Communities of practice: bridging technology and knowledge assessment

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Abstract

Introduces an assessment model being developed around a knowledge initiative in Pepperdine University's Educational Technology Doctoral program (http://moon.pepperdine.edu/gsep/programs/ET). The knowledge initiative involves the implementation of group memory technology, developed by Intraspect Software (http://www.intraspect.com), in an attempt to cultivate a community of practice in the program. The assessment model looks for indicators of communities of practice and mines for usage patterns called "knowledge transactions", as forms of measures.

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Introduction

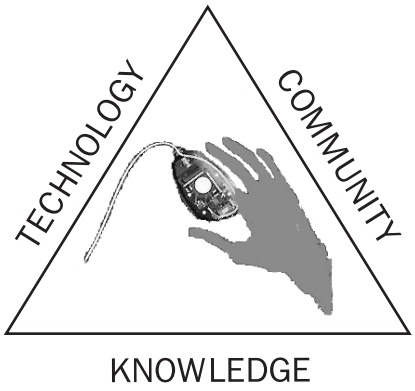
A knowledge initiative in the Pepperdine University Educational Technology (EdTech) Doctoral program has implemented group memory technology developed by Intraspect Software with the fourth cadre of a doctoral students, and their professors, into the program in an attempt to cultivate a community of practice (CoP). The goal of the Pepperdine EdTech initiative to cultivate a CoP is fostered in the belief that CoPs can function as a bridge between technology and the knowledge. Our definition of a CoP is derived from social learning theory, which mirrors knowledge management (KM) principles in that it views knowledge as something that is actively constructed in a social setting as represented in Figure 1. This parallel fortifies our contention that the ideal environments for the generation and transfer of knowledge work are CoPs.

The group memory is being implemented to capture and transfer the knowledge being generated by participants engaged in the EdTech program. Essentially the EdTech program is about exploring, utilizing and designing technologies that support teaching and learning. Consequently, it didn't take the cadre long to discover KM. The EdTech doctoral program has two major characteristics, which situate it within CoPs and KM. First, each doctoral class of approximately 23 students participates in the lock-step program as a cadre. This characteristic helps to cultivate a sense of community among the students and professors in the program, which is imperative in attempting to lead and learn across differences in time and space.

The second characteristic of the EdTech program worth mentioning is that it is 40 percent online and 60 percent face-to-face. This means that participants utilize technology not only as an object to support our knowledge work, but also as an environment in which we do our knowledge work. This became very important when implementing the Intraspect group memory technology into the program. The interface and underlying technology had to transparently support and capture our knowledge work in order to successfully facilitate, and not impede, our cultivation of community.

Journal of Knowledge Management
Volume 4 · Number 1 · 2000 · 38–43

Figure 1



Communities of practice

Communities evolve just as human relationships do. For example, each cadre exists as de-facto community on the acceptance into the program. The participants, by and large, are strangers to each other at this point but constitute a community based on shared interest, not necessarily proximity. The cadre then evolves into an intentional community when members of the previous cadres attempt to make membership into the Pepperdine EdTech community explicit through initiation, during what is referred to as "Tech Camp". Tech Camp is the first face-to-face experience of the cadre and formally begins the lock-step program. With the creation of learning teams and knowledge projects during the course of trimesters, the cadre increasingly functions as a generative learning community; where the cadre of students transform the EdTech program as much as it attempts to transform them. Now with the knowledge initiative undertaken with Intraspect software, attempts are being made to cultivate a CoP in the Pepperdine program.

Certain critical characteristics differentiate CoPs from these other forms of community. Most important for the purposes of any knowledge initiative is that in CoPs, knowledge is self-generating and perpetuating, and transfer is an intrinsic aspect of its functioning. The characteristics of a CoP, derived partially from the work of Lave and Wenger's *Situated Learning: Legitimate Peripheral Participation* (1991) are:

- common activity;
- legitimate access;
- peripheral participation;
- dynamic roles of leader and learner;
- overlap of communities of practice.

These are the characteristics that we are attempting to foster and measure in the implementation and creation of a "cadre four group memory".

Knowledge work

Before measuring any knowledge initiative, we had to decide what specific areas needed to be measured and what exactly constitutes knowledge work. The four sequential activities that constitute knowledge work as espoused in Davenport and Prusak's *Working Knowledge* (1997) are:

(1) access;
(2) generating;
(3) embedding;
(4) transfer.

We will look at each of these four sections briefly within the context of the EdTech program and CoPs.

Access

Legitimacy of access is dependent on the transparency of the access as well as the situatedness of access. While technology is commonly not transparent upon its inception, the tools being utilized for access must become second nature after a reasonable period of assimilation and sufficient training. If the training itself is not legitimate and situated within the context of the user, then legitimate access will be unavailable. We too often put people in front of a trainer and walk them through how to use the software without providing any context for its use. Intraspect software provided the cadre and professors training at Pepperdine, directly within the context and environment of our face-to-face knowledge work. This provided us access to the Intraspect trainer as well as each other during the initial implementation.

When discussing access we tend to overlook the human side of the equation, ignoring the issue of access to colleagues. Access to other people must become as transparent as the technological interface. People must be open to communicating about shared ideas and have access to these ideas and other individuals. This access is facilitated by the ability to view information, from select e-mails and newsgroup postings, URLs, documents etc. in the group memory by all cadre participants. Cadre colleagues then

Journal of Knowledge Management
Volume 4 · Number 1 · 2000 · 38–43

have access to each other's work in progress, finalized projects and posted comments and reflections. The group memory provides the cadre with access to a repository of its knowledge and augments other mediums of access such as synchronous chat, e-mail and newsgroups.

Generation

One of the main goals in any knowledge initiative is to recycle and generate new and better knowledge. In order for this to occur the proper culture must be in place. One must cultivate a sense of community that recognizes the benefit and leveraging capabilities of knowledge sharing. This is the opposite of many doctoral programs that have a culture of competition instead of a community of collaboration. This is a distinguishing characteristic of the Pepperdine EdTech program and primary indicator of the readiness of the human infrastructure for this knowledge initiative.

For knowledge to be generated, people need time to dialogue and interact. This leads to the formation of learning teams; groups of individuals that form and learn from each other based on mutual interests. This is the primary work unit of the EdTech program. This interaction is complicated by the fact that the learning teams must continue and maintain dialogue during the 40 percent online periods of the program. This speaks to the ability of the group memory to transparently support our knowledge work by providing an environment that facilitates our ability to share knowledge work during these periods of difference in time and space.

Embedding

Trying to embed knowledge in a useful form is difficult, especially when it comes to tacit knowledge. Since our memory is limited, the ability to embed what we know into cognitive artifacts can greatly enhance our abilities to recall and replicate successful practices. These artifacts are the final projects in forms of documents, URLs and presentations published by individuals and learning teams in the group memory. The process that CoP members go through in order to generate knowledge is also the knowledge you want to capture. The processes leading to the publication of final artifacts are embedded through the submission of e-mails, newsgroup postings, chat logs and drafts into the cadre group memory. The cadre group memory then acts as our repository of these embedded information processes and knowledge artifacts.

This then provides a road map of the process individuals and groups went through in generating solutions and ideas. The Intraspect group memory facilitates these knowledge connections by capturing the context (i.e. who submitted it, when was it submitted, where in the group memory it resides) of submissions to the group memory in addition to the submission itself. Keep in mind that the information and processes mapped from these contexts still don't constitute knowledge for someone else. This information must be transferred in order for the knowledge work to be complete. One without the other is of little use.

Transfer

Knowledge transfer is the last of the sequential knowledge work activities and the one that KM assessment is most concerned with. We previously discussed how the self-generating and perpetuating characteristics of CoPs make it an ideal environment for knowledge transfers. Table I represents some ways in which knowledge are transferred in a CoP.

Under close inspection it is revealed that these situations of transfer within a CoP actually mirror the sequential knowledge activities as outlined by Davenport and Prusak. This revelation is a convincing reason that CoPs are an ideal human infrastructure to cultivate around technologies that attempt to capture knowledge work. These transfer situations within a CoP then become an important aspect of our assessment model.

We will be discussing the assessment in three sections. First, the overall model of the assessment which shows a systems view of where the knowledge transfer is occurring and how we translated that into measures. Then the indicators and patterns we are using to

Table I Knowledge work in communities of practice

Knowledge transfer in CoPs	Sequential knowledge work activities
Apprenticeship	Access
Transformational displacement of leader and learner	Generating
Cognitive artifacts	Embedding
Overlap of CoPs	Transfer

Journal of Knowledge Management
Volume 4 · Number 1 · 2000 · 38–43

discriminate from the information generated by and contained within the group memory.

Assessment model

Our model (see Figure 2) is based on assessing the impact the Intraspect group memory has on cultivating a CoP in the Pepperdine EdTech program. We have attempted to gather our data in two ways. First we mined the EdTech group memory for usage patterns that we refer to as "knowledge transactions". These usage patterns parallel the sequential activities of the knowledge process and capture our use of technology as an environment in which to do our knowledge work. Second, we developed surveys that gather attitudinal and usage data before and three months after the initial implementation of the group memory into the EdTech program. We assessed the results of these surveys for indicators of CoP cultivation, which captures our use of technology as a tool to support our knowledge work. We intend to continue gathering subsequent usage patterns and attitudinal data in three-month increments. This model gathers data and information from both sides of the knowledge initiative, the attitudes and usage patterns espoused by the users and the data-processing capabilities of the technology.

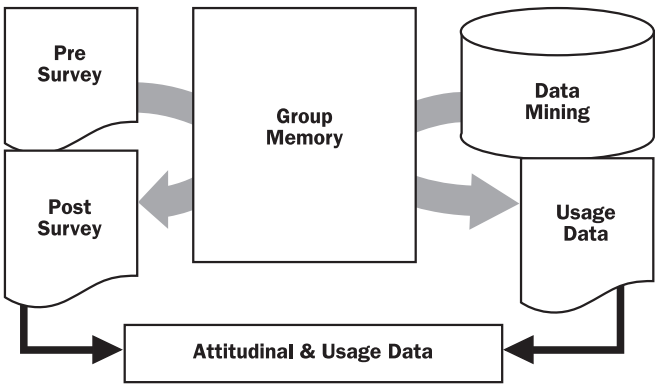
Attitudinal data

In taking an attitudinal survey, one is trying to determine some characteristics that might not be shown by data analysis alone. In developing KM principles the human factor is tremendously important. It is important to develop a sharing culture thus it is important to gauge where the current culture stands in terms of satisfaction, self efficacy, and transparency of not only the technological tools being used for knowledge capture, but also the human factors involved in the knowledge sharing process. Community members must feel satisfied in the major areas of access, legitimacy, training, etc. Self-efficacy is important in terms of developing a generative community in which every member feels important and a viable contributor to the community's knowledge. Transparency speaks to the technology being utilized as well as to the transparency available in the process of knowledge sharing.

If you can gauge how members of the community feel about these three areas, you will get a good understanding of how successful KM and CoP characteristics are being implemented from the human side. The questions included in our survey with their corresponding results are represented in Table II.

These questions were pertinent to our situation. Each organization needs to develop their own set of attitudinal questions to evaluate their own community members. You are simply trying to take the temperature of community members, much like sticking your finger into the wind to get a feel for what is going on. These numbers would tend to show that our cadre has the proper culture in place to successfully implement a knowledge management initiative.

Figure 2 Assessment model



Usage patterns

For our usage patterns we used a data-mining tool normally used to mine e-commerce Web-sites. This coupled with the advanced search capabilities of the Intraspect group memory yielded us the majority, but not all, of the necessary data for the measure. Usage data gave us very raw indicators of information exchange. Sifting through this data for patterns provided us indications of "knowledge exchanges". Its value alone is not enough to determine the success of our knowledge initiative. However, it definitely can determine whether or not information is becoming more accessible and if it is actually being looked at and applied within a different context than it's point of origin. In mining the usage data we look for the four measures shown in Table III, which mirror the four sequential activities of knowledge work.

Viewed collectively, a "knowledge transaction" can be inferred from this group

Journal of Knowledge Management
Volume 4 · Number 1 · 2000 · 38–43

Table II Attitudinal survey results

	Yes	Somewhat	No
Do you feel encouraged and/or rewarded to work with your fellow cadre members and share your knowledge with them?	85%	15%	0%
Does the EdTech program do a good job in facilitating or fostering a sharing environment or culture?	80%	20%	0%
Do you feel comfortable sharing your knowledge or information with other cadre members?	80%	20%	0%
Do you feel comfortable utilizing the available technologies in sharing information and knowledge with cadre members?	65%	30%	5%

Table III Knowledge transactions

Knowledge transfer in CoPs	Sequential knowledge activities	"Knowledge transactions"
Apprenticeship	Access	Requests
Transformational displacement of leader and learner	Generating	Revisions
Cognitive artifacts	Embedding	Publications
Overlap of CoPs	Transfer	References

memory usage pattern. This usage pattern inference could be applied to any group memory, data warehouse or database technology. The data we needed and how we attempted to derive it are as follows:

Requests
This aspect of the measure speaks to the accessing of the information contained in the group memory. Our total number of visits was 1,066 and we can allocate them among participants through the IP addresses listed in the mining report.

Revisions
This aspect of the measure speaks to the generation of new information residing within the group memory. This was derived by the advanced search capabilities of Intraspect, not the mining report. Revisions refer to the number of group memory items "modified" by an individual. Performing an Advanced search "By someone whose name matches <insert user name> who is the modifier" yielded the necessary data.

Publications
This aspect of the measure speaks to the embedding of information into the group memory. Performing an Advanced search "By someone whose name matches <user name> who is the creator" yielded the necessary results. It would have been useful if this data could be derived collectively, i.e. the number of total items residing in the group memory.

References
This aspect of the measure speaks to the transfer of information within the group memory. We can rudimentarily begin to move towards this by looking at the mining report section, which shows that the Intraspect search capability was used 586 times. This speaks to transfer insofar as one assumes the access was situated enough that the user was looking for information needed for application outside of the group memory. Ideally this item would speak to the number of contexts a single group memory object resides in. However, we found nothing in the mining report or in the Intraspect search capabilities, which could yield this information at this time. It would also be beneficial if in addition to the "Tell people" command in the group memory there was a "Who knows about this" command in the Intraspect interface which could then add transparency to such exchanges.

As you can see, the mining alone does not supply the data for the measure. Coupled with the advanced search capabilities of Intraspect it comes very close. Each of these four sections alone represents information, but by viewing them collectively a knowledge transaction can be inferred. Ideally, each group memory object could be tracked during these exchanges but technical limitations on data acquisition forced us to track the user and not the object transaction, although we do believe that the latter is where the measure should be evolving. This knowledge measure would be much more legitimate if we could track group memory objects through the process of the transaction (request, revise, publish, refer) and not the user as we are now doing. With Intraspect assigning every group memory object a unique e-mail address, this object tracking is highly feasible given the

Journal of Knowledge Management
Volume 4 · Number 1 · 2000 · 38–43

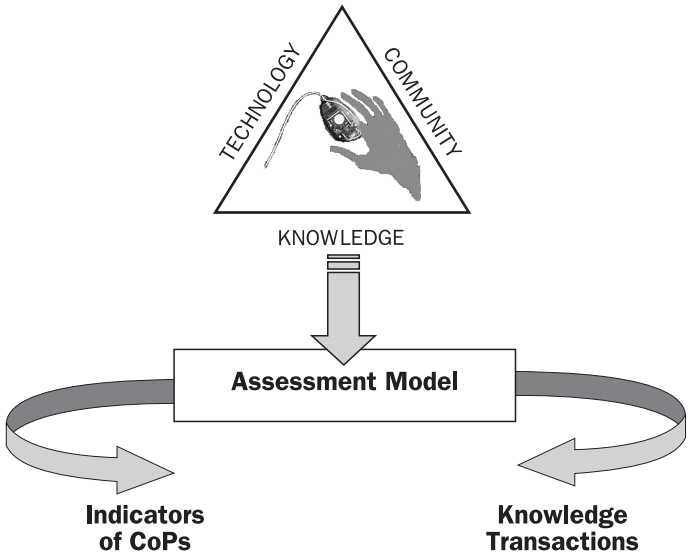
development of an adequate mining tool. Then tracking the usage of the actual intellectual property, the transformation of information into knowledge by the completion of the sequential transaction process could be inferred.

What was of unexpected interest is that when we matched the modification and creation numbers by users, an interesting result emerges. Some people may have had contributed no documents to the group memory but modified a dozen other documents contributed by another user. This shows that the user expanded on others' information and from that a knowledge exchange may be inferred. The aggregate results are shown in Table IV.

Table IV Aggregate results

	Number of:				
	Requests	Revisions	Publications	References	Modified others' creations
Total	1,066	1,048	1,056	Unable to derive	60

Figure 3



Conclusion

For successful KM implementation, one must look at the human side as well as the data side of the equation. If KM is to be implemented, it can only be done so successfully if a CoP is in place. Understanding the key characteristics of a CoP is imperative for successful KM. As such, a means for measuring KM initiatives is to look for indicators of CoP cultivation and specifically for initiatives involving group memory technologies and principle patterns which reflect the completed cycle of the knowledge work process (as shown in Figure 3).

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