Organizational Learning in STEM Education Contexts: Analyzing the "Stickiness" of High Impact Practices

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ABSTRACT

This research initiative addresses problems involving how higher educational institutions acquire and disseminate knowledge, with emphases on knowledge about the effectiveness of high impact practices (HIPs) and the concept of "stickiness" (Szulanski, 2003). HIPs, which include such activities as capstone experiences and internships, have been shown to have considerable impact on the overall quality of the academic experiences of undergraduates although their importance is often overlooked and systematic accounts rarely retained and shared. This initiative outlines and expands the notion of stickiness, a construct that incorporates insights from knowledge transfer milestones and communication theory, and applies it to the context of STEM (science, technology, engineering, and mathematics) education. The notion of stickiness captures the ability of some kinds of knowledge to be more easily transferred among organizational units. The research is applied to the problems of developing an "HIP Toolkit" to exchange knowledge about HIP as well as evaluating social network infrastructures for knowledge transfer. The literature on organizational learning shows how practices labeled as "failures" are often forgotten, leading to repetition of mistakes in contexts of critical importance. This research initiative extends the stickiness notion with analysis of differences in knowledge transfer of HIP failures as well as successes.

Keywords: STEM, Conference Proceedings, Critical Thinking, Change Management

INTRODUCTION

The management and transfer of knowledge about effective practices in organizations have been expanding areas of research in education as well as in such contexts as health sciences, public administration, and manufacturing (Elwyn, Taubert, & Kowalczuk, 2007; Turner & Carriveau, 2010). Valuable knowledge pertaining to the success or failure of particular practices can be effectively hidden if not disseminated in timely ways to the units in which it is needed. This research initiative addresses specific problems involving how higher educational institutions handle knowledge about the effectiveness of high impact practices (HIPs) with an emphasis on STEM (science, technology, engineering, and mathematics) contexts. The notion of "stickiness" used in this research is rooted in the work of Szulanski (2003) and Van Hippel (1994). One of the major outcomes of the Szulanski and Van Hippel approach is that the motivation of receivers of knowledge is generally less responsible for problems in terms of knowledge dissemination than are factors involving the knowledge itself (as outlined in the next section). Focusing on these latter factors can facilitate development of systems for dissemination of knowledge about HIP successes as well as failures, helping organizations gain from hard-won and often expensive experience.

Consider the experiences of individuals who are taking classes in STEM areas. They will be exposed to many hours of classroom time and lab work. The amount of time that they will spend on HIPs will generally be a fraction of their total educational experiences. However, this relatively-small investment in time can have considerable return. HIPs include internships, guest speakers, and field experiences as well as online simulations (Annetta, 2012; Kuh, 2008). HIPs that are rooted in STEM content are particularly problematic to share

among organizational units because of their specialized nature, often increasing difficulties of capturing and transferring accounts of their impacts to various audiences (Drew, 2011).

What is "Stickiness"? Can the Notion Enhance Development of Knowledge Systems?
The term "sticky" has been related to information and knowledge in an assortment of ways, including the concept of "sticky ideas" (ideas that are especially memorable) as portrayed in Heath and Heath (2007). The kind of stickiness outlined in this research is of a different variety, however: sticky knowledge of the sort described by Szulanski stays in a restricted organizational context and may not flow to units where it could potentially be of value. Szulanski's analysis outlines how factors such as causal ambiguity, unproven knowledge, motivation of source, credibility of source, recipient motivation, recipient absorptive capacity, recipient retentive capacity, and organizational context can play a role in how or whether knowledge is transferred in timely and appropriate ways from one unit to another.

   This research initiative uses a system modeling approach to map the potential stickiness of knowledge about HIPs in STEM contexts toward the end of increasing the flow of knowledge between and among organizational units. The analysis is aimed toward the design of social network platforms to support academic institutions. In the case study outlined in this research, this platform is called a "HIP Toolkit." The unit of emphasis for this research is the academic department although the design methodology employed can be utilized at a variety of organizational levels. Examination of the capabilities of various online collaboration platforms to support knowledge transfer efforts about positive as well as negative outcomes is also a major outcome of this research. Valuable organizational knowledge is lost when only information about organizational successes is retained and less successful efforts are forgotten or even erased (Nonaka & Takeuchi, 1996). Online collaboration platforms can change features and participation over time, so their use in long-term organizational memory can be problematic, an issue also addressed in this initiative. Such social media strategies as "crowdsourcing" (Howe, 2008) will be explored for their relation to idea stickiness.

Case Study from a University Setting: Developing the HIP Toolkit
This research initiative outlines in depth the methodology behind the development of an online HIP Toolkit for organization and subsequent dissemination of knowledge related to specific HIP activities. The toolkit is specifically designed to benefit from the research on stickiness previously outlined. It is designed in the context of STEM education and captures information that relates to the complex dimensions of this area. The toolkit development process as well as the toolkit itself will be described and diagrammed in the presentation.

REFLECTIONS AND CONCLUSIONS

Knowledge about the successes and failures of HIPs is critically important, given the practices' well-documented positive influence on student outcomes (Brownell & Swaner, 2010; Kuh, 2008). Exchange of this knowledge is thus important to facilitate, despite the complexities involved in knowledge-related organizational interventions. The literature on organizational learning provides insight as to how HIP-related knowledge can be more easily shared. This research initiative gleans insights from this literature to develop a systems approach to organizational learning and knowledge transfer issues, specifically applying the "stickiness" approach to technological aspects of social network support. It provides a case study of an academic department developing a methodology for capturing and analyzing knowledge about HIP-related activities. The methodology developed to design the "HIP toolkit" has application beyond the specific departmental and curricular context. The toolkit

offers structured ways to retain and process information related to HIP development and implementation (both successes and failures), with an emphasis on the potential for knowledge sharing and exchange among departmental units. This research also addresses the difficulties of constructing appropriate technological infrastructures for organizational memory, providing a critical analysis of online collaboration platforms.

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