nature of collaboration when creating a knowledge product (i.e., instructional material) in a long-term process. Such a process requires, among other things, follow-ups on created ideas, persistence in applying plans of action, and shared thought and actions. The decision to document discussions indicates the group's awareness of the necessity to document ideas produced and to ensure their use in the final design product. But it also indicates that group members were able to identify flaws in their work as well as actively search for and apply strategies for improving their knowledge-related activities. One question that guides the current investigation is what enables groups to systematically proceed in their work and collaboratively pursue design product development. Carrying out authentic and complex collaborative projects requires advanced collaborative practices involving active and sustained knowledge-driven activities and use of collective knowledge. We maintain that especially in the context of open, ill-structured, and authentic tasks that request the collaborative production of new ideas and knowledge, intentional and joint conduct are of great importance. We believe that the capacity enabling and steering such activities can be associated with agency. This article discusses empirical material, such as that presented above, in order to analyze this characteristic of collaborative groups, denominated by the construct of *shared epistemic agency*.

Collaborative learning has often been explained as a mere collection of individual actions (Barron, 2000). Recent studies indicate that simply bringing people together in groups and giving them tasks, or pooling a group's knowledge, are necessary but not sufficient conditions for productive collaboration (Barron, 2000, 2003; Perkins, 2003; Salas, Sims, & Burke, 2005; Scardamalia & Bereiter, 1991). These studies indicate that creating the premises for collaboration that brings about both the production of new knowledge objects and the advancement of individual knowledge necessitates more than just individual performance of assigned collaborative tasks. In this line of thought, Scardamalia (2002) maintained that a

novel type of agency, *epistemic agency*, is essential to support such collective efforts of knowledge advancement.

The concept of epistemic agency was introduced to the field of educational research within the knowledge-building perspective approach to learning. Although considered important from the perspective of learning communities (van Aalst & Chan, 2007; Muukkonen, Lakkala, & Hakkarainen, 2005; Scardamalia, 2002), the concept has not been comprehensively investigated. Scardamalia depicted it as the process that sustains the creation and improvement of ideas via collective contributions in which students take cognitive responsibility for their learning. Her studies indicated a number of discrete characteristics of epistemic agency but they did not provide an integrated theoretical account of the concept, nor did they elucidate how epistemic agency can be identified in educational practice.

In our investigation, we draw upon the *knowledge creation perspective* (Paavola & Hakkarainen, 2005), which holds that learning takes place through sustained collaborative activities whose aim is to create new knowledge through work on shared objects. Within this view of learning, epistemic agency is assigned a crucial role in the sense that it enables learners to pursue collective epistemic goals (Muukkonen et al., 2005). We therefore propose and investigate shared epistemic agency as a notion that depicts a specific form of epistemic agency that emerges in the context of collaborative activities aimed at the creation of shared knowledge objects. It emphasizes the capacity that enables people to be more than mere knowledge "carriers" but to be productive participants in these knowledge-laden, object-driven collaborative activities and to be in charge of their own knowledge advancement. Shared epistemic agency is important because, we assume, both individual learners and groups with a higher sense of agency should have a greater potential to engage in productive collaborative activities that generate new knowledge. In order to create a basis to support learners to develop shared epistemic agency, experts need a clear account of what this agency is and whether there are differences in how it is articulated in practice. Hence, this investigation attempts to provide an empirically founded description and operationalization of the construct.

GOALS OF THIS STUDY

In the qualitative study reported in this article, we attempt to capture and create an account of shared epistemic agency in two respects. First, the study aims to shed light and conceptually elaborate on the construct of shared epistemic agency. For this purpose, we attempt to ground the construct by revealing how it is evident in practice. Second, this study seeks to show how different groups can show different forms or levels of shared epistemic agency. To achieve these goals, we use Scardamalia's (2002) definition of epistemic agency and other theoretical views of

agency to create a framework of the new construct. We use this framework to understand productive interaction in the collaborative object-oriented learning activities of two groups of university students that conducted an instructional design project for external clients. We attempt to make this theoretical definition more concrete and to enrich the initial framework by identifying indicators of shared epistemic agency in learning practice.

We address the following research questions:

1. Which indicators of shared epistemic agency can be identified in the collaborative design work of university student groups?
2. How does the occurrence of these indicators differ between groups?

The remainder of this article is structured as follows. We begin with a discussion of the knowledge creation perspective, followed by an examination of theoretical and empirical studies on agency and epistemic agency, primarily within educational contexts. To delineate the nature of the construct of shared epistemic agency we attempt to identify elements that refer to agentic conduct in relation to knowledge-driven collaborative activities. Then we build upon this theoretical foundation and develop a preliminary framework for the construct. This is followed by an empirical analysis of two cases that aims to identify indications of shared epistemic agency in practice, as shown by different groups. The article concludes with a discussion of the outcomes, focusing on the insights gained as to what constitutes the notion of shared epistemic agency, how this construct serves to pin down and analyze productive collaborative knowledge practices in concrete educational contexts, and what the value is of these outcomes for the educational practice.

THEORETICAL PERSPECTIVES

Learning as Knowledge Creation

Paavola and Hakkarainen (2005) argued that learning involves the creation of new knowledge instead of the learning of predefined knowledge structures or skills. Building upon this, they developed the knowledge creation perspective on learning as an integration of two metaphors of learning proposed by Sfard (1998), namely the *acquisition* metaphor and the *participation* metaphor. The knowledge creation perspective highlights the idea that learning involves the creation of new knowledge by means of collaboration around shared knowledge objects. The idea of new knowledge should be understood in the context of the learners' activities and development—the knowledge they create is new to them, not necessarily to

the world. This view of learning draws upon Bereiter's (2002) model of knowledge building, adding ideas by Piaget (1955) and Popper (1972).

Knowledge building consists of the continuous collective production and improvement of ideas (i.e., conceptual artifacts) that contribute to a community's knowledge advancement (Bereiter, 2002). However, the knowledge creation perspective goes beyond the knowledge-building approach. Whereas knowledge building emphasizes collaborative development and improvement of singular ideas, this new perspective proposes creating knowledge through the development and advancement of complex knowledge objects and involves more than work with one singular idea. Although acknowledging the value of interaction between implicit and explicit knowledge as fertile ground for knowledge creation, this approach underlines the idea that concretized conceptual artifacts fulfill their envisaged purposes for learning when materialized in shared knowledge objects (e.g., essays, textual reports, visual models, software). Viewing learning from this perspective is important because it makes explicit "those activities through which the interaction between individual expertise and communal knowledge becomes materialized, a fertile way as common objects of activity are developed" (Paavola & Hakkarainen, 2005, p. 546). It emphasizes the object-orientedness of learning as a human activity, that is, the interaction whereby individual learners participate in collaborative learning activities *through* common, tangible objects of activity or tools (Engeström, 1987; Vygotsky, 1930/1978). Constructing shared knowledge objects involves more than just carrying out dialogic interaction. It requires combining individual and collective contributions and learners becoming actively involved in the materialization of ideas in order to give conceptual artifacts a concrete shape and to create a tangible representation of what they are making. It is a complex endeavor that brings about groups' agency.

Perspectives on Human Agency

Various domains of inquiry have generated different stances on the concept of agency, which expresses the sentient and intentional character of human nature. Philosophical perspectives consider agency to represent one's ability to exert control over one's course of actions, to determine how to apply one's will in concrete acts (Reed, 2001) and to enable individuals to be autonomous in relation to their environments (Schwartz & Okita, 2004).

Social cognitive theory (Bandura, 2001) emphasizes *intentionality* as the core aspect of agency. Intentionality implies purposefulness of action, determination of the course of actions, and reflective regulation of the activity. This approach is dominated by the position that humans can only exert agency by internal goal setting, independent of external input, and that this can be expressed through self-control and beliefs as one's self-efficacy.

Activity theory and sociocultural views depict agency as a human being's ability to act (Engeström, 2008). This includes the capacity for goal-directed and purposive action and for using mediating means to perform this action (Wertsch, Del Rio, & Alvarez, 1995). Sociological approaches take stances on agency that emphasize creativity and intersubjectivity. In a seminal theoretical contribution, Emirbayer and Mische (1998) maintained that agency reflects the potential of human beings to selectively reactivate existing, known patterns of thought and action; to find new ways to express their ideas; to generate future trajectories of action in a creative manner; and to make practical and normative judgments of possible trajectories of action. They posited that both habitual (see also Giddens, 1991) and innovative, creative actions can account for agentic behavior. Agency emerges in problematic situations through newly emerging actions or through the (re)adjustment of existing patterns of action that "may allow for greater imagination, choice, and conscious purpose" (Emirbayer & Mische, 1998, p. 973).

Perspectives on Epistemic Agency

Etymologically speaking, the word *epistemic* refers to knowledge and what it means to know something. Epistemic agency, then, refers to activities involving knowledge and knowing. A common conception presupposes that epistemic agents are responsible for what they themselves know and that knowledge arises from choices for which the agent is responsible (Reed, 2001). Epistemic agency is also one of the principles in the design of knowledge-building communities (Scardamalia, 2002; Scardamalia & Bereiter, 2003). This type of learning challenges learners to go beyond individual efforts and to collaborate with peers in order to advance the knowledge of the community (Bereiter, 2002). Epistemic, then, refers to activities that are directly involved in generating and advancing ideas in the context of learning activities. From the perspective of learning as knowledge creation, agency can be considered epistemic when it expresses learners' intentional, goal-directed, and sustained involvement in knowledge-driven, object-oriented, collaborative activities.

Several empirical studies in educational contexts have pointed to actions or characteristics of the learning process that are related to epistemic agency. The majority of these studies did not focus on examining the concept itself; agency is discussed occasionally in relation to learning and collaboration, but the authors do not explicitly establish the link between knowledge creation and agency. Table 1 contains an overview of such characteristics organized according to a categorization that emerged during the analysis. We analyze and cluster these characteristics to create a basis for identifying and proposing indicators for the construct of shared epistemic agency.

Based on the ideas in these studies, we discriminate different categories of indicators of epistemic agency. The first category ("Knowledge Related" columns

TABLE 1
Overview of Aspects and Activities Related to (Epistemic) Agency

| | *Indicative Aspect or Activity* | | | | | | |
| | *Knowledge Related* | | | | *Process Related* | | |
Author/Study	*Searching Information*	*Sharing Ideas*	*Structuring Ideas*	*Producing Ideas*	*Projective*	*Regulative*	*Relational*
Scardamalia (1991, 2002); Hill & Van Aalst (2001); Russel (2002); Erstad (2004)	Searching scientific evidence	Sharing ideas Coordinating personal ideas with others	Structuring collective ideas Rising above individual ideas	Intentionally engaging in epistemic discourse Purposeful and progressive collective discourse Further understanding Idea production Idea uptake	Setting goals Long-range planning Pursuing collective goals	Monitoring collaborative efforts	Negotiating
Schwartz & Okita (2004) Stahl (2005, 2006)	Awareness of lack of knowledge				Shared intentionality		

Palonen & Hakkarainen (2000)	Making intellectual resources available	Knowledge brokering	Coordinating collaborative activities	Crossing boundaries between students Relational skills
Bandura (2001)			Proactive commitment Creating plans of action Forethought	Self-monitoring Corrective self-reaction Reflection on thoughts and actions
Emirbayer & Mische (1998)		Finding new ways to express ideas		Reactivating and adjusting known patterns of action	Negotiating future courses of action
Wertsch et al. (1995); Engeström (1987)		Mediated action	Goal-directedness Purposive action	Social participation
Edwards (2005)				Negotiation

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of Table 1) concerns knowledge-related activities highlighted primarily in re-
search studies in educational settings (Palonen & Hakkarainen, 2000; Scar-
damalia & Bereiter, 1991, 2002; Stahl, 2005, 2006). The emphasis here is on col-
laborative idea production as an outcome of epistemic agency, mainly through
participation in conversational interaction. Elaborating on empirical findings,
Scardamalia (2002) depicted epistemic agency as characterized by the improve-
ment or development of ideas through making collective contributions and
through relating personal ideas to one another. Empirical studies on knowl-
edge-building activities in professional settings (Erstad, 2004; Russel, 2002)
have indicated that both purposeful and progressive discourse between group
members and the coordination of their personal ideas with others' help realize
epistemic agency. In an empirical study on the knowledge-building activities of
secondary school students, van Aalst and Chan (2007) interpreted epistemic
agency as being about further inquiry for understanding. In theoretical studies of
knowledge building and on the locus of agency in computer-supported collabo-
ration, Stahl (2005, 2006) discussed the importance of awareness of lack of un-
derstanding and knowledge, whereas Neale, Carroll, and Rosson (2004) consid-
ered awareness and agency the main condition for productive collaborative
work. In an empirical study of students' social networks, Palonen and Hak-
karainen (2000) concluded that students considered to be epistemic agents bro-
kered knowledge and mediated access to intellectual resources. Furthermore, case
studies on joint problem space by Roschelle (1992) and Barron (2000, 2003) ex-
plained the generation of conceptual change through conversational means during
group problem solving by pointing at the convergent interactions that create pre-
mises for constructive collaboration. Finally, Perkins's (2003) contribution identi-
fied interaction patterns resembling agentic conduct (i.e., identifying alternatives
and consequences of one's actions, evaluating options, and creating a common vi-
sion) that enable constructive group action.

In sum, we infer four types of *knowledge-related* actions. First, there is a sub-
category of actions whose goal is collecting information (i.e., scientific evidence)
from various sources, concretized in the exploration of sources as a starting point
in the process of creating one's own ideas. Second, there are actions that seek the
sharing of ideas and knowledge, which requires the exchange of insights. Third,
structuring ideas should create the basis for further epistemic endeavors. Finally,
there are actions geared toward producing new ideas through participation in
epistemic collective discourse.

The second category ("Process Related" columns of Table 1) encompasses *pro-
cess-related* activities that play a role in steering and organizing the process of
knowledge production. Studies investigating collaborative or cooperative prac-
tices strongly emphasized the interactional aspect of collaboration and the idea
that collaboration is more than performing common tasks. With respect to pro-
cess-related activities, three subcategories of actions were discerned. First, there

are projective actions (Bandura, 2001; Emirbayer & Mische, 1998), which emphasize the orientation of agency toward future courses of action and the intention to actively engage in activity. Actions such as common goal setting, making (long-range) plans of action (Scardamalia, 2002), or displaying a proactive attitude belong to this category. Second, there are actions aimed at regulating the epistemic activities. Various studies emphasized coordination and monitoring of group activities (Bandura, 2001; Palonen & Hakkarainen, 2000; Russel, 2002; Scardamalia, 2002). Scardamalia depicted epistemic agency as also being characterized by students showing responsibility for their learning through monitoring the advancement of collective activities and overcoming challenges emerging in the process. Third, there are actions at the relational level, which emphasize the social aspects of collaboration. Roschelle's (1992) and Barron's (2003) studies point to the importance of personal–relational aspects that mediate solving problems, creating shared conceptual structures, or mutually constructing knowledge. In Palonen and Hakkarainen's study, students who were considered agents initiated boundary crossing between groups of students, involved other students' knowledge and skills, and encouraged the participation of others who did not possess equally strong academic skills. Barron (2000) restated the idea of emerging actions through the mutual creation of conversational opportunities. Making collaboration work involves interacting, dealing with group-related problems, and applying strategies (such as negotiation) that keep the participants level-headed and involved (Edwards, 2005; Emirbayer & Mische, 1998; Erstad, 2004).

SHARED EPISTEMIC AGENCY

An Emerging Construct

We propose an integrative perspective in which the creation of shared knowledge objects is central to collaboration. Drawing upon the insights discussed in the previous section, we identify two major dimensions of shared epistemic agency: the *epistemic* (i.e., knowledge-related) and the *regulative*[1] (i.e., process-related) dimensions. The knowledge-related dimension is considered in terms of collaborative activities that lead directly to the creation of the knowledge object. This dimension draws upon the idea of epistemic collaboration as advanced by Scardamalia (2002) but takes it a step further, pinpointing the specific elements necessary to create and develop shared knowledge objects. Characteristic of this dimension is the *productional* aspect that situates concrete (knowledge) objects in the center of the collaborative activities. Accordingly, agentic conduct is required

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[1]We use the term *regulative* in its broader sense, referring to the management of collaborative process.

to bring idea generation toward materialization in tangible knowledge objects. Schwartz and Okita's (2004) idea about the potential of humans to concretize the choices made for a particular trajectory of action and to actually perform the activities that give knowledge a concrete shape also provides ground for introducing the productional element. In this context, the shared knowledge object is the outcome of the productive epistemic collaboration, the latter enabled by shared epistemic agency.

We define the regulative dimension based on the stances on agency formulated specifically by Bandura (2001) and Emirbayer and Mische (1998). Although we do not fully share Bandura's view on agency as an exclusively internally driven human trait, we see intentionality as a core aspect of agency. This dimension consists of *projective* elements, such as forethought and anticipation of and choice for future joint actions concerning the work on the shared object. Once the choice for action is made, regulation at *procedural* (see Bandura, 2001; Emirbayer & Mische, 1998) and *relational* (Edwards, 2005) levels is emergent and steers the object development process.

Within the context of the knowledge creation framework, *intersubjectivity* is an overarching element. We do not take a stance on the concept of group cognition but acknowledge that shared epistemic agency involves elements of group mind (Akkerman et al., 2007). We adopt the conceptual position suggested by Akkerman et al. that conceives of "cognition as individual property but the individual itself as an inherently social entity, constituted through its social relations with others" (p. 55). The concept of *sharedness* related to epistemic agency suggests, however, a specific type of praxis that, in turn, generates certain collaborative strategies. Sharing, whether of ideas, strategies, or practices, happens in a community and with an interdependency of partners (Barron, 2000) and is triggered by actions that do not occur in individualistic settings (Matusov, 1996; Wertsch et al., 1995). This participatory perspective on agency involves coordination of actions and contribution to the joint venture (Akkerman et al., 2007; Matusov, 1996) driven both by common goals and by disagreements (Matusov, 1996). This concurs with Martin's (2007) position that productive agency involves more than individual strategizing but "[engaging] with others within collectively organized contexts of action" (Emirbayer & Mische, 1998, pp. 973–974), participating in collective activities (Holland, Lachicotte, Skinner, & Cain, 1998), and creating a social basis for negotiating ideas and knowledge (Edwards, 2005). We expect intersubjectivity to be explicitly expressed in actions at the regulative level but also implicitly expressed in the joint nature of the epistemic actions performed.

To this end, we regard shared epistemic agency as a capacity that enables groups to deliberately carry out collaborative, knowledge-driven activities with the aim of creating shared knowledge objects. It designates the epistemic–productional, intentional, and intersubjective character of the collaborative activities taking place during knowledge object creation. It implies that group members act

jointly to create and develop these objects. As a result, we assume that shared efforts at the group level indicate shared epistemic agency and not each individual member's activities or pursuits. These arguments lead us to surmise that shared epistemic agency suggests a specific type of practice that is not automatically possessed or attained when groups of students work on collaborative assignments; such groups do not appear as established communities with customary ways of creating knowledge objects and with a given level of agency. In this sense, shared epistemic agency is not a trait but an emerging, recursive, and gradual process, (Schwartz & Okita, 2004) simultaneously triggered and influenced by individual input and interaction with peers and the object of activity, and steered by feedback and relational elements.

Actions as Units of Analysis of Shared Epistemic Agency

For analytical purposes, we empirically investigate shared epistemic agency by studying its observable elements; that is, *actions*. Actions are observable components of activity (Elkonin, 1999; Engeström, 1987) and express materialized intention, which indicates agentic behavior (Emirbayer & Mische, 1998; Engeström, 2008). Actions can be ascribed to both individuals and groups, with a social facet that involves interactions, (inter)subjectivity (Bronckart, 1995), and interconnection with the productive side of activity.

Based on the theoretical dimensions specified previously, we distinguish epistemic and regulative actions. *Epistemic actions* contribute to the conceptual and physical progress of the shared knowledge objects situated in the center of the collaborative learning activities. Developing and translating ideas (or conceptual artifacts; see Bereiter, 2002) into concrete, tangible knowledge objects brings about the productive aspect of these actions. This is similar to Schwartz and Okita's (2004) idea of productive agency, which implies that people produce ideas, artifacts, and the like in order to produce themselves. Also, Elkonin's (1999) account of two different types of actions involved in object-oriented activities—object-directed and "people-directed" actions—supports this stance.

Regulative actions concern the processes necessary to direct and support the collaborative activity (Bandura, 2001; Emirbayer & Mische, 1998; Palonen & Hakkarainen, 2000; Scardamalia, 2002). The focus of these actions is not directly on object development but rather on those aspects that serve the object-oriented work and its management. Encompassing elements of both intentional and intersubjective nature, projective (Emirbayer & Mische, 1998), regulative (Bandura, 2001), and relational (Edwards, 2005; Elkonin, 1999; Palonen & Hakkarainen, 2000) actions can express these aspects. Ideally, shared epistemic agency is a combination of these types of actions, emergent when conducting collaborative work for creating knowledge objects.

METHODS

A case study approach (Yin, 2003) was chosen as the most appropriate research method, given the need for in-depth understanding of the construct analyzed.

Participants

The participants were 7 out of the 32 students attending the course Educational and Instructional Design at a large Dutch university. We gained access to the sample group through contact with the course coordinator. The participants expressed their willingness to participate in the study after a call by the first author. The need to collect a large and varied data set related to the aspect investigated motivated the choice to use an open sampling approach, in which the selection of participants can be indiscriminate (Yin, 2003). The seven participants, one man and six women, were members of two project groups, both supervised by the same tutor. One group was formed at the end of the first course lecture based on the preference of the four students for particular design topics. The members of this group were all full-time students. Three of them had entered the university immediately after graduating from high school; one had previously attended another university. These four students had taken the same courses in the past but had never worked together on a collaborative task. The second group[2] was formed based on personal preferences before the design topic was chosen. This group's members were all part-time students who had graduated from institutions of higher professional education and had day jobs. Halfway through the project period, one group member dropped out.

Educational Context

Course Setup

Educational and Instructional Design is a 10-week course offered during the second year of bachelor's degree study in Educational Sciences. The aim of the course is to familiarize students with the major theories and methods of instructional design and to provide them with a context in which to apply this knowledge in practice. The course includes a collaborative design project, lectures about design theories and methodology every second week, and tutorial sessions (face-to-face meetings with the tutor) organized on an as-needed basis. The group work on the design product represents the main part of the course. A Blackboard® System facilitates students' collaboration during most of these activities.

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[2]This group joined the research project 2 weeks after the start of the course. Therefore, fewer data were collected from this group.

Design project.   The design project requires students to apply their theoretical knowledge about instructional design in an extended design task, preferably for an external client from either the educational field or the private sector. Students are required to form project groups of three or four persons, search for a client, and negotiate a design topic. The knowledge objects to be delivered at the end of the course period are a common instructional design product and a group justification report.

The design project uses the instructional design model of Morrison, Ross, and Kemp (2004), which provides a scenario that prescribes the main design activities. It offers sufficient space for creativity and productive collaboration, especially by challenging the groups to solve problems for which they have no prescribed solutions. The scenario includes a number of phases and activities but it provides a flexible model that can be applied by students in their own way (see Table 2).

In the *project initiation* phase, setting up the project and developing a project plan characterize group work. The first aspect involves finding a client and negotiating the design project. The outcome here is a project plan. To do this, groups must create a description of the instructional problem and of how the designed material could solve the respective problem. They also produce an overview of design activities, including a plan and a specification of the products to be delivered.

The *analysis* phase consists of a number of analyses preceding the actual design. These analyses provide information about the instructional problem, the learning needs of the target group, the characteristics of the target group, the context in which the design would be implemented, and the knowledge domain. The outcome of this phase is an analysis report.

TABLE 2
Overview of Design Phases, Activities, and Knowledge Objects Produced

Design Phase	Design Activity	Intermediate Object	Final Object
Project initiation	Finding a client and negotiating a design project	Project plan	
	Preparing a project plan		
Analysis	Problem analysis	Analysis report	
	Needs analysis		
	Context analysis		Design product
	Target group analysis		Justification report
	Domain analysis		
	Reporting		
Construction	Learning goal specification	Macro-design	
	Creation of macro-design	Micro-design	
	Creation of micro-design		
	Creation of evaluation instrument(s)		
	Reporting		

The *construction* phase consists of creating the actual design product. This product consists of (a) a macro-design presenting the general structure of the design product and (b) a micro-design in which one or more sections of the macro-design is developed in detail. Depending on the project, this might consist of lesson plans and lesson material, training materials, manuals for teachers and instructors, and so on. This phase also includes the construction of an evaluation instrument. An activity that, ideally, takes place during all three phases and that cannot be assigned to a specific phase is the reporting on the design activities performed. The groups are required to produce a justification report through which to present and motivate the choices for various analyses, design methods, or evaluation methods based on the theories at their core.

Group A: The learning module project.[3]   Group A carried out a design project assigned by a nonprofit charitable foundation[4] that provides educational material for raising the awareness of Dutch primary school pupils about the lives of their peers in developing countries and about foreign aid. Teachers and pupils can download material from the foundation's Web site. The project involved developing a learning module for primary school pupils (aged 11–12) consisting of a number of lessons, lesson materials, and teaching guidelines. This module had to include material on world poverty, millennium goals, geography, topography, culture, and educational facilities. The foundation provided the group with a written assignment accompanied by explanations and background information given during the first meeting with two group representatives. In addition, the client provided existing Web site information, a number of short educational films on DVD and videotape with information about developing countries, and information about the charitable activities of the foundation.

Group B: The evaluation training project.   Group B's client was a cooperative of professional educational institutions that trains students (aged 13–17) for work in the construction sector. This client required the group to design training for the external evaluators in these institutions. Customarily, only the teachers perform the evaluation because external specialists (e.g., engineers, technicians) are not familiar with evaluation methods and techniques. The design product had to include theoretical information about evaluation techniques, actual training materials, and an evaluation instrument. During a meeting with one of the group members, the client provided the group with an assignment text accompanied by explanations and documentation about the current evaluation system.

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[3]The two groups are referred to throughout as *Group A* (*Learning module* group) and *Group B* (Evaluation training group).

[4]For confidentiality reasons, the client institutions are referred to throughout as *Client A* and *Client B*.

Methodological Approach

The in-depth case studies used explorative and descriptive methods, combining various data sources and analysis methods. For the purpose of this study, a *case* was defined as the activities and the products of one group of students during the 10-week course period.

Data Sources

A mix of qualitative methods of collecting data (Speer et al., 1992) through discussion protocols, semistructured in-depth interviews, e-mail correspondence, meeting minutes, and written documents was used, which allowed for data triangulation (Yin, 2003). We developed interview topics based on the preliminary insights gained through theory analysis, providing sufficient liberty for students to express their thoughts, interpretations, and reflections on the process. Data collection activities yielded 20 hr of audio recordings of group discussions, 300 e-mails, and 250 intermediate and final group products. This article discusses a cross-section of the data, drawing primarily from the transcribed group discussions, final interviews, meeting notes, e-mail correspondence, and group products. Table 3 briefly describes the types of data collected.

Analytic Approach

The analyses focused on the intersection of individuals' efforts and group processes in an effort to preserve the group as the primary unit of analysis (Barron, 2003; Stahl, 2006). Therefore, this analysis highlights group processes and knowledge products (Hogan, Nastasi, & Pressley, 2000). In this approach, we relied on our interpretation of the intersubjective character of shared epistemic agency as involving individual contributions and participation shaped, and often determined, by interaction with the shared knowledge objects. Hence, we applied a contextualized analysis that allowed for dependable interpretations about what took place while the groups were collaboratively creating these knowledge objects.

TABLE 3
Overview of Data Gathered

Data	Purpose
Group discussion protocols	Insight into how decisions are negotiated and made
Semistructured (group) interviews	Reflection and analysis of decisions and of activity outcomes
Intermediate and final products	Overview of the results of the applied decisions
E-mail correspondence	Insight into how decisions and ideas are communicated
Minutes of group meetings	Overview of decisions made by groups

Before the analyses, we organized the gathered data chronologically, and the recordings of the complete group discussions and interviews were transcribed verbatim. We determined the granularity of the analysis unit and refined the analysis approach while reviewing several transcripts by applying the preliminary framework and by interacting with the data. A preliminary analysis indicated that the phenomena investigated could best be described based on the idea of activity trajectories (see Lemke, 2001; Ludvigsen, Rasmussen, Krange, Moen, & Middleton, in press). Thus, we analyzed longer sequences of the text protocols instead of data at the statement level.

We analyzed the data in an iterative manner in three steps. First, we carried out multiple readings of the transcriptions and of the other data, together with a description of both group activities for the entire project period. Second, we categorized groups' actions revealed by the group discussions, interviews, e-mails, and meeting notes. In the analysis of the interviews, we used a procedure resembling the phenomenographic approach (Marton, 1986) in which we highlighted students' interpretations of their own experiences and reasons for activities. For this categorization, we applied the preliminary framework, but the data also provided information that led to the addition of new categories. To reach a set of distinctive categories we needed to continually compare the data with the preliminary categories. We used the process description and a selection of the data episodes to examine sequences of ideas and actions with regard to the knowledge object(s) produced. Finally, we used these selected episodes to identify critical points in the process. Of particular interest were group members' interactions and actions that led to the further development of the knowledge object. To understand how shared epistemic agency was shaped, we interpreted episodes that included expressed intentions and actions regarding the developing knowledge objects.

RESULTS

The results presented are used to answer two research questions: (a) Which indicators of shared epistemic agency can be identified in the collaborative design work of university student groups? and (b) How does the occurrence of these indicators differ between groups?

In this section, each design phase is presented separately, with a short introduction that pinpoints the most characteristic actions performed by groups. For each phase, we briefly sketch the object-oriented activities performed by each group and show the knowledge objects produced. We illustrate activities relevant for each phase by data excerpts[5] that provide examples of how shared epistemic

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[5]The excerpts shown are translations of the original dialogues. These excerpts are for illustrative purposes only; not all episodes of data showing shared epistemic agency are presented in this report.

agency was given shape in different contexts and phases of the process. Each excerpt is then discussed and interpreted with an emphasis on aspects that illuminate the nature of the collaborative design process leading to different types of knowledge objects during the respective phase. This interpretation leads to the identification of indicators of shared epistemic agency. The results of the analyses of Group A's data guide the discussion; the results from Group B help illustrate alternative agentic actions identified in Group A. At the end of this section we present both an integration and discussion of the findings.

Analysis of Sequences of Group Activities

Project Initiation Phase

In the first phase, both groups discussed their preferences for design topics and client institutions and then created a list of topics and institutions they were interested in. Eventually, the groups selected the clients based on interest and availability. Predominant activities were discussions of topics of interest, e-mailing and phoning potential client institutions, and updating (via e-mail) the other group members about the progress made. Knowledge objects produced were scarce (see Table 4).

For creating the project plan, predominant activities were negotiating the design topic with the client, choosing the work strategy, structuring the design task, and constructing the sections of the project plan. The knowledge objects produced were sections of the project plan and notes of the group meetings with clients.

Group A—Phase characteristics.   Meeting notes revealed that group members made agreements on collaborative strategies during this phase. They agreed that particular tasks, such as searching for information, could be performed more

TABLE 4
Overview of Intermediate Knowledge Objects Produced
During the Project Initiation Phase

Group A	Group B
Description of client organization: 2 versions	Topic list for interview with client: 3 documents
Topic list for interview with client	Description of structure of client organization
Goal analysis of client organization	Protocol of interview with client
Project plan: 3 versions and comments	Project plan: 3 versions
Meeting notes and planning: 2 documents	E-mails to client: 3 documents
E-mail correspondence: 21 messages	E-mail to target group
	Meeting notes: 2 documents
	E-mail correspondence: 38 messages

efficiently individually but that all decisions and written drafts should be discussed by the group. Feedback was to be given verbally during group meetings or in written form (i.e., via e-mail). However, the e-mail correspondence revealed that the planning of activities at the beginning of the period caused some difficulties. Although the course guidelines required long-term planning, group members adopted a different strategy; namely, during every group meeting they planned their activities for the following week. They indicated in the final interview that this intermediate planning helped them structure their activities and create an overview of the intermediate objects to be produced. Another decision—made in the second group meeting—was to document (especially the object-related) activities carried out, regardless of whether they were individual or joint, by using a logbook (see the second and third excerpt at the beginning of this article). The intermediate objects produced during this phase (see Table 4) were intended to support the identification of the instructional problem, the formulation of the assignment, and the construction of the project plan.

Group A—Actions illustrating shared epistemic agency.   Group discussions revealed that the group was not familiar with the design methodology. At a certain moment, group members acknowledged that the development of the project plan was not evolving well. This was interpreted as a consequence of their erroneous understanding of the fundamental theoretical design concepts. One of the group members explicitly signaled the group's lack of knowledge and the fact that the group needed to gain more insight into the theoretical design concepts and models before writing the plan. The following sequence of activity, which was part of the third face-to-face meeting, presents the group's conversation that followed this realization.

Episode 1: Excerpt of face-to-face discussion, Group A, third project week
 1. Mel: … But anyway, the first step is that problem analysis. *Is that sufficient?*
 2. Val: We could check that. *Those were the things mentioned in today's lecture, the first three steps are problem analysis, target group analysis and …*
 3. Sam: … domain analysis.
 4. Mel: Yes, and in that target group analysis somewhere in the needs analysis the target group is mentioned. *Let's check; yes, that might be another approach.* Instructional problem …
 5. Val: I have it written down here, analysis phase for target group, domain and learning goals.
 6. Mel: *The analysis phase once more*?
 7. Val: Analysis phase, within that you conduct a target group analysis because that is what you started with. Then, a domain analysis and an analysis of the learning goals.
 8. Sam: Problem analysis, it comprises … oh, no. You have a problem, and then you analyze everything.

9. Val: Yes, but your instructional problem … yes, you have a problem.

10. Mel: Well *he [course lecturer] started talking about it, "Have you conducted a problem analysis that leads to a target group analysis?" Then, you continue to the domain analysis and then … you had to check whether it was an instructional problem or no*t. Or, if you could solve the problem in another way …

This excerpt shows how the group placed concepts such as *problem analysis*, *needs analysis*, and *goal analysis* in the context of prior knowledge and provided a certain structure to the information extracted from course material. The members tried to organize and structure the concepts by using notes, lecturer's explanations, and the textbook. The strategies used were naming and repeating the aspects that were not understood (line 6)[6] and searching for relevant information in the lecture notes (lines 2 and 10). What we see is the group creating a basic understanding of the elementary concepts of instructional design by relying on authoritative sources, such as the textbook or the teacher. At this stage, the members did not have a clear idea of the purpose for which these sources were being used, but they did seem to understand that clarifying and organizing the concepts would lead to developing the project plan. Furthermore, the style of discussion indicates that the group members were involved in a joint effort of clarifying the concepts. They were interested in one another's insights, which is illustrated by their asking the other members' opinions of the level of knowledge (line 1) and engaging the entire group in the inquiry (line 4).

Creating awareness of the group's lack of instructional design knowledge generates basis for the emerging agency. The *epistemic* aspect of group's agency is characterized by the deliberate attempt and shared efforts to understand and then alleviate this lack of knowledge. Group members stopped the discussion and took time to discuss the problem. Here, preliminary indications of agency are visible in the group members' attempt to identify their lack of knowledge and inconsistencies in their knowledge about design and to alleviate these by using authoritative sources. However, group members had neither reached shared understanding of these concepts nor attempted to bring in new interpretations of the design concepts. This structuring and initial understanding of the theory provides the basis for applying the theoretical concepts in the design of the required intermediate object. The *shared* aspect of agency features the joint effort of the group members to alleviate the identified lack of knowledge. Group members build upon one another's input and in the end combine it into a joint stance. Strategies the members use for making sure that discussion converges make the relational aspects of agency evident.

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[6](line …): Indication in the article text of the position of the discussed utterances in the transcript.

In this activity sequence, we can identify a succession of steps that form a pattern of agentic behavior, namely the group creating awareness of the divergent ideas regarding theoretical knowledge by establishing the problem and by engaging in actions to resolve this dissonance through discussion and consultation of sources.

Group B—Phase characteristics and actions illustrating shared epistemic agency.   Within Group B, the agreements regarding collaborative work consisted solely of creating task lists. Meeting notes indicated that, during group meetings, a division of labor took place. The work strategy developed along the way and consisted of each individual member carrying out a task and informing the others through e-mail about it and the resulting objects. However, the interview and the group discussions indicated the type of agency shown by this group. An example is the group's effort to correctly determine the learning problem in relation to the practical context. After understanding that the client had identified the problem in a faulty manner, the group decided to collect additional information from external sources (i.e., experts, documents), contact the various stakeholders involved, reformulate the problem, reconsider the design strategy in order to match the current design situation, and adjust the project plan.

This decision illustrates the group's proactive conduct, which indicates agency of both a projective and regulative nature. The group members creating awareness of the problematic situation, discussing alternatives, making a decision, and taking action to apply this decision illustrates patterns of actions indicating agency. Furthermore, the group members were able to assess the level of information needed to reformulate the problem, which allowed them to proceed with alleviating the lack of information identified and to reframe the analysis strategy. Moreover, although this type of action does not lead to a concrete object, it sets the foundation for the emergence of productive actions.

Analysis Phase

During this phase, both groups conducted a number of analyses and reported the results. These analyses concerned the learning needs of the target group, the learning context, the target group, and the knowledge domain. To conduct the analyses, the groups had to identify appropriate methods and information sources and to construct instruments. Once the data collection and analysis were complete, the groups reported on the results in their analysis reports. Instrument construction and reporting resulted in a number of intermediate knowledge objects (see Table 5).

The way in which the two groups approached the analyses varied. Discussion on the analysis strategy and the information collected characterized Group A's activities. Division of labor and individual activities characterized Group B's work.

Group A—Phase characteristics. Group A's analysis activities commenced with identifying the target group and its needs (because these two aspects were not clearly specified by the client) and clarifying the client's goal. Knowledge objects—instruments for data collection (i.e., questionnaires and interview topic lists)—were developed, group members started the search for respondents, and an interview with the client was planned. The collected data were processed individually in intermediate objects (i.e., the sections of the analysis report), but drafts were sent to the other group members for feedback and were discussed in the group meetings. The group members set up the justification report together.

Group A—Actions illustrating shared epistemic agency. The group's analyzing activities were shaped by the fact that the client did not provide a clear-cut design task; it was not clear what the learning needs were, and the knowledge domain was ill defined. After a meeting with the client, the group members acknowledged that the information they possessed about the learning needs was insufficient. During the third face-to-face group meeting, the group decided that an additional inquiry was needed to gain better insight into the learning needs of the target group, the client's goals, and the nature of the learning domain. An idea to conduct an additional needs analysis within the target group using questionnaires was proposed.

TABLE 5
Overview of Intermediate Knowledge Objects Produced During the
Analysis Phase

Group A	*Group B*
Teacher questionnaire: 1 draft and final version	Project plan: 6 versions
Pupil questionnaire: 2 drafts and final version	Topic list for explorative interview target group
Summary of source material: millennium goals, core and instructional primary school goals, pedagogic methods	Topic list for interview for target group: 3 documents
Summary of source material from client	Introduction to interview
Analysis of source material	Overview interview group member 1
Learning needs analysis: 2 versions and comments	Overview interview group member 2
Target group analysis: 2 versions and comments	Protocol interview different members: 4 documents
Domain analysis: 3 versions and comments	Summary materials client organization
Analyses report: 4 drafts	Questionnaire task analyses external experts: 2 documents
Analysis report for client: 2 versions and comments	Task analysis: 5 versions
Meeting notes and planning: 3 documents	Summary findings needs analysis
E-mail correspondence: 41 messages	Description context: 2 versions
	Justifications report sections—analysis of target group and learning needs: 4 versions
	Advising report for client: 3 versions
	Meeting notes: 3 documents
	E-mail correspondence: 38 messages

This suggestion was not further discussed, but the group agreed upon it and decided to discuss it in the following meeting. The following excerpt illustrates how this idea was taken up and developed by the group in a subsequent meeting.

Episode 2: Excerpt of chat discussion, Group A, fourth project week
1. Val: … Shall we start with the questions for Client A?
2. Sam: *Wait … shouldn't we first check which needs we'll analyze*?
3. Val: How do you mean?
4. Alex: To the client it is a goal, isn't it?
5. Sam: First, Client A has a need?
6. Val: Well, basically, it's a goal.
7. Alex: *I thought* the teachers had a need for further explanations and material, so Client A is willing to provide those; a teachers' manual. In other words, Client A has a certain goal in mind with this. […]
8. Val: *Well, we have different stakeholders → the teachers with a need and Client A with a goal, and the pupils with a need … and those we have to bring in tune with each other.* […]
9. Alex: But those can probably be done together. With needs analysis, you look for the problem, but we partly learned about needs from Client A.
10. Sam: *So … a goal analysis for Client A it is*?
11. Val: And teachers' expressed needs, which we investigate through a questionnaire.
12. Sam: Yes … and then the pupils' needs in another questionnaire.
13. Val: Ok, let's start with the goal analysis for Client A …
14. Alex: So, basically, what we want is Client A to express the goal in the behavior of the pupils.
15. Sam: Can we just ask: "What behavior would you like to see in pupils to prove they are more aware?"
16. Val: Or is that too abstract?
17. Sam: A lot depends, I think, on whether he ever gave it any thought.
18. Alex: Maybe we can present to him: After the module, the kids must know what aid is, and where those countries are.
19. Val: Maybe we could ask him for examples from other projects that indicate an achieved goal. […]
20. Sam: So, this is done … on to teachers ?
21. Alex: Yes, on to the teachers.
22. Sam: Okay ….

The group realized that to develop the questionnaire they first had to have the same understanding of seminal design concepts: those of *learning needs* and design *goals*. The excerpt illustrates how the group attempted to create shared understanding of these concepts and then apply them when creating the instrument for the needs analysis. Group members first became aware that they could not advance their work on the intermediate object before gaining a correct and shared understanding of the meaning of these theoretical concepts and how they apply in practice (line 2). At this point, the group's understanding of the theoretical concepts

was upgraded (line 8, first part). Then the group matched the now-shared meaning of these concepts to the situation in practice (lines 8, second part; line 10).

As illustrated in this excerpt, characteristic of this group's agency is proactive conduct and the capacity to provide solutions to the problematic situation, in this case the incorrect application of theoretical design concepts. The concrete idea of constructing a questionnaire to collect the necessary information from the field expresses the former; the intention to solve the problem expresses the latter.

The excerpt also indicates that the group goes beyond sole awareness of the lack of knowledge about learning needs. The group members acted to resolve this problematic situation and the inconsistencies in the meaning of the theoretical concepts. The excerpt also demonstrates that the group members can translate theoretical knowledge into their own practice, which indicates a step up from simply understanding theoretical concepts. By sharing their insights and generating and negotiating meaning, the group creates a joint view of how these theoretical concepts fit the practice. We see the group reaching for shared understanding of the concepts and moving closer to the intermediate object (i.e., the needs analysis questionnaire). Furthermore, the immediate translation of this intention into concrete actions follows the expressed intention to act on resolving the problematic situation.

Understanding the problem, coordinating one another's ideas, anticipating and engaging in the development of the object, and acting accordingly are all agentic actions of an epistemic nature. The shared aspects of epistemic agency are evident in the *joint* effort to understand the concepts and to apply them in the intermediate object. The way in which group members take one another's opinions and insights into account and create space for one another's contributions also reflects this joint epistemic effort.

Group B—Phase characteristics.   The analyses conducted by Group B were combined with the problem description because the instructional problem needed to be reformulated. The group decided to collect information from various sources and various stakeholders (e.g., external subject matter experts, the head of education, the target group, auditors). Interviews and a questionnaire for the external experts facilitated data collection. The group members agreed on the interview procedure and the main topics, but they prepared their own interviews individually. Conducting the interviews separately required much coordination within the group, which took place through e-mail. Finally, one of the group members integrated each individually produced section into the analysis report.

Group B—Actions illustrating shared epistemic agency.   The following excerpt was selected from a group discussion from the fifth project week. During the meeting, group members looked back at materials from the analysis report sections. They came across a number of design concepts that were applied in the ma-

terial previously produced individually but that were not correctly interpreted; *re-call* was one of them.

Episode 3: Excerpt of face-to-face discussion, Group B, fifth project week
  1. Chris: … Yes. Is that "recall" or "application"?
  2. Kim: Er, recall is *applying*. Applying on … er … […]
  3. Chris: Recall is … er …
  4. Kim: Applying? […]
  5. Chris: *Recall is remembering, and then being able to execute*. Maybe that's what they mean here. Maybe, and otherwise you apply it somewhere. No, just forget it.
  6. Kim: But you know what I don't understand? Simple skills, which category are those? Procedures?
  7. Chris: So, executing things? Maybe you have to apply them in procedures …
  8. Kim: Then, I would use recall first and then applying.
  9. Chris: But recall?
 10. Kim: *That's ok, we just put "recall," and we come back to it some other time. I think it is applying in the same way what you have learned. And otherwise somebody will correct us … it's ok like this ….*

This discussion presents a brief attempt by the group to understand one of the concepts used in the analysis report. The students came up with suggestions for what the concept could mean: in line 2 is *applying* and in line 5 is *remembering*. These suggestions were based on prior knowledge and personal opinions; no sources were consulted that could provide them with a correct definition or explanation. Furthermore, although the concept was still not clear, they ceased their inquiry and accepted their own suggestion for the meaning of the concept in statement (line 10, first part). They relied on someone else to clarify it, probably the tutor (line 10, second part).

This excerpt shows that the group does not persevere in creating shared understanding of the concept *recall*. Upon realizing the lack of understanding, group members try to give it meaning but in a superficial way that does not lead to success, and their deference to the tutor indicates that they do not rely on their own knowledge and capacities to solve this problem. Therefore, the discussion does not evolve toward an activity at the epistemic level. Nevertheless, the group continues the design and reporting work, and this work does not seem obstructed by this lack of understanding. This group's approach to understanding the theoretical concepts differs substantially from Group A's approach. Even during this face-to-face discussion, the members postpone achieving a deeper and clearer understanding of the concept, and the knowledge negotiation process ends without a clear result.

These examples illustrate different facets of epistemic agency. Indicators identified show that the groups differ in the way they share insights and knowledge and

in the manner in which they approach and overcome the various obstacles encountered. Group A constructs a better basis for shared understanding of ideas and of the shared intermediate objects, which creates the premises for collaborative creation of new knowledge. Group B is less thorough in achieving an understanding of concepts and shares knowledge incidentally, which elicits mainly individual knowledge production. The patterns of actions indicating agency are also present in this group's conduct. With respect to the regulative aspect of agency, Group B shows continuous awareness of the activities taking place, monitoring and adjusting its strategies as deemed necessary. Lack of knowledge is signaled, necessity of action is established, but action to solve these problems is taken incidentally and often at an individual level. With respect to the epistemic aspect, the series of actions is often incomplete, which is evidence of the limited shared epistemic agency of this group.

Construction Phase

The gradual production of the design product dominates this phase. Groups used the analysis results as a starting point for formulating learning goals and for creating a blueprint of the macro-design. This served as a framework for creating the sections of the macro- and the micro-design. The groups developed materials for the learners and trainer or teacher (see Table 6). Both groups wrote sections of the justification report in parallel with developing the design product.

Group A—Phase characteristics.   During this phase, Group A worked on sections of the design product and of the justification report. This involved structuring and organizing the collected domain knowledge, creating worksheets, writing user manuals, and constructing an evaluation instrument. The collaborative development of intermediate knowledge objects usually took place after the creation of shared understanding of these objects during group discussions. Group members generated numerous ideas that were further discussed, considered, rejected, and then reconsidered. After making a decision, group members worked in dyads on different intermediate objects, using ideas generated during group discussions to make a blueprint of these objects. All object drafts were distributed by e-mail or uploaded to the virtual group space, accompanied by requests for feedback. The group chose to give systematic written feedback on drafts. When time allowed, the drafts were discussed during the weekly group meetings. In the final interview, group members indicated that feedback was necessary because this helped the group, to keep track of the advancement of the shared object. Also, group members noted that feedback is always valuable and can often be used to improve drafts.

Group A—Actions illustrating shared epistemic agency.   Two data excerpts illustrate actions that characterized shared epistemic agency in this phase. In

TABLE 6
Overview of Intermediate Knowledge Objects Produced
During the Construction Phase

Group A	Group B
Set up instructional goals	Design setup
Instructional goals: 5 versions and comments	Training setup
Summary of theory and ideas about design: 3 versions	Learning goals: 2 documents
Fact sheet India	Micro-design set up
Fact sheet Peru	Evaluation plan: 2 versions
Fact sheet Malawi	Macro-design: 7 versions
Macro-design each country: 12 documents (lessons structure, methods, overview of assignments and material) and comments	Micro-design: 6 versions
	Observation form trainees
	Training material: protocol verbal examination
Assignments and background stories per country: 8 documents	Assignments for training: 2 documents
Worksheets pupils: 13 documents	PowerPoint slides for training: 3 documents
Teacher's manual: 11 versions and comments	Justification report sections: 9 documents (analyses report, description and justification design, appendixes)
Overview materials for Web site for client	
Justification report sections: 12 documents (analyses, description of macro- and micro-designs, justification design approach, materials, reference list)	Justification report: 6 versions
	Meeting minutes: 2 documents
	E-mail correspondence: 26 messages
Justification report: 15 versions and comments	
Meeting minutes and planning: 3 documents	
E-mail correspondence: 115 messages	

the sixth face-to-face meeting, Group A met to discuss the results of the work done individually. Discussion revealed that these materials contained divergent ideas, and the group members immediately started negotiating and collaboratively producing new ideas for the intermediate knowledge object—the learning goals. This object was central to future work on the design product. The following excerpt illustrates how this process took place.

Episode 4: Excerpt of face-to-face discussion, Group A, sixth project week
1. Mel: *… But shall we start brainstorming*? *We can definitely use the material we have as input …*
2. Alex: *Yes, we have the topics we chose for the macro-design part*: foreign aid, geography and topography, life of children in these countries … *those we can relate the learning goals to.*
3. Val: I'd suggest to start with the topic of foreign aid. What must they [pupils] know? Then, I immediately say: millennium goals.

4. Sam: *But what do we want them to know?* Not that they learn everything by heart, right?

5. Val: That they know what it's about, that the goals are to improve the living standard, to make the world more fair, and you name a few examples.

6. Alex: *Maybe it's handy to point at what the reasons were for the millennium goals*, what they are and examples that are illustrative. […]

7. Alex: Do we need more here? What's the second topic? Geography and topography.

8. Val: *With topography: it depends where the country is situated, how big it is.* We collected these things separately in the fact sheets.

9. Mel: But we have to present this a bit more in detail. We have a couple of those complicated concepts we need to explain … […].

10. Alex: *But you could, for example, use a map and indicate with arrows and images* the landscape in each area; and a short description of the savanna climate, for example.

11. Mel: *Shall I start writing that down, we'll need this to make the goals setup?*

12. All: *Yes …*

It was the individual production of inadequate material for the learning goals that triggered this group's discussion. Group members decided without much hesitation not to stick to the material produced individually but to start thinking together about the content of this intermediate object (line 1, first part). In their discussion, they draw upon the material already produced (line 1, second part; line 2). This discussion was triggered by the question about a core aspect, that is, what should pupils know (line 4). The statements that follow were contributions by all group members to this discussion aimed at generating new ideas and content (lines 6, 8, 10). The group also kept an eye on the development of the object by consciously deciding to write down the ideas generated in this discussion, because they would be necessary for creating this object (lines 11 and 12).

Once the group framed the final object, students worked on object sections in dyads: One dyad constructed lesson materials, the other constructed material for teachers. Both dyads uploaded the developed material to the group's virtual space and requested feedback on it. One dyad provided critical feedback on the quality of the lesson series developed by the other. Because feedback was returned via e-mail, it provoked a conflict as the two authors felt that the criticism was too strong. An excerpt from the final interview illustrates how the group dealt with this drawback in the object development.

Episode 5: Excerpt from the final interview, Group A

1. Val: It was a tough situation. *Feedback was given in a way that I thought "What is this?"* […]

2. Interviewer: Did you discuss this situation in the group?

3. Val:	*Yes, we talked about it shortly*. At that moment we thought, yeah, we don't have much time until the deadline, and I really don't want to stir up a conflict now. Because then so much time gets lost. And that time we needed for working on the design product. *So, we postponed it for after the deadline, and we only discussed the content-related feedback, so we understood what they actually meant*.
4. Mel:	I think I would have said anyway that I reacted hastily, and that it would have been enough to limit my comments to saying that the quality of the material was low; because that was the core of the entire feedback, and that is what they needed to know.
5. Val:	That's exactly what I was trying to say. And we also thought, they are right, *so we have to discuss their criticism and use it the best possible way for improving the draft*. […]
6. Sam:	Eventually, we met, went through all the texts and *realized how easy it was to improve them when taking their criticism into account*.…

As indicated, the criticism given by the dyad was very sharp, which created tension within the group (line 1). The criticized dyad had the choice to either discuss the conflict with the entire group or analyze the content-related criticism and use it to improve the material. As they indicated during the interview, they chose the latter (line 3, second part; line 5). As the group members indicated, dealing with feedback is a skill one needs when working in collaboration, and they found the most productive way of doing it (line 3, first part). The group did not, ultimately, consider this experience to be negative (line 6).

The actions characterizing this group's agency become evident in these fragments. The decision to start rethinking the content of the information is noteworthy. The projective aspect of agency is evident in the group's orientation toward progressive object development, whereas the intersubjective aspect is shown by the capacity to put the common group goals at the center of attention as guidance for the collaborative work. The individual ideas provided the basis for creating new knowledge through discussion and negotiation. We regard this discussion as a good example of knowledge creation contributing to the development of the intermediate knowledge object. The fragment illustrates actions such as organizing knowledge, negotiating knowledge, producing ideas, and framing the knowledge object. The group focuses on creating new ideas that can efficiently and immediately be built into the object to be produced. We interpret these actions as characteristic of the epistemic dimension of this group's shared epistemic agency.

The Episode 5 excerpt indicates how the group actually succeeded in dealing with an emerging conflict. The action discussed indicates a distinct level of the group's awareness regarding the value of feedback and the role it plays in developing shared knowledge objects. But the group also provides a concrete example of how honest feedback is transformed into input with a distinct epistemic value. The

group members channeled negative tensions into epistemic ventures instead of allowing conflict to dominate their activities. Agency is evident in the group's capacity to identify the emergent conflict, to reflect on its meaning and possible consequences, and to approach it in a constructive manner. The actions of revising the knowledge objects already produced based on the given feedback are evidence that the group can deal with problems of a relational nature and concentrate on the epistemic actions needed at that moment. The pattern of actions identified in previous sequences of activities (i.e., creating awareness of the problem, reflection, action toward solving the problem) is present here, too.

In terms of regulative elements, we identified the conscious monitoring of object development and quality agency as actions indicate.

Group B—Phase characteristics and actions illustrating shared epistemic agency.   Group B frequently engaged in the division of labor. They split tasks: One developed the general structure of the design product, the other the material necessary to fill in this structure, such as the manual for teachers, training material, and the evaluation method. No further discussions were conducted on the topic. The group members decided to inform each other about the progress of their sections, but the data showed that they did this both minimally and infrequently. The object production strategy they used was to upload drafts to the online group space on Blackboard® and send short e-mails as notifications. They then individually evaluated the drafts by making additions without further consultation. Each group member wrote separately sections of the justification report, which were subsequently aggregated by one of the them. Both group members checked the knowledge object at the end of the process. The following excerpt from a discussion that took place when the group was constructing the design product gives an indication of this group's regulative strategy.

Episode 6: Excerpt of face-to-face discussion, Group B, seventh project week
1. Kim: … Er … then I'll move to the next point, tasks list of the last meeting. *See, I did the meeting notes, you checked the goal analysis and was ok. You also did the interview.*
2. Chris: Yes.
3. Kim: *Task analysis is revised. Guidelines for testing, you looked at that.* […]
4. Chris: Then further, macro-design 2, 3, 4, *I did that*. We look at it later. Yes, I checked that on the list, I think …

The excerpt shows a sequence of actions of monitoring the state of the intermediate objects produced up to that moment. Using a task list, the group members checked the intermediate objects that were finalized without going into much detail about the content or quality of these objects (lines 1, 3, and 4). Most of the time, they performed this quality check individually (see also next excerpt). When nec-

essary, additions or revisions were made, and the author generally accepted them without further discussion.

The following excerpt from the final interview with this group gives deeper insight into the nature of the regulative strategy applied by this group.

Episode 7: Excerpt of face-to-face discussion Group B, seventh project week
1. Interviewer: … What strategy did you use when working together?
2. Chris: *We divided tasks …*
3. Kim: *Who does what, yes, I am a supporter of this approach.* Otherwise, you do things double. *And with this project, we agreed clearly what we will do, then you do that.* […]
4. Chris: *… yes, we discussed that regularly, who does what.* […]
5. Interviewer: Did you discuss the content of the tasks you divided?
6. Chris: Sometimes, but …
7. Kim: *But sometimes we just individually decided what is important to do and to search for.*
8. Chris: Well, decided … I said, "Oh, we must do that and that, I'll do it." We informed the other about what we did. But didn't always explain about the content.

The excerpt reveals that the group divided tasks and made clear agreements on individual responsibilities (lines 2, 3, and 4), a strategy that was consciously chosen. Moreover, group members chose, again consciously, not to always discuss the content of these tasks and the outcomes (line 7). Just informing the other about the intention to perform a certain task seemed sufficient for this group.

In Group B, task coordination and monitoring of the state of the design product represented the main aspect of the collaborative actions undertaken; specifically, the finalization of (intermediate and final) objects was closely monitored. This group's data showed a different emphasis in the identified indications of shared epistemic agency. The pattern of agentic actions is present in Group B's case but is structured in a specific way. A high awareness of the progress of the process and of the general progress of the knowledge object characterized their agency. However, this awareness does not always result in collaborative epistemic actions. Both group members are aware of problematic situations that need to be resolved; in some cases, they reflect on them together, but action taken to solve the problems is mostly individual. It is noteworthy that little sharing of ideas and content to be developed was registered. This group's agency is productive because content is produced, but the group members do not discuss much, do not share, and do not construct knowledge together.

Integration and Discussion of Findings

The collaborative work strategy of Group A was consistent throughout the project period. The group organized weekly face-to-face meetings during which concepts,

ideas, and plans were discussed and decisions were made about the content of the shared objects. Discussions on content-related ideas usually took place during these meetings. Group B's collaborative work was characterized by a division of labor without much content-related discussion. The coordination and monitoring of group activities prevailed. One of the group members most often performed these activities. Upon completion of a preliminary product, it was added as a section to the shared object, often without feedback from the other group member. However, this group also finalized the design product successfully.

The analysis of the empirical material provided insight into the different types of actions that are indicative of shared epistemic agency and of collaborative knowledge creation during object-oriented activities. These insights provided input for adjusting the initial framework constructed based on the literature review. An overview of these actions is shown in Table 7.

TABLE 7
Overview of Actions Indicating Shared Epistemic Agency

Dimension	Category (of Action)	Action
Epistemic (knowledge related)	Creating awareness	Identifying a lack of knowledge
		Identifying problems
	Alleviating lack of knowledge	Examining given sources
		Collecting additional information
		Structuring new concepts
	Creating shared understanding	Sharing information (from sources)
		Giving meaning to new concepts
		Discussing misunderstandings
		Sharing ideas and knowledge
		(Re)framing the problem
	Generative collaborative actions	Generating new ideas
		Engaging in collaborative uptake of ideas
		Negotiating new ideas
		(Re)framing the object
		Engaging in shared construction of (intermediate) objects
		Revising ideas and object drafts
		Using feedback constructively
Regulative (process related)	Projective	Setting common goals
		Creating a joint plan of action
		Engaging in proactive conduct
	Regulative	Monitoring object advancement
		Coordinating object-related activities
		Reflecting on actions, ideas, and problems
		Adjusting the group's current strategy
	Relational	Transcending (social) conflict
		Redirecting critical feedback
		Creating space for others' contributions

We identified four main categories of actions illustrating the epistemic dimension of shared epistemic agency. *Creating awareness* is the first category of actions. Creating awareness of a *lack of knowledge* and of *problematic situations* was essential for the emergence and manifestation of shared epistemic agency. Palonen and Hakkarainen (2000) emphasized that group members' awareness of their own or the group's lack of knowledge is an essential element of epistemic agency, and Stahl (2005) singled it out as an essential prerequisite for creating knowledge. We construe it as a condition for the emergence of shared epistemic agency and as the basis for further epistemic endeavors.

The second category is that of the groups' deliberate attempts to *alleviate lack of knowledge*. This category consisted of epistemic actions such as *examining given sources*, *collecting additional information*, and *structuring new concepts*. These actions addressed the need for acquiring and structuring existing knowledge but without seeking a deeper understanding of this knowledge.

Creating shared understanding is the third category of epistemic actions, which establishes the conceptual basis for the collaborative creation of knowledge objects. These actions aim to synchronize the knowledge level of the group members and reach a common understanding of ideas and knowledge used in the design. We found that actions of *sharing information from sources* illustrate these efforts, leveling group members' knowledge (e.g., on the design). Actions of *giving meaning to new concepts* were aimed at applying the gained understanding of the theoretical elements of the design to the particular design context, and actions of *discussing misunderstandings* addressed inconsistencies in participants' understanding of knowledge. At a higher conceptual level, actions of intentionally *sharing of ideas and knowledge* occurred. These types of epistemic actions are convergent with activities indicated by Erstad (2004), Russel (2002), and Scardamalia (2002). When done consciously and consistently during the creation of the object, sharing ideas denotes the groups' orientation toward equal understanding of the topic and toward creating common ground for further epistemic endeavors. An action that occurred when groups encountered problematic situations was that of *(re)framing the problem*. Groups needed to define or redefine identified problems to be able to consider possible solutions. This action was often performed by using actions previously described, such as discussing concepts, using sources, or sharing ideas.

The fourth category is that of *generative collaborative actions*. These actions depict the productional aspect of shared epistemic agency and lead to the creation and development of the knowledge objects. At various points in the design process, groups deliberately carried out actions aimed at *generating new ideas*. These actions are situated at the level of collective idea production, as also indicated by Scardamalia (2002) and Schwartz and Okita (2004). Another epistemic action was *collaborative idea uptake*, illustrated by, for example, how an individual's expressed ideas or intentions were taken up by the group and used as a basis for constructing an object creation trajectory (see also Lemke, 2001; Suthers, 2006). The

action of *negotiating ideas* consists of purposive discussion and negotiation (Edwards, 2005; see also Martin, 2007) and occurred at the level of object development when the ideas generated needed to be tuned and processed into (intermediate) objects. Furthermore, *(re)framing the object*, to the extent that the group members reached consensus regarding the content and shape of this object, was another epistemic action that led to progress of the shared object. Finally, the *revision of ideas and object drafts* based on *constructive use of feedback* also accounted for actions indicating the productive side of agency. Group members were open for reconsidering ideas and knowledge through discussion and negotiation, which created the prerequisites for knowledge creation. The results indicate that these collaboratively generated ideas fed the development of the final knowledge objects.

Although the actions characterizing the epistemic dimension are considered the core components of shared epistemic agency, the regulative dimension seems to be indispensable for successful finalization of common knowledge objects. The category of *projective* actions depicts the capacity of groups to anticipate and choose future trajectories of action beneficial for object creation and development. Actions that illustrate this category were *setting common goals* and *creating a joint plan*. These findings are in line with Bandura's (2001) and Scardamalia's (2002) stances on agency. Defining the knowledge objects to be created supported groups in setting common goals. The creation of a joint plan indicated how groups thought ahead and envisioned activities necessary for advancing the knowledge object. Another type of projective action identified was *proactive conduct*, characterized by groups actively pursuing their goals and plans and anticipating problems.

The *regulation* of groups' object-oriented activities arises as a category of actions indicating shared epistemic agency. The results show that an action belonging to this category was *monitoring of object advancement* to sustain object progression (see also Erstad, 2004; Scardamalia, 2002). In this specific context, regulation takes on a distinct orientation that also involves *coordinating object-related activities*, comparable to the activities described by Bandura (2001). Notably, Group A's conduct was characterized by *reflection on actions*, *ideas, or problematic situations*. Such individual or collective reflection plays a regulative role in the sense that it provides the premises for creating new ideas and solutions. Deliberate choices for coordinating group activities that lead to reflection on performed actions also indicate the presence of the regulative intent, expressed in actions consisting of *adjusting the group's current strategy*.

Furthermore, we identified actions of a *relational* nature, which we consider important for creating the premises for convergent interaction (see Barron, 2000; Roschelle, 1992). Actions such as *transcending social conflict* and *redirecting critical feedback* toward object-related work illustrate this. The former enables the group to rise above potential disagreements and create the foundation for agentic behavior (Edwards, 2005). The latter indicates that a group is able to construc-

tively subsume the social aspects of its collaborative process with the ultimate purpose of creating the shared object. Another relational action was that of *creating space for others' contributions*, through which all group members were given the chance to pose their ideas and contribute to the development of the shared knowledge object.

We identified patterns of both epistemic and regulative actions in the agency conduct of the two groups. These patterns consisted of creating awareness as a starting point in a series of concrete actions aimed at alleviating a lack of knowledge or solving identified problems. Becoming aware enticed the groups to reflect on various problematic situations or a lack of knowledge and to make plans for future courses of action. We identified several situations in which members of Group A insisted on pointing to a lack of knowledge. Often, group members felt insufficiently informed, took action in order to collect more information, or approached the other group members and discussed ambiguities of their knowledge. The majority of ideas posed, problematic situations, and plans were discussed among group members. When the group chose a solution from the envisioned alternatives, a decision was made for concrete actions toward pursuing object development, and the group undertook action and created new intermediate objects. In Group B, members often identified problems or came up with ideas but reflected on and resolved them individually.

At this point, Group A's collaborative work is characterized by a combination of epistemic and regulative actions. These occurred in patterns that consisted of identification of problems or a lack of knowledge, discussion and joint decision making, short successions of actions performed by (individual) members, consultation with or feedback from the others, revision of produced objects, and discussion with the group on the outcome of those actions (i.e., either an object or a suggestion for new actions). In more general terms, these patterns consist of creating awareness, posing ideas or alternatives for action, and reflecting and then acting upon the object, and they reveal both epistemic and regulatives aspects of this group's agency. Group B's members acted more individually and informed each other of outcomes. The patterns of action that occurred in this group were typically of a regulative nature. We consider that the groups showed a high level of agency when group members came together, created shared understanding of the existing knowledge, generated and selected new ideas and alternatives needed for developing the object, and translated this knowledge into object content.

GENERAL DISCUSSION AND CONCLUSION

The primary goal of this study was to create an account of the concept of shared epistemic agency and to investigate how shared epistemic agency manifests in the context of collaborative object creation activities of two university student groups.

We started this investigation with the assumption that shared epistemic agency embodies the enabling force that supports a group's sustained object-oriented collaboration and that groups that display a higher degree of agency have a greater potential to engage in knowledge creation. In our empirical attempt to examine this, we sought to characterize and illustrate these sustained efforts of collaborative object creation and advancement. The following questions were posed: (a) Which indicators of shared epistemic agency can be identified in the collaborative design work of university student groups?; and (b) How does the occurrence of these indicators differ between groups?

When seeking progress at the theoretical level, we turned to studies both inside and outside the educational field that revealed different conceptions and distinguished typical actions indicating the presence or emergence of agency. The conceptualization of shared epistemic agency started from a baseline, using three studies as a reference point. These studies viewed agency from completely different perspectives: social–cognitive (Bandura, 2001), sociological (Emirbayer & Mische, 1998), and learning theoretical (Scardamalia, 2002). Furthermore, the specific views of learning as situated (Akkerman et al., 2007) and object-mediated (Engeström, 1987; Vygotsky, 1930/1978) activity supported a better focus on the concept of agency. These insights provided a broader array of conceptualizations and a basis for creating an integrative view of what agency is about in the specific context of collaborative knowledge-driven activities.

Shared epistemic agency is thought to be characterized by the capacity that enables groups to deliberately engage in and perform sustainable collaboration that results in the creation of new knowledge, materialized in shared knowledge objects. We identified and described two main dimensions of agency, namely the epistemic (knowledge-related) and the regulative (process-related) dimensions. We assigned actions identified in the literature to these dimensions, resulting in a preliminary framework. We extended and refined this framework based on the outcomes of an empirical analysis of two collaborative groups. We searched for visible indications of agency at the empirical level that were concretized in observable actions; we identified these in the way the (object-oriented) activities were performed and organized by groups. The results showed that in the context of collaborative creation of shared knowledge objects, specific actions characterizing shared epistemic agency emerge.

We identified agentic patterns consisting of a succession of actions that consist of creating awareness of problems or a lack of knowledge, reflecting on ideas and alternatives for object development trajectories, and engaging in actions that serve the purposes of object creation and advancement. Both groups' activities illustrate the state of affairs indicating the presence of agency. But the empirical data show that, despite a similarity in intentions, groups demonstrated differences in the way these intentions were translated into action, in how insights and knowledge were shared, and in how various problems encountered during the process were ap-

proached and solved. Group A's agency was characterized by a dominance of epistemic actions, such as creating awareness of a lack of knowledge and of emerging problems, discussing and sharing ideas, collaboratively generating ideas, and using feedback constructively. In combination with projective–regulative actions, which were also identified in this group's conduct, this type of collaboration led, eventually, to the creation of new knowledge, materialized in the knowledge objects produced. The results show that shared goals also characterized Group B's agency, but the actions indicating agency in this group's conduct were mostly of a projective–regulative nature. This dimension is characterized by sustained regulation of group activities and less content-related discussion. This resulted in the finalization of the shared knowledge objects but it is primarily associated with a limited manifestation of shared epistemic agency. Although epistemic agency was evident at the level of intention, and action was taken only at the individual level.

In our view, these differences provide a view of different facets of shared epistemic agency and how this agency manifests in practice. They are assigned to a prevalent dimension of agency identified in group conduct, which can be associated with a normative difference in quality. From the perspective of knowledge creation, Group A's conduct illustrates shared epistemic agency through shared intention enacted in shared (epistemic) actions, which brought about good examples of knowledge creation practices. In sum, this study indicates that collaborative tasks can be finalized successfully by using a division of labor and rigorous regulation of collaborative work but that sharedness and joint action of an epistemic nature create a stronger foundation for collaborative knowledge creation.

To conclude, we can state that the process of collaborative creation of shared knowledge objects frames the conditions for emerging agency, and the characteristics of this agency are more or less related to how different groups approach this process. It is important to mention that this study did not intend to provide an exhaustive outline of all possible factors that could explain differences between the groups. The results indicate that shared epistemic agency can be described neither as being a distinguishing quality between groups nor as generally characterizing a collaborative process. Ideally, shared epistemic agency is a combination of actions belonging to both the epistemic and regulative dimensions that emerge when groups are conducting collaborative work for creating knowledge objects. Therefore, we regard the findings for the two groups as complementary, informing the theoretical framework and contributing to its enrichment. Shared epistemic agency is, thus, constructed not as a polarized entity but as a continuum (see also Emirbayer & Mische, 1998) upon which groups can situate themselves at certain moments during their collaborative work and during their development.

The dimensions and patterns of action identified and thought to characterize agentic conduct also indicate that shared epistemic agency is not a one-dimensional concept that can be described in normative terms. Agency involves aware-

ness creation and intentionality, with concrete, discernable actions. As illustrated by some of the examples in this study, the description of this construct is in line with Emirbayer and Mische (1998), whose study identified three elements of agency, namely the iterational, the projective, and the practical–evaluative. The multidimensionality of the concept of shared epistemic agency was alluded to in other studies, such as Elkonin's (1999), which pointed to object-bound actions that indicate agency and other actions aimed at establishing the relational context necessary for performing them. In a case study investigating the development of individual agency in school social practices, Rainio (2008) discriminated between aspects of agency expressed through transforming the object of activity through self-change and through responsible and intentional membership.

Various studies have emphasized the importance of intersubjectivity and interaction through objects of activity for collaborative learning activities (Akkerman et al., 2007; Engeström, 1987; Matusov, 1996; Wertsch et al., 1995). From this perspective, it is the presence of the common knowledge object that makes shared epistemic agency emergent. The results show that the common knowledge object forms a shared focal point for students and creates the premises for joint actions. We can thus argue that agency can be a group production when expressed in the context of working on shared objects of activity. The examples in this study reveal that plans for future courses of action were jointly shared, members engaged in mutually monitoring progress, and ideas that were collaboratively generated and acted upon materialized into concrete objects.

The outcomes of this explorative study also require consideration from the perspective of educational practice. This study indicates that agency emerges in different ways and to varying degrees in different groups. In some cases, it emerges naturally, and group members find a way of dealing with what it takes; other groups need guidance and support to discover and pursue object-bound collaboration in an agentic manner. Although we framed the construct within the limits of university education, we believe that this conceptualization can serve future efforts to pinpoint agentic behavior in collaborative learning and collaboration in general. In general terms, the outcomes relate to other studies that targeted younger learners. For example, aspects of shared epistemic agency come close to the cognitive and meta-cognitive features identified in studies on students' disciplinary engagement (Engle & Conant, 2002) and collective cognitive responsibility (Zhang, Scardamalia, Reeve, & Messina, 2009) as being important to productive collaboration. Furthermore, similarities emerge with aspects identified in studies that have applied design-based research (Bell & Linn, 2000; Engle, 2006) and problem-based learning approaches (Barron, 2000, 2003; Hmelo-Silver, 2004). These studies distinguish learners' awareness or conscious involvement and participation in collaborative inquiry and knowledge-creating learning, deep understanding of content knowledge, self-reflective behavior, ownership and accountability for their own learning, and self-management of collaboration and inquiry as

important aspects for productive engagement in the collaborative process. They also point to elements of learning environments and technology that prove beneficial for such types of learning. Although the present study makes an initial attempt to describe a construct relevant to educational practice, in the end the results can play a role in designing learning environments that support productive object-bound collaboration and agentic conduct.

This empirical investigation consisted of the analysis of material from two participant groups. We acknowledge that the empirical substantiation for shared epistemic agency is limited and that, possibly, other aspects characterizing the construct might emerge from analyzing more groups in different collaborative settings. By using a case study approach, this research aimed to provide a deep insight into the characteristics of the construct of agency with the acknowledgment that the research offers a small basis for generalization. At this point, we adopt Roschelle's (1992) stance on the value of the case study, which "… can clarify the meaning and import of a set of ideas […], it can attract attention to problems that have been overlooked, and create awareness of powerful theories that have not been fully tapped" (p. 268). In this sense, this case study serves as a step forward toward creating an integrative account of the emerging construct of shared epistemic agency.

FUTURE DIRECTIONS

The current study highlights a number of aspects that require further investigation and discussion. Four directions for future research are of special interest. First, this study leaves open the investigation of the quality of actions identified, whether epistemic or regulative. Future studies should investigate whether degrees of quality can be discerned and how these potential differences relate to aspects of agency and to the resulting knowledge objects.

Second, this study brings forward the fuzzy boundary between individual and collective characteristics of shared epistemic agency. This relationship was often addressed in dichotomous terms wherein individual agency was the aspect emphasized (Bandura, 2001). In light of Vygotsky's (1930/1978) interpersonal approach to development, future studies should also consider shared epistemic agency from the perspective of the interdependence between the individual and social processes in the creation of knowledge.

Third, the current study did not conduct a comprehensive analysis of the knowledge objects and their development over time. Future investigations should pinpoint object-mediated collaboration in terms of the nature of the knowledge objects and their semantic content, their development, their affordances, salience, the ways in which they distract, their symbolic and physical features, and how these affect learners' actions.

Finally, we acknowledge the importance of the normative perspective on learning processes and their outcomes. Therefore, we raise the question of how shared epistemic agency can be stimulated and supported. Investigations of how to elicit agentic conduct in collaborative groups, and how pedagogical and technological means can support groups in their object-oriented collaboration, represent major topics for future research.

In addition, future studies should take up the methodological challenge posed by this investigation. Difficulties beset the creation of the analysis framework for these complex interactions, because creating this framework required a comprehensive view of how the different sequences of groups' work were linked to one another, and what was the interconnection and flow of actions encompassing agentic behavior, but not in a normative manner. This, however, leads to a certain degree of subjectivity in interpretation. Although our analytic approach proved very purposeful in terms of the selection and analysis of sequences of episodes instead of single utterances, it requires refinement and verification through application to other data sets and, eventually, a formalized description.

In closing, these findings not only underscore the nature and place of agency in collaborative object-bound activities but also the need to shift from a view of collaboration that emphasizes successful performance to a view that acknowledges the value of productive interaction and collaboration itself. Because production seems to be a need of human beings (Schwartz & Okita, 2004), why not create the environment and provide the support for students to produce themselves in school settings, along with developing the agency that enhances the occurrence of these creative processes?

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APPENDIX A

Reading indications for the quoted data excerpts:

[…]: Utterances removed from the original dialog (maximum of three).

… utterance: Start of quoted excerpt.

utterance … utterance: Short pause in speech.

utterance ….: End of quoted excerp t. The original group discussion continues.

[text]: Our comments added to the original text.

Italics in the excerpts indicates sequences of utterances discussed in the Results section.