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COMMUNITIES OF PRACTICE: EXPLORING THE DIVERSE USE OF A THEORY

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The social learning theory of communities of practice is frequently used in mathematics education research. However, we have come to recognise that the theory is used in diverse ways, regarding both the parts that are used and the ways in which those parts are used. This paper presents an overview of this diverse use of the theory based on three themes: Are communities of practice viewed as pre-existing or are they designed within the study? Are individuals or groups foregrounded in the study? Which parts of the theory are mainly used? The aim of the paper is twofold: to make visible the diverse possibilities within one single theory, and to make visible how, even though we might think we know what a theory implies in research, if we look beneath the surface we may find that “the same” theory can imply many different things.

Keywords: communities of practice, theory, social, learning, Wenger

INTRODUCTION

Since Etienne Wenger published his book *Communities of Practice: Learning, Meaning, and Identity* in 1998 the notion of communities of practice has become common in mathematics education research as well as in other areas of educational research. Both authors of this paper have been using Wenger’s social theory of learning in research within mathematics education. In reading other researchers’ work we have discovered that the theory of communities of practice is frequently used in mathematics education, but there are many differences regarding both *which* parts are used and *how* those parts are used. In this paper we will explore some of the ways in which the theory of community of practice is used in different mathematics education studies. The aim of this is twofold: to make visible the diverse possibilities and uses of one single theory, and to make visible how we in research may think we know what using a specific theory in a study implies, but when we look beneath the surface we may find that “the same” theory can imply different things to different researchers.

The notion of communities of practice has been investigated and discussed before, for example by Kanes and Lerman (2008). They investigated similarities and differences in how the notion is used by Lave and Wenger (1991) and by Wenger (1998), respectively. (However, we find Kanes and Lerman’s (2008) description of Wenger’s communities of practice very different from our own interpretation and the interpretations we found when preparing this paper.) In this paper we focus only on research referring to Wenger’s 1998 book, in which he writes that his aim is to

present a conceptual framework where learning is placed “in the context of our lived experience of participation in the world” (p.3). In this paper we will not present Wenger’s theory more than that, in order to avoid imposing our own interpretations of which concepts are the main ones in his theory. Instead, the use of communities of practice will be explored according to the differences we found when reading other researchers using Wenger’s theories. Hence, the exploration is divided based on the following three themes: Are communities of practice viewed as pre-existing or are they designed within the study? Are individuals or groups foregrounded in the study? Which parts of the theory are mainly used? These three themes will be presented under each heading followed by a concluding discussion.

SELECTION OF STUDIES

Our selection of studies to explore was limited to those focusing on mathematics teaching or learning and/or mathematics teachers’ professional development. We searched 19 databases, using the search words *communities of practice*, *mathematic** and/or *teach**; the search was limited to peer reviewed journals or books. From this selection, consisting of more than 8000 articles, we limited the search to *communities of practice* and *mathematic** and/or *Wenger*; although that reduced the number of articles, there were still too many in some of the databases. We then removed “or” *teach**. Thereafter we were able to browse through all the titles and keywords to find a selection of research articles using *communities of practice*. This selection is not at all comprehensive, however, the purpose is not to generalise but to illustrate some of the differences we have found. Wenger’s theory is also used frequently in studies within economy and management, but such studies are not explored in this paper.

Due to space limitations, this paper cannot present all the articles we have read; instead, we present articles that together illustrate the differences we found based on our three themes. The following ten studies will be discussed in relation to the three themes in the paper: Bohl and Van Zoest (2003); Corbin, McNamara and Williams (2003); Cuddapah and Clayton (2011); Cwikla (2007); Franke and Kazemi (2001); Goos and Bennison (2008); Graven (2004); Hodges and Cady (2013); Pratt and Back (2009) and Siemon (2009).

DESIGNED OR PRE-EXISTING COMMUNITIES OF PRACTICE

Some studies using Wenger’s social theory of learning view communities of practice as pre-existing. In some other studies, for example, Bohl and Van Zoest (2003), Cuddapah and Clayton (2011), Goos and Bennison (2008), Hodges and Cady (2013) and Franke and Kazemi (2001), communities of practice are designed by the researcher(s).

In the study by Goos and Bennison (2008), a web-based community of practice is designed within teacher education. After graduation, interaction in the community of practice continues through the web-based tool developing an “online community”

(p.41). In their article, Goos and Bennison discuss the issue of emergent versus designed communities of practice. Although, in their study Goos and Bennison design the external frames for the community of practice, their interest is in whether or not the web-based community develops into a community of practice. To give the community the best chance to develop into a community of practice on its own, the researchers provide only a minimum of structure concerning how community members are to communicate using the web-based tool. As such, they design a community, but it is its emergence as a community of practice they investigate in their study.

Hodges and Cady (2013) seek to expand on the work of Goos and Bennison (2008) by investigating the development of communities of practice within a professional mathematics teacher's development initiative. In this study a web-based tool is used to "foster the development of communities of practice" (p.302). Hodges and Cady design a virtual space in order to see the emergence of communities of practice. However, unlike Goos and Bennison (2008), Hodges and Cady do not highlight the issue of an emergent or a designed community, even though the emergence of potential communities of practice is in focus.

Cuddapah and Clayton (2011) design a community of practice by arranging physical sessions with a group of novice teachers. They focus on one of several groups of novice teachers that, within a university-sponsored project, meet every second week. The novice teachers meet 15 times during the study. Every session has a theme and the sessions are planned and led by experienced educators. Cuddapah and Clayton write that the group of novice teachers "itself was a community" (p.69) and they use Wenger's theories to analyse the development of the group and its function as a resource for new teacher support. In their analysis they present how the "community was observed throughout and between the data" (p.72). As such, the group of novice teachers being a community of practice was both a precondition and a result of their analysis.

A fourth example of researchers who design communities of practice is Franke and Kazemi (2001). In their study they design communities of practice with mathematics teachers with the purpose of providing teachers with opportunities to learn about mathematics teaching and learning. The teachers in this study do mathematical tasks with their students in their classrooms and then they meet and discuss their experiences. The researchers take part in the discussions and they also visit the teachers at their schools several times. Franke and Kazemi do not describe why or how the group of teachers is a community of practice, but they analyse and describe the interactions in the group connected to teacher professional development.

Examples of studies in which communities of practice are treated as pre-existing, developed before the study began and without the influence of the researchers, are studies by Bohl and Van Zoest (2003), Corbin et al. (2003), Cwikla (2007), Graven

(2004), Pratt and Back (2009) and Siemon (2009). In some studies the communities of practice are identified in the research process based on concepts from Wenger's theory, whereas other studies do not explain how they are identified as communities of practice.

Bohl and Van Zoest (2003), Graven (2004), Corbin et al. (2003), Cwikla (2007) and Pratt and Back (2009) are examples of studies where communities of practice are viewed as pre-existing at the start of the study, where the researchers do not explain how the communities have been identified as such.

Bohl and Van Zoest (2003) analyse how different communities of practice in which novice teachers participate influence their mathematics teaching. They give an empirical example of one novice teacher, in relation to whom they discuss differences in the role of novice teachers in different communities of practice, but they do not present how they identified these as communities of practice, nor do they explain how they identified the novice teacher's membership in these communities.

Graven (2004) investigates teacher learning in a mathematics in-service program. In this study an in-service program is considered to be a community of practice, but it is not explained how this community of practice has been identified as such. This is also the case in the study of Corbin et al. (2003), who investigate numeracy coordinators in an implementation of a national numeracy strategy. They use the notion of communities of practice as a tool to describe the participation of the coordinators in different communities, but they do not explain how they define the communities.

Pratt and Back (2009) investigate participation in interactive discussion boards designed for mathematics students. They simply state that "two idealised communities of practice" (p.119) were adopted as a means to understand the discussion boards. How these communities were created and why they can be seen as such is not explained. They even describe the communities of practice as "hypothetical communities" (p.128). Cwikla (2007) uses the concept of communities of practice in her study of the evolution of a middle school mathematics faculty. The concept of communities of practice is used to identify boundary encounters, but the article does not present any definition of communities of practice, nor does it specify which communities of practice are identified within the study.

Siemon (2009) is an example of a study where communities of practice are viewed as pre-existing at the start of the study, but where the researcher explains how the communities of practice have been identified as such. Siemon (2009) investigates improvements in indigenous students' numeracy skills after they worked on key numeracy issues in their first language. Three pre-existing communities of practice are described and it is explained, using Wenger's concepts, why these are considered to be communities of practice. In the study, the intersection between the acknowledged pre-existing communities of practice is investigated. The members of

these communities are not described in detail, only as, for example “members of the local Indigenous community” (p.225), or “all those that by virtue of their responsibilities are concerned in some way with school mathematics” (p.225). The intersection between the communities of practice is not highlighted, although the author states that the edges of the communities took time to emerge.

FOCUS ON INDIVIDUALS OR GROUPS

Wenger’s theory makes it possible to foreground groups (communities of practice) or individuals (learning and/or identity) or both. Since Wenger’s theory is very broad and yet detailed, it is not surprising that either groups (communities of practice) or individuals are foregrounded in the studies. Wenger explains that this is not a “change of topic but rather a shift in focus within the same general topic” (p.145). Franke and Kazemi’s (2001) study is an exception, however, and an example of “both” since they analyse both the interaction within the community of practice and the identity development of individual participants.

In the studies by Cwikla (2007), Cuddapah and Clayton (2011), Goos and Bennison (2008), Hodges and Cady (2013) and Siemon (2009), groups of teachers are in the foreground and individuals are in the background or are not mentioned as individuals at all. Bohl and Van Zoest (2003), Corbin et al. (2003), Graven (2004) and Pratt and Back (2009), however, foreground the individuals, trying to understand how they are influenced by the different communities of practice in which they participate.

The issue of communities of practice or individuals being foregrounded in the studies as presented in this section is connected to which parts or concepts from Wenger’s theory are used in the analyses, which is the focus of the next section.

WHICH PARTS OF THE THEORY ARE MAINLY USED?

Another consequence of Wenger’s theory being very broad and yet detailed is that researchers focus on and use smaller parts of the theory, selecting just some of the concepts within it.

Graven (2004) uses the concepts of *practice*, *meaning*, *identity*, and *community* to describe and explain teacher learning. These four concepts are, according to Wenger “interconnected and mutually defining” (p.5). Graven also mentions Lave and Wenger’s (1991) concepts of *co-participation* and *participation*, but these are not used in her analysis. Even though Graven describes communities of practice in her study, the “three dimensions” (p.72) that according to Wenger are the source of a community of practice, *mutual engagement*, *joint enterprise* and *shared repertoire*, are not used. However, Graven instead wants to add *confidence* as a supplement to *practice*, *meaning*, *identity*, and *community*.

Cuddapah and Clayton, like Graven (2004), initially refer to Lave and Wenger (1991) but to the concept of *legitimate peripheral participation*. They discuss this concept as

one that can be used when analysing novice teachers as newcomers in teaching. However, as all novice teachers in their study are new members of a new community of practice designed by the researchers, they instead, like Graven (2004), use *practice, meaning, identity, and community* when coding their empirical material. They briefly mention the concepts of *mutual engagement, joint enterprise* and *shared repertoire*, but they do not use them in their analysis.

Those three concepts, *mutual engagement, joint enterprise, and, shared repertoire*, are used by Goos and Bennison (2008), Hodges and Cady (2013) and Siemon (2009) in their studies. As shown in the last section, these three studies have communities of practice in the foreground. Goos and Bennison (2008) use the three concepts when they analyse the emergence of their designed web-based community of practice. To investigate mutual engagement they count the number of interactions in the web-based tool. By analysing the content in these interactions they also investigate the joint enterprise and the shared repertoire that develops. Siemon (2009) uses the three concepts by making lists of what it is in the different communities of practice identified in the study that indicates joint enterprise, mutual engagement and a shared repertoire. Consequently, in her study communities of practice are pre-existing, but she defines them by mutual engagement, joint enterprise and shared repertoire. Three communities of practice are acknowledged this way. Hodges and Cady (2013) use the three concepts in the same way, but their approach is somewhat different. They use the concept in order to find and/or see development of communities of practice in a designed web-based tool. In their analysis they look for evidence of joint enterprise, mutual engagement and a shared set of ways of interacting in order to see if a community of practice has been developed. As such, the concepts of *mutual engagement, joint enterprise* and *shared repertoire* are used to identify both designed (Goos & Bennison, 2003; Hodges & Cady, 2013) and pre-existing (Siemon, 2009) communities of practice.

In addition to mutual engagement, joint enterprise and a shared repertoire, Siemon (2009) also uses Wenger's concept of *negotiation of shared meaning* when referring to a space where the participants in the different communities of practice can meet. This space is used both as a place to negotiate meaning and as a research tool to "explore the processes involved in building community capital" (p.226). Furthermore, Siemon uses Wenger's concept of *boundary objects* when defining Probe Tasks³ as a boundary object in the negotiation described above. Cwikla (2007) also uses the concept of *boundary objects*. In her investigation of the evolution of a middle school mathematics faculty, she uses this concept together with the concept of *brokers*, which is also from Wenger. She mentions communities of practice, but she

³ A Probe Task is described in the paper as a specifically chosen or designed task to support indigenous teacher assistants as they teach key aspects of number.

does not define them. When using the concept of brokers, she refers to Wenger's definition, stating, "a broker can serve as a conduit for communication and translation between communities of practice" (p.558). Corbin et al. (2003) also use the concept of *brokering* when investigating numeracy coordinators in an implementation of a national numeracy strategy. The concept is used to theorise tensions in the work of the coordinators. Corbin et al. find signs of brokering in their analysis by using three more of Wenger's concepts: the *modes of belonging: engagement, alignment and imagination*. Pratt and Back (2009) also use the concepts of *engagement, alignment and imagination* in their analysis. They also use Lave and Wenger's (1991) concept of *legitimate peripheral participant* as well as *peripheral and central participation* in their analysis. These concepts are used to describe a person's participation, and changes in participation, in two different communities of practice.

Bohl and Van Zoest (2003) mention that communities of practice develop through mutual engagement, joint enterprise and shared repertoire, but in their analysis they use two other concepts of Wenger's: *modes of participation* (their term for what Wenger refers to as *modes of belonging*) and *regimes of accountability*. They use these two concepts to analyse how novice teachers have different roles in different communities of practice and how this influences their mathematics teaching.

As mentioned, Franke and Kazemi (2001) analyse both the interaction in one community of practice and the identity development of individual participants. However, they do this without explicitly using any of Wenger's concepts. The artefacts they mention are not identified explicitly as artefacts used by Wenger but as used in sociocultural theories in general. They also mention *identity* and *negotiation of meaning*, both of which are thoroughly elaborated by Wenger, but they do not refer explicitly to how the concepts are used by Wenger. As such, Franke and Kazemi refer to, and use, Wenger's social theory of learning, but not explicitly or solely; rather, they present it as part of a general sociocultural view of learning.

Overall, several of Wenger's concepts are used in the studies presented in this paper, including *practice, meaning, identity, community, mutual engagement, joint enterprise, shared repertoire, modes of belonging, engagement, alignment, imagination, identity, brokering, negotiation of meaning, boundary objects, regimes of accountability, co-participation and participation*. However, seldom are more than three or four concepts used in the same study. Since the theory is broad and yet detailed, it is not surprising that researchers focus on and use only parts of it. Even so, none of the articles referred to in this paper draws attention to the fact that only certain parts of Wenger's theory will be used. Neither do they discuss the eventual consequences of not using the theory in its entirety. Hence, anyone reading only one of the articles may easily believe that the whole of Wenger's theory is used.

DISCUSSION

As seen in the examples in this paper, Wenger's social theory of learning is used in different ways in different studies. Wenger (1998) terms his work a "conceptual framework" (for example, p.5), a "social theory of learning" (for example, p.4) and/or a "perspective" (for example, p.3). According to Eisenhart (1991), there are three kinds of research frameworks: theoretical, practical and conceptual. Eisenhart distinguishes these as theoretical frameworks based on formal logic, practical frameworks based on practitioner knowledge and conceptual frameworks based on justification. Somehow Wenger's social theory of learning comprises all three of these features. According to Niss (2007), theories are stable, coherent and consistent systems of concepts that are organised and linked in hierarchical networks. Those criteria apply to the content of Wenger's book. However, when researchers use only some of Wenger's concepts the criteria are no longer met. Furthermore, Niss (2007) writes that one purpose of theories "is to provide *a structured set of lenses* through which aspects or parts of the world can be approached, observed, studied, analysed or interpreted" (p.100). The diverse uses of Wenger's social theory of learning presented in this paper show that the *structured set of lenses* used in these studies differ substantially.

According to Lester (2005), a framework provides structure in research when it comes to the questions being asked and the concepts, constructs and processes being used. Connected to the overview in this paper, the use of Wenger's social theory of learning appears to coincide with the first (questions), but not the rest. Even though the use of Wenger's social theory of learning differs in the studies presented in this paper, one similarity is the type of questions asked. These questions imply that the theory is considered suitable for studies of mathematics teachers', novice teachers', student teachers' and/or students' learning. Furthermore, in several of the studies (for example, Bohl & Van Zoest, 2003; Siemon, 2009) the social dimension of learning provided by Wenger is emphasised as its main strengths. As such, the use of Wenger's theory in mathematics education research seems to be part of the "turn to social theories in the field of mathematics education" (Lerman, 2000, p.20). According to Lerman (2000), social theories make it possible to foreground individuals (practice in person) or practice (person in practice). However, both elements (person and practice) are always present and part of the analysis, which is in line with Wenger's "shift in focus within the same general topic" (p.145).

As shown in this paper there are differences in the presented studies in terms of communities of practice being viewed as pre-existing or designed as well as communities of practice being identified based on Wenger's concepts or not. In his book Wenger actually writes that since communities of practice are about content and negotiation of meaning – and not form – they are not "designable units" (p.229). That

is, according to Wenger, it is possible to design the outer limits but not the practice that may, or may not, emerge.

As presented above, there is also diversity with respect to whether individuals or (communities of) practice are in the foreground. As also shown, there are differences regarding which of Wenger's concepts is used, even when the same perspective (individuals or communities of practice) is in the foreground. In terms of the concepts used, we were surprised by the rare presence of *reification* and *negotiation of meaning*, as these two concepts recur frequently throughout Wenger's book. Furthermore, there are many other concepts of Wenger's that are not used in any of the studies we read, including *local/global*, *identification*, *economies of meaning*, *ownership of meaning* and *trajectories*.

Finally, what can be learned from this overview of how Wenger's social theory of learning is used in different ways in mathematics education research? Well, often we (think that we) know what researchers imply when they say they have been using a specific theory in their research. However, from the overview presented in this paper, we know that if a researcher says that (s)he has been using Wenger's social theory of learning, we can be quite sure that we do *not* know exactly what that use of Wenger's theory might imply. In this paper we have highlighted some of the diverse uses of Wenger's social theory of learning based on three themes: Are communities of practice viewed as pre-existing or are they designed within the study? Are individuals or groups foregrounded in the study? Which parts of the theory are mainly used? Probably further comparisons based on other themes will reveal other diversities. Further, based on the breadth and wealth of details in Wenger's social theory of learning, the list of themes and diversities may become quite long.

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