

Generative online learning communities: The effect of peer participation perception on the acceptance and use of conceptual artefacts

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Generative online learning communities (GOLC) rely on the generation and use of technology-based conceptual artefacts. Consequently, artefact acceptance and use is a design goal of learning environments. In spite of intensive acceptance research, little is known about designing for acceptance, which outlines a significant research gap. This paper proposes that social presence, i.e., the sensorial, emotional or cognitive perception of peer participation in the GOLC, stimulates the acceptance and use of the contained conceptual artefacts. Correspondingly, two empirical studies are summarized. The former study examines the acceptance of an annotation tool for satellite images. Social presence is induced by the minimal group paradigm, suggesting individual participants that they are involved by the annotation task either in software development (control group) or in a humanitarian action (treatment group). The treatment group perceived stronger group salience and evaluative social identity, along with a higher acceptance of the annotation task. The latter study examines the relationship between the perception of peer participation and individual writing activity in the discussion forums of a learning environment for clinical psychology. Learners' acceptance and their contributing behavior were correlated with the number of built-in comments. Moreover, the perception of peer participation was a stronger acceptance predictor than learners' previous knowledge. Both studies represent generative activity in online learning communities and induce social presence by design elements. In both cases, induced social presence increased the acceptance and use of the provided technology-based conceptual artefacts. Additional research is called for to extend the validity of the presented studies.

Key words: Generative online learning communities, technology-based conceptual artefacts, technology acceptance, social presence, perceptions of peer participation

I. Introduction

Participation in online knowledge communities has become ubiquitous since the explosive development of the Internet around the year 2000, and especially since the development of the Web 2.0 (O'Reilly, 2007). Hence, understanding participation in online knowledge communities is an important educational endeavour aimed at the analysis and design of online learning environments (Nistor, 2010; Nistor & Fischer, 2012).

Knowledge communities are groups of people

sharing interests, activities, experience, knowledge and "ways of doing things" over longer periods of time (Lave & Wenger, 1991; Nistor, 2010; Paavola, Lipponen, & Hakkarainen, 2004; Wenger, 1998). Lewis, Pea and Rosen (2010) emphasize the participatory aspect of knowledge communities by coining the term "generative online learning communities" (GOLCs) that refers to knowledge communities generating and using technology-based conceptual artefacts (Bereiter, 2002; Nistor, 2012; Zenios, 2011). Relying on the theory of expansive learning (Engeström & Sannino, 2010), Lewis et al.

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(2010) describe GOLCs as expansive in the sense of permanently increasing the number of participants, intensifying their engagement in dynamic learning interactions, and consequently creating knowledge based on members' experience and interactions.

Fostering GOLCs requires above all the creation of technology-based conceptual artefacts that are accepted, used and further developed in the GOLC. While the acceptance and use of technology was intensively studied in the past two or three decades (as synthesized, for instance, by Venkatesh, Thong and Xu, 2012, in their Unified Theory of Acceptance and Use of Technology, UTAUT), the Information Systems research could hardly establish a connection to the Educational Research, and failed to build a theory that identifies methods and elements of learning environment design that may be accepted to a greater degree by the learners (Bagozzi, 2007; Benbasat & Barki, 2007).

Addressing this gap, the paper at hand suggests a possible design approach focused on social presence (Kozan & Richardson, 2014; Short, Williams, & Christie, 1976). The authors claim that sensorially, affectively or cognitively perceived social presence stimulates technology users to actively take part in GOLCs. To start social interaction, the users have to firstly perceive the co-existence of other users within the learning environment. As an illustration, two empirical studies are presented, in which the perceived co-existence of others leads to more intensive generative activity in GOLCs.

The remainder of this paper is organized as follows. Section II and III give insight in the research on acceptance and use of technology-based conceptual artefacts taking into account the socio-cognitive context of the generative technology use. Section IV and V summarize a case study and a laboratory experiment addressing the relationship between the perception of peer participation and the acceptance and use of conceptual artefacts. Finally, section VI draws conclusions focused on the design of online learning environments.

II. Acceptance and use of technology-based conceptual artefacts

Psychological research on the acceptance

and use of technology-based conceptual artefacts includes, so far, mainly technology acceptance theories and their empirical verification. Acceptance research was initiated by Fred Davis (1985), who most prominently applied Ajzen and Fishbein's (2000) Theory of Reasoned Action, later updated as the Theory of Planned Behavior, to link attitudes towards technology with the actual technology use. In this vein, Davis and several other researchers established the Technology Acceptance Model (TAM) that was updated several times (e.g., TAM3 by Venkatesh & Bala, 2008). This and other technology acceptance models were synthesized by Venkatesh and colleagues (e.g., Venkatesh et al., 2012) in their Unified Theory of Acceptance and Use of Technology (UTAUT). Accordingly, 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. Further variables such as voluntariness of use, knowledge of technology, culture etc. moderate the effects within the UTAUT (e.g., Nistor et al., 2014).

In an educational context, Nistor, Schworm and Werner (2012) applied the UTAUT to model the acceptance of technology-based conceptual artefacts. In addition to the mainstream acceptance research that is positioned in the domain of Information Systems, Nistor and colleagues observe additional acceptance predictors that are specific for educational settings. Fundamentally, they differentiate between receptive and generative acceptance and use of conceptual artefacts. The studied conceptual artefacts were collections of frequently asked questions and answers, therefore in further studies the artefact development process was approached as online academic help seeking (Mäkitalo-Siegel & Fischer, 2011; Mercier & Frederiksen, 2007). Specific problems of online help seeking, such as lengthy text-based instructions and being "lost in hyperspace" appeared to influence participants' attitudes towards technology. Moreover, the social identities and roles of the participants had an effect on their generative intentions related to the conceptual artefacts. Thus, Nistor et al.'s (2012) study is clearly positioned in the context of GOLCs (Lewis et al., 2010; Pea, 1994),

and points toward the socio-cognitive impact factors affecting the acceptance and use of conceptual artefacts.

Nevertheless, traditional technology acceptance research was subjected to criticism. One of the most discussed – and least successfully addressed so far – points of criticism is the oversimplification of the acceptance phenomenon and its one-dimensional representation (Bagozzi, 2007). Moreover, the object of acceptance research is mostly a new technology, which emphasizes the novelty effect, keeps the technology in the foreground and ignores the acquisition of knowledge and skills other than those directly related to the employed technology (Nistor, 2013a). While acceptance models are applied in the evaluation of learning environments (e.g., Nistor, 2013b), little is known so far how to design learning environments for acceptance (Bagozzi, 2007). The mainstream acceptance research “has provided little in terms of actionable research [...], hence a paucity of recommendations to direct design and practice” (Benbasat & Barki, 2007, p. 213).

Attempting to overcome this critique, one approach has been to regard technological tools as technology-based conceptual artefacts used in socio-cognitive context (Bereiter, 2002; Nistor et al., 2012); while another approach has been to consider the concurring effects of cognitive scripts, e.g., of acceptance and collaboration scripts (Fischer et al., 2013; Murillo Montes de Oca & Nistor, 2014). This suggests that considering the socio-cognitive context of technology use may address current criticism more successfully, and further build upon existing knowledge in the field of acceptance research.

III. The socio-cognitive context of technology acceptance and use: Perceptions of peer participation

The socio-cognitive context of educational technology comprises the knowledge communities in which the technology-based conceptual artefacts are used. This structure of knowledge communities includes participants with different intensities of participation (from peripheral to central), different degrees of expertise (from novice to expert) and

different community ages (from newcomer to oldtimer), as described by Lave and Wenger (1991). Within this framework, Wenger (1998) describes the process of learning as an interplay of (generative) participation and reification. Notably, reification is understood as the production of (conceptual) artefacts that can be technology-based, as well, e.g., in online communities. As Lewis et al. (2010, p. 1) explain, “the artifacts we manifest in the world elicit new forms of social and material interaction that in turn give birth to new artifacts, conditions and consciousnesses. Around these we in turn organize social and productive life and find new aspects of who we are as humans – the makers and users of worlds of mediating symbols and systems of communication that employ them.” Conversely, “by together questioning texts and situations, conceptualizing problems, designing solutions, building artifacts, redesigning, re-conceptualizing and reinterpreting, people generate forms of public knowledge that in turn provide conceptual and relational support for further interaction and learning” (ibid., p. 7). Thus, conceptual artefacts reify and support collaborative knowledge construction in GOLCs.

The collaborative use of technology-based artefacts generates social presence. Initially, Short et al. (1976) defined social presence as the intrinsic property of a medium to make users aware of each other. Clark and Brennan (1991) further differentiated communication media by the costs and constraints they impose to the construction of shared knowledge, thus conceptualizing the link between technology and collaborative task from a social-constructivist perspective. Recently, Kozan and Richardson (2014) defined social presence as a technologically and socially induced individual construction, meeting thus Tajfel’s concept of social identity as induced by the perception of simple social cues, such as group names in the minimal group paradigm (Tajfel, 1982).

The perception of social presence can vary in its intensity, and therefore in its effects. In online collaborative environments and GOLCs, research regularly shows the phenomenon of “participation inequality” (Nielsen, 2006) pointing at users’ lack of participation within an environment that was explicitly designed and implemented to be developed and improved by a community of users and experts.

While some participants intensively generate and further develop conceptual artefacts, others choose to “lurk”, i.e. to receive and use the artefacts generated by others. Such different levels of participation result in the GOLC members’ different degrees of social presence. Nielsen (2006), as well as Schworm and Nistor (2013) describe the “long-tail” phenomenon, in which a very small subgroup of the community sustains the largest part of the tasks in practice. In the context of collaborative tasks, “lurking” is assimilated to “social loafing” or “free-riding” (Jones & Rafaeli, 1999; Preece, Nonnecke, & Andrews, 2000), which, in turn, demotivates collaboration partners (“sucker effect”, Kreijns, Kirschner, & Jochems, 2003).

One possible explanation for this phenomenon (as explained above) is “lurking” or “social loafing”, which implies the users’ unwillingness to invest any effort in generative participation. Schworm and Nistor (2013) assume a different motivational perspective often discussed in the context of help-seeking avoidance (e.g. Aleven et al., 2003): Learners may regard themselves as not being competent to actively contribute or they may expect others to be far more competent to comment on an issue. This may even be more important the less comparable contributions of others are available within the environment. Perceived social presence (sensorial, affectively or cognitively) is regarded to influence users’ motivation to actively take part in a virtual community (Shen, Yu, & Khalifa, 2010), and thus enhance the acceptance and use of the technology-based conceptual artefacts. In terms of designing collaborative environments and GOLCs, this means that in newly implemented environments there may be no recognizable activities of peers, which may strongly delay or even impair the start of social interaction. To prevent this, collaboration scenarios may include elements that increase social presence by inducing the awareness of other users’ co-existence and participation within the environment (Prasolova-Førland, Sourin, & Sourina, 2006). However, such a design principle is not sufficiently backed by empirical findings. Therefore, the authors of this paper have supervised two related empirical studies that are summarized in the following.

IV. Case study: Inducing social presence by minimal group paradigm

The German Aerospace Center (DLR) permanently records and archives a huge number of satellite images, therefore the topic of image information mining, so that searching for specific information within these images is of interest. Researching ways in which specific information related to the content of the image can be first annotated in a semi-automatic manner, and then searched for, requires annotated reference data sets for benchmarking (Murillo Montes de Oca, Nistor & Datcu, 2014). Manually annotating a reference data set of images is an effortful task, which finds low acceptance among human users. Against this background, a research project aimed at enhancing the acceptance and use of annotation tools was initiated. The theoretical approach of the project was based on the social identity theory and the minimal group paradigm (Tajfel, 1982). More specifically, it was assumed that users would be more likely to accept and use the annotation tool, if they are assigned to a user group they perceive as a community engaged in a humanitarian action (Murillo Montes de Oca & Nistor, in preparation).

This assumption was tested in a laboratory experiment involving a small number of case studies. All participants were given a satellite image very similar to the satellite views of Google Maps (maps.google.com) and representing an area at the city periphery of Munich that none of the participants immediately recognized. Subsequently, the participants were asked to outline and label what they had seen in the satellite image, and later organize their labels into a semantic hierarchical classification. The task was contextualized differently for the treatment vs. control group, by describing different application scenarios, either humanitarian or scientific. The treatment group was told that, through the annotation task, they were directly involved in a humanitarian action, i.e., disaster relief. The control group was told that the annotation task was part of the development of an automated annotation system that was further needed for humanitarian actions. Thus, a stronger social identity was intended to induce for the humanitarian group.

The use of the annotation tool was operationalized in terms of number of annotated image areas and corresponding labels, as well as time-on-task. Additionally, the participants were questioned about their perceptions of group salience (“I am a valuable member of the group of annotators I work with”), evaluative social identity (“I am a cooperative participant in the group of annotators I work with”)(Luthanen & Crocker, 1992), and tool acceptance. The latter was operationalized as performance expectancy (e.g., “I find the annotation task useful for helping people in need of humanitarian aid” and, respectively “...for helping people refining algorithms for automatic annotations”) and effort expectancy (e.g., “It is easy to me to become skilful at doing the annotation”)(both adapted after Venkatesh et al. 2012), the willingness to continue the annotation task at a later moment of time (task continuance) and to continue working with the same people (social continuance)(Christian et al., 2012).

The measurement of these variables confirmed that the treatment group had perceived a stronger social identity, expressed as both group salience and evaluative social identity. The effect was probably due to the more pervasive and emotional context definition. This, in turn, led to a higher acceptance of the annotation task. As expected, the use of the annotation tool, task continuance and social continuance were higher for the treatment group. However, performance and effort expectancy were somewhat higher for the control group.

In conclusion, these findings confirm the assumption that stronger perceptions of a social group (Tajfel, 1982), such as group salience and evaluative social identity (Luthanen & Crocker, 1992) can improve the attitudinal and behavioural acceptance of a technology-based task performed in the group. On the other hand, the traditional predictors of technology acceptance, i.e., performance and effort expectancy (Venkatesh et al., 2012) seem to indicate opposite effects. A possible explanation of this counterintuitive finding may be that the stronger social presence moves participants’ attention from the use of technology to the social aspects, and thus lowers the expectations towards technology, which is an effect of two concurring cognitive scripts, an acceptance and a collaborative script (Fischer et al.,

2013; Murillo Montes de Oca & Nistor, 2014).

Nevertheless, replications of this study with larger participant samples are needed to increase the validity of findings.

V. Laboratory study: Inducing social presence by built-in comments

As a prominent feature of the Web 2.0, blogging has become very popular and its learning outcomes promoted it to a frequently used component of learning environments (Park, Heo, & Lee, 2011). Learners can write and edit articles, thus creating and building upon conceptual artefacts, evaluate content of other learners by rating and tagging, and publish their personal experiences in blogs. A particularly useful feature of blogs for the context of instructional design is the possibility of blog author and blog readers, respectively learning content designer and learner, to communicate. Here, users can leave comments including questions or suggestions to written blog posts. This may foster collaboration between designers and learners, and offer the possibility to bridge the communication gap between them. However, this process may only be fruitful if a noteworthy number of users actively take part. This raises the question, how can users be encouraged to actively contribute to a learning environment by e.g. writing blog entries? If the reason of lacking participation lies in a feeling of insecurity of one’s own competencies, examples of blog entries of peers may reduce this insecurity and foster learners’ active participation.

Following the assumption discussed above, that perceptions of others’ participation may stimulate learner’s own activities, a laboratory study (Schworm & Nistor, 2013) investigated whether learners’ own writing activities differ according to the perceived social presence of peers, and whether these activities may be predicted by learners’ attitudes towards the comment function and their prior knowledge.

Within a learning environment entitled “Mental disorders in adolescents” a varying number of already written blog entries on each of the 40 content-paragraphs was implemented, so that some paragraphs showed, e.g., one peer comment, another two and a third one three. The number of built-in

comments was randomly assigned to the paragraphs. Forty students attending a German university voluntarily took part in the study. The participants' prior knowledge on symptoms and diagnosis of mental disorders was measured in a knowledge test before starting with the learning environment in which the learners reached a mean of 13.28 out of 30 possible points. Thus, there was a medium level of prior knowledge observable which should have a positive influence on learners' activities.

The learning environment itself comprised various representations of the treated disorders, which the learners could view and click through. Afterwards, the learning outcome was assessed. A within-subjects design was implemented. The number of comments was randomly assigned to the paragraphs. 60 different comments were included: 54% evaluated the presented content, 31% gave additional information on the content, 10% were questions, and 2% just contained a link to an external website. The comments seemed to be written by 6 different persons to give the impression of peers' social presence. Learners' acceptance of the environment and its comment function was assessed via a questionnaire. The results showed a significant effect of the number of artificially created comments: The existence of a comment encourages learners to generate a comment on their own. However, learners' participation activity was not influenced by the amount of comments (it made no difference whether there was one comment or three).

The authors wanted to further investigate whether learners' contributing behavior can be predicted by their attitude towards the comment function and their prior knowledge. To answer this question a regression analysis was performed including prior knowledge and learners' acceptance of the integrated comment function as predictors and the number of generated comments as criterion. Both variables significantly predicted the amount of user-generated comments. However, learners' acceptance of the comment function shows a stronger effect than learners' prior knowledge.

In conclusion, learners' active use of a comment function within a learning environment can be fostered by simulating social presence by implementing comments of different number and

types within the environment. Participation inequality is not inevitably a question of lacking motivation: Feeling knowledgeable fosters activity, as well as a positive attitude towards features of learning environments that require social participation. Thus, learners' acceptance of the tool is crucial. Thereby recognizing the acceptance of the tool by peers (indicated by their active use) may be an effective screw to turn.

VI. Conclusions

To summarize the theoretical and empirical considerations presented above, since the advent of the Internet and especially of the Web 2.0, generative online learning communities (GOLCs; Lewis et al., 2010) are informally accepted and used by a large number of learners. GOLC usage can be assimilated to the use of conceptual artefacts (Bereiter, 2002; Nistor, 2012). Thus, a focus on the socio-cognitive context of educational technology use may be the key to closing the research gap between acceptance research in Information Systems and educational research, and to provide design methods and elements that may increase GOLC acceptance. Notably, the current research on educational technology acceptance hardly provides design guidelines (Bagozzi, 2007; Benbasat & Barki, 2007).

Acceptance and use of conceptual artefacts in GOLCs appear to be increased by the perception of social presence in the learning environment. This statement relies on the understanding of social presence as technologically and socially induced individual construction based on sensorial, emotional or cognitive perception of peer participation in the GOLC (Prasolova-Førland et al., 2006). The minimal group paradigm (Tajfel, 1982) provides a simple way to induce social presence. Thus, "seeing what we build together" (Pea, 1994) impacts not only the social and cognitive processes of collaborative learning, but also the acceptance of related technology-based conceptual artefacts (Bereiter, 2002; Nistor, 2012). However, these considerations must be still backed by stronger empirical findings.

VII. References

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