Online Conceptual Artefacts
and Their Acceptance Among Adult Users

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Abstract: Adult learning is largely based on informal interactions between members of communities of practice (CoPs), which result in the collaborative construction of meaning, knowledge creation and, at individual level, the acquisition of skills and applicable knowledge. Due to these advantages, CoPs appear to be recommendable environments for continuing education; however, corresponding pedagogical instruments are hardly available. A possible method of fostering CoPs and supporting knowledge sharing may be to offer CoP members appropriate cultural or conceptual artefacts. Addressing this need, the contribution at hand first defines CoPs and conceptual artefacts, showing how artefacts are an organic part of the socio-cognitive activity at three levels: (1) communication between CoP members, (2) knowledge construction and help seeking in the frame of community practice, and (3) knowledge reification, artefact development and collective memory synthesising basic knowledge, interaction rules and values of the CoP. The article further describes the acceptance of technology-based conceptual artefacts against the background of current technology acceptance models. According to these, the acceptance of conceptual artefacts is influenced by CoP members' performance and effort expectations, and by the CoP environment, which includes social roles and social influence; members' expectancies are further influenced by the perception of online seeking problems. In conclusion, this contribution shows how offering appropriate conceptual artefacts may be a means of fostering CoPs, and suggests consequences for the practice of workplace learning in academic environments and for supporting CoPs by developing online help seeking systems and shaping the interaction between community members.

Key words: communities of practice, academic help seeking, cultural artefacts, conceptual artefacts, technology acceptance

I. Introduction

Adult learning is largely based on informal interactions between members of a community of practice (CoP)(Boud & Middleton, 2003; Eraut, 2004), such as help seeking and help giving while solving current problems of the community practice (Mäkitalo-Siegel & Fischer, 2011). This is how learning becomes situated in a socio-cognitive context, which results in the collaborative construction of meaning (Lave & Wenger, 1991; Wenger, 1999), knowledge creation (Bereiter, 2002; Paavola, Lipponen & Hakkarainen, 2004) and, at individual level, the acquisition of skills (Dochy, Segers, Van den Bossche & Gijbels, 2003) and applicable knowledge (Reinmann-Rothmeier & Mandl, 2001). Although these advantages call for a wider educational use of CoPs, specific fostering methods are yet hardly defined. Nistor (2010) suggests that providing appropriate artefacts may be an effective method to initiate and sustain knowledge sharing in CoPs. This contribution examines the ways in which conceptual artefacts are integrated in the socio-cultural activity of CoPs, and which factors

have an impact on their acceptance and use in CoP practice.

This article first defines CoPs (Lave & Wenger, 1991; Wenger (1999) and conceptual artefacts (Bereiter, 2002). Subsequently, it proposes a theoretical frame describing three levels of socio-cognitive activity in CoPs, integrating artefacts production and use, and the help-seeking approach (Mäkitalo-Siegel & Fischer, 2011; Mercier & Frederiksen 2007; Puustinen & Rouet, 2009). Next, the article discusses the acceptance of technology-based conceptual artefacts against the background of current technology acceptance models. In conclusion, this contribution further develops the idea that offering appropriate cultural artefacts may be a means of fostering CoPs (Nistor, 2010), and indicates several factors influencing the acceptance of these artefacts. For education, this implies several measures with respect to learning and knowledge sharing at workplace, especially in academic environments.

II. Communities of practice and cultural artefacts

Two decades ago, educational scientists rediscovered the meaning and importance of the social context of learning. Brown, Collins and Duguid (1989) published a manifest in which they argued that knowledge is always situated in a socio-cultural context, in the centre of which they positioned practical activities. At the same time, Resnick, Levine and Teasley (1991) emphasized the importance of socially shared cognition as a ground for, and as a result of collaborative activities. The link between social environment, i.e. community (Bessant, 2010), and knowledge-building was further explored by Scardamalia and Bereiter (1994), who made one of the first attempts to bring knowledge communities into school. In time, further types of knowledge communities were conceptualized and developed in the context of formal education, including communities of inquiry (Garrison & Arbaugh, 2007) communities of innovation (West & Hannafin, 2011), and several others, all of these involving students of various age. The learning approach aims at cultivating collective expertise within knowledge-practice networks and knowledge creation (Hakkarainen, Lallimo, Toikka & White, 2011).

The particular case of communities of practice (CoPs) was defined from anthropological perspective by Jean Lave and Etienne Wenger (1991). According to them, CoPs are groups of people, i.e. mostly adult participants with common goals and activities, engaged in problem solving and help seeking. CoP members maintain contact over periods of time longer than those needed for asking a question or solving a problem, while sharing experience and knowledge activities (Lave & Wenger, 1991; Wenger, 1999). Wenger (1999, p. 72) considers on-going practice to constitute a fundamental dimension of CoPs. Together with mutual engagement and shared repertoire of community members, practice represents the source of coherence within a community.

The activity theory (Engeström & Sannino, 2010) regards the interactions between subject (CoP members) and object (products of community practice) as mediated by tools and signs, which can be further regarded as cultural artefacts, i.e., material or immaterial objects "from entries in a journal to historical records, from poems to encyclopaedias, from names to classification systems, from dolmens to space probes, from the Constitution to a signature on a credit card slip, from gourmet recipes to medical procedures… etc." (Wenger, 1999, p. 59) with a specific meaning in practice context. In their position as tools, artefacts facilitate certain activities, while making others more difficult or even impossible.

Nistor and Lipka-Krischke (2011) observe that cultural artefacts comprise fixed and adaptable components, which correspond to the canonical, and respectively to the negotiable knowledge involved in the social practice where the artefact is used (A. Assmann, 2008). The use of cultural artefacts may thus be dichotomized in an exact, appropriate use in a sense largely shared by the community, and a creative use in a sense shared by a limited number of community members. Further, Nistor and

Fischer (2012) bring empirical evidence of the interconnection between members' participation in CoP and their access to artefacts. Accordingly, peripheral CoP members have limited access to artefacts (Lave & Wenger, 1991), meaning that they need first a certain amount of specific knowledge allowing them to perceive, understand and use the artefact "as it is", whereas central and regular CoP members possess knowledge and experience, and have a status in the CoP that allow them to further develop artefacts by integrating additional knowledge of the community practice. Corroborating these findings, Nistor (2010) claims that offering appropriate cultural artefacts may be a means of fostering CoPs.

Bereiter (2002, p. 75) defines conceptual artefacts, a special case of cultural artefacts, as immaterial, abstract artefacts that explain and predict the surrounding world. He emphasizes that conceptual artefacts can be improved by re-shaping them in concordance with negotiation of meaning and the knowledge constructed in the process of participation. In learning sciences research, Weinberger, Ertl, Fischer and Mandl (2005) investigate external knowledge representations, and make a difference between two kinds of learning scripts: at epistemic level, contents processing scripts comprise describing, explaining, predicting, arguing, evaluating, explicating and defining concepts (Zenios, 2011); at metacognitive level, e.g. social scripts induce collaboration of a specific kind, defined by the didactics of the learning environment. Weinberger et al. (2005), as well as Ertl, Kopp and Mandl (2008) show that learners particularly benefit more from epistemic scripts than from social scripts.

A simple example illustrates the notion of (technology-based) conceptual artefact, and the way in which artefacts are used in CoPs. In the early times of the Internet, virtual communities (Rheingold, 1994) used FAQ collections, which listed the most frequent questions that were asked e.g. in a newsgroup. FAQ lists were usually posted on a regular basis (e.g. monthly, or whenever needed) to the group by a moderator. Instead of answering a newcomer's question, oldtimers could thus save time by simply referring to the FAQ list, for which they even developed a special acronym, RTFAQ (Read the Frequently Asked Questions). Later development of the Internet, especially in the frame of Web 2.0 (O'Reilly, 2005), included platforms such as Wiki, where common knowledge was written, negotiated and published on the Internet. Thus, the moderators of virtual communities had no longer to extract material from the group discussions and regularly post it to the community; the platform design included structures that performed this functions.

III. The socio-cognitive activity in communities of practice

Community practice includes socio-cognitive activities of diverse complexity and difficulty, in which CoP members make use of cultural artefacts. Socio-cognitive activity in CoPs can be classified on three levels, according to the corresponding requirements and, respectively, to the degree in which CoP members with different status and practice-related expertise are involved: (1) communication, (2) help-seeking and knowledge construction, and (3) artefact development and collective memory.

1. Activity level 1: Communication

Communication is a basic process taking place in groups, and particularly in CoPs. The simple exchange of information is usually described by communication theories (e.g., Watzlawick, 1967) in terms of messages transmitted from a source or sender to a receiver via a communication channel. The communication channel may consist of face-to-face social contact or printed or electronic media. The basic activity in CoPs relies upon community members with different levels and forms of knowledge asking questions and receiving answers. This is generally possible and usual at all levels of participation, although, visitors' and beginners' access to a community and its knowledge can be

sometimes restricted (e.g., Merriam, Courtenay & Baumgartner, 2003).

Communicative knowledge construction was first the object of psycholinguistic approaches such as the grounding theory (Clark & Brennan, 1991; Schegloff, 1991), which refers to the construction of a shared knowledge background or (common) ground. This is often reflected in communication partners posing and answering simple questions and negotiating the meaning of things (Wenger, 1999, p. 52). Once the negotiation of meaning has been completed, shared knowledge not only means that everybody has roughly the same knowledge and a similar understanding of a given topic, but also that the involved persons are aware of the common ground.

2. Activity level 2: Knowledge construction and help-seeking

Knowledge construction in CoPs encompasses the exchange, negotiation, and creation of complex knowledge in complex environments. These processes can be regarded as everyday practice and particularly involve the regular members and sometimes also the experts of a community. They can also take various forms; one of these is initiated by help-seeking, a resource-based learning strategy requiring interaction with persons expected to be more knowledgeable. The interaction can be direct or computer-mediated such as in online help systems (Mäkitalo-Siegel & Fischer, 2011; Puustinen & Rouet, 2009).

Based on collaborative learning in pairs, Mercier and Frederiksen (2007) propose a help-seeking model in five steps: (1) Recognition of an impasse indicates that a relevant task cannot be successfully completed, which leads to the awareness of need for help. (2) Diagnosis of the origin of the impasse leads to a specification of a need for help. (3) Consequently a help goal is set. (4) The learner looks for appropriate help. Help is appropriate if it enables the learner to complete the task. This implies that the learner is able to comprehend help content. (5) Evaluating the received help completes the process. Help-seeking behaviour may be initiated by goals and activities, which are part of a wider practice, and that the actors are integrated in a larger social context, as conceptualized by Lave and Wenger (1991). Both the overarching practice and the social context may decisively influence help-seeking behaviour.

Obviously, knowledge construction is not accessible to all CoPs members in the same way and to the same degree. While regular members and experts participate, reify their experience, and continuously construct knowledge, beginners must first absolve a cognitive apprenticeship (Collins, 2006). They adopt the role of observers, while other community members with greater expertise model certain procedures for them; they learn to understand and use specific artefacts to accomplish certain practices while performing a specific discourse (Lave & Wenger, 1991).

3. Activity level 3: Artefact development and collective memory

Wenger (1999, p. 63) regards the production of cultural artefacts in CoPs as reification of knowledge, and the duality of participation and reification as the key to learning processes in CoPs. Reification must be understood in this context as representation, or concretization of knowledge related to community practice, resulting in a material or immaterial artefact. Through participation, knowledge is constructed and reified. Conversely, reified knowledge enables further participation. CoP members thus continuously add new knowledge and meaning to existing artefacts (Bereiter, 2002).

At a larger scale, the theory of collective memory (Halbwachs, 1994; also A. Assmann, 2008; J. Assmann, 2008; Harris, Paterson & Kemp, 2008) explains the storage, recollection, and transmission of the most important values of mankind, tradition, and culture, which overarch the individual memory and lifetime. Collective memory is approached similarly to individual memory. Items of information are transferred from short-term into long-term memory via repetition and elaboration. A difference is, however, to be found in the fact that collective memory comprises the preservation of knowledge

that is relevant to large groups of people. If certain items of knowledge are particularly relevant to the group, group members may initiate repetition and elaboration. In this way, individual memory contents are negotiated, socially shared, and finally transferred to the collective memory. Therefore, collective memory can contain fixed or canonical knowledge, as opposed to negotiable knowledge. The processes of memorising and remembering are mostly ritualised and institutionalised (e.g., in the form of school classes, religious services, or cultural events). The community's value system and the form of the rituals performed define the community's identity.

Returning now to CoPs, communities will produce artefacts emerging from their most frequent and important activities. According to Jan Assmann (2008), so-called landscapes of memory, such as monuments, temples, churches, museums, theatres, concert and conference halls, libraries, and schools, or even whole cities, represent sites of cultural rituals that embody references to highly significant events, personalities, or to Wenger's (1999) "ways of doing things", all of which in turn define the cultural identity of the community.

At first sight, the contents of cultural memory are readily accessible to all. It is, however, particularly difficult for new community members to understand all aspects of the respective culture and to apply them in the right way, at the right time and in the right context. It is even more difficult for them to significantly contribute new knowledge to the collective memory. We may thus suppose that adding meaning to, or changing the contents of cultural memory is reserved for members with central participation (Nistor & Fischer, 2012).

IV. Acceptance of technology-based conceptual artefacts

The socio-cognitive activity described above is largely based on the use of cultural and conceptual artefacts. This is only possible if CoP members accept and adopt the artefacts, and make them an organic part of the individual activity and community practice (Rogers, 1995). Acceptance is critical when the artefact is new to the community, or when new members enter the CoP. Understanding the factors that have an influence on the acceptance of cultural and conceptual artefacts may contribute to the repertoire of methods fostering CoPs in educational practice. Within this scope, the following section addresses approaches, concepts and empirical findings of acceptance research, as currently applied to technology-based artefacts.

Artefact acceptance refers to the individual intention to use the artefact (attitudinal acceptance) and to the corresponding, actual use behaviour (behavioural acceptance)(Müller-Böling & Müller, 1986; Nistor, Wagner & Heymann, in press; Straub, 2009). Both attitudinal and behavioural acceptance range from total refusal of the artefact (Hodas, 1996; Sanford & Oh, 2010) to total, unreflected acceptance and even fashion (Wang, 2010). A large part of previous research focuses on the acceptance of technology-based artefacts, which is also addressed in the following. Venkatesh, Thong and Xu (2012) synthesize several predecessor acceptance models (e.g., Davis, Bagozzi & Warshaw, 1989; Goodhue, 1995) and explain technology acceptance under the influence of behavioural, normative and control beliefs, thus applying the theory of reasoned action (TRA) and its expanded version, the theory of planned behaviour (TPB)(Ajzen & Fishbein, 2000). According to Venkatesh et al. and to their Unified Theory of Acceptance and Use of Technology (UTAUT), the use of technology-based artefacts is determined by use intention, which is further influenced by performance expectancy, effort expectancy, and social influence. Additionally, facilitating conditions have a direct effect on technology usage. The research done by Venkatesh and colleagues in the domain of Information System was extended by several other researchers in the domain of educational psychology (e.g. Pynoo, Tondeur, Braak, Duyck, Sijnave & Duyck, 2012). Chen, Chen and Kinshuk (2009) as well as Yang and Lai (2011) regard knowledge sharing in virtual CoPs as a particular case of technology use, and provide empirical

evidence for the influence of the same acceptance predictors on knowledge sharing intention, and on corresponding behaviour. However, the influences of members' roles in the CoP and division of labour are not taken into consideration. Further, Sykes, Venkatesh and Gossain (2009) propose a model of information system acceptance with peer support, and conclude that system use at workplace is better explained by community-related social network constructs than by individual variables.
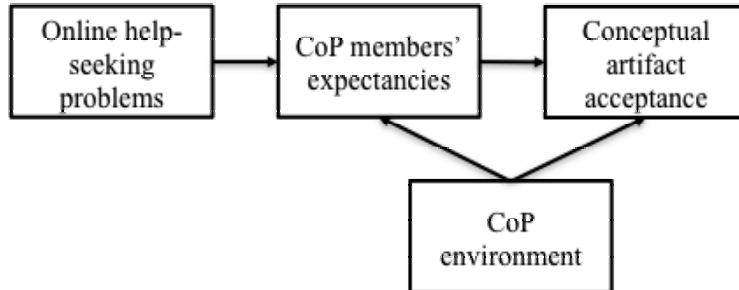

Fig. 1. Conceptual model of the influence factors of conceptual artefact acceptance

Applying now TRA/TPB and UTAUT in this context, the acceptance of technology-based artefacts is likely to be determined by CoP members' expectancies, which in turn may be influenced by occurring online help-seeking problems (Heckner, Schworm & Wolf, 2010). CoP environment, e.g. CoP members' roles and expertise may have an impact on both their expectancies and their acceptance. These interdependencies outline a generic conceptual model shown in fig. 1. Nistor, Schworm and Werner (2012) provided empirical evidence for this conceptual model by studying a CoP of technology users located at a German university in the fields of Educational Sciences and Psychology. The object of community practice was to establish and exchange ways of using technology for research and university teaching. To do so, frequent helpdesk questions were collected along with their answers and published on a wiki-like help-system that allowed collaborative optimization of the help contents. The wiki platform and the help contents built an online conceptual artefact used as a tool in the academic practice. Within this setting, a difference appeared between the receptive and the active use of the conceptual artefact. CoP members performance and effort expectancies strongly predicted the receptive use intention of the conceptual artefact, while the CoP social environment, i.e. social influence and members' responsibility for technology tasks, predicted its active use. CoP member's expectancies were predicted by their perceived disorientation while navigating through the help system ("lost in hyperspace"). Thus, the model could explain a relatively large part of the variance in artefact use intention. The actual artefact use behaviour was, surprisingly, not significantly predicted by the corresponding intention, but only by members' responsibility with technology.

V. Conclusions

As a conclusion for educational practice, knowledge sharing and help-seeking in online CoPs may be fostered by CoP members' use of technology-based conceptual artefacts (Bereiter, 2002; Scardamalia & Bereiter, 1994), where artefact usage implies negotiation of meaning (Wenger, 1999) and epistemic activities (Zenios, 2011) related to community practice. For educational systems developers, this requires a system design comprising comprehensive and transparent navigation, which allows users to remember and pursue their help-seeking goals and prevents them from getting "lost in hyperspace" (Heckner et al., 2010). At the same time, the system should take into account social structures, roles and division of labour, so that participants with different backgrounds and roles may easily contribute

their questions and answers to the help system, and negotiate shared "ways of doing things" in the CoP (Wenger, 1999). This may in turn provide more transparency to members' navigation through the help system, and through the community practice as well.

For educators, the task of supporting workplace learning requires not only making help systems available, but also adopting appropriate organization measures. Helpdesk staff can effectively stimulate and practice active use of technology-based conceptual artefacts. A similar, positive effect on knowledge sharing acceptance may be obtained by assigning helpdesk tasks to skilled CoP members outside the helpdesk. Help seeking and help giving between colleagues may be as stimulating and helpful as helpdesk support.

The presented conceptualization and the corresponding empirical findings require additional research for a more in-depth insight in the development and use of technology-based conceptual artefacts from a socio-cognitive perspective. Research topics of interest include studies of academic CoPs focusing on social network analysis and sense of community, intercultural acceptance studies, studies of situated learning in academic environments, and artefact use studies.

VI. References

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