

Shared Epistemic Agency and Agency of Individuals, Collaborative Groups, and Research Communities

Crina Damşa, University of Oslo, PO Box 1092 Blindern, 0317 Oslo, Norway, crina.damsa@ipeds.uio.no

Abstract: This paper aims to clarify the concept of shared epistemic agency, with its constituting aspects, and to examine research that illustrates how these are expressed in different settings that involve knowledge construction. Building on theoretical works from learning sciences, educational psychology and sociology, shared epistemic agency is conceived as a complex phenomenon that emerges in a dynamic way, and is defined as a capacity that enables groups to carry out collaborative knowledge-based activities that lead to a shared outcome. A comparative analysis of empirical studies of agency shows different ways epistemic agency is expressed in the context of individual and collaborative groups' learning and research communities' knowledge work. This discussion foregrounds the idea that creating intellectual interdependence, which is deemed necessary to co-construct knowledge, is an effort that can be assigned both to individuals and groups, but also to how the structural context affords and facilitates this interdependence.

Introduction

In recent years, constructive views of learning and knowledge work have put forward the argument that processes of knowledge construction require a particular type of engagement and conduct from participants (Bereiter, 2002; Valsiner & Van der Veer, 2000). In this context, the discussion about agency has emerged stronger; consequently, there is more interest in research concerning what agency means and how it is expressed. This paper addresses the notion of *shared epistemic agency* and how agency that is related to learning and knowledge work is being expressed at the levels of individual, collaborative groups, and research communities. I argue for the thesis that epistemic agency can have a shared nature and is expressed differently in various contexts. In support of this, I first conduct a conceptual discussion of shared epistemic agency, by analyzing the constituting aspects of the notion. Ultimately, I aim at a synthesizing definition of shared epistemic agency. Second, I provide examples of empirical studies, which investigated epistemic agency in the contexts of learning and knowledge work. This analysis is used to create a better understanding and to provide an illustration of how epistemic agency, and shared epistemic agency in particular, is expressed in different settings.

Before diving into the theoretical analysis, I present an example of two contrasting groups of students. Their characteristics were identified based on empirical analyses conducted in various research studies of collaborative learning.

GROUP A	GROUP B
<ul style="list-style-type: none">• Bring in own ideas and alternative solutions• Create common plans of action, follow through• Search for sources of information• Discuss ideas, alternatives, solutions; exchange insights• Create drafts and work iteratively• Seek feedback	<ul style="list-style-type: none">• Rely on teacher/course ideas• Work based on momentary needs• Use only given sources• Discuss ideas but do not follow them up• Create materials individually• Use feedback sporadically• Create emergency solutions under time pressure

Figure 1. Contrasting collaborative groups

In all likelihood, this appears familiar to anyone who has been teaching in higher education. If we were to choose, probably the majority of us would prefer to work with groups such as Group A. While that is clear, have we thought in depth what is, in fact, happening in these groups? What makes the collaboration productive and meaningful? What drives it? Is it individual intellectual qualities, or the interest for the knowledge content, or for the final grade? I address some of these issues in the following discussion, with a particular focus on what drives these groups to engage in collaboration the way they do. I associate that with shared epistemic agency, which is viewed as the “capacity that enables groups to carry out collaborative knowledge-based activities that lead to a shared outcome” (Damşa, Kirschner, Andriessen, Erkens, & Sins, 2010, p. 154)

The “Question” of Agency

A quick look at the concept of agency, and how it has been theorized, shows that many of the present-day conceptions of human agency can be traced back to ideas of the Enlightenment. Original postulates referred to agency in terms of human freedom, in reaction to deterministic views of the religious morality of the time (Biesta & Tedder, 2006; Martin, 2011). Accordingly, people were conceived as willful beings, with capacity for independent judgment and autonomous action. *Philosophical* perspectives depicted agency in terms of an antagonistic relationship between a non-rational, normative action (based on Kantian ideas) and a rational–instrumental or utilitarian action (elaborated by American pragmatism and Continental phenomenology). Agency that emerges from the former reflects a moral will, in which actors (individual or collective) pursue free, moral action. On the opposite end, an individualistic conception pictures agency as rational but instrumental action. This is focused on agency serving an utilitarian purpose, the means to achieve an interest, or a material necessity. So, on one end, we have a focus on a self-legislating morality that can lead to good deeds, and on the other end, on purposeful thinking and action that serves the achievement of (individual) goals.

Within *sociology*, a vast discussion has unfolded with regard to whether agency is possible, how it should be conceptualized, and what are the conditions in which it emerges (see Figure 2 for a graphical representation of trends in sociology). Action, structure, and habitus were used as flagship notions. Discussions in the 70s and 80s commonly opposed agency to social structure and defined it as “the ability of actors to operate independently of the constraints of social structure” (Biesta & Tedder, 2006, p. 6). Later, Giddens (1991) and Bourdieu (1990) generated accounts that attempted to overcome this structure/agency dualism. Essentially, Giddens considered structure as a product of patterns of action, emerging from human activity but being constrained by rules. Bourdieu’s view stressed that patterns, or habitual action, originate in the past, but then become structure and shape new, future activity and things in the world. Reactions to Giddens’s view emphasized that agency is not just patterned action but action that breaks with patterns and defined rules and involves thought and reflexivity. A more recent conceptualization was put forward by Emirbayer and Mische (1998) in a seminal work within social theory. Essentially, these authors argue that the focus of previous conceptualizations is too much on judgment, routine, and structure, and not enough on the creative potential of agency.

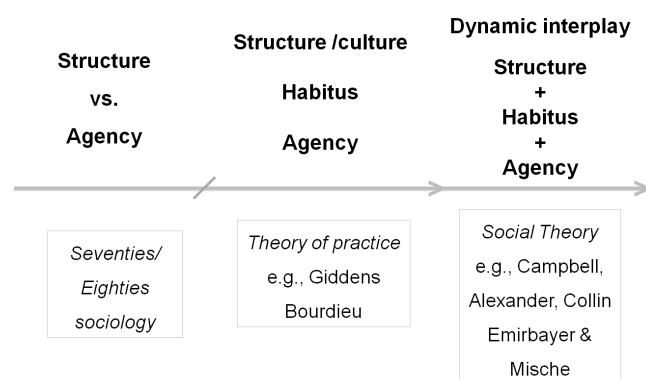


Figure 2. Sociological perspectives

A Relational–Pragmatic Perspective

To frame their conceptualization, Emirbayer and Mische state clearly that it is necessary to take distance from strict individualistic or holistic stances. The former are mainly represented by psychological theories, which focus on the ego as the main driver of decision-making and of the way to achieve an individual interest. The structural and cultural theories account for the latter. These emphasize the prevalence of structure and routinized action as following from this already established order. Emirbayer and Mische argue for a conception of agency that focuses on the dynamic interplay between routine, judgment, interest, and action. They further argue that agency can only be captured in its full complexity if it is situated within the flow of time and takes into account relational and structural aspects toward which participants can assume different orientations. Participants can be oriented toward the past, the future, and the present at any given moment, and while they move among these different contexts and timeframes, they also change their relationship to each other and to the context.

Following this re-conceptualization, an analytic distinction is possible between three dimensions of agency (Emirbayer & Mische, 1998). The *iterational dimension* is manifested in the participants’ ability to recall, select, and apply taken-for-granted schemas of action developed through past activities. The agentic aspects do not simply lie in knowing such schemas but in how actors selectively recognize, locate, and implement such schemas. This refers mainly to how people capitalize on the existing body of knowledge and practices. The *projective dimension* indicates how agency implies orientation toward the future. This highlights the idea that people are able to challenge, reconsider, and reformulate their ideas, projects, and plans. This

assumes that people do not merely repeat past routines. They distance themselves from the established ways of action, can invent new possibilities for thought and action, and generate alternative responses to problems. It is about constructing images of “where they think they are going, where they want to go, and how they can get there (ibid., p. 984). Finally, the *practical–evaluative* dimension responds to the demands and contingencies of the present. This is about contextualizing experiences and knowledge to address problematic situations. It involves momentary judgment and deliberation and decision-making, about both means and ends of action. This capacity for practical evaluation enables participants to pursue their projects in ways that may challenge and transform the existing structures and action. Given this, agency is re-conceptualized “as a temporally embedded process of social engagement, informed by the past (in its habitual aspect), but also oriented toward the future (as a capacity to imagine alternative possibilities and outcomes) and toward the present (as a capacity to contextualize past habits and future projects with the contingencies of the moment)” (ibid., p. 963).

It is interesting to note that Emirbayer and Mische emphasize that an understanding of agency is only complete when it is able to account for the interplay between structure and agency. For them, agency is a dimension that is present in all empirical instances of human action, and there exist only actors who engage agentically with their structuring environments. This implies that all social action is shaped by the temporal–relational contexts of action *and* by the dynamic element of agency. This dynamic element itself leads to social action never being completely determined or structured.

Conception of Knowledge and Learning

In parallel, agency has emerged also as an interesting notion in the discussion concerning learning and knowledge work. The major epistemological shift that poses that knowledge is, in fact, not given but constructed assigned the individual and the environment completely different positions and roles in the knowledge processes. This shift and the discussion in itself brought about new concepts and the need to better understand the individual and the collective and their roles and interplay in the context of knowledge-bound activities. Within the sociocultural framework, Valsiner (1996) proposed a *bi-directional constructive* model that applies also to learning and knowledge. In this model, human actions and the social or cultural environment are given meaning by the participants through symbolizing activities. Accordingly, the individual is in an active process of relating to the environment and other individuals. The individual receives and transforms the information from/about the world into internalized personal knowledge, in the fashion Vygotsky (1978) described it. But the process is not unidirectional. Once the individual has constructed some form of personal knowledge, this becomes externalized in various forms—actions, artifacts, language; it then enters the communication with other individuals. Through this iterative process, knowledge is exchanged, adjusted, and elaborated. It is a co-construction process that can generate ideas, knowledge, and, ideally, development.

Commonly agreed upon, also by theoretical approaches such as the sociocognition or situated cognition, is that this co-construction process calls for conduct that renders possible the emergence of new ideas, insights, or knowledge (Greeno, 2006). Two aspects have been acknowledged as essential in this regard. One is the need for active involvement with the knowledge content, often framed in terms of productive engagement (Engle & Conant, 2002). Holding a belief about knowledge and simply memorizing given knowledge is a passive strategy, or lack of strategy. Participating actively involves re-constructing the meaning of this knowledge. An illustrative explanation is given by Bereiter (2002), in his elaboration of the belief and design modes in knowledge building, an approach that specifies deliberate activities for building knowledge in interaction. In a belief mode, learners attempt to understand given knowledge. In a design mode, a more participative and productive stance allows engaging with knowledge. Bereiter talks about *productive knowledge*, which allows the learners to use, question, and elaborate it, and proves as a stepping-stone toward new conceptualizations. A second aspect is what Valsiner and Van der Veer (2000) call “intellectual interdependence”. Through this, individuals involved in shared contexts influence and guide each other. The individuals monitor one other’s orientations and actions, modify their own intentions, and act in accordance. This generates the necessity of a relationship at the social-relational level. It is based both on social mechanisms of engagement, through means that mediate the interaction and on an individual’s availability to be part of this relationship. Knowledge co-construction is realized through interaction and by using mediating means, among which communication with others is most important. In other words, this type of interactional achievement is realized in productive moment-to-moment interaction, in which a certain degree of intersubjectivity is required.

Intersubjectivity has been, traditionally, conceived as a collection of individual subjectivities or lifeworlds (Rommetsveit, 1992), in the phenomenological sense, which describe a person’s subjectively experienced world. He asserted that the social communication process starts from the assumption of shared understanding based on individual understanding, moves toward overcoming the mutual misunderstanding and results in joint, novel understanding. Matusov (1996) argues, however, that intersubjectivity cannot be viewed as a set of overlapping subjectivities or understandings, but rather as the coordination of contributions in joint activity. According to Crook (2013), intersubjectivity involves bringing states of knowing and doing in coordination with another person’s; it involves *togetherness*, as he frames it. One of the important questions

Matusov brings to the fore is “how can the diversity of individual goals, ideas, actions unite people in activity?” While using different ways to express it, both Matusov and Crook suggest three stages in the emergence of intersubjectivity. Searching for common background and mutual “mindreading” is a first stage and involves coordinating with others about common goals and interests. An intermediate stage is about creating common ground for engagement, based on explicit communication among the participants. This involves a shared understanding, but which is by no means equal to intersubjectivity. This prepares for the final stage, of joint activity. The common ground and shared states drive joint action toward an outcome. In this way, intersubjectivity becomes leverage for productive interaction and the expression of agency in a shared manner.

Agency of the Epistemic Kind

Agency appears as a suitable concept that can depict what drives individual and collective learning and knowledge work, and within the field of the learning sciences, it has been conceived in different ways.

Productive agency, coined by Schwartz (1999), emphasizes the means and the way to arrive to a product. The underlying principles are grounded in Marxist ideas, namely, that any activity can be considered as having a product of some sort. In learning contexts, the main intended products are increased learner knowledge and understanding. Also, individual self-efficacy beliefs that drive one’s behavior toward achieving a goal inspired this notion. Then, *epistemic agency*; etymologically, the term epistemic refers to knowledge, therefore, epistemic agency is considered the type of agency that entails acquiring knowledge. In education, the term was coined by Scardamalia (2000), as a synonym for collective cognitive responsibility, in the context of knowledge-building activities. It implicates students’ willingness to see themselves as members of a community and to take responsibility for their own learning, but also for the advancement of the community’s knowledge. In accordance, students demonstrate their epistemic agency through goal-setting, self-evaluation, and long-range planning. Finally, Pickering (1995) put forward the notions of *conceptual* and *disciplinary* agency, as an expression of different facets of accountability in intellectual practices. *Disciplinary* agency involves the use of accepted methods and procedures that are established in the practice of the domain. When individuals use an established method, agency is turned over to the discipline. In carrying out the method, a mathematician makes what Greeno calls “forced moves”, and the individual’s agency is limited to performing patterned actions, according to accepted practice. *Conceptual* agency involves the individual making choices and judgments about the appropriateness of methods and interpretations. Mathematicians can exercise conceptual agency when they engage in decision-making, exploration, and strategizing; they carry out *free moves*, in Greeno’s terms. The conclusion that emerges from this quick overview is that most of these forms of epistemic agency have, in the strict sense, a focus on the individual. Eventually, Schwartz states that “agency develops through interaction, not only action” (2005, p. 50). But while the claim is that the collective is important in how the agency is played out, the individual expression of agency is prevalent.

These conceptualizations tend to take distance from the individualistic view and assign more importance to how knowledge is constructed and emerges through interaction with the structure, environment, and peers. But the notion of epistemic agency alone does not capture this shared nature in its full complexity. Conceiving shared epistemic agency as a construct based on intersubjectivity, which emerges from intellectual interdependence among individuals, seems paramount. Shared epistemic agency expresses this intersubjective nature, together with the productive features that lead toward knowledge being materialized into tangible, shared knowledge objects. Furthermore, it captures the dynamic interplay between individual agency and the surrounding structure, as it happens within a temporality that also influences how this agency unfolds and is being expressed. It becomes an evolving, constructed entity.

Agency in Different Settings

Individual Agency

In the second half of the previous century, the majority of the approaches in research on learning emphasized the individual cognitive aspects, the way learners could become efficient in individually processing information, and in monitoring and regulating this process (Bereiter, 2002). The concept of agency was framed within this theoretical context, with an emphasis on pragmatic aspects of the process. Ideally, the cognitive activity was to be organized through clear goal orientation and self-regulation. This is the closest we get to epistemic agency, which was equaled to self-efficacy and was assessed from a normative perspective. The unit of analysis in these studies was the individual belief and action.

Within this theoretical context, Bandura’s (2001) theory of social cognitive learning generated studies on self-efficacy and self-regulation of learning at various educational levels. This research was strongly focused on the qualities necessary for a learner to be efficient and successful in control of his own knowledge acquisition process. In studies such as by Pajares (1996), agency was seen as being expressed through clear goal-orientation and self-efficacy beliefs in relation to the academic performance. Bandura (1990) identified agency through acting upon intentions and reflecting on action and Boekaerts and Corno (2005) through strategies of self-

regulation in classroom learning. Another line of research was generated by the self-determination theory, in which agency is equaled to autonomy. Deci and Ryan (2000) considered goal and action as insufficient for defining agency; values attached to beliefs and actions were needed too. Epistemic agency here is aimed at achieving individually set goals and places cognitive performance at the core of the notion, with much lesser attention given to knowledge and how that plays a role in the process.

Epistemic Agency: Individual within Collective

It is essential to acknowledge an area of research that situates epistemic agency between the individual and collaborative planes. This research accounts for the social but still allocates agency to the individual. The individual is expected to contribute to the community's knowledge or some collective outcome. This could be called the individual-collective perspective. The unit of analysis is the individual action but in natural connection to the collective activity.

A relevant set of studies follows Scardamalia's (2002) conceptualization of epistemic agency in knowledge building, wherein participants must contribute ideas to the advancement and improvement of the community's knowledge. Epistemic agency is defined as the responsibility taken by individuals for contributing to a collective set of ideas and to refining this knowledge through notes and comments. Most of the studies were conducted in the context of classroom-related inquiry-based learning. Epistemic agency was followed as the way for learners to direct and sustain their contribution to the pool of knowledge generated by the class. A study by van Aalst and Chan (2007) on the knowledge-building activities of secondary school students interpreted epistemic agency as being about further inquiry for understanding, since the ideas produced needed to be refined in order to be a meaningful contribution. Following knowledge-building ideas, Hakkarainen and colleagues (2004) designed and investigated networked learning. Their thesis was that agency is collectively constructed by individual actors that build and maintain an epistemic network. Students who share, facilitate sharing, and inquire further act as epistemic agents, who pursue collective epistemic goals and take responsibility for collective knowledge advancement. Analyzing students' social networks, Palonen and Hakkarainen (2000) concluded that students considered to be epistemic agents brokered knowledge and supported communication and information flow among members of the group. Also in this research, epistemic agency is placed in a collaborative space, but it is mainly expressed through individual actions that contribute to the collective goals.

Finally, studies on *disciplinary engagement* also touched upon the notion of agency of an epistemic nature. In Greeno's (2003) study of authoritative and accountable learning, the thesis is that participants express conceptual agency in domains, activity settings, and environments that facilitate that learning. This conjecture is consistent with analysis by Engle and Conant (2002), who identified aspects of productive disciplinary engagement in classroom discussions about biological concepts. Lastly, the notion of conceptual and disciplinary agency is transposed in a study of classroom competence in mathematics by Gresalfi and colleagues (2008). In their analysis of short episodes of discussion on mathematical concepts, agency is depicted based on whether a student initiates an idea, agrees with, elaborates on, questions, or disagrees with what someone else initiated, or refrains from responding. The most relevant conclusion is related to the role of the task, which can determine or influence students as they move productively through the task or resist being engaged in it. Again, agency is framed in relation to what that task involves in terms of content knowledge and strategies, at the individual level.

Shared Epistemic Agency of Collaborative Groups

A more specific conception of the interplay between individual and collective thought and action is provided by the sociocultural approach. As discussed previously, social input and individual action are intertwined, and this interplay can be empirically sought-after in the moment-to-moment interaction. In general, this type of tight collaborative activity has been organized in small group learning or project-based work. In small group settings, the changes in orientation and action course, both of the individual and the group, are more detectable (Damşa & Ludvigsen, under review). As is assumed theoretically from this perspective, agency involves a close dynamic interplay between structural elements (of the instructional settings) and active individual participation; and also, between patterned activities and actions that might have creative value. The unit of analysis in this case is the group-level action, in which individual and collective actions are presumed to blend in naturally.

Charles and Shumar's (2009) study of student groups solving math problems in a virtual environment provides a good example of how shared agency can be enacted at the discursive level. The findings show an interplay between the individual and the group, in which group members managed their trajectory as a team. They also constructed meaning through dialog, bridged problem-solving episodes, and capitalized on jointly created artifacts. The authors think that the virtual chat, which is liberated from the social constraints of a physical space, encourages individuals to be agentic and to act like mathematicians. The epistemic aspect of agency is accounted for by the actions focused toward the mathematical domain—the shared aspect, through the intersubjectivity created by the group interaction in a coordinated manner.

Research by Damşa et al. (2010) and Muukkonen-Van der Veer (2010) focused on identifying and designing scenarios for collaborative construction of knowledge. Joint work aimed at generating new ideas and

elaborating and materializing them into shared knowledge objects was a central feature of the design. The type of agency considered to be necessary for such collaborative accomplishments is of a shared nature. Empirically, these studies searched for expressions of agency at three levels. First, in verbal interaction, agency was identified in the way groups raised awareness on a lack of knowledge, created shared understanding, and generated ideas. Second, they looked for how groups followed up on their verbal discussions and elaborations and used these in the construction of their shared knowledge objects. Third, these studies analyzed how groups made and followed up plans and how they coordinated their actions. The studies identified groups that displayed shared epistemic agency but also groups that encountered problems in both dealing with the knowledge content *and* their collaborative process. What follows is an example of verbal interaction that shows how a group discusses concepts that are central to their collaborative project. The excerpt below shows actions that indicate: lack of understanding, creating shared understanding, elaborating on an idea, and coordinating future actions. This is an example of how epistemic actions that indicate agency can be traced in momentary interaction of Group A.

Excerpt 1. Agency in momentary interaction (based on Damşa & Ludvigsen, under review)

- | | | |
|----------|---|------------------------|
| 1. Ann: | Can you explain? I don't really get it... | |
| 2. Jane: | Erm, well, <i>in my school they have, for example, this common assessment form for the proof of competence.</i>
All the assessors must use it, and the assessment of the same pupils by more assessors is discussed at the end among themselves. Isn't that something that has to do with reliability ? | Sharing
information |
| 3. Liz: | While reading about validity, I came across things I recognized in practice. <i>The task for example, how that is covered by the tests, has to do with content validity.</i> | Elaborating
ideas |
| 4. Ann: | Also with authenticity . <i>Tasks have to reflect the real work situation, the context...</i> | |
| 5. Liz: | Yes, let's see how we do this! <i>We can each collect the information from own schools, as an example. We discuss it first again before we start writing?</i> | Coordination |

When followed in time, throughout the course of the whole project, these actions can be indicative of a group's shared epistemic agency. There is a clear joint approach in this group's work, and data has the potential to showed how they consciously sustained this joint strategy when dealing with the knowledge involved and when organizing their process. This group's joint approach supported both productive collaboration that allowed knowledge co-construction and the emergence of shared epistemic agency.

Epistemic Agency in Research Communities

The theories underlining the conceptualization and the research of agency in knowledge communities are mainly of a sociocultural or sociomaterial nature. The individual is viewed as part of a structure, in which content, strategies, and methods are often customary. This system can involve collaborative practice, but it can also impede them. Agency can be expressed in the individuals' actions aimed at contributing to a) the knowledge domain or b) in them finding a way to navigate, in a productive manner, within the complicated structures of their domain practice. In general, the unit of analysis is individual action embedded in the larger structures or culture, but it can also be the collective action of a group within the community.

Studies by Knorr Cetina (1999) elaborate on epistemic agency as being part of the epistemic cultures emerging in different professional domains. In her empirical work, she analyzed how scientific groups function within particular epistemic cultures and touched upon agency as an aspect that plays a role in knowledge being constructed. Two of her laboratory studies, on the CERN atomic physics lab and the molecular biology lab, provide interesting illustrations of how scientific practice can develop. The analysis was focused on how physicists and biologists understand scientific work, the use of instruments and social structures (including organization of the lab). Three main conclusions can be drawn based on the findings. The *first* one is that epistemic agency contributes to the development and expansion of the domain's body of knowledge. The studies showed mainly how knowledge and epistemic objects emerge from scientific practices that draw upon individual and collective expertise. The knowledge generated in this way adds to the existing knowledge structures, in an incremental manner. This is the productive aspect of the epistemic agency, expressed on a scale of extended temporality. *Second*, Knorr Cetina shows that epistemic agency is formed in distinct ways in different epistemic cultures. She uses the notion of "machineries of knowledge construction" to depict the way actions and agency are shaped in a particular knowledge domain. It is a situated and contextualized process. In the case of the atomic physics lab, work was distributed in time and across sites. The characteristics of the methods within the domain of quantum physics also determined the work strategy. Epistemic agency was expressed in the way the

community kept the focus on shared goals and pursued that, despite the physical distance and other emerging problematic aspects. In the biology lab, where the group was smaller and the work took place in a confined space, agency was expressed more in relation to the social relationships and the material resources of the lab. And *finally*, Pickering's distinction between conceptual and disciplinary agency is applicable here. We see scientists working within the established boundaries of disciplinary practice but also some searching for alternative methods and strategies, attempting the free moves. But there is a certain specific logic to the interplay between agency and structure in this case. The structure here is represented by the existing knowledge domain and also by the set of scientific methods, procedures, and instruments. A scientist can choose to be compliant with the established methods of the domain and community or take a different path and bring in new ideas. The final conclusion is that "knowledge-centered practices" are forms of creative and constructive practices that go beyond routine and habits, and epistemic agency typically emerges when confronting non-routine problems.

Conclusions

This paper attempted to clarify the notion of shared epistemic agency, with its constituting aspects, and to examine empirical research that illustrates how these are expressed in different knowledge activities and settings. The theoretical analysis led to a depiction of shared epistemic agency as a complex phenomenon that emerges in a dynamic way. It can be viewed as a capacity that enables individuals, groups, or collectives to make appropriate judgments, to make plans and to pursue these through purposeful action, in order to achieve the construction of knowledge. A set of features emerged as characteristic of this notion. Productivity is expressed by following established ways of working with knowledge or by attempting new and creative strategies, methods, or interpretations. The sharedness refers to the social-relational aspects of the processes of knowledge co-construction. Theoretically, it is assumed that creating a strong intersubjective layer supports the manifestation of shared epistemic agency and the co-constructive process. Finally, the temporality refers to agency as an emerging entity, which unfolds through successions of intertwined thought and action. It combines the focus on past experiences and practices, with how these can be employed to attend to problems in the present and to create plans of action that aim at constructive processes projected in the future.

In practice, the studies analyzed showed that the shared epistemic agency is a complex construct, which is expressed empirically in different ways, depending on the context, its temporality, and the nature of the constructive activities. At the *individual level*, epistemic agency can be expressed in relation to individual work, but also in connection to collective work to which the individual might be expected to contribute actively. The purposive and productive aspects of agency are emphasized here, with the main focus on individual understanding of knowledge that is fed back into the collective knowledge. At the level of *research communities*, the iterational aspect of agency has a strong presence, since the knowledge and established practices are created through cumulative efforts and serve the community as a pool of options. Research communities are good examples of a dynamic interplay between structure and agency, since science and research are typically marked by creative-constructive actions geared toward the future. In order to build on the existing pool of knowledge, scientists might find creative ways to navigate within the structural context. In *collaborative groups*, shared epistemic agency is expressed in stronger terms. The way intersubjectivity is created can influence how agency unfolds in time and how its productive aspects are expressed. For example, when intersubjectivity is achieved, the joint resources bring about the intellectual interdependence that can afford sophisticated solutions and outcomes. One interesting point to make here is that technology mediation, as shown in Charles and Shumar's (2009) study, might open up new alternatives for shared agency to manifest itself.

Within this context, the interplay between structure and agency has specific characteristics. In institutionalized learning settings, individual students or groups are expected to acquire and master knowledge set by curricular demands. But they are also provided with a rich set of structural resources through the curriculum, which supports the knowledge construction process. Creative and alternative solutions are welcomed, but are not necessarily the standard way of work. In the research community, however, the stakes are higher when scientists engage in creative or innovative actions that break away from customary practices; but the rewards can be just as high. Individuals and groups that express epistemic agency and engage constructively with the knowledge domain and practice are the ones bringing science forward. In an ideal depiction, structure feeds into agency and allows the individual the freedom to choose a particular type of relationship with the contextual structure. Attempting to create intellectual interdependence is an effort that can be assigned both to individuals but also to how structural contexts afford and facilitate this interdependence. Regardless, understanding the notion of shared epistemic agency and creating the appropriate strategies to activate it is a complex challenge, to which further analytic work must provide the necessary input.

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