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Participation in virtual academic communities of practice under the influence of technology acceptance and community factors. A learning analytics application

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ABSTRACT

Participation in virtual communities of practice (vCoP) can be influenced at the same time by technology acceptance and by community factors. To overcome methodological issues connected with the analysis of these influences, learning analytics were applied. Based on a recent vCoP model, the collaborative dialogue comprising 4040 interventions in 1981 messages created by a vCoP located at a US American online university was automatically analyzed. The text-based asynchronous online discussions were scored using a cohesion-based participation and collaboration analysis. Additionally, a sample of $N = 133$ vCoP participants responded a technology acceptance survey. Thus, a combined research model including the vCoP model and an established technology acceptance model was verified. The results confirmed the vCoP model entirely, and the acceptance model only partially. As consequence for educational research, the CoP model was confirmed and extended to vCoP settings, while the acceptance model appears to need reconsideration. For academic practice, the study initiates the development of assessment tools fostering knowledge sharing through dialogue in vCoP. Also, it suggests how virtual classrooms can be extended to open spaces where value creation takes place through social learning. Learning analytics proved thus successful, provides information that impacts both theory and practice of technology-enhanced learning.

1. Introduction

Communities of practice (CoP; Wenger, 1998) are effective environments of knowledge sharing and knowledge creation (Paavola, Lipponen, & Hakkarainen, 2004), therefore participation in CoP is desirable for many academic activities. In many cases, participation can be mediated by communication technologies, (e.g., when CoP are geographically distributed), thus building the so-called virtual CoP (vCoP; Stewart, 2010). In vCoP, participation takes place by means of technology. Hence, it may be influenced both by technology acceptance and by community factors. In the research literature, there are several examples of acceptance studies conducted in vCoP (e.g., Park & Yang, 2012), a few examples of quantitative studies in vCoP (e.g., Ma & Yuen, 2011), and insufficient examples of studies where the combination of acceptance and community factors is examined. Methodologically, such combined analysis is somewhat problematic. Besides the conceptual and empirical aspects of acceptance research criticized by Bagozzi (2007) and illustrated by all articles in this special issue, quantitative CoP and vCoP research may imply content analysis of large interaction data sets, which is effortful and susceptible to subjectivity. Especially "higher education, a field that gathers an astonishing array of data about its 'customers,' has traditionally been inefficient in its data use, often operating with substantial delays in analyzing readily evident data and feedback" (Siemens & Long, 2011).

A possible solution of this problem is offered by learning analytics, i.e. the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs (Siemens & Gasevic, 2012). Online social learning such as that

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taking place in vCoP sets a particular context of learning analytics (Buckingham Shum & Ferguson, 2011) from which the discourse-centered learning analytics emerged (De Liddo, Buckingham Shum, Quinto, Bachler, & Cannavacciuolo, 2011), which appears as a promising approach for identifying patterns of activity that correspond to meaningful learning and knowledge construction. However, developing and validating such procedures is still at the very beginning. Applications of learning analytics in educational studies of vCoP are still needed to prove its assumed potential for educational research.

Against this background, the study at hand aims to apply learning analytics in a vCoP context to verify a research model combining the CoP (Nistor & Fischer, 2012) and the acceptance model (Venkatesh, Morris, Davis, & Davis, 2003; Venkatesh, Thong, & Xu, 2012). The resulting insight in the quantitative relationships of vCoP variables may contribute to the development of innovative instructional models and automated tools for fostering vCoP.

The remainder of this paper is organized as follows. The theoretical section gives a brief overview of the addressed concepts and models of CoP and technology acceptance research, concluding with the research model and the research questions of the presented study. Further, the empirical section describes the employed research methods along with their results. Finally, the results are discussed and conclusions pertaining to educational research and practice are drawn.

2. Theoretical background

2.1. Communities of practice

Communities of Practice (CoP) are groups of people sharing goals, activities, and experiences in the frame of a given practice over lengthy periods of time (Wenger, 1998). Participation in a CoP leads to the accumulation of experience, stimulates the social construction of knowledge and the development of expertise (Paavola et al., 2004), hence, making it particularly interesting for educational research and practice.

In a CoP, expertise and expert status define the identity of the CoP members. Wenger (1998) describes a core-periphery social structure, distinguishing between central and peripheral community members. Members with higher expertise are involved in more activities, especially in those with a higher degree of difficulty and responsibility. The central members of a CoP not only possess superior knowledge and skills, but also are socially recognized as experts. Thus, expert identity is the result of negotiation with and recognition of other CoP members, which takes place in the context of participation and dialogue. Hence, experts are also successful negotiators in their social environment, and can sustain high quality dialogue within the community practice. In line with these observations, the quantitative CoP model proposed by Nistor and Fischer (2012) maintains that expertise has a strong and positive influence on participation in CoP. Moreover, the quality of the community dialogue directly reflects participants' expertise, hence impact their participation intensity.

A CoP member's expert status can be measured through social network analysis, determining a member's so-called centrality, defined by mathematic formulae expressing the relationships within the social network (Borgatti, Mehra, Brass, & Labianca, 2009). The activity in a social network can be graphically represented as a collection of nodes (persons) and arches (relations between persons). The "betweenness centrality" of a node is defined as the number of shortest paths connecting all nodes with each other and passing through that node (Freeman, 1977). Employing social network analysis, the quantitative CoP model (Nistor & Fischer, 2012) highlights a positive influence of expertise on expert status, mediated by participation.

2.2. Educational technology acceptance

When technology is employed to mediate communication in CoP and community practice, it is reasonable to assume that successful vCoP activity requires in first place the acceptance and use of technology. A prominent acceptance theory is Venkatesh's Unified Theory of Acceptance and Use of Technology (UTAUT; Venkatesh et al., 2003, 2012) that explains the use of educational technology under the influence of use intention, further determined by performance and effort expectancy, and social influence. Additionally, facilitating conditions and computer anxiety (Nistor, Lerche, Weinberger, Ceobanu, & Heymann, 2012) directly affect the use of educational technology.

A critical review of technology acceptance models including UTAUT was done by Bagozzi (2007) who observed the oversimplifying, unidimensional definition of acceptance. This may be adequate for the study of some information systems, but gives insufficient consideration of learning and collaboration aspects. Furthermore, Bagozzi argued that "the intention-behavior linkage is probably the most uncritically accepted assumption in social science research" (p. 245). While many studies regard technology use intention as the most representative acceptance indicator and ignore the actual use behavior, the few studies that include use behavior mainly relay on self-report (Turner, Kitchenham, Brereton, Charters, & Budgen, 2010), so that the intention–behavior correlation may be inflated by common methods variance (Podsakoff, MacKenzie, & Podsakoff, 2012). Correspondingly, Nistor et al. (2012), as well as all articles in this special issue, found weak or non-significant effects of participants' technology use intention on their actual use behavior. Besides common methods variance, there are several possible explanations for the non-significant influence. For example, the UTAUT2 model (Venkatesh et al., 2012) implies that moderator variables such as experience can lead to weaker intention–behavior effects if users have much experience in using the examined technology. Another reason may be the cultural influence described by Nistor, Göğüş, and Lerche (2013), who suggest a direct influence of cultural masculinity and individualism (sensu Hofstede, 2001) on technology use behavior. Nevertheless, the UTAUT seems to provide a robust and reliable model that can be used to gain deeper understanding of technology acceptance in various contexts.

3. Research model

Against the presented theoretical background, a combined research model including the UTAUT (Venkatesh et al., 2003, 2012) and the CoP model (Nistor & Fischer, 2012) is depicted in Fig. 1. Accordingly, this study aims to answer the following research questions:

RQ1 (acceptance model verification): To what extent do acceptance factors (technology use intention, performance expectancy, effort expectancy, social influence, facilitating conditions and technology anxiety) predict participation in vCoP?
RQ2 (CoP model verification): Does participation in vCoP significantly mediate the influence of expertise on expert status?

4. Methodology

4.1. Population and sample

A correlational study was conducted in the vCoP of an online university located in the United States. The university provides a diverse community of career professionals with the opportunity