LEARNING TO BECOME A RESEARCHER IN AN ONGOING RESEARCH PROJECT: A COMMUNITIES OF PRACTICE PERSPECTIVE

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We apply Wenger's (1998) communities of practice ideas to the process of incorporating new researchers into an ongoing mathematics education research project. We illustrate this application by describing how the Leveraging MOSTs research project coding team can be viewed as a community of practice. We describe how we have used this particular community of practice to bring new researchers into the project, and new researchers reflect on their experiences with the coding team. Mutual engagement in project work with experienced researchers and having a rich shared repertoire to draw on led to the new researchers developing a shared understanding of the project and being successfully incorporated into the MOST community. This work speaks to the importance of deliberately creating communities of practice for new mathematics researchers to participate within.

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Researchers have found that participating in well-designed and effectively-implemented *communities of practice* (Wenger, 1998) supports preservice and in-service mathematics teachers' professional learning (e.g., Goos & Bennison, 2008; Hodges & Cady, 2012). Applying Wenger's ideas to research projects holds promise for increasing both the functionality of the project—by improving ways project staff work in community together—and the learning of new researchers. In this paper, we use Wenger's ideas to make sense of how to develop synergy at the crossroads that occur when new researchers become part of an ongoing research community.

Theoretical Framework: Applying Wenger's Social Theory of Learning

Wenger's (1998) social theory of learning identifies three essential dimensions of a *community of practice* (CoP): *mutual engagement*, *joint enterprise*, and *shared repertoire*. Mutual engagement refers to participants' regular interactions with others in a community; joint enterprise refers to participants' common understanding of, and desires to, achieve the purposes of that community; and shared repertoire refers to the shared ways of doing things developed during mutual engagements for the joint enterprise of that community (e.g., routines, tools, artifacts, stories). Participating in a CoP enables individuals to interact with the others in that CoP, which in turn enables them to acquire meanings from these interactions. Negotiating these meanings with others in the CoP contributes to their learning (Wenger, 1998). Therefore, participation, negotiation of meaning, CoP and learning are all interpreted as interrelated and essential dynamics of Wenger's social theory of learning.

The National Science Foundation Collaborative Research Project *Leveraging MOSTs* (LeveragingMOSTs.org) is an example of a CoP. Researchers from Brigham Young University, Michigan Technological University, and Western Michigan University came together to work on the joint enterprise of investigating secondary school mathematics teachers' productive use of student mathematical thinking during instruction. In line with this joint enterprise, researchers mutually engaged in practices (e.g., online and face-to-face meetings, data collection, data analysis), and these engagements produced tools, artifacts and shared ways of doing things (e.g., research reports, further research ideas, codebooks, meeting notes). As more researchers became involved and the scope of the work broadened, the MOST research project became a constellation. Constellation is a term used by Wenger (1998) to describe individual, but interacting CoPs in a system. For example, in the

MOST research project, teams work on analyzing the same data to answer different research questions; that is, they work on different but related parts of the joint enterprise. The interaction among these CoPs in the MOST constellation is primarily carried out by the principal investigators (PIs) of the project. Wenger (1998) defines such people—those who mutually engage in different CoPs in a constellation—as *brokers*. These brokers enable the joint enterprise and shared repertoire of the constellation as a whole.

Wenger has also likened CoPs to "black boxes." From the outside, it can be seen that there is a box, but since the box is opaque it is not possible to see what is inside it (Wenger, 1990). As newcomers' understanding of a CoP increases, the box becomes more transparent until eventually they can see through it to the workings of the CoP. When the box finally becomes invisible, as if there is no box, the newcomer has been fully integrated into the CoP (Wenger, 1990). The difficult process of making the box transparent may explain why Wenger (1998) claimed that becoming a part of a CoP is a challenging process for newcomers.

In longitudinal research projects, such as MOST, it is highly likely that new researchers will join the research team. Integrating these new researchers into a project CoP is essential for them to fully participate in pursuing the joint enterprise of the research team. Since this integration is a challenging process, there is a need to better understand productive ways for new researchers to join ongoing research projects. Toward this end, we explain our process for integrating new researchers into the MOST project and provide insights into how the opaque box of our CoP gradually became transparent for a recent group of researchers who joined the project.

The MOST Coding Team as a Community of Practice

Coding based on the MOST Analytic Framework (see Leatham, Peterson, Stockero, & Van Zoest, 2015) serves as the foundation for the vast majority of the CoPs in the MOST constellation. Thus, the *joint enterprise* of the coding CoP is to label and organize the data to enable further analysis by the other CoPs of the MOST constellation. As a result, the coding CoP is a logical place for new researchers to begin their participation in the MOST constellation. In the current coding CoP, there are five researchers who are new to the project and two PIs. Initially, all seven researchers met twice a week in online video meetings to work on the shared repertoire of the MOST constellation in general and of the coding CoP specifically. The main reifications in the *shared repertoire* of the MOST constellation for the coding CoP are publications related to the MOST Analytic Framework, the MOST codebook, and meeting notes. During the initial meetings, the PIs and the new researchers began coding a set of training data using the MOST Analytic Framework. After coding individually, the group met to reconcile their coding and discuss any discrepancies, connecting those discrepancies to the shared repertoire of the MOST project. Once the new researchers had established a basic working knowledge of the coding framework and its applications, the new researchers continued these online coding meetings on their own. The PIs occasionally rejoined the coding meetings to discuss issues that arose during the new researchers' discussions and to serve as brokers of knowledge for the CoPs in the MOST constellation. These different types of meetings were the main source of *mutual engagement* for the coding CoP, which enabled the new researchers to negotiate meanings about the coding process.

The Voices of New Researchers: Reflections on How the Opaque Box of the Coding CoP Became Transparent

The first step to participating in the MOST constellation and the coding CoP was to understand the constellation itself. In order to do this, we were given access to artifacts such as published articles, the NSF grant proposal, previous meeting notes, and the MOST codebook. Having this rich shared repertoire helped us to develop a general understanding of the constellation of the MOST

project: why this research is being done, how this research is being done, and outcomes of the research. After this process, we had a general sense of the joint enterprise of the MOST research team and the coding CoP, so we tried coding the training data using the MOST codebook—what would become our most important artifact.

At this point, the black box of the coding CoP had only become slightly less opaque for us as new researchers, and we needed mutual engagement with brokers regularly to help make the box more transparent. During our initial coding CoP meetings, the PIs helped us to make sense of an important aspect of the joint enterprise of the CoP through the application and understanding of the coding framework. At first, we asked a lot of questions to help us determine what was in the opaque box, but after the box became a little more transparent, our questions changed to discussions with the brokers about how things should be coded. In other words, we could see into the box enough to discuss its inner workings. Through these mutual engagements, we gained a better understanding of the joint enterprise of the coding CoP.

The next step to becoming full participants in the coding CoP was for us to continue our discussions and try to reach agreements on coding the training data without the direct help of the brokers. At this point, the box had become transparent enough that we could discuss it using the codebook as our main resource. During this period, we felt that we were increasing the transparency of the box. However, our developing understanding did not mean that we had fully internalized the joint enterprise of the coding CoP and were using the shared repertoire in an authentic way. Therefore, occasional mutual engagement with the brokers was still crucial to maintain alignment with the MOST project's joint enterprise and shared repertoire. For example, as new researchers, we thought that it was always important to focus on very small details of what we were coding, but as the brokers explained, we could not do this at the expense of looking at the bigger picture. Eventually, we got to a point where we felt that the box had become transparent and the understanding of the CoP that had been captured by the codebook had been transformed back into understanding for us as new researchers. The brokers agreed that we were well on our way to becoming full participants in the coding CoP. This does not mean that the box was invisible—there were still aspects of the joint enterprise that we did not fully understand—but the box had become transparent enough that we were able to move to more central participation in the coding CoP by engaging with coding not-yet-coded data from the project.

Discussion & Conclusion

The reflections of new researchers in the MOST coding CoP revealed the process they went through during their integration into the MOST project. After developing a general understanding of the project through engaging with reifications of project work, the new researchers improved their understanding of the joint enterprise of the coding CoP through mutual engagements with each other and experienced researchers from the project. As a result of this process, these new researchers moved from being peripheral participants towards being central participants in the MOST research project. There were two significant contributors to their learning to become full participants in the MOST constellation: (1) having a rich shared repertoire, and (2) mutually engaging with the other new researchers and brokers. The rich shared repertoire in the MOST constellation helped the new researchers to gain a general understanding of the joint enterprise of the MOST constellation and the coding CoP. Their mutual engagement with the other new researchers in the coding CoP allowed them to develop their own thinking about the shared repertoire, while the mutual engagement with the brokers of the MOST constellation calibrated their shared repertoire with that of the larger project. Thus, our experiences integrating new researchers into the MOST project support Wenger's (1998) claim that participation and reification work as complementary pieces of learning. It appears that neither rich reifications nor mutual engagements of researchers are sufficient on their own to

make the box completely transparent. Rather, making the box completely transparent for new researchers requires blending the shared repertoire of the research team with the mutual engagements of both new and experienced researchers.

Our experience is an example of how Wenger's (1998) *communities of practice* ideas can be used to make sense of how to develop synergy at the crossroads that occur when new researchers become part of an ongoing research community. Applying Wenger's ideas to the MOST research project helped to integrate new researchers into our project and prepared them to be central participants in the work. We encourage other research projects to carefully design and effectively implement CoPs. Specifically, we emphasize the importance of research projects both intentionally developing rich reifications of their shared repertoire to serve as the foundation for new researchers' participation in their projects and deliberately creating opportunities for new researchers to mutually engage with each other and experienced researchers.

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