

Problematizing Participatory Research for Developing Semantic Web Technologies

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Abstract

This paper contributes to a symposium on ‘Designs for learning with the Semantic Web (Web 3.0)’ by presenting the outcomes of critical reflection on methodological issues relating to the design of semantic web technologies for networked learning. Semantic web technologies show great potential for supporting networked learning but are unsettled and under-researched in educational contexts, thus classed within this symposium as ‘emergent’. The design of this emergent and complex technology is considered in relation to empirical research data from an interdisciplinary, multi-institutional technology enhanced learning (TEL) research project. The research project explored the potential of semantic web technologies in Higher Education (HE) to support the use of cases in teaching and learning. Data was collected throughout the project including researcher's wiki-based reflective research logs, transcripts from project meetings and interviews and focus groups with participants and observation notes. Critical reflection on the research process was supported through engagement with this data, which allowed the recognition of nondeterministic constructs and fluidity and contingency in research practice. Therefore, this paper problematises participation by highlighting uncertainties and contingencies inherent in the enactment of participatory research methodology. Rather than viewing uncertainty and contingency as devaluing research, the case is made that this can allow for enrichment of the development process and subsequently the research outcomes. The flexible and emergent nature of semantic web technology matched with participatory approaches in the design of emergent technologies allows for reflection, adaptation and flexible action relating to pedagogy and practices which is essential in educational contexts that are rapidly changing. The findings highlight the uncertain and contingent nature of (1) the settings where design took place; (2) acceptance or rejection of research methods; and (3) the community groups that emerged as interested parties in our work. Vignettes from two different research settings are used to show how participation was enacted reflectively and responsively leading to some positive outcomes; including the development of new teaching practices and new technologies, which were fed back into the open source development of educational semantic web technologies. Therefore, researchers in the field of networked learning are encouraged to ‘design with participatory research’ to match the challenges posed by complex and emergent technologies and changeable educational contexts rather than attempting to apply standardised forms of design methodologies.

Keywords

Participation; networked learning; higher education; semantic web technology

Introduction

This paper stands alongside two others within a symposium titled ‘Designs for Learning with the Semantic Web (Web 3.0)’. The symposium addresses the first conference theme of ‘Theories, methodologies, perspectives and paradigms for research in networked learning’ by critically reflecting on methodological issues relating to the design of networked learning technologies and the educational contexts in which they are used. All three papers in the symposium consider how the emergent nature of semantic web technologies affected our experiences of research and design, how participatory research practices were affected during the development of semantic web technologies and how both these concepts find a new place in increasingly complex and changeable educational environments. This paper specifically examines how aspects of participatory practices impact on the research, development and implementation of semantic web technologies. The argument is made that in investigating complex educational contexts which are open to pedagogical and technological change, the semantic web is paradigmatic because it is not only able to adapt and keep pace with the change, but can also influence and

significantly build on it. The uncertainties and contingencies inherent in adopting a participatory approach are aligned with the development of the semantic web as an emergent technology that is ‘radically novel’, fast growing and with potential to impact on ‘knowledge production processes’ (Rotolo, Hicks and Martin, 2015:p4).

Within the field of technology enhanced learning (TEL) research there is a tendency to create a role for technology as the enhancer of existing educational practice and to fail to report ‘disruptive, disturbing and generative’ effects (Bayne, 2014: 4). This approach to dissemination has a hegemonic effect, which leads to stagnation and a lack of creativity in research practice. When uncertainty is not recognised, then changes in focus, definitions and boundaries during research can be viewed as indicating shortcomings in the practices of researchers, unclear project goals, or inadequate design processes. On the other hand, deficit might be attributed to institutional structures, academic boundaries or resistance to particular approaches to technological innovation and change. Viewing uncertainties as negative would reflect the ‘deeply conservative’ (Bayne, 2014: 4) assumptions held in TEL research where the role of researchers is seen to be that of brokers of ‘transformation’ or ‘harnessers’ of technological power (Bayne, 2014: 15). The field of networked learning presents an alternative where it is recognised that various forms of visible and invisible work are involved in both doing research and design and participating as researchers (Hodgson et al., 2014). We take responsibility for our participation as researchers but also recognise the limited agency of any particular participant to control the production or use of technology. In research on networked learning, focus is maintained on ‘praxis’ as action in the world informed by theory and values (Jones, 2015: p3). Therefore, this paper aims to prompt discussion during the symposium where reasons for action are scrutinized, critiqued and subsequently modified.

This paper draws on the author’s experiences of uncertainty and contingency associated with participatory research on a multi-institutional, interdisciplinary, Technology Enhanced Learning (TEL) project called Ensemble (2008-2011). Ensemble explored the potential of semantic web technologies in Higher Education (HE) to support the use of cases in teaching and learning. The semantic web is dependant on common formats being used with online data, allowing integration and combination across applications, to reveal relationships between pieces of data (World Wide Web Consortium, 2010). The Ensemble project chose to investigate and develop semantic web technologies through the use of SIMILE open source tools initially developed by the Massachusetts Institute of Technology (MIT) Libraries and MIT Computer Science and Artificial Intelligence Laboratory (CSAIL) (Mazzochi, Garland and Lee, 2005). These tools were developed to ‘empower users to access, manage, visualise and reuse digital assets’¹. This facilitates their use in networked learning and the examples in this paper show how semantic web tools were used to ‘promote connections’ between people, communities and resources (Goodyear et al., 2004). It is worth noting that these examples also go beyond ICT-situated contexts as the development and implementation of new technologies contributed to a third aspect of networked learning described by Dohn (2014) as ‘mediator activity’ to resituate content across existing virtual and physical settings. Therefore the nature and affordances of the technologies being researched were designed to align with participatory approaches and engage users in development. Teaching staff and students took major roles in researching pedagogy and technology development in their own disciplinary fields alongside the wider research team. This was made more possible due to the emergent and flexible nature of the technology being developed. The concept of the semantic web and its affordances created a focus for discussions and personal reflections that surfaced the tacit knowledge of students, lecturers and researchers. A participatory approach was also taken to the definition of ‘case based learning’, which was found to be interpreted differently between and within each setting (Tscholl, Tracy and Carmichael, 2009). Taking a social-constructivist view of learning, participants in the research could be described as being involved in learning as knowledge creation; with different forms of knowledge outputs including, new research approaches and collaborative networks, new pedagogical practice, new formats for online technologies and new understanding of how these can be combined (Tracy and Jordan, 2012). The potential for empowerment of research participants is examined further in this symposium by Carmichael (2016) who applies the lens of ‘Operaismo’ to explore the experiences of ‘precarious’ workers in their participation with designs of semantic web technologies.

Participatory Traditions

The concept of participation is widely invoked in applied research as is evident in the literature across disciplines - social sciences, education and technology design (e.g. Noffke and Somekh, 2009; Billies et al.,

¹ <http://simile.mit.edu/>

2010; Olsson 2004; Könings, Brand-Gruwel & Merriënboer, 2010). In this symposium, Jensen and Dohn (2016) present a paper which considers the challenges and advantages of using Design Based Research in the development of semantic web technology, which has increasingly been adopted as a research approach in the field of networked learning. This serves as an important reflection on the methodological challenges and advantages of undertaking Design Based Research with an emergent technology. However, outside of this symposium the way in which participation is interpreted and enacted as part of research practice is rarely examined using empirical data.

The Ensemble project brought together researchers with divergent backgrounds and ontological and methodological assumptions, which were found to influence different aspects of the enactment of research (Rimpiläinen, 2013). The project proposal signalled a commitment to participatory research (citing Elliott, 2009) alongside an equal commitment to participatory design (citing Suchman, 2007). This commitment was also shown within the inter-disciplinary team who were influenced by their backgrounds in Human Computer Interaction (HCI) research, participatory design and participatory action research. The tensions between multiple meanings of ‘participation’ have led us to examine how they were manifested in research practice for this project. However, these different participatory fields do not necessarily take the same meaning from the concept of participation. They also have connections to multiple fields outside of the design and development of information technologies. A key element of this divergence relates to understandings of participation between researchers and participants. Therefore there is a need to problematise this concept in order to create a space for reflection on the values, assumptions and commitments that we hold as researchers and how that translates to practice (Carmichael and Jordan, 2012).

In this paper, participatory constructs are compared with an analysis of the working relations of participation that took place through Ensemble TEL research. Empirical data collected during the Ensemble project has been examined to acknowledge the fluid and contingent nature of our participatory practices and semantic web technologies. It was found that enactments of our research and development varied in relation to where participation takes place, who or what facilitates participation and the selection or creation of methods and expectations for group dynamics and community creation. The uncertainties and contingencies relating to each of these constructs are demonstrated in a description of research practice taking place in two different research settings. Through this analysis it is shown that uncertainty and contingency in the development of an emergent technology enabled flexibility and adaptation within practice that enriched the outcomes of the research.

Methodology

To support the problematisation of participation we have drawn on data collected during research and development for the Ensemble project to represent the fluidity of research and acknowledge the uncertainties, contradictions and struggles related to participation in TEL research. This data was from reflective research wiki logs of the encounters and events in the settings, ethnographic observations by researchers in the field and key informants from the setting, and documentary data including, notes on whiteboards and images from settings, which were part of the enquiry. Analysis focussed on two of the disciplinary fields where research for the Ensemble project took place, which we denoted as ‘settings’ within the project group. Initially the settings were regarded as relatively bounded groups in line with a loosely classical notion of the site in anthropology. Each setting was assigned a research associate and each setting had a key informant who taught undergraduate or postgraduate students. This analysis draws on data from: Plant Sciences, and Archaeology.

In Plant Sciences a new third year undergraduate module was developed, which became the focus for Ensemble research and development activities. The academic module leaders acted as key participants and worked with Ensemble to design a case-based module for students. Groups of three or four students were tasked with a project to investigate the production of biofuel from algae, which they would report on in a presentation at the end of a week of literature-based research. The groups were supported through a Virtual Learning Environment hosting a wiki and a ‘citation manager’ in the form of an online digital repository of journal articles created by the Ensemble team. The articles could be visualised in a SIMILIE Exhibit web application (Huynh, Karger and Miller, 2007) that allowed faceted browsing so that records could be searched and filtered. At the start of the project the repository was populated with articles recommended by the lecturers. Each article was associated with Metadata drawn from sources such as PubMed and Scopus in addition to comments and recommendations from the lecturers. This integrated formal Metadata tagging with the social software functions of annotating and reviewing articles. During the project students added new papers when they found them; these were shared through the repository with other students in their group or the other groups. In order to facilitate student

additions, an editing tool called FELIX (Form Editor Lightweight Interface for eXhibit) was developed by Ensemble researchers (Martinez-Garcia, et al. 2012), which creates a user-friendly interface with relevant fields to complete before submitting a new entry. Because it was possible to supplement the face to face group work with knowledge contributed from resources in the citation manager, this could be classed as networked learning which promotes connections between a learning community of students, researchers and lecturers (Goodyear et al., 2004). This module was repeated three times annually over the course of the Ensemble research project and each iteration involved changes in the participants, the module aims, the technology and the outcomes. Through successive cycles of pedagogical and technological development the rationale for case-based learning changed from facilitating links between student projects and ‘real world’ professional contexts to the reinforcement of academic scientific concepts. Both of these roles could be supported because of the flexibility of the semantic web tools to draw on data and resources from a variety of sources, which can be switched on and off according to the interests of the students and lecturers involved. Therefore, this also promoted networked learning by making connections between diverse contexts in which the learners participated (Dohn, 2014). The participatory methodology and the semantic web technology enabled the creation of different forms of new knowledge but it is important to note that only certain mobilities enabled by the technology were seen as legitimate; it was the academic context for the research which ‘moored’ the technology to local responsibilities for students, subject knowledge and identity (Edwards, Tracy and Jordan, 2011).

The second setting was undergraduate Archaeology where initial engagement was made through a key informant based at a Museum. The Museum has a large online database and potential was recognised for this to become the basis for a semantic web tool for use in teaching and learning for undergraduate and postgraduate Archaeologists. Course structures and organisational associations were found to be complex and rich and varied in their use of cases. Multiple avenues were pursued for the development of Semantic web technologies. The most advanced development led to the creation of a form of ‘data aggregating document’ (DAD) (Martinez-Garcia et al., 2012) as an online and ‘live’ version of a final year student project about a small collection of Anglo-Saxon brooches. The final year projects represented a case study of a specific locality, collection or archaeological artefact. Ethnographic observations and interviews with staff and students uncovered feelings of disappointment that these rich sources of case study were printed as hard copy and stored in offices around the department slowly going out of date and without any scope for future development. Ensemble researchers used an example of one of these projects as the basis for ‘recreation’ in the format of an online document, which draws on digital repository content from the Museum and external data sources. Within the document, links were made to a live photo gallery, timeline of excavations, interactive map of finds, a table of types of brooches and a searchable and sortable bibliography. Unlike the collaborative example from Plant Sciences the educational activity here is inherently a solo project, initially with one student taking responsibility for authorship of a report. However, the translation of that report to an online data aggregating document opened up the possibilities for networked learning by making the data and findings accessible to a wider community of users. The live feed of updates to data represented in the report also creates links from the professional and material world of archaeologists to the academic outputs from a university.

Results of Analysis- Uncertainties and Contingencies

Analysis of participatory practices undertaken through research in these two settings uncovered three themes of uncertainty and contingency in participation. We have entitled these themes as ‘research settings’, ‘participatory research methods’ and ‘community’. The analysis of each theme is represented through an example based on data and our reflections on experiences from the two disciplinary settings. These examples often represent pragmatic responses to operational or organisational issues interplayed with commitments to enacting democracy through participation. But they are clearly also related to the uncertainty and contingency inherent in the development of an emergent technology.

Research Settings

Within the project group we attempted to define enclosed settings, in which semantic web tools could be developed, deployed and evaluated. Our settings were notionally enclosed by academic structures such as departments, faculties and modules; physical spaces such as classrooms, online spaces and disciplinary discourses. But our understanding of these structures as settings was changeable and developed over time. It was important to remain flexible in the focus of our research and design activities so that new avenues of inquiry could be pursued if they appeared to have potential for implementation of new Semantic web technologies. An

example from the setting we referred to as Archaeology gives a sense of inevitable contingencies at work and the outcome of working with this rather than against it.

In Archaeology the structure of the setting proved elusive in its multiplicity. Initially researchers were concerned to identify the meaning of ‘case’ within this setting to enable the link with technology use for the project. The focus for the research moved from a single ceramics class to also include lectures and seminars in other modules as well as fieldwork and several staff and student participants. Initial engagement with Archaeology was made through a key informant based at the Museum. The Museum has a large online database and potential was recognised for this to become the basis for a semantic web tool for use in teaching and learning but the requirement for linkage to case-based learning was harder to realise. The database acted as an initial focus for the Archaeology setting and was as strong a driver of our research as the key informant was. However, project priorities to focus on the use of cases in teaching forced us to widen the field for the location of the ‘setting’, which was intentionally left open and un-defined for the majority of the research period.

Initially, the teaching environment most closely related to the Museum database was considered to be undergraduate practical ceramics classes, which were observed to identify how the physical forms of database entries (pots) are used as cases in teaching (Rimpiläinen, 2013). But, by following recommendations from participants, further links were made across the Faculty. This led us to access undergraduate lectures, field trips and post graduate seminars where teaching was diverse, localised and varied according to the time, place and academics involved. This proved to be a sticking point, which delayed technology development in relation to this setting. It was hard to design technology without a fixed notion of the user and context of application. Later on the project goals relating to semantic web technologies influenced a refocusing of continuing research on undergraduate student ‘artefact projects’. From one of the researchers point of view, this showed the most ‘potential’ for being supported with semantic technologies and created a suitably bounded focus for application. On pursuit of this route a novel implementation of Semantic web technology was developed in the form of the Data Aggregating Document, which links up the student produced ‘case’ report with the Museum online repository and other sources of open data available online.

This experience suggests that settings of TEL research and development are uncertain and it is the activity of investigative work and negotiating the pragmatics of project priorities and deadlines that steer temporary closures. In this example it was important to allow the definition and boundaries of the setting to be wide and flexible to allow for participation of a variety of staff and students and for the focus to be steered towards the use of cases in a complex teaching and learning environment. The outcomes from this enabled the creation of a new form of online document, which has wide ranging potential for use in educational environments.

Participatory Research Methods

The drivers of research practice are examined here to draw out uncertainties and contingencies related to the concept of pre-fixed methods for use in TEL research. There is a danger that the translation of methods from participatory traditions into new contexts and settings is simplified in accounts of research practice in order to adhere to conventions and increase perceived validity (McTaggart, 1996). In Ensemble research we did not adopt a set of methods and transpose them literally to and between our research settings. Methods needed to be re-interpreted for the different settings due to contingencies inherent in engagement with academic timetables, key participants and student users. Ethical considerations also had a strong influence over our choice and development of research methods. This required us to use our understanding of the different contexts and reference to prior experience to consider ethical issues alongside methodological deliberations (Tracy and Carmichael, 2010). An example from Plant Sciences shows how we had to adapt and repurpose methods along with changes in staff and student interests and priorities. This enabled us to collect data on the process of student group work and collaboration and to develop a new interface for inputting bibliographic data into an online repository that was considered to be ‘user friendly’ for the students accessing the Semantic web tool.

In Plant Sciences a new case based module was implemented over three successive semesters enabling iterative development of the pedagogical and organisational structure of the module. Understandably, the emphasis was always placed on providing a supportive environment for student learning and tensions were always present about how Ensemble researcher goals may affect the student experience. One academic ([E]) openly discusses these tensions in this extract from a planning meeting ([E] Interview 27/01/09): “Don’t let them feel like guinea pigs that are being used as experimental animals... The big idea is that, if you like, this is a new way of learning. And we want them to get the benefits of that new way of learning. But, at the same time, we’d like to monitor

and follow and track how this develops. Are you with me?” Sensitivity to these concerns led Ensemble researchers to focus their presence in the setting on organisational and technological support rather than implementing structured research activities that could be interpreted as ‘experimental’. However, research project goals created a need to gather some form of observational data to allow analysis of student group working practices and evaluation of the technological support. This was negotiated with lecturers and it was decided that the most unobtrusive method would be to ask students for their consent to make digital audio recordings of student group meetings and invite them to an informal focus group for evaluation once the module was complete.

Flexibility and sensitivity had to be applied to the implementation of research methods to maintain the engagement of staff and students with our research. It was not possible to implement formulaic plans, instead, situated action was needed. Critically this meant knowing about different participatory approaches and translating possibilities into practice.

Community

This theme is concerned with acknowledging disjuncture within notional participatory ‘communities’ and the uncertainties that come along with identification and classification of groups for structuring research activities. This was shown through differences in understandings of researcher identities and roles and issues with identification of communities within settings.

Participatory practices in Plant Sciences were greatly influenced by the backgrounds and perceived identities of the researchers and academics involved. One of the Ensemble researchers was a former student and researcher from the Plant Sciences setting itself and one of the academics involved in teaching the module was also a co-investigator for Ensemble (labelled as [A] in excerpt below). This was key in enabling the involvement of Ensemble in this setting and it helped to keep the disciplinary and research goals in focus. The following comment made by the Ensemble researcher during a planning meeting illustrates that it produced some confusion and tension about where priorities and identities were being placed: “What I was trying to work out, is what role [A] is playing. Because if... you’re the practitioner, I’m the researcher and I understand that and I want to get more involved with running the course and stuff. And I can give you a lot of time this next couple of weeks.” (Planning Meeting, 27/01/09). In practice the researcher acted as administrative support for the module as well as arranging digital recordings for observation of student group work practices. Other members of the Ensemble research group provided technological support and were included as part of the module team supporting students in their engagement with this new way of working and learning. Identities remained blurred and flexible throughout and roles changed with each iteration of the module. Both the key researcher and academic involved in research are likely to have identified themselves as ‘brokers’, but the communities that they worked between were in flux and had little sense of a negotiated and stable disciplinary practice associated with case based learning.

The Archaeology setting gives an example of the difficulty of defining ‘community’ within a diverse and dispersed field. The key informant in this setting ([F]) explained ([F] interview 08/05/09) that the access to a global scope of researchers who teach was seen as an unusual and valuable resource in that Faculty. However, this variety also created difficulties in keeping the links between different groups of researchers, lecturers and museum archivists active. Brokerage activities were hindered by the lack of definition of a ‘community’ that could be engaged in research or enrolled in helping to integrate technology with teaching. The museum archivist ([G]) reflected on this in an early interview:

“although we are still a faculty we are much more separate...and that has made a huge difference so there is much less communication between the departments...the museum is now a separate unit and it didn’t used to be. And so one of my fears is that the actual objects will get used less and less and I think we are the only university I think probably in the whole of the UK that can teach Archaeology in the way that we do that has its own tame Museum as it were, right next to the Department.” ([G] Interview 17/11/09).

This dispersal caused difficulties for Ensemble researchers and introduced uncertainty to the vision of an Archaeological ‘community’ which could be engaged in technology development leading to implementation in teaching. The communities that have recognisable labels like Plant Scientists and Archaeologists are not necessarily cohesive or coherent. Work was involved in enabling the ‘settings’ to emerge as viable sites of

research and the same applied to community. Struggles took place over who to include and exclude from project definitions of ‘users’ and ‘settings’ and advocates within the Ensemble research group were needed to argue the case for definitions of these temporary boundaries. What we are suggesting is that there is no community of users ‘out there’; communities can emerge from networks of relations, but the direction this can take is by no means certain. Adapting our roles as researchers and being open in recruitment of participants enabled us to balance our project research priorities with the interests and needs of a complex and undefined ‘community’.

Conclusions

Through the analysis of research practices taking place in two settings, the contingencies and uncertainty inherent in our participatory research have been highlighted. Three themes were identified that represent participatory constructs that were found to be fluid and contingent. 1) Findings show that the pragmatics of project deadlines, institutional structures, and cultural attitudes to innovation or change affect the boundaries and classifications of settings. 2) Suitable procedures and methods for design or development are hard to pre-empt and need to be adapted and translated to suit the culture and structure of the research setting. 3) Also, ‘users’ have complex identities so that community definitions and boundaries can have a confining as well as enabling effect. These contingencies are magnified in relation to the undefined, flexible and ‘emergent’ nature of the semantic web technologies that were developed to support networked learning in both settings.

Being able to take flexible action in the face of these contingencies was a strength of our research, and allowing for reflection and adaptation in the face of uncertainty enriched the processes and outcomes of the research. In many of our settings a rigid approach to the definition of users and community would have stalled the research prematurely or limited the scope of the technology that was developed. Unless settings are theorised as fluid and contingencies are expected, participation in the setting becomes a form of hegemony, which hides or undervalues the subtle work of finding a place for new technologies within dynamic teaching and learning practices. Equally, following a prescribed approach for the design of technology could have created data and online tools that were inappropriate for the educational context. In this kind of multi-institutional and inter-disciplinary research environment it was essential to be reflective and adaptable to be able to effectively reach project goals of the creation of new technologies, pedagogies and practices.

This also highlights practical implications for how research is planned and managed for networked learning. The natural uncertainties need to be acknowledged and considered in approaches to research that allow for investigative work and space and scope for reflection and experimentation with a range of research methodologies. Our approach could be described as having been open to a variety of methods that enabled us to ‘design with participatory research’. The role of researchers for this project was to find strategies (or develop new ones) for bridging multiple, complex and variable worlds (Carmichael and Jordan, 2012). Even radical shifts in theorisation of participation and intervention are open to being mythologised, or made invisible. This is possible when research is constructed as an intervention in a world that is more or less stable and known before, during and after the technology is produced and put into that world. A different ontology is advocated here; one that makes the case for greater awareness of the uncertainties and contingencies that are part of the work of achieving technology stabilisations. In this, both ‘doing research’ and the ‘participation of the researcher’ are positioned within the network of working systems that make technology stabilisations possible. Designing with participatory research can be understood as continuous reimagining of the possibilities for networked learning. This has wide ranging implications for how design and research are imagined, conducted, reported and evaluated.

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