Professional Engineering Pathways Study: Using a Community of Practice Model to Propagate Findings and Engage the Community

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Angela conducts research related to water, sanitation, and child health in developing countries. Angela has extensive experience in developing survey questionnaires and conducting structured observations at the household level as a part of research studies in Tanzania, Kenya, and Bangladesh. Alongside her work in environmental engineering, Angela also conducts research related to engineering education as part of DEL group. Currently her work related to education seeks to better understand student career choices and institutional support for students in career development and career preparation. She also works on better understanding undergraduate engineering student interests, behaviors, development, and career choices related to innovation and entrepreneurship.

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Introduction

This paper focuses on the Community of Practice (CoP) element of the Professional Engineering Pathways Study (PEPS), a three-year project funded by the National Science Foundation. PEPS' aim is to build knowledge about the early-career preparedness and career decision-making of engineering undergraduates.[1]

Data about career-preparedness and decision-making is being collected at six U.S. institutions via surveys and interviews with engineering students, and with staff and faculty who influence their career decisions. We are using cognitive information processing theory [2] as a lens for expectancy value theory [3]. Other publications have discussed specific PEPS results to date [4, 5].

This paper focuses on one particular aspect of PEPS research design – the Community of Practice element that is being used as a mechanism for propagating our findings. Through the CoP we hope to engage the staff and faculty at our six partner institutions and share our results with the broader career services community.

Community of Practice

What is a Community of Practice and how are we using it in PEPS? Jean Lave and Etienne Wenger coined the phrase Communities of Practice (CoP) to describe a natural kind of learning that is social and context-dependent (situated) [6, 7]. They define a CoP in the following way:

> *Communities of practice are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly.* [8]

A community of practice has three components that develop in parallel:

- *A community – people who voluntarily interact regularly*
- *A domain – an area of shared concern or passion*
- *A practice – a set of shared stories/resources/cases/ behaviors*

What is the structure of a CoP? Wenger and colleagues [9] posited a structure that can be represented by three concentric circles (Figure 1). The inner circle represents the CoP's **core group**. These are the members who lead and help to define the direction of the community, and determine specific actions and processes with the CoP. Within the core, one person or a small group assumes the role of community **coordinator -** who takes responsibility for the health and growth of the community. In the PEPS CoP, the core group is initially comprised of the PEPS researchers, with one researcher taking on the role of the coordinator.

The next circle represents the **active group.** These are members that are the "regulars" of the community – those who can be counted on to interact and participate on an ongoing basis. In

PEPS, the active group is comprised of key members from the six partner schools. As shown in Table 1, the active members were identified during the planning stages of PEPS.

The outermost circle is comprised of the **peripheral group.** These are members who pop in and out of the community and who interact less regularly. In PEPS the peripheral group is comprised of advisors and career center personnel at other engineering institutions. And finally, outside the circle are **outsiders** –those who are not yet in the community of practice. In order to have a vibrant community, the membership of the three levels needs to dynamic. Outsiders need to keep coming into the community, and the core, active, and peripheral membership needs to keep changing. For example, if the same members continue in the core, the community can become stagnant or cliquish. If peripheral members never become active, there is no vibrancy. And if outsiders are not welcomed into the community, the community begins to shrink. Wenger stressed that there needs to be a conscious effort of the "old-timers" – members who have been around a long time and at the core or active levels - to welcome in "newcomers" – those who are just entering the community. This is an essential mechanism for revitalizing the community.

In order for the PEPS CoP to function as a mechanism for propagation of ideas and practices, it is vital that there is a flow of outsiders entering the peripheral group and that peripheral members step up to become active, and even core members of the CoP.

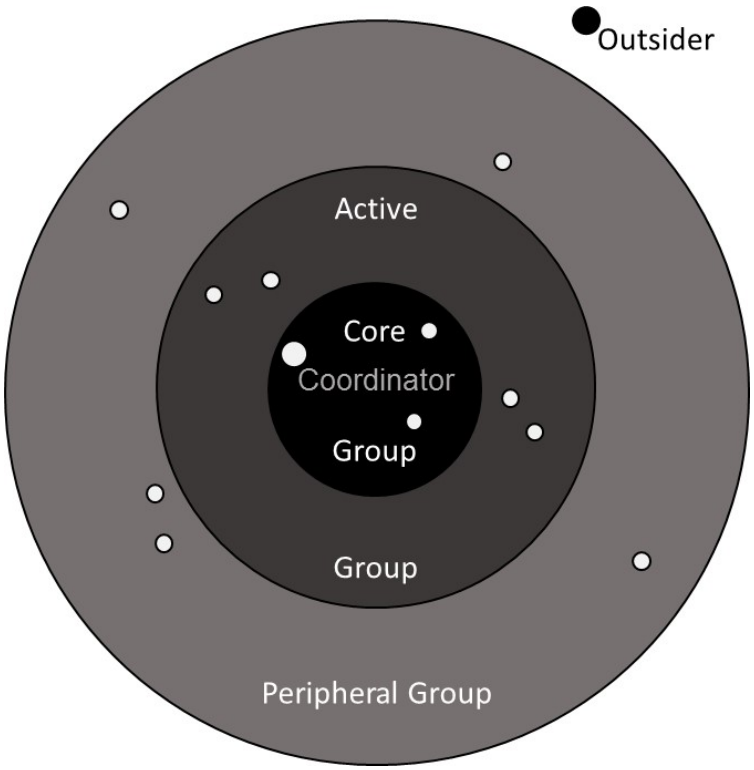

Figure 1. The structure of a Community of Practice (adapted from [9])

How we are creating a CoP in PEPS?

We looked to the definition of a CoP to establish actions the research team needed to foster a CoP within PEPS. First recall that a CoP needs to be a group of people who voluntarily interact, who share an interest in a common domain and a set of behaviors or resources within that domain. In PEPS, we are hoping to foster a CoP among professionals who support engineering undergraduates in attaining employment after graduation. These people often are working within a centralized career services office at the institution, or are academic or faculty advisors within specific engineering departments. Our first job was thus to locate people who might be in the initial active group of the CoP. The core group also needed to interact regularly with the new active group in order to bring the community together. The core group used discussions about PEPS deliverables – especially the PEPS surveys – as a mechanism both for gathering valuable input for survey development and as a reason to interact.

After potential active members have been identified, the next objective was to allow potential members to begin to coalesce around an authentic and meaningful activity. It is important that the active group decide on the target activity. They are the only ones who can truly gauge if the activity is meaningful and authentic to their practice. If there is shared interest, the CoP will continue to form organically as members work together. And the community members will be intrinsically motivated to continue interacting.

In PEPS, the active group has suggested the meaningful activity be a symposium about PEPS results and implications at a conference that is important to their community. A symposium including all six partner schools provides an opportunity for full participation of all active members and also creates a forum for comparing respective PEPS results and for discussing the implications of the those results. The venue chosen is the National Association of Colleges and Employers (NACE) , a conference regularly attended by career services personnel. Planning the NACE symposium will allow the active group to interact regularly sometimes with, sometimes without the core group to discuss the symposium. The core group will support but not lead the group.

As the symposium planning progresses, the PEPS research team will gradually move out of the core group, and active members will become the new core group. The aspiration goal is for this new core to attract new active members who will continue to interact after the project funding has ended and the research team has disbanded.

How will the CoP be evaluated? The external project evaluation team will use a two-pronged approach. The first set of the evaluation questions will focus on the NACE symposium itself. Did it occur? Who presented? What was the size of the audience? Were there any longer-term results from the presentation? For example, is there evidence that those in the audience might become active members of the CoP? The second set of evaluation questions will center on the benefits of the CoP to participants. In order to investigate benefits, the external evaluation team will interview active CoP members from the six partner schools to determine the outcomes of CoP participation and to gauge the likelihood that the CoP can become self-sustaining.

Table 1 provides a summary of PEPS activities as they relate to the formation of the CoP.

Table 1. Timeline and activities in PEPS CoP formation

Date	Activity	Function within the CoP
Summer 2014	Core members of the CoP contact potential CoP members at the six partner schools began during project planning	Core members begin to identify potential active members
Spring 2015	Initial interviews with school liaisons (Career Center directors and key staff). Learn more about active members	Strengthen relationship between core and active members
Fall 2015	Progress report on project outcomes and get input on survey dates and general kinds of questions to be investigated, collect ideas for authentic activity, gauge existing connections among active members	Begin to coalesce around an authentic activity
Summer 2016	Input on wording of PEPS 1.0 survey questions. Begin to form relationships between core and active members	Interaction between core and active members. Active members' participation
Fall 2016	Distribute PEPS 1.0 to engineering juniors and seniors at the six institutions. Collect data to help guide the practice of the active members	Gather information essential to the practice
Fall 2016	Thank yous are sent to active members. Acknowledge active members' contribution. Interaction between core and active members	Strengthen relationship between core and active members. Stimulate interest
Fall 2016, Winter 2017	Interview selected respondents of PEPS 1.0 survey.	Gather information essential to the practice
Winter 2017	Get input active members on the most useful format for PEPS 1.0 school report	Strengthen relationship between core and active members. Active members' participation
Winter 2017	Generate and distribute PEPS 1.0 school reports to active group	Strengthen relationship between core and active members
Summer 2017	Active group meets to discuss PEPS 1.0 results with the core members and with each other. What is most interesting? Most surprising? Is there additional analysis they would like to see? Begin to look at common themes and important differences.	Crucial step – interaction is stimulated among active members.
Summer 2017, Fall 2017	Core group supports the active group to coalesce around a meaningful authentic activity (NACE symposium). Core group begins to transfer coordination of the CoP to the active group.	Crucial step – active group interacts around an authentic activity that is meaningful to them.
Fall 2017	CoP writes proposal for NACE symposium. Due date is November.	Active group increases their level of leadership and continues to move toward the core of the community. Active members step up to assume "coordinator" role.
Fall 2017, Spring 2018	CoP continues to interact and discuss results and how they will use the results to inform their activities (new programs? different mechanisms for reaching their audience?)	Active group interacts on a deeper level about changing practice.
Summer 2018	Symposium at NACE	Active group becomes the new core of the CoP. Outsiders (symposium audience) are inspired to join the peripheral (and perhaps even the active group) of the CoP.

Discussion and implications

In a CoP, members are always sharing behaviors, stories, cases and resources in order to learn and to optimize their practice. In the PEPS CoP, our intention is to reinforce the use of evidence such as the PEPS data to make decisions about the operations, direction, or activities of their respective career centers. Functioning as the initial core group, the PEPS research team's primary responsibility is to provide the data the schools can use for the presentations and afterward. As the original core members of the community, PEPS researchers very intentionally build the initial community. As the active group moves into the core, the PEPS researchers will turn over the responsibility for maintaining the CoP to the new core members.

How might other projects use the CoP model? In order to foster a CoP, it is critical to provide an opportunity for people to find others who share their interests and goals and then to allow them to self-organize. A true community is voluntary and one must give potential CoP participants the time to meet as well as provide ad hoc spaces - physical and/or virtual - where two or more members can meet. A community cannot form if people cannot meet each other. Those hoping to foster a CoP need to allow the members to craft an activity or deliverable that is authentic and meaningful to them. The research team, functioning as initial core group, must then balance providing support without taking over the community. One must allow the active group to become the core group in order to maximize the possibility of a lasting and vibrant community that sustains itself after the project funding has ended.

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