Knowledge creation in networked learning: combined tools and affordances

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Abstract

Although the pedagogic potential of structured online discussions in higher education has been realised, the promise of rapidly developing wiki technology and synchronous audio and video technology in teaching and learning needs to be examined. A better understanding of the affordances of these tools and a clearer articulation of the kinds of interactions needed for knowledge creation in networked learning is required. This study aims to explore the ways in which knowledge can be jointly created among geographically dispersed communities of developing researchers through combined web-based tools both synchronous and asynchronous enabled though networked technology. We focus on the role online discussion spaces, wikis and synchronous discussions can play in collaborative creation of knowledge by looking at participation processes as they occur online and collaboratively. The study is conceived in the broader context of socio-constructivist approach using concepts around the notion of epistemic fluency. Qualitative data are generated through a focus group and semi-structured interviews which are triangulated with naturally occurring data from online discussion forums as part of an exploratory case study approach. Findings suggest that different kinds of networked technologies can support users in multiple and complementary ways when it comes to sharing experiences, exploring concepts and developing new forms of knowledge around key questions and problems. As such, qualitative differences seem to exist in the perceived affordances of online discussion forums and wikis as tools to promote collaborative advancement of knowledge. We suggest that online structured discussion forums provide affordances for probing, interrogating and posing arguments among groups of learners working collaboratively in knowledge creation. Implications suggest switching attention away from wikis as a standalone collaboration tools suitable for educational purposes and turning it on to their functionality as repository spaces for storing and sustaining shared information and collaboratively created knowledge. Evidence pointing to the conditions for successful use of educational wikis identifies affordances of parallel use of synchronous audio and video technology as mediating tools in supporting collaborative wiki-based activity. On this basis, we argue for the necessity for social dialogue in knowledge creation and the implementation of combined tools to offer complementary affordances in the process.

Keywords

Knowledge creation, affordance, epistemic fluency, combined tools

Introduction

New paradigms of learning through networked technology emerge at a time when web-based tools and flexible learning environments are being used in higher education. These developments fit well with initiatives to move away from teacher-oriented instruction to more student-centred learning (Ramsden, 1992; Biggs, 2003). Networked learning having the potential to stimulate collaborative and pedagogic processes in learning is at the core of such initiatives. Among the range of collaborative learning arrangements provided, interest is growing around the advent of Web2.0 technologies, such as discussion forums and wikis. Web2.0 technologies incorporate features that enable social interaction necessary for collaboration online.

It was emphasised that socialising was essential as the 'glue' to hold online communities together and that it needed to be greatly valued as an important element in online dialogues. (Seddon and Postlethwaite, 2007, p.195)

Research during the last decade indicates that online discussion tools facilitate representation and sharing of ideas reified as online texts (Goodyear and Steeples, 1998; Zenios 2008) and stimulates knowledge construction processes (Goodyear and Zenios, 2007). Recent research on rapidly developing wiki technology promoting user-created content suggests mixed outcomes about their use in education (Wheeler et al., 2008; Cole, 2009). This study examines knowledge construction seen as advancement of shared knowledge resulting from rigorous and continuous negotiation around key problems and questions in doctoral education. Discussions around knowledge creation relate to the purposes of doctoral education as rapid changes in modern society call individuals to constantly and readily apply their previously acquired knowledge and skills into new contexts.

This work-in-progress paper explores the innovative ways in which new knowledge is being co-constructed within geographically dispersed communities of developing researchers through the use of asynchronous text-based discussions and wikis, and synchronous audio and video technology. This is achieved by:

- looking at and comparing the role online discussion forums and wikis can play in collaborative knowledge creation
- unpacking participation in knowledge creation processes as they occur online and collaboratively i)synchronously and ii)asynchronously.
- understanding learning activities that trigger collaborative knowledge creation processes as part of online discussions and collaborative wikis.

Theoretical framework

Researching networked learning can be quite complex and a single theoretical framework cannot provide a research agenda for this task (De Laat and Lally, 2004). For this study we use a conceptual framework based on the notions of epistemic activity and epistemic fluency (Collins and Ferguson, 1993; Zenios and Goodyear, 2008). The notion of epistemic fluency is linked to the ability to move beyond understanding of the key norms, practices and language of a professional culture. It essentially leads towards participating actively in its processes including creating knowledge with others (Goodyear and Zenios, 2007). Based on these ideas and further informed by the notion of affordance (Derry, 2007) the study focuses on the different ways in which aspects of knowledge are being constructed collaboratively through the use of online discussion tools and collaborative wikis respectively.

The notion of epistemic fluency we see as closely related to what Wenger calls 'reification' (1998, p.55) i.e. the introduction of new concepts and terms which is an important dimension of the relationship between practice and understanding. Understanding we argue is linked to what participants are doing in networked learning as part of online discussion and wiki development. We are using the notion of epistemic tasks (Ohlsson's, 1995, p.51) or activities to help conduct empirical work on knowledge construction (see table 1). In exploring knowledge creation process across different tools such as wikis and online forums we employ the notion of affordance (Gibson, 1986) to illuminate properties inherent in these tools and ways in which they act as facilitators for learning. Building upon Gibson's definition of 'affordance' (1986), we may define the social affordance of a tool, within its environment, as what it offers, provides or furnishes for social interaction: 'Social affordances are properties of CSCL environment that act as social-contextual facilitators relevant for the learner's social interactions'. (Kreijns et al., 2002, p.13).

Methodology

A case study investigation has been employed that involves qualitative forms of data analysis to allow carrying out more thorough checking of events embodied in the descriptions produced by the research participants and eliminating complexity through in-depth analysis. The case study focuses on a newly designed doctoral

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programme aiming to enable participants to research their professional practice as part of a critical approach and research interpretation. An earlier study has been used as a pilot to develop methodological tools that provide the basis for further investigation (see Zenios and Goodyear, 2008). Data analysis from the pilot study provided some primary examples of epistemic activities and guided the framing of the following research questions for the main study:

- What kinds of epistemic activities can trigger collaborative knowledge creation?
- What are the conditions for knowledge creation in online discussions?
- What are the conditions for knowledge creation in wikis?

The case study includes data from asynchronous online discussions among thirteen participants collected following participant observation methods from two modules and triangulated with qualitative interviews with seven of the participants. In exploring the use of wiki technology, a closer look was taken following a focus group approach to solicit the opinions of the participants generated and produced as a result of their interaction. In line with the university ethical research procedures permissions were sought from participants and pseudonyms are used to ensure confidentiality and anonymity. Different analytical tools have been employed in analysing various forms of data. A grounded approach was followed for wikis and interview transcripts. In analysing online discussions, Ohlsson's (1995) list of 'epistemic activities' (p. 51) was employed as a tool to allow a level of classification. We employed pattern-matching as a dominant analytic technique to examine, categorise and recombine the evidence.

Table 1: Ohlsson's epistemic tasks (after Ohlsson, 1995, p. 51)

Epistemic activity or task	Description
Describing	To fashion a discourse referring to an object or event such that a person who partakes of that discourse acquires an accurate conception of that object or event.
Explaining	To fashion a discourse referring to an event or pattern of events such that a person who partakes of that discourse understands why that event or pattern of events happened
Predicting	To fashion a discourse such that a person who partakes of that discourse becomes convinced that such and such an event will happen
Arguing	To state reasons for (or against) a particular position on some issue, thereby increasing (or decreasing) the recipient's confidence that the position is right
Critiquing (evaluating)	To critique a cultural product is to fashion a discourse such that a person who partakes of that discourse becomes aware of the good and bad points of that product
Explicating	To explicate a concept is to fashion a discourse such that a person who partakes of that discourse acquires a clearer understanding of its meaning
Defining	To define a term is to propose a usage for it.

Focus group

> The hallmark of focus groups is their explicit use of group interaction to produce data and insights that would be less accessible without the interaction found in a group. (Morgan, 1997, p.2)

Widely used by market researchers, focus groups have only lately been used by social scientists as a primary data collection approach or in addition to other approaches (Kidd and Parshall, 2000). Focus groups are particularly useful for obtaining 'direct evidence of similarities and differences in the participants' opinions and experiences' (Morgan, 1997, p.10). They have the advantage of being efficient in terms of time and resources, but less effective in terms of the amount and depth of data obtained from individual participants. However, as a means of testing a hypothesis before launching further detailed research, they seem particularly well suited. We decided on a semi-structured approach to the focus group, using a series of predesigned questions to guide the discussion in a 'funnel-based' manner (Morgan, 1997), whilst remaining flexible as to how these would be

used in order to keep the discussion as open as possible. Participants were not told of the specific focus of the meeting in advance in order to leave some spontaneity in the discussion, and the duration was announced as 90 minutes – a typical length for such a group (Morgan, 1997). As it was not possible for the group to meet physically, the discussion was held online using Skype (without video). The session was recorded using Audacity and an analogue tape recorder as backup. The transcript of the focus group was subsequently analysed manually and the ideas raised were clustered around common themes using a mind-map. These clusters are used in section 3 to guide the analysis, with appropriate quotations from the discussion to reinforce the results (see section 5).

Forms of collaborative knowledge creation in online discussions

During the first three weeks of the duration of the module, sixteen threads were developed in total by participants. These focused around specific themes touching upon theoretical and methodological issues which discussants identified from the core readings given by the tutor as well as other supplementary resources provided by the members of the group. It can be suggested that there is sufficient understanding of the issues discussed among participants as they are able to comment reasonably and insightfully. The dialogic nature of online discussion forums suggests that these offered social affordances (Kreijns et al., 2002) that enabled collaboration among participants. Most importantly, the extracts shown below can be clustered as observable and recognisable moves that serve as epistemic tasks i.e. describing, explaining, arguing, critiquing, explicating and defining in the co-creation of working knowledge. Similar extracts have been identified to correspond to moves such as predicting, questioning evaluating and challenging.

Table 2: Epistemic moves in online discussions

Ep. Task or move	Example taken from the online discussions
Describing	…The CSALT Research Network suggests it is bounded within that context and this also sets it up with some identity. I could easily see this as a CoP [Community of Practice] with strong identities and strong ties between us, and as us all being apprentices. I could also see it with other members having weak ties from a wider community – other educational researchers in [X] or even wider still, perhaps with a range of different strengths of ties. In fact to blur the boundaries as Ryberg and Larsen are suggesting then non researching practitioners might also be part of this CoP/Learning Community. […] It will be interesting to see how the next cohort of PhD students are integrated with us and what impact this has on our current individual identities. (Posted 9 November)
Explaining	I do not actually see a real difference between networked learning and Cop's. For example, our cohort is concerned with establishing connections and relationships […] at the same time is concerned with the establishment of shared practice [...] it is crucial to stress the notions of meaning –making processes and identity, so as to have stronger ties in the complex social fabric of networked learning. (Posted 2 November)
Explicating	[…] You make me think about what the characteristics of the members CoP should be and then I realized how relevant Aristotle's idea of the rhetorical appeals [pathos, logos, ethos] is to a CoP, [i.e. pathos involves using language that will stir the feeling of the CoP. If you misuse pathos …] In my mind the term learning community bears a very broad meaning and the notion of CoP is its sub-group. Just some thoughts. Do you agree? (Posted 5 November)
Arguing	I don't think I would very much agree […] I agree that communities of practice might be more specific in nature, perhaps they can be defined in a more narrow sense than learning communities. They both refer to different kinds of communities which have diverse aims and outcomes. To make a crude distinction, a community of practice is very much oriented towards production of very specific outputs or provision of well-defined services to the outside world. Learning, identity production and development of generations of practitioners can be biproducts of the CoP. To me, a learning community has clearly different and more diverse aims and objectives than a CoP. As such, it grows for the benefit of the development of participants in

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	it rather than having the creation of artifacts and materials as the end goal. I certainly need to be challenged to expand on this. (Posted 7 November)
Critiquing	[…] most authors considered [communities of practice] to be more than simply learning together in a community or network. They indicate that networks of learning often focus on the simple exchange of information or involve collaboration on a piece of work over a fixed period. Whereas CoP involve longer term relationships that focus on the exchange of practice. Wenger says that for there to be a CoP there should be mutual engagement, a joint enterprise and a shared repertoire. Perhaps this is just semantics, and what really counts is respect, reciprocity, mutual support and some form of common identity - as you say to establish 'stronger ties in the complex social fabric of networked learning'. […] I am not sure that we are yet [in our community] exchanging sufficient stories, experiences, etc about our daily practice to be considered a CoP. Is this a problem? Should we expect all networks of learning to aspire to become CoP? (Posted 3 November)
Defining	I support your description of CoP but would add a further dimension. A CoP is a learning entity with the iterative development of members adding to culture, histories, artefacts and protocols, to the identity of each member and thus to the *identity* of the CoP in itself. Our learning community can impact upon the formation of a CoP and provides a range of community enhancing boundary objects; it is not in itself a CoP and is unlikely to become on as we share learning (and learning outcomes too, Ella) but not necessarily goals and practice. (Posted 10 November).

It is suggested that participants relied heavily on each other for their on-going participation in the online discussions and joint refinement of ideas in order to achieve understanding of their complex roles as researching professionals. This task involved a shared exploration of problems based on negotiation of knowledge found in literature suggested by peers and shared among the group as well as previous experiences made explicit as part of the group's on-going discussions. Ideas, themes and issues suggested by the literature were integrated into the context of the group's experiences as part of their trajectories as researching professionals. Participants' responses to the epistemic activities and emerging interpretations suggest a rather context-bound flow of learning activity. Making inferences about each other's written contributions enabled close examinations of concepts across various workplace settings and cultures.

Wikis as part of knowledge creation in doctoral research

For a further three weeks of the module, the participants in the doctoral programme developed collaborative wikis around three specific themes which they identified themselves as timely and interesting for the broader TEL community. These were entitled a)Action research in the context of technology-enhanced learning, teaching and assessment, b) Researching co-construction of knowledge and c)Asynchronous video in networked learning. While tutor input in these has been absolutely minimal, a technical guide and support was provided by the learning technologist. A sandbox space was used to test the technology and determine the layout of the wiki. There had been a noticeable change in the group dynamics, as the centre of activity moved from the online discussion forums to the wikis. Findings generated from the focus group reveal that there had been insufficient dialogue at the beginning of the wiki work on expectations, the use of the tools and the process it should follow. Such 'grounding' is important for collaborative work (Stahl, 2005), especially when students are working at a distance across countries (Volet and Wosnitza, 2004). In this respect, the group seemed to fall foul of the two pitfalls of computer supported collaborative learning (CSCL) environments identified by Kreijns et al (2003): i) taking social interaction for granted and ii) the tendency to restrict social interaction to educational interventions. For a while there was some confusion, with parallel activity taking place both in the main wiki and in the sandbox, and contributions continuing within the Moodle forum. Some members were actively contributing whilst others were largely silent. The main breakthrough came when the group started to hold synchronous voice discussions online using Skype2. It then became clear that the wiki was not developing the way that everyone preferred and some dissatisfaction was mentioned that had not been apparent in the wiki itself. Brundage and MacKeracher (1980) describe this as the reactive stage when learners 'often express negative feelings and opinions' (p.30).

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An open discussion on the expectations of the group members in Skype helped them to progress through the subsequent stages of development: storming on issues of contention and norming around new, agreed standards for layout and ways of working (Tuckman, 1965). It also allowed members to develop the 'common ground' which forms the basis for collaborative work (Stahl, 2003, 2004) and increased awareness within the group of our common goals (Dillenbourg, 1999). Participant observation indicates that the group only began to collaborate once time was taken out in Skype to reflect on what had been written, to discuss it and to then modify it to reflect common understanding. As part of the wiki "continuance of the dialogue and needs of the community were more important than individual needs". (Focus group discussion). As such, findings point to the importance of dialogue prior to and during the development of the collaborative wikis. The dialogue encouraged group sense making and reflection in action. Course participants stated: "(it) spurned on the process of knowledge creation [and] reflection in action and reflection after action". "I don't think it would have been as enriching if we hadn't had Skype". "Once we got into Skype there was much more of a collaborative effort".

Similar to asynchronous online discussions, Skype offered dialogic processes and social affordances (Kreijns et al., 2002) i.e. the swift sharing of ideas and exchange of emotions and personal comments of a more informal nature. These were clearly absent in the wiki: "…a very difficult place to engage in dialogue" (Interviewee). These affordances were the key to making the collaborative wiki a reciprocal activity and supported the group to advance further in its stages of development and to develop social capital – an essential requirement for trust and shared understanding (Nahapiet and Ghoshal, 1998; Daniel et al., 2003). The Skype environment provided affordances that were unavailable in the wiki; the synchronous nature of the former facilitated the bouncing of ideas and rapid feedback, whereas the latter, with its persistence, offered the group an organisational memory – as illustrated by the recording of meeting minutes in a sub-page shown on the wiki. Evidence from seven interviewees suggests that wikis were used more like a repository facility for the organisation and deposit of ideas and resources around a specific topic. Hence it was decided to continue to develop the resource over the years ahead to support doctoral thesis work to support participants who mentioned: " the wiki became an external memory for us". "Wiki keeps everything concise and compact, it's very useful".

The use of wiki in combination with synchronous tools has offered functionalities for knowledge creation processes. Being "a powerful learning tool" participants suggested, it "[allows] co-author ideas [...] and share co-construction of knowledge […]. "You've got a knowledge dynamic, knowledge repository that you can update continuously and you don't get lost in the labyrinth of messages like you would in the moodle forum". As such, it has been clear that the locus for collaborative knowledge construction has been outside the wiki and limitations existed in working solely on it. Most of the activity had taken place at synchronous virtual meetings enabled via Skype:

> The Skype sort of took over a bit…I think we all found it very energising in the sense that we started to really engage in learning together and we had our own beliefs and we started sharing view and as we took on other peoples' thoughts about knowledge and how it's created and how it's constructed, …this became very lively and quite intense and quite focused and quite enjoyable and emotional in many respects. (Interviewee).

Parallel tools and especially social technologies such as Ning and Facebook where used throughout the programme quite extensively, however it is wiki which was perceived to be quite difficult to work on solely without using parallel communication channels. As such wiki outputs have been the result of an earlier dialogue conducted outside wiki:

> The history feature is the really powerful feature because it allowed you to compare […]   that gave you an idea of the thought process, so in a sense if you looked at the changed you could get an understanding of why they might have made that change and you could think whether that was a good reflection of our dialogue and in general it was. (Interviewee).

The history feature mentioned above was underused as evidence from the wiki spaces suggests that some members chose to announce changes to the wiki in different ways. The focus group highlighted some important differences between the wiki and Skype, summarised in Table 3.

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Table 3: Differences in social affordances between wiki and skype

Type of affordance	Wiki	Skype
Social affordances	More formal written interaction, task based	More informal verbal interaction, with social activity (chit chat)
	More individual contributions, personal perspectives	More group interactions, group perspectives - social dialogue
	Less emotional, focused more on content	More emotional, audio cues (intonation, etc)
	Less easy to identify authors of text (need to retrace history)	Easy to identify speakers (face picture or image with name)
	Lower social presence	Higher social presence, increasing confidence and community feeling
Cognitive affordances	Slower feedback of ideas, allowing time for reflection	Rapid feedback of ideas, supporting group reflection – a stream of consciousness, 'trading of ideas'
	Low context	High context
	A memory for the group, a baseline for discussions;	Discussion on ideas in wiki, generating new group knowledge
	Succinct and easy to index, reducing cognitive overload	Requires discipline and facilitation to keep on track; chat facility supports
	Individual interpretations	Group sense making

Working together, it can be argued that the two tools facilitated non-linear learning (Conole and Dyke, 2004) where the learner weaves and navigates through information, finding personal routes and pathways. This is characteristic of deep or 'higher-order' learning (Goodyear and Zenios, 2007) where participation in epistemic tasks – such as describing, arguing, critiquing and explicating – leads to 'the kinds of learning implicated in *coming to understand'* (p.357). Within the context of a group with its own culture, involvement in such activity or epistemic games can engender epistemic fluency. Epistemic fluency allows one to recognise, appreciate and understand the subtlety and complexity of a belief system that one has not encountered before, whether that belief system is associated with a religious or ethnic community, or a scientific or professional community. (Goodyear and Zenios, 2007, p.358). Creation of new knowledge is for Engestrom (2001) not simply the enculturation of existing ideas, norms and practices, but is qualitatively another level. Building upon the Vygotskian notion of cultural mediation of learning, the term 'expansive learning' is introduced:

> In short, the theory of expansive learning accounts for how 'new' practices and collective activities emerge through the collective expansion of existing activities. (Ryberg and Christiansen, 2008, p.209).

Conclusion

This work-in-progress paper provides preliminary evidence about possible ways in which participants' experiences gained from collaboration with peers are used in the process of constructing new shared knowledge as part of a doctoral programme. Findings point to qualitative differences in the perceived affordances of online discussion forums and wikis as tools to promote knowledge creation in H.E. The adoption of specific epistemic activities identified as moves within texts of messages communicated among participants allowed negotiation of existing knowledge and reification of processes that formed part of new emerging shared knowledge. As such, refinement of tacit knowledge did not take place exclusively in isolated minds of individual members of the course, it rather emerged from the collaborative activities enabled through online discussions that have internal logic and promote joint representation of ideas. The online discussion spaces were perceived as more open and transparent in terms of providing immediate access to peers. Participants relied on colleagues being active contributors and key agents within the social environment with whom they could relate. Build upon each other's

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work in an indexical and reflective manner, they managed to create and develop the context for their learning. This process fostered the development of epistemic fluency as the ability to identify and pervasively respond to epistemic activities initiated by members of the group. There is evidence that similar processes of negotiation and sharing took place as part of the wiki development exercise. The latter has been, however, perceived as more static rather than fluid and flexible and any dialogic approaches and processes inevitably would have to take place outside the locus of the wiki. It has been proved very difficult to take the perspective of one another without engaging other technologies in the process and working solely in wikis has been quite troublesome. The wiki set the context for the collaboration, offering a sustainable, persistent memory which encouraged individual reflection and interpretation. Skype, on the other hand, provided the opportunity for group reflection and meaning-making, through the rapid exchange of ideas and feedback. It was the combination of the two that offered the necessary affordances for epistemic tasks to take place and for the group to develop new knowledge as well as group cognition (Stahl, 2005), which provides for expansive learning (Engeström, 2001) and engenders the development of epistemic fluency amongst the participants (Goodyear and Zenios, 2007). Discussions enabled by all three combined tools enabled the group to develop shared meaning and externalisation of individual interpretations which were then re-internalised and interpreted by individuals. Implications of the study place dialogic processes at the centre of educational activities as part of the design of technology-enhanced postgraduate programmes of study across university departments.

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