e-Portfolio assessment in networked learning based communities

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This thesis was completed as part of the Doctoral Programme in e-Research & Technology Enhanced Learning.

This thesis results entirely from my own work and has not been offered previously for any other degree or diploma.

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Abstract

There is a substantial body of research suggesting the advantages of using e-Portfolios in higher education assessment, where work is collated by individuals to record their learning. The use of learning communities in this context is an under-researched area, despite the number of e-Portfolios that implement a social component.

This work develops an alternative e-Portfolio approach by using a networked learning based pedagogy, which brings richer descriptions of both artifacts and the structure of the underlying community. Action research and free/open source development principles have been aligned over two cycles, where students have participated as both co-researchers and co-developers. Evolving the nature and presentation of assessment artifacts, participants have determined how these are best shared and reused, and the ways in which larger contextual information about the community can improve both the learning and the knowledge of the learning taking place.

A multi-method research framework is used to show what artifacts are created, who is interacting with whom and why participants act as they do. Data has been collected using interviews, focus groups and from analytics from the e-Portfolio itself.

The findings suggest that the types of artifacts created are influenced by both the community and by the nature of the material being learnt. Artifacts reveal the sources that students use for their work and although participants can be reluctant to reveal incorrect or incomplete work to the community, this can be encouraged by a carefully constructed induction, reinforcing the importance of the role of teacher as tutor. Expertise is quickly associated with some participants by the quality and regularity of their artifact construction, who become more central and influential to the community, with their work becoming increasingly visible through search activities.

This work presents the framework, an analysis of the results, conclusions and recommendations along with a reference implementation.

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This work would not have been possible without the support of a large number of people. I would like to dedicate this work to my teachers, my colleagues, my friends and family.

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This work is dedicated to my wife Min and my two sons Jacob and Nick.

List of abbreviations

APL	Accreditation of Prior Learning
AR	Action Research
BIS	Business Information Systems taught module
BIT	Business Information Technology
CA	Content Analysis
CMC	Computer Mediated Communication
cMOOC	Connectivist MOOC
COI	Community of Inquiry
COP	Community of Practice
CSCL	Computer Supported Collaborative Learning
CSS	Cascading Style Sheets
CxA	Context Analysis
DI	Direct Instruction
FLOSS	Free Libre Open Source Software
FSF	Free Software Foundation
GNU GPL	GNU Not Unix General Public License
HTML	Hypertext Markup Language
ICT	Information Communications Technology
JISC	Joint Information Systems Committee
LMS	Learning Management System
MBIT	MSc Business Information Technology
MOOC	Massive Open Online Course
NL	Networked Learning
OSDM	Open Source Development Methodology
OSI	Open Systems Interconnection
PLE	Personal Learning Environment
SNA	Social Network Analysis
SQL	Structured Query Language
TEL	Technology Enhanced Learning
TP	Teaching Presence
VLE	Virtual Learning Environment
WSA	Web Scripting for Application taught module
WYSIWYG	What You See Is What You Get
XML	Extensible Markup Language
xMOOC	Instructivist or constructivist MOOC
ZPD	Zone Proximal Development

Software used in this work

Software used in coding and for general statistics

Excel
ATLAS.ti

Software, languages and libraries used in the development of the portfolio

Apache
CSS Edit
JQuery
mySQL
mySQLWorkbench
Netvibes Integrated Development Environment
PHP
SMARTY
Textmate

Software developed in this project is available under the GNU GPL from www.foliocube.com/software

Author's note on Artifact vs Artefact

This work uses the American spelling of *artifact* rather than the European spelling *artefact*. As many of the e-Portfolio implementations are produced in America this spelling dominates the technical literature; it is also common in Wenger's work on the Community of Practice model. Rather than switching between the two depending on the context, the US centric version has been used here.

List of figures and tables

Chapter 1 Introduction and background

This chapter introduces the wider context for this work, describing the ways in which recent technological changes and research into community based pedagogies has not seen an accompanying advance in e-Portfolio assessment practices. It then details the purpose, domain and participants used in this research; undergraduate and postgraduate students on business information technology courses in a university based in outer London.

The underlying theoretical framework of networked learning is described along with the way that action research and the open source development methodology have been interleaved in this work. The research questions are then detailed and the audience of researchers interested in the practices of assessment in learning communities, or lecturers seeking more sophisticated assessment practices is then identified. The chapter concludes with an overview of the structure of this work.

1.1 Context and purpose

The wider context

Technological advancements, massification and an appreciation of social constructionist based pedagogies have combined to offer opportunities for radical change in the way that higher education functions. Popular mobile devices have more computing power and connectivity than what was used to power multinational corporations twenty years ago and it is commonplace for each inherently technology-savvy cohort (Margaryan, Littlejohn, & Vojt, 2011) to have brought their own devices with greater computing power than that offered by the institution they are joining (Johnson et al., 2013).

Western Europe's shift to knowledge-based economies has signalled a desire to increase graduate numbers although this has been paradoxically accompanied by a reduced resource allocation (Altbach, Reisberg, & Rumbley, 2010). Higher education institutions have seen the cheapening and increasing availability of technology in a series of revolutionary movements, each promising solutions to the issues brought about by globalisation and massification (Selwyn, 2007). Blended learning and technology enhanced learning (TEL) have been seen as the latest "silver bullet" approaches (Watson, 2006) that could slay this crisis, improving student access, engagement and participation in the learning process (Garrison & Kanuka, 2004). For most institutions this is implemented through the use of a learning management system, such as Blackboard or the open source

software Moodle. After the rise, and in some cases fall, of technologies such as Myspace, Bebo and Facebook, learning management systems have attempted to respond to the demand for social interactivity (Dalsgaard, 2006) by bolting on community forums, blogs, social networking and collaborative tagging of learning artifacts creating separate distinct learning spaces.

The simultaneous resurgence of research into community based pedagogies such as communities of practice, learning communities and the current in-vogue idea of massive open online courses (MOOCs) have suggested a greater acknowledgement of the power that can come from learning in a group. These social based pedagogies offer foundational support to the technological solutions, asserting that peer based learning and feedback, enhanced through appropriate technology can support engagement, enculturalisation and better forms of learning through collaborative activities and dialogue (JISC, 2010). They can also empower, allowing greater student autonomy (Beetham & Sharpe, 2007), aligning with the principles of sustainable lifelong learning (Knapper & Cropley, 2000).

Despite these advances, the nature of assessment practices in the academy has not dramatically changed – the overriding assessment methodology is still built around marking and measurement rather than on learning (Price, Carroll, O'Donovan, & Rust, 2011). The lack of interest in more sophisticated assessment is hampered by narrow legacy practices (Delandshere, 2001); exacerbated by the costs of massification (Gibbs & Simpson, 2004) and the lure of cheap pre-packaged cartridges of material, which come with aligned multiple choice questions, reigniting the debate about the applicability of such tests when assessing the demonstration of higher order approaches to learning (Scouller, 1998). Knight (2002) highlights a number of critical issues in assessment practices, including non-transferability of results, limitations in criteria-referencing and poor reusability of the results in future career guidance. Students can readily access open educational resources, share, reshape and mix-up materials freely online, in ways which often conflict with traditional notions of authorship, ownership and plagiarism. Finding a way to integrate these practices into assessment challenges the idea of a tutor designed assessment and the role of assessor as final arbiter.

E-Portfolios offer a solution to many of these issues, using technology to empower learners in deciding what evidence they present and allowing this to be

placed in a social context, promoting reflection and peer collaboration (Stevenson, 2006). They can be used for career preparation, and credential documentation (Lorenzo & Ittelson, 2005); as workspace and showcase (Barrett, 2010); as sonnet, mirror or map (Diez, 1994). The swift uptake of e-Portfolios has seen a proliferation of commercial offerings becoming available, often supplied as additions to institutional learning management systems. These are complimented by numerous open source implementations, which are developed and maintained by the coding community at large. E-Portfolio pedagogy sits in a constructivist philosophy, but the addition of social networking to many of the implementations has not seen a revision in the underlying theory as it has outpaced by practice (Stefani, Mason, & Pegler, 2007). Extensions to Kolb's reflective cycle are often suggested as a way to include social activities in the artifact constructive cycle (Gray, 2008), but these lack reference to an appropriate community based pedagogy. Much of the e-Portfolio literature has been criticised in lacking veracity or depth, leading to a call for more rigorous research (Rhodes, Chen, Watson, & Garrison, 2014).

Networked learning (NL) offers a framework to ground an e-Portfolio learning community, situated in social constructivism. NL advocates supporting connections between learners and the electronic resources available (Goodyear, Jones, Asensio, Hodgson, & Steeples, 2004) and differentiates itself by acknowledging the importance of weak ties along with the non-privileging of particular types of relationships (Jones & Esnault, 2004; Ryberg & Larsen, 2008), which distinguishes it from other community based models where strong relationships and human-human relations are emphasised. The richness of relationships possible through networks (Granovetter, 1973) are acknowledged through the variability of tie-features, which include emotional intensity, measures of time, intimacy and reciprocal services (Jones, Ferreday, & Hodgson, 2008). An e-Portfolio learning community based on NL would benefit from both these characteristics and the rich theoretical underpinnings that have been validated over the last decade.

Research purpose

The overall purpose of this study is to investigate the ways in which networked learning can be used as the underlying community model for the collaborative activities that occur during the use of an e-Portfolio. Despite the breadth of research in learning communities and (separately) in assessment practices, there is a gap in the literature in how the practices and work constructed during a communities' lifecycle could be used, both for the growth of the community and

as evidence for assessment inside the e-Portfolio itself. Well planned high quality assessment is vital for academic learning communities, providing feedback opportunities for evaluation and improvement (Matthews, Smith, & MacGregor, 2012; Moule, 2007). Principles long held in networked learning such as dialogue, reflection and the nature of power relationships are noted as becoming increasingly important in e-assessment (McConnell, 2006; Whitelock, 2009). Combining e-Portfolios and networked learning in this way should reinforce the use of both.

E-Portfolio assessment emphasises the importance of an individual taking a greater control in the choice of work to be presented, compiled using the e-Portfolio architecture for an agreed purpose and audience. Best practice advises that each participant is given the opportunity to take part in reflective cycles (after Dewey, Kolb and Schön), to improve the created artifacts over time. The possibilities of community participation to allow for deeper learning (Ehiyazaryan-White, 2012; Tosh, Werdmuller, Chen, Light, & Haywood, 2006), suggests increasing the use of feedback from both tutor and peers, a process that has been enabled by many manufacturers bolting social networking features into e-Portfolios implementations. E-Portfolio use has increased in the academy, but they are frequently used for little more than assessment and reflection (Schwier, 2001; Sherman, 2006). More recent analysis of the potential of e-Portfolios suggests that a better educational experience can result from the consideration and embedding of the roles of artifact creation and goal setting, with an acknowledgement of the advantages that would come from the promotion of improved interaction (Chang & Tseng, 2009; Jones & Peachey, 2005).

Because of a lack of clarity in the application of an appropriate social pedagogy in the e-Portfolio literature, the nature of the participation, the philosophy of the community and the way in which such contributions should be shown are unclear. The research presented here will suggest that networked learning can provide an appropriate pedagogy for e-Portfolios, where the artifacts created by individuals in the NL context can be classified as resources that are shared, reused and collaborated on and with.

Despite its history, NL has to an extent been side-lined by the popularity of certain technologies and the claims of the connectivist community. Personal learning environments (PLEs) were initially a rebuttal to the monolithic institutional LMS, which was seen as controlled, archaic and unresponsive to

change. Social technologies such as Twitter and LinkedIn, include social interaction and extend the PLE concept into personal learning networks (PLNs), but it could be questioned whether these technologies promote individualised learning, rather than community and mutual engagement (Çimer, 2011; Dirckinck-Holmfeld, Hodgson, & McConnell, 2011). MOOCs currently dominate the e-learning debate either with an underlying, as yet unverified, connectivist approach (cMOOCs), or more commonly as more open versions of commercial learning management systems with little obvious pedagogy (xMOOCs) (Liyanagunawardena & Adams, 2013). This work will seek to reaffirm the validity of networked learning in the use of e-Portfolios.

Power relations in assessment

There is a conflict between the necessity of demonstrating individual learning to satisfy institutional requirements, and the nature of collaborative learning in a community. In subjects where there are many small repetitive skills or small subsets of knowledge, the ability for students to evidence their individual learning is small – in programming, for example, declaring variables or performing simple mathematical tasks become trivial duplicate tasks. It is in the application of this knowledge and these skills in medium to longer tasks, with a student initiated focus, that better assessment becomes possible. E-Portfolios allow for the nature of the assessment artifacts to be decided by the community itself. The underlying principles of peer based learning communities align with the empowerment that comes from allowing learners to dictate the nature of the material created, curated and presented. This should act to rebalance the tutor-student relationship, allowing the participants to alter the power relationships implicit in traditional assessment practices (Huot & Williamson, 1997). This work will also address the call for further research on peer-review in e-assessment (De Laat, Lally, Lipponen, & Simons, 2006a; Stödberg, 2012).

What this work will do – the contribution

Despite the increase in the availability of technology in education and the movement towards the read/write web (Web 2.0), Dirckinck (2011), suggests that it is unclear whether the potential and promise of networked learning posed by Harasim (1995) has been achieved.

This work will construct a framework for e-Portfolio assessment practices in networked learning based communities. This should serve to provide a theoretical approach, practical examples of the process, and a reference

implementation to enable an assessment process that supports collaboration. Using the notion of a learning community based on networked learning principles where co-operating peers are encouraged to create and share artifacts, this work attempts to devise a way for the participant's artifacts, the path they follow through their learning and the connections they make to form an overall picture that can be used for assessment purposes. Rather than being tutor directed, the shape, paths and the nature of the work constructed should emerge from the peers themselves.

Personal reasons for approach

As an action research (AR) project, a major aim of this work is to change my practice, allowing the opportunity for reflection and improvement in the assessment processes that are used in my teaching. Aligning AR with the open source development methodology (OSDM) ensures that any software generated in the project can be used elsewhere and that the participants will learn the principles of both AR and OSDM, which is a valuable outcome in itself.

A wider discussion of learning communities, networked learning and the use of e-Portfolios in assessment will be explored in the literature review in Chapter 2. The following section explores the local domain in which this work is situated, along with detail on the participants available for the study.

1.2 Domain

About the research site

Kingston University is a medium sized and middle ranked university 10 miles outside London. It has a student base with a diverse ethnicity, a large number of students who are the first entrants into higher education, and a widening participation agenda that is reinforced by the links it maintains with further education colleges in the local area (McDuff & Marcelline, 2012).

When a polytechnic, the institution recruited students with lower A level grades and compensated for this with more staff contact time, a lower staff student ratio and a focus on a variety of authentic assessments, using close links with business to situate learning in realistic settings.

In 1992, the polytechnic became a university and followed the government's massification policy to dramatically increase its intake – a policy aimed at increasing participation in higher education to 50% for all 18-24 year olds. As a

result, the number of full time students increased from 10400 in 1997 to more than 18500. This placed tensions on a stretched resource base and was countered with modularisation and an embrace in the use of blended learning. Modularisation has been a favoured approach in dealing with an upsurge in numbers - finding common subjects across degrees, and unifying them into a single delivery model can have apparent cost and efficiency gains. Common in America, it is also claimed that modular structures can provide more choice for students, allowing them to personalise their degree (Goldschmid & Goldschmid, 1973).

The business faculty is one of the largest in the university, with 5000 undergraduate and postgraduate students on general business courses and specialised degrees such as Accounting, Marketing and Business Information Technology. In the faculty the consequence of massification and modularisation has been much larger class sizes, particularly in the earlier years of the courses where modules can have up to 750 students enrolled on them. There is some degree of course identity loss, as students mix with more students from other degree courses, rarely repeatedly only interacting with students on their own degree. Attendance for most first year lectures in the business faculty is typically 50-70%, which indicates that the 'churn' rate for physical attendance is high, with many students not attending every session and using the learning management system for missed materials. Contact time and opportunities for assessment has been reduced, but these are aligned with offerings from competitor institutions operating in the same sector.

The Faculty of Business at Kingston University has a distinct philosophy towards integrating technical and theoretical practices. It has specific courses, modules and staff delivering computing and information technology subjects to business students to create what were originally called hybrid managers, graduates able to use, create and manage technology in business processes (Palmer & Ottley, 1990). Despite the term hybrid manager falling out of popular use, there have been recent calls to re-engage with the concept (Brackley, 2013) and the philosophy remains in the undergraduate BSc Business Information Technology course and the MSc Business Information Technology postgraduate conversion course. The modularisation structure means that specialist and non-specialist students, at both undergraduate and at postgraduate level, can take modules that cover systems analysis and design, along with implementation skills such as programming in server side scripting and database languages.

Pedagogic practices and the participants available for the study

Kingston has embedded technology enhanced learning practices throughout the institution, investing in learning management systems (Heaton Shrestha, Edirisingha, Burke, & Linsey, 2005) and advocating a hybrid blended learning approach (Garrison & Kanuka, 2004; Martyn, 2003; Singh, 2003) with e-learning technologists situated in each department (Ooms, Burke, Linsey, & Heaton Shrestha, 2008). Despite an increase in the use of the system for distributing lecture materials, the use of the more sophisticated collaborative tools such as social media, blogs and wikis remains low. Like most institutions, LMS usage statistics broken down by feature are not in the public domain, but Kingston's figures align with those institutions that do publish these details (Ashford-Rowe, 2013; University of Queensland, 2013).

Assessment technologies in the LMS are automated multiple choice testing, along with online short and long answer interfaces. The facilities for short and long answer questions, along with the digital drop box, are electronic manifestations of existing assessment practices where issues of alignment, authenticity, validity and sustainability apply. The increasing use of automatically marked multiple-choice tests has reignited an old debate about the usefulness (and consequences) of their use. Generally though, the assessment features are particularly underutilised, which is one of the core reasons for the initiation of this project.

For this study, undergraduate and postgraduate students on two taught modules will be available to participate:

- Web Scripting for Applications, and
- Business Internet Systems.

Web Scripting for Applications is a second year undergraduate module, with predominantly technically capable students. Typically 75-80% of the students tend to be on a BSc Business Information Technology (BIT) course, with the remainder coming from the other general or specialised degrees. Students electing to take the module from outside the BIT course have to demonstrate a level of technical aptitude, either in their first year module choices or from previous experience. Class sizes are between 30-50. In its original form, this module used an assignment and exam for assessment.

Business Internet Systems is a postgraduate module offered on M level courses, such as the MSc in Business Information Technology and the MSc Accounting Information Systems. Both these courses are conversion degrees, with class sizes between 13-20. The module is placed in the second half of the academic year, after a first semester technology module ensures that the requisite technical level has been achieved. Assessment on this module was traditionally by group work and exam.

Both modules have a blended delivery pattern, with face-to-face taught sessions in practical and theoretical exercises in laboratory settings, delivered over a 12 week period embedded in a semesterised pattern. Like most higher education institutions, there are no formal attendance requirements, although some modules monitor attendance for formative feedback processes. In both modules, there is evidence that students have variable engagement, with more intensity of activity, effort and attendance occurring around assessments.

This work presents two phases of an on-going project, in two action research cycles:

- Cycle one in the undergraduate Web Scripting for Application module for eight weeks.

- Cycle two in the postgraduate Business Internet Systems module for eight weeks.

The placement of the cycles has been designed to fit with the pattern of the academic year, the availability of the students, to allow gaps for developmental work and space for reflection on each action research cycle. Cycle one runs from the midpoint of the second year module, whilst cycle two starts from the beginning of the postgraduate module.

1.3 The framework and research questions

Underlying theoretical framework

This study is situated in interpretivism, with its acknowledgement of subjective perceptions of truth and the consequences of this for research methodology. Phenomena are considered in their natural environment and this intervention affects the reality of the study, which in itself forms part of the interpretation. Action research will be used for the intervention here, aiming for theory to be intertwined with practical emancipatory outcomes.

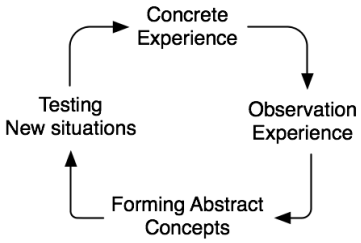


Figure 1.1 – Kolb's experiential cycle

E-Portfolio pedagogy is based on an experiential cycle situated in Dewey's work on learning, experience and transformation into action. A four step reflective learning cycle is most frequently cited (figure 1.1, from Kolb, 1984), which Kolb derived using models constructed from Dewey, Lewin and Piaget's learning approaches. Attempts at reframing the experiential cycle for portfolios to include an interaction element bolt on additional phases to include collaboration and feedback (JISC, 2008), but the underlying process is not clear (figure 1.2).

Figure 1.2 – JISC e-Portfolio learning process

This work uses a networked learning based community to clarify the nature of the collaboration and community driven feedback that should be used. Learning communities vary in definition, underlying pedagogy and technology, with development occurring in both practical settings and in theoretical discourse. Networked learning has differentiated itself by emphasising the peer-based nature of the learning community used, although this is not explicit in the NL definition:

> "'networked learning' is learning in which information and communications technology is used to promote connections: between one learner and other learners, between learners and tutors; between a learning community and its learning resources" (Jones, Asensio, & Goodyear, 2000, p. 18).

Aligning the networked learning definition with an appropriate e-Portfolio design allows the repository of participant generated artifacts to act as learning resources to be shared between the communicating peers. In this context both the tutor and the e-Portfolio system itself will act as the agents undertaking the promotion of these connections. The literature on learning communities also provides a greater theoretical underpinning on the nature of shared artifacts.

The popularity in the use of learning communities has come from the emergence of communities of practice (Clow, 2013; Wenger, 1999; 2002), the rediscovery of Vygotsky's work on zones of proximal development (ZPDs) and the increasing availability of social based technologies. The overarching philosophy in social learning systems is that deeper knowledge and understanding comes from co-constructed learning, acknowledging that cultural knowledge is situated in a social cultural context. Meaningful learning has participation and reification (making into an object),

> "the process of creating produce physical and conceptual artifacts—words, tools, concepts, methods, stories, documents, links to resources, and other forms of reification—that reflect our shared experience and around which we organize our participation" (Wenger, 2010, p. 1).

Numerous frameworks and analytical approaches have been applied in networked learning (Conole, 2010; Siemens & Long, 2011). This work seeks to improve practice and as such uses action research and a thematic analytical framework with an underlying mixed methods approach, a transformative study, where a triangulation of quantitative and qualitative data will be the best way to converge the information (Creswell, 2013; Kennedy, Ioannou, Zhou, Bailey, & O'Leary, 2013). Mixed methods offers the possibilities of cross validation and corroboration, but also an increase in required effort and the possibilities of discrepancies (p. 217). Thematic analysis will be used here to qualitatively interpret and organise the data, using analytics, social network analysis and

interviews, an approach that is suggested as appropriate for the complexity of the activity taking place (Campbell, DeBlois, & Oblinger, 2007; De Laat, 2005; De Laat & Lally, 2003; 2004; De Laat, Lally, Lipponen, & Simons, 2006a; 2007).

Research questions

Research into the use of e-Portfolios technology commonly focuses on the individual learner, with the notion of the community either missing from the discussion or briefly mentioned as part of a design to satisfy peer appraisal. This work flips this, using a networked learning community as the core, with participant's artifacts placed in a shared communal space for peer appraisal. The research questions focus on the nature of artifacts that are created, how they are used in the community and the form of the community itself:

Research question 1: What assessment artifacts emerge from co-operating participants in a learning community?

Research question 2: How are artifacts shared, used and reused by the community?

Research question 3: What is the role of the tutor and the form of the community?

1.4 Research approach and the intended audience

Using action research

This work will use action research for a number of reasons - it is work that is informed by a degree of pragmatism in that it seeks to improve my own practice and the belief that the change process can be emancipatory for the participants. This will result in better ways of integrating technology, learning processes and assessment practices. There is a long history in the use of action research in educational projects as a consequence of the teacher as researcher movement, which advocated that curriculum research and development ought to be the remit of the teacher (Clow, 2012; Elliott, 1991; Stenhouse, 1975). Action research concerns an improvement of practice, in the understanding of practice and in the situation in which practice takes place (Carr & Kemmis, 2003). The emancipatory nature of AR correlates with the networked learning peer community philosophy and there are many example of its use in NL projects (Clow, 2013; Dirckinck-Holmfeld & Jones, 2009; McConnell, 2006).

The open source development methodology (OSDM) has principles and processes that naturally align with action research, including cycles of activity, peer like relationships between participants (participant as researcher in AR, participant as co-developer in OSDM) and a critical agenda in the free software movements freedoms enshrined in the principles of the GNU general public license (GNU GPL). The use of action research and the open source development methodology in this project are discussed in more detail in chapter 3, which deals with the research design.

Intended audience

The research may prove useful to educators in promoting learning community use for assessment. Despite the availability of forums and e-Portfolio technology in learning management systems, usage remains low. By demonstrating the advantages that arrive from combining these, it is hoped that there could be an increase in use, along with an acknowledgment that more sophisticated frameworks and implementations are required. The e-Portfolio moderation model suggested here may be useful in other settings and the application developed during this project will be placed under a free software license, which means that the code is available for free for any further researcher to use, develop or integrate in further projects.

Emphasising the use of the networked learning community based model is also important. NL has a rich history demonstrated by conferences, research, analytical frameworks and practitioners and it is hoped that this work will contribute to that field.

1.5 Overview of the thesis

This document has the following structure:

Chapter 2	Contains a literature review concerning learning communities, networked learning and e-Portfolios.
Chapter 3	Contains the research design, the methodology and methods used for data collection, along with the pedagogy and ethical approaches used.
Chapter 4	Explores the first action research cycle, with second year undergraduate students. Data is collected through the e-Portfolio artifacts, posts and activity in the learning community, along with a post cycle questionnaire.
Chapter 5	Contains the discussion of the data from the first cycle, a reflection on the process and changes to be fed forward into the second cycle.
Chapter 6	Explores the second action research cycle, with postgraduate students. Data is collected through the e-Portfolio artifacts, posts and activity in the learning community, along with post cycle interviews.
Chapter 7	Contains the discussion of the results from the second cycle, a reflection and suggested improvements that would carry forward.
Chapter 8	Conclusions, answering the research questions, reflections, implications and suggestions for further work.
	References

Chapter 2 Literature review

This chapter reviews the literature that informs my research. I begin by exploring the major movements in assessment to derive the characteristics of better assessment practices. I then trace the three distinct phases of portfolio development through analogue, digital and online architectures, and the ways in which they are categorised and used. I follow this with a consideration of the underlying pedagogy for e-Portfolios, showing how the extension of Web 2.0 social technologies into portfolios has resulted in poor or missing explanations for both the nature of the artifacts and the underlying community that exists in this context.

I argue that the learning community literature, specifically networked learning, can offer an applicable theory that can be used to address this gap and to situate the learning and assessment that occurs around portfolios. Frameworks used in the analysis of networked learning communities, such as Community of Practice and Community of Inquiry, are shown to provide a better description of an e-Portfolio artifact and a model for the analysis of the community interaction through which artifacts are created.

Learning communities are not without difficulties, and a discussion of the inconsistencies and possible dark sides of community-think are explored. The literature review concludes with a discussion of the contribution my research makes to the understanding and implementation of e-Portfolios based around a social pedagogy.

2.1 Assessment, technology and e-Portfolios

Boud (1995) suggests that there have been four distinct eras in the development of assessment practices, which he delineates as traditional summative assessment; assessment as measure; competency or authentic assessment; and a period of a broader holistic approach.

The earliest forms of assessment derived from the scientific model, where post-teaching testing occurred to see if necessary facts and skills had been acquired. A consequence of the space race in the 1960's was that the perceived inadequacies of the educational process came under higher levels of scrutiny. Assessment results became an obvious, but blunt, quantifiable measure of the quality of the teaching process and an indicator of institutional achievement (Eisner, 2003). Assessment fell into two broad types and language was developed to distinguish between them; formative evaluation where the feedback was used reflectively to

improve performance and summative evaluation, typically in the form of terminal assessment, to decide or sort (Scriven, 1966). The constructive alignment movement can be seen as a response to this. If assessment is an indicator of the quality of a process, closely aligning the learning objectives and outcomes to the assessment process was predicted to raise the quality of both (Biggs, 1996). In practice, the possibility of overly prescriptive, subjective learning outcomes can fail to represent the complexity of the learning taking place (Entwistle, 2005; Hussey & Smith, 2008). Biggs' approach, where 'students are entrapped in this web of consistency, optimising the likelihood that they will engage the appropriate learning activities' (Biggs & Tang, 2010, p. 54) can also remove the opportunities for self-direction (Beetham & Sharpe, 2007) or, as even Biggs (2014) suggests, support a managerial approach.

The increasing influence of the employability agenda can be seen in the introduction of competency measurement and authentic assessment. Rubrics indicating kinds of work to be performed along with levels to be acquired, are a more natural indictor of workplace progress than learning outcomes (Andrade, 1997; Bean, 2005). Authentic assessments, where problems or realistic tasks are wrapped in real world simulations and a context that resembles professional practice, are seen as ensuring the appropriateness and transferability of knowledge and skills (Wiggins, 1999). Such simulations must be authentic and be *perceived* to be authentic to succeed (Gulikers, Bastiaens, Kirschner, & Kester, 2006). The consequential validity of assessment, specifically the intended and unintended effects on the learning process, can be seen in the idea of sustainable assessment. This addresses the on-going education of the student after the course completes (Boud, 2000), emphasising a duality where assessment is used both during the teaching process and also later in life to increase the facility for self-assessment and reflection (Boud & Walker, 1998).

Acknowledging that students have differing initial skills and requirements, accreditation for prior learning (APL), has been popular in tertiary or vocational training, traditionally through portfolio building and rubrics. There are higher education models in use, such as the prior learning assessment and recognition movement in Canada (Wong, 2008) and the European Bologna scheme (Adam, 2002). Despite the possibility of credit movement based on APL and QAA guidelines advocating its use (2004), there has not been a significant take up of this approach in UK higher education.

The overemphasis on summative results led to a resurgence in supportive work on formative feedback in the assessment for learning movement. Here, assessment is part of a continuous process, which focuses on the future path learners are to follow (Wiliam, 2006), with verbal or written feedback feeding forward, indicating the progression and direction for the learner (Black & Wiliam, 1998). Current definitions emphasise the appropriateness of the forward path, suggesting that this direction will be better than that which would have been taken without the elicited evidence (Black & Wiliam, 2009a). Formative assessment processes are less concerned with reliability, but by rapid and frequent feedback which suggests validity through improved action (Harlen & James, 1997).

Formative assessment tends to be criterion based and occurs during a learning activity with the aim of activating students so that they become owners of their own learning (Wiliam, 2011), providing a richer picture compared to representations possible through summative measures (Yorke, 2005). The traditional role of the teacher as assessor can be re-evaluated, seen in the many examples of formative feedback processes advocating reflection, co-operation and collaboration using self, peer and co-review of work (Bostock, 2000; Boud, Cohen, & Sampson, 2001; Dochy, Segers, & Sluijsmans, 1999; Gielen, Dochy, & Onghena, 2011). In this context peer and community review can tackle issues of plagiarism, by suggesting that it is a cultural practice that involves social relationships, identity, values and attitudes (Valentine, 2006). Solutions involve asking the community to self-police its own work, embodying a culture of honesty and integrity (Kenny, 2007).

The lifelong learning movement can be seen as a counter to the alignment, competency and authentic assessment strategies. This promotes a holistic view of education based on balance, inclusion and connection where student centred learning is integrated into a whole world context of growth, process and personal development (Miller, 2007). Despite a focus on learning how to learn in this context, there is frequently a failure to acknowledge the requirement for the capacity to be developed of assessment; of formatively determining what has been learnt and then planning future actions accordingly (Boud & Falchikov, 2006).

The full consequences in the advances of web technologies to assessment are still being felt. The closest models to the read/write web are approaches that involve

the students in a collaborative constructivist process such as in discussion forums, setting assessment goals (Rust, Price, & O'Donovan, 2003) and participating in self and peer marking processes (Orsmond, Merry, & Reiling, 2000). These work best when embedded in a process with a distinct learning pedagogy, such as resource-based learning, problem-based learning or one of the learning community models. Assigning individual marks can be problematic in these rich environments, particularly if the role of assessor has been decentralised. Some attempts at measuring amounts or degrees of participation have been attempted using portfolios, data mining or content analysis (Blignaut, Blignaut, & Trollip, 2003; Dringus & Ellis, 2005; Littlejohn & Pegler, 2004). Most portfolio style approaches require students to present artifacts resulting from their participation, along with justifications for their inclusion to add context (Macdonald & Twining, 2002; McConnell, 2000).

Virtual learning environments (VLEs) are the main institutional mechanism for delivering technology enhanced learning, whose introduction coincided with the popularity of the blended learning movement. Initially providing simple file management capabilities, they have transitioned by adding features such as assessment, student management, collaboration and communication. The recent addition of technologies typically associated with the web 2.0 movement such as blogs, wikis and podcasts have suggested a movement away from transmission based pedagogies towards more constructivist approaches. Despite these advances, VLEs typically offer assessment mechanisms which are online versions of familiar analogue methods such as short answer and multiple choice tests. Longer reports or assignments can be submitted through digital drop boxes, and scanned by plagiarism systems. There are a few examples of non-traditional use of these (Draaijer & van Boxel, 2006; Ledwith & Rísquez, 2008), but most practices replicate the traditional tutor-led marking processes. The majority of the blended learning texts focus purely on learning and teaching mechanisms, assuming that the assessment tools supplied by the VLE systems will be appropriate. The poor use of such tools coupled with the perception of a low consequential validity can induce a negative backwash effect (Gielen, Dochy, & Dierick, 2003) or reignite the arguments over the assessment of knowledge and skills at the higher end of Bloom's taxonomy (Anderson et al., 2000) in multiple choice tests (Scouller, 1998; Woodford & Bancroft, 2005).

Blogs, wikis and podcasting in assessment typically use social constructivist and community based pedagogies (Bruns & Humphreys, 2005; Williams & Jacobs,

2004). Although initially difficult to construct and integrate into other technologies, the arrival of sophisticated web toolkits has allowed for the building of more complex interactive and responsive based learning and assessment applications. Perhaps because of the lack of such sophistication in the VLE tools, there has been a rise in the use of personal learning environments (Beauvoir, 2010) and personal learning networks. These are a loose collection of web based tools bound together by the user, typically consisting of a blog, bookmark manager, wikis for collaborative work, themed social networking using products such as NING (2014) and a personalised homepage. These exist outside the institutional VLE domain and the closest thing to assessment here is the use of public personal learning journals, frequently becoming the place for participatory reflection (Attwell, 2008).

The wide variety of types, technologies and underlying theories results in assessment being used in numerous ways, ranging from temperature taking, gate-keeping, assessment of course objectives, feedback for teachers and for assessment of the quality of the educational process (Eisner, 2003). These multiple uses led some to decry the whole summative model as being in disarray (Knight, 2002), particularly as studies indicate that the knowledge and use of many of the more advanced practices are low amongst staff in higher education (Taras, 2008). The idea of a hidden curriculum, where the actual learning that takes place is separate and distinct from the lecture hall or classroom activities (Snyder, 1971), suggests that assessment has been and will remain a key tool in the interaction between staff and student.

The definition and origins of e-Portfolios

Portfolios have been an accepted form for presenting student work for decades, with an origin in art education through to their more recent use in competency based vocational qualifications. Perhaps because of the broad use of portfolios in a variety of different fields and implementations, there is no single agreed definition for the term. Some focus on the nature of the collated work, “a portfolio is a place where a student’s selected work is kept, ... [any] container designed or created by the student to hold his or her artifacts” (Graves, 1994, p. 171), “a purposeful collection of student’s work that illustrates efforts, progress and achievement” (Barrett, 1998, p. 6). Other definitions focus on how the collation process itself can reveal a view of student performance in context (Paulson, Paulson, & Meyer, 1991), where portfolios make learning visible (Johnsen, 2012). This variability in definition led Barrett to call for the

overloaded term to be qualified to indicate whether used as a showcase or to "illuminate capabilities not covered by standard assessment" (2005, p. 2).

Portfolios offer a way of addressing good practice in assessment:

- Reflection – assessments should increase the opportunities for self-assessment (Boud & Walker, 1998; Schon, 1983).
- Sustainability – assessments should address the on-going education of the student in the context of lifelong learning (Boud, 2000).
- Authenticity – problems or tasks should be realistic and use a context that resembles professional practice (Gulikers, Bastiaens, & Kirschner, 2004).

The transition from portfolio to e-Portfolio occurred two decades ago, with digital artifacts and containers becoming available in the classroom. First generation digital portfolios used a proliferation of different implementation strategies from authoring of multimedia CDs and DVDs, through to hypertext based web pages containing blog style entries using web servers. The claimed educational advantages of portfolios such as inducing deeper learning, emphasising learner autonomy and promoting reflection have all carried forward in this transformation. Driven by national and international acceptance of e-Portfolios as a preferred assessment approach, they survived the inevitable description as the next in vogue practice that would transform assessment, to become a leading technology in the assessment for learning movement, promoting more varied types of assessment and richer records of achievement (Zeichner & Wray, 2001). Shulman suggests that they:

- permit the tracking and documentation of longer episodes of teaching and learning;
- allow reconnection between process and product;
- institutionalise norms of collaboration, reflection, and discussion;
- introduce structure to a field experience; and
- shift agency, empowering the learner

(Shulman, 1998, p. 24).

It was a natural progression for second-generation e-Portfolios to switch to internet technologies, using many of the techniques developed in the multimedia, hypertext and database based portfolio processes. These rapid technological changes have rendered a variety of terms, platforms and technologies redundant,

although the movement towards digital artifacts in teaching and education has made the collation process easier (Batson, 2002). In its current usage, the term e-Portfolio refers to database-driven, dynamic web sites, rather than static, HTML-driven constructions (p. 3). The flexibility in implementation, linked to the e-Portfolio ontology, brings with it tensions between flexibility and rigidity. Either the systems allow complete customisation requiring a higher degree of technical ability in authoring web pages or offer fixed templates which are easier to use but restrict choice and design. Both types provide opportunities for feedback on performance and reflection (Steeples, Jones, & Goodyear, 2002), but poor implementations may give rise to entries that "lack purpose, offer limited integration of knowledge and weak connections between evidence and actual practice involving growth" (Pitts & Ruggirello, 2012, p. 49).

Types of e-Portfolios

There are a variety of e-Portfolio implementations, with little compatibility between the systems or the working processes explicit in their use. E-Portfolios can be differentiated by the way they are used rather than by type, indicating their use for developmental, presentation or assessment purposes (Mason, Pegler, & Weller, 2004).

What goes into the portfolio depends on the purposes of student, teacher or institution (Graves, 1994). Portfolios are positioned into broad uses where they:

- demonstrate individual competence; to develop, demonstrate and reflect on pedagogical practice, show their attitudes, knowledge and skills (Sherry & Bartlett, 2005);

- showcase qualifications and competencies, as well as for critical reflection and learning purposes (Lorenzo & Ittelson, 2005), and as a vehicle for institution-wide reflection, learning and improvement;

- demonstrate institutional accountability outwards, to make accreditation processes more visible, and to show collective student progress (p. 6).

Showcase portfolios typically have artifacts which are the 'best' examples of completed work, with writing or reflective analysis that place the work in context. *Working portfolios* show in-progress artifacts, where growth and improvement are detailed over time, so that the collected work indicates a pathway through a developmental process. Portfolios that emphasise reflection

through facets or phases of learning fall into the *process portfolio* category. These categories may overlap to some extent, depending on the e-Portfolio pedagogy and implementation in use. With such variability in features and use, aligning pedagogy with the technology is vital, through appropriate guidance and scaffolding (Yancey, 2009a).

A further way to categorise e-Portfolio implementations is by the degree of learner choice in artifact creation, and whether the learner loosely collects external artifacts together, or is allowed to weave a story together suggesting the learning taking place over time.

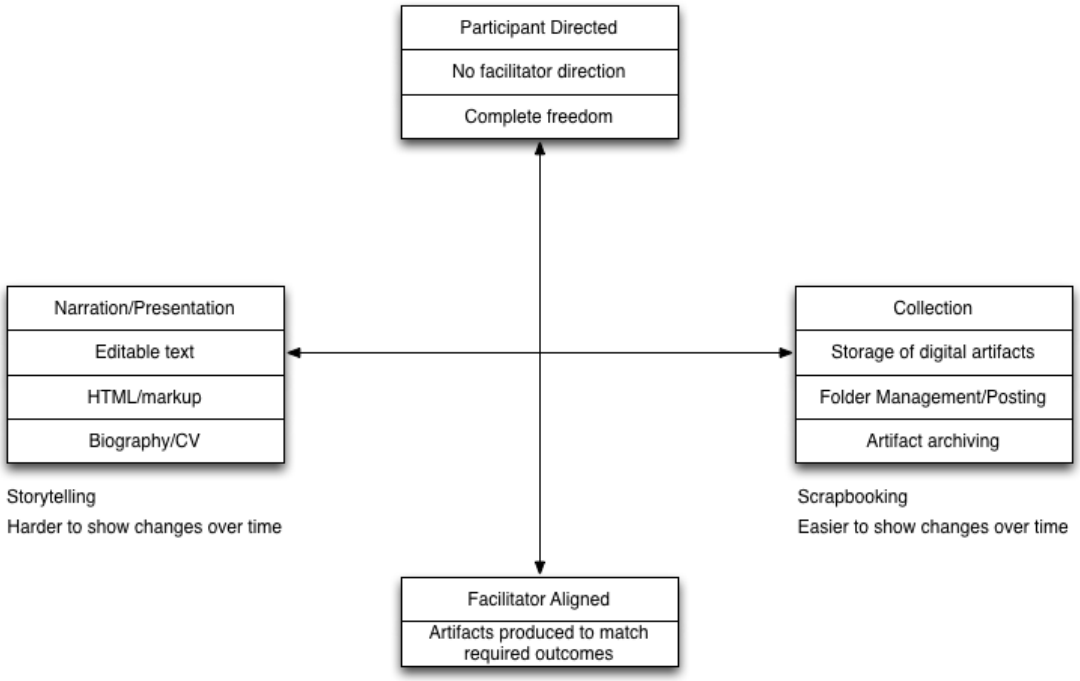


Figure 2.1 - e-Portfolio types

Some implementations build principles of constructive alignment into the artifact creation process, shown as the vertical axis in figure 2.1. These portfolios are tutor led, with participants aligning artifacts to learning outcomes embedded in the interface, as evidence of their progression. This differentiation can suggest a divide between summative and formative assessment (Barrett, 2006). Such alignment can be regarded as being problematic, when the artifacts are measured against "some high-stakes purpose", as the deeper learning possible through reflective processes could be at jeopardy (Barrett & Carney, 2005, p. 4).
Paulson and Paulson (1994) align the participant/facilitator axis with particular paradigms, suggesting that the facilitator aligned model is positivistic, in that it has participants match against distinct agreed outcomes. The constructivist

portfolio allows greater freedom in artifact choice, so that the portfolio is a mirror of each individual's unique learning path.

The horizontal axis indicates where the artifacts are created and their context. Scrapbooking style portfolios allow for the loose collation of external artifacts, typically as attached digital objects laid out in a file/folder system. Storytelling portfolios require the learners to articulate a narrative, showing their flow and progression over time, typically in the form of mark-up based web pages, which are created inside the system itself (Barrett, 2008).

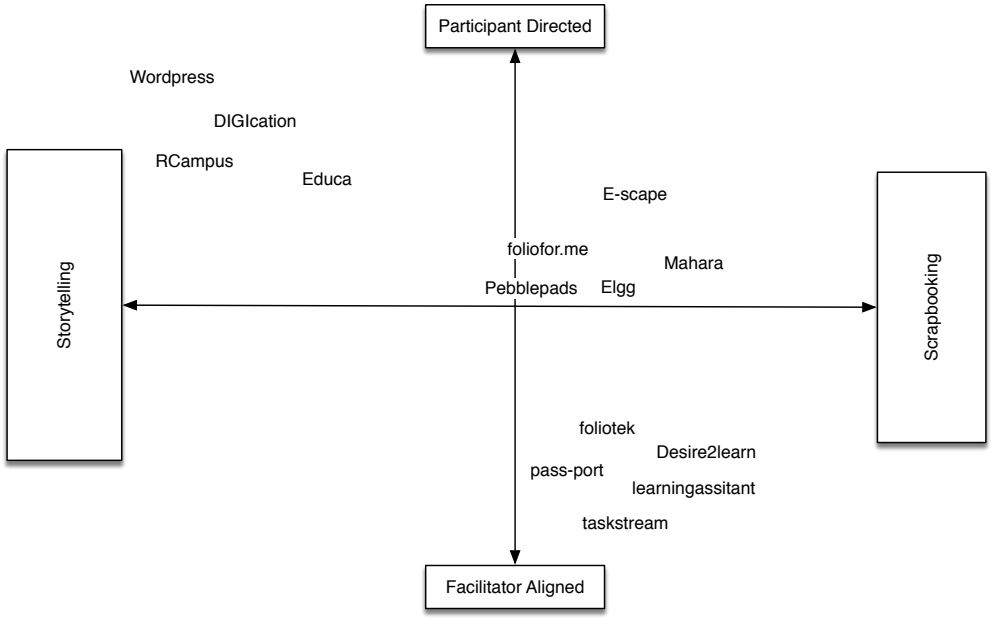


Figure 2.2 - e-Portfolio implementations

Implementations vary, but can be placed according to the degree of participant freedom and the way that the artifacts are presented (figure 2.2). e-Portfolios such as DIGIcation or Educa use a curated web page approach. WYSIWYG engines allow users to customise pages to look like CVs, reports or descriptions of activities. Mahara and Elgg allow artifact management; resources can be created outside the system and uploaded to the users library. There are then various ways of presenting uploaded artifacts, such as micro blogging around each item or by using templates for viewing. Portfolios such as Foliotek or Taskstream allow artifacts to be uploaded aligned to tutor described requirements; tutors can then see progression through which artifacts have been pinned to which outcome. This is the approach that many of the new generation of cloud based e-Portfolios use, such as OpenSchool (OpenSchool, n.d.).

The placement of portfolios along these axes is open to variation, as some of the systems allow add-on or plug-in architectures that change the functionality. It is also possible for portfolios to be used in alternative ways, for example a portfolio which does not enforce tutor led outcomes through the interface could be used with an 'external' list of tutor suggested artifacts enforcing what should be created.

There is no agreed standard single representation for an artifact, with XML descriptions encapsulating the wide variety of forms that an artifact can take by repurposing the ATOM XML specification (Grant, 2009) or by focussing on the interoperability of artifacts (Cambridge, 2006). The use of images has always been integral to e-Portfolio construction, either through their use in storytelling type structures in mark-up or through collation in album catalogues. The technical advantages of using images to represent evidence are that they can overcome issues such as file type support, the variety of proprietary software that users may have and the unpredictability of the rapidly changing nature of software, which combine to create wide variations in platforms, devices and use cases.

Most e-Portfolios acknowledge the importance of reflective text to both situate the artifact in context, assessment purposes and to promote the deeper understanding that is claimed from reflection. Situating the text is also important where the artifacts are being placed in a social context. Many acknowledge a constructive pedagogy and claim a social constructive element through the use of discussion forums that can attached to public artifacts. There is little pedagogic detail on the way in which this sharing is formalised, or how collaboration and cooperation is promoted. Most sites that place artifacts in a social context allow cataloguing to aid searching, sorting and filtering to take place (YouTube, Delicious, Pinterest). Educational taxonomies (Bloom, Biggs) and folksonomies can be used for this purpose, but the evidence for their use in artifact representation is scant.

2.2 Pedagogy and process in e-Portfolios

The activities of learners using an e-Portfolio are most frequently presented as a series of stages or processes, either in terms of whole portfolio usage or as an interactive process used repeatedly to create, present and then reflect on artifacts. Danielson (1997) styles the portfolio creation process as five stages in a sequence - conception, collection, selection, reflection, and connection (to goals). Most authors place the process in the cognitive processing tradition, suggesting

that each artifact is created using a reflective cycle derived from Dewey and Kolb. e-Portfolios offer the best example of this kind of process, containing individually constructed artifacts and reflections on each piece of evidence. Typical elements included could be education history, certificates, work-samples, awards, personal values, photos, videos and observation. Work here is "configured … as a context for learning" which can allow the demonstration of learning outcomes that may be difficult to present using more traditional assessment techniques (Sherman, 2006, p. 2). The artifacts that are collected can be from an authentic practice or simulation and when gathered at the end of the process, form a valuable record of the reification process.

Asking learners to select and create their own artifacts induces a more learning-oriented view of assessment. As learners become skilled they are more likely to become autonomous and fluent in the collecting evidence process (Smith & Tillema, 1998). Chen (2002; 2005) uses the term 'folio thinking' to suggest the embedding of the collection and reflection process into the learning that occurs.

Increasing the agency of the learner requires flexibility in the nature of the teacher role, requiring facilitation, tutoring and project management skills. Strategic approaches such as instructional scaffolding (Acosta & Lui, 2006) can enhance the teaching and learning by changing the traditional role of assessors from authoritative gate keeper to collaborative guide. Successful e-Portfolio tutors steer students through the process, providing continuous and prompt feedback and promoting student self-reflection through reflective comments (Çimer, 2011). The level of guidance given on the nature of artifacts to be created is key, with balances required on the specificity of the items to be collated. More prescriptive specific detail on the nature of the artifacts can supply metacognitive scaffolding, but may run counter to the principle of encouraging participants in setting their own learning goals (Sherman, 2006).

Most e-Portfolio implementations introduce this procedural disconnect (Pitts & Ruggirello, 2012), by insisting that artifacts are uploaded to satisfy a particular rubric generally set by the teacher. A post reflection process may then be required on the experiences and material presented, similar to Schön's reflection-on-action, "re-establishing a logical connection by synthesizing and interpreting" (p. 51). Pitt's alternative approach suggests that each artifact should in itself be viewed as an opportunity for reflection and be used as a unit of analysis for reflection-in-action. How frequently the tutor provides feedback

does appear to affect the artifact creation cycle, with more frequent interventions likely to add clarity, coherence and lack of ambiguity (Steeples et al., 2002), but reduce the participants agency and time to reflect. Ultimately, tutors have to assume the gatekeeper role to validate artifacts as student's authentic work (Lorenzo & Ittelson, 2005). Despite this difficulty, portfolios provide a way to actualise a shift in the locus of control to emphasise student centric learning and to develop students' social capital (Acosta & Lui, 2006; Batson, 2011).

The importance of reflection and feedback

Nearly all explanations for the underlying portfolio pedagogy emphasise the importance of the feedback and reflection part of the process, where participants can monitor their own development from continuous feedback, reveal discrepancies between self perceptions and actual competency, and enable their performance to be documented (Smith & Tillema, 1998). The opportunity for the use of reflection amongst the participants is seen as the key advantage of portfolio use over more traditional forms of assessment (Barrett, 2005; Cross, 2012; Pitts & Ruggirello, 2012) and its use has been suggested as a spearhead in the transformation towards situated learning (Batson, 2011).

Dewey (1910) originated the concept of reflection as a holistic disciplined way of thinking where meaning making is achieved through "active, persistent and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it, and the further conclusions to which it tends" (p. 118). Boud (1985) describes it in terms of recapturing experience involving thinking, mulling and evaluating in a process of continuous learning. Various authors have attempted to further define, refine or categorise the concept, particularly in teacher training where the acceptance of the reflective model in education has required more detail on the ways in which reflective thinking can be induced. Schön (1990) critiques the positivistic model and learning transmission process, indicating that they fail to address the nature of problem solving in scenarios involving real world complexity. His model of reflection-in-action and reflection-on-action is used frequently, and adds procedural detail addressing the context of professional development, where reflection is seen as a key solution to the failures of technical rationality.

Despite its wide acceptance, Schön's model of reflection may be harder to use in practice (Boud & Walker, 1998) and can be criticised for failing to more fully acknowledge the social context of reflection – even though the inherent dialogical nature of reflective feedback is addressed, the aspects of wider social interaction are not fully tackled (Kotzee, 2012) despite being critical (Rodgers, 2002). Eraut (1995) critiques the divide of reflection into the in-action and on-action model and although supportive of on-action, suggests that the nature of time and speed of cognition are not fully acknowledged (p. 19).

Figure 2.3 - Kolb's learning cycle

The portfolio literature uses the reflective cycle as its core pedagogy, most frequently citing Kolb's experiential learning cycle (Kolb, 2005). This model derived from Dewey, Lewin and Piaget enhances the detail of the reflective process by describing four activities in the reflective cycle (figure 2.3). The constructive stages of collection, selection, projection and presentation encourage students to adopt a more reflective approach to learning (Sherman, 2006), which allows students to act upon the feedback and revise or redraft work integrating the advice from faculty, advisors and others (Pachler & Daly, 2011; Walz, 2006). Making connections between the artifacts, learning self-assessment skills and developing the stance of the reflective practitioner are all claimed advantages (Yancey, 2009b). Despite the fact the Kolb himself moved away from the successive cycle model in his later work (Illeris, 2007), it is still frequently advocated, for example in JISC publications (Gray, 2008).

There can be issues with e-Portfolio use. Shifting the locus of control to the learner allows for the possibility of "lamination", where the portfolio becomes an exhibition or self-advertisement, used for superficially showing off (Shulman, 1998). Deciding what should or should not be represented as an artifact is an acquired skill, so it is common for participants to initially misjudge this, adding trivial artifacts with limited reflection (p. 24). It is also possible that the "best work" represented may not describe the typical true picture of competency, although this can happen in other assessment practices (Delandshere & Arens, 2003). Institutional requirements for marking schemes and outcome guidance act against the idea of learner set objectives. Attempts at using constructive

alignment may result in an overly detailed description of outcomes, regimenting the artifacts chosen and reducing the e-Portfolio to little more than a traditional assignment (Shulman, 1998).

With the wide uptake of social networks and the inclusion of social facilities into learning management systems, it has been a natural progression for similar technologies to be added to both commercial and open source e-Portfolio systems. One of the significant indicators for portfolio maturation is the degree to which social interaction is supported (Love, McKean, & Gathercoal, 2004). Unfortunately most of the e-Portfolio architectures available do not supply effective facilities that support collaboration, with many of them not revealing what peers are learning (Hartnell-Young, 2007). With the switch to cloud based implementations, the e-Portfolio cycle has been extended to include collaborating peers. This may increase the opportunity for plagiarism, or uniformity in artifact reification, although better portfolio architectures makes this visible (Dalziel, 2008).

How an artifact is constructed, improved and presented within a social context is problematic, as there are gaps in the e-Portfolio literature. Most discussions situate artifact creation in a constructive epistemology, offering little guidance on what a socially constructed artifact should be. JISC offers a modified version of Kolb's learning cycle with an attached social component (figure 3.4), where the collaboration, sharing and social feedback are disjoint from the main cycle (Gray, 2008).

Figure 2.4 – JISC modified learning cycle

Although e-Portfolios can be used for both formative and summative processes, the reflective cycle is claimed to support superior formative assessment (Barrett, 2010) when situated in a constructive pedagogy (Barrett & Carney, 2005). This

transparent space makes the teaching and learning visible (Parkes, 2013) and if the nature of the practice is clear and well defined (Strivens, Baume, Owen, Grant, & Ward, 2009) the openness can be used to overcome issues in formative assessment processes (Stefani et al., 2007).

The reflective cycle is still key in e-Portfolios architectures that support the enhanced social aspect. Portfolio prototypes with these features are starting to appear, suggesting that the emphasis on the social component motivates and fosters "authentic student voices and facilitates student-centred social content" (Klein, 2013, p. 71). Seeing others' content improved their own work and increased their perceived ownership of the materials by putting them "in charge of their work" (Garrett, Thoms, Alrushiedat, & Ryan, 2009, p. 205).

The nature of the supporting portfolio community is generally unclear and typically sidesteps discussions on the nature of the underlying pedagogy that should be applied. Most of the literature agrees with the importance and value of peer assessment, suggesting that promoting collaborative peer to peer learning increases social awareness through community interactions (Acosta & Lui, 2006). Deeper, more meaningful learning is created through social contextual experiences (Carmean & Christie, 2006), but there is a failure to provide any guidance on how to achieve this in a portfolio system, for example, Barrett and Carney (2005). There are occasional examples that attempt to clarify this process, for example a learning portfolio using a secondary layering of peer assessment through a blog with anonymous review situated in a community of practice (Stevenson, 2006). Skills such as learning in a network, collection, aggregation and forming 'connectedness' are declared essential (Cambridge, 2009) but without clarity in how they should be encouraged.

The next section explores the recent history of learning communities and then suggests how the community models associated with networked learning can be applicable to e-Portfolios.

2.3 Learning communities and networked learning

The increasing popularity of the learning community in the academy has a complex set of roots, from investigations into the apparent collapse of western social capitalism, the rediscovery of the soviet philosophers, the practicalities of American college education in the 1980's, through to community pedagogy popularisation and shifts towards inclusive connecting and mobile technologies. The historical development of the learning community can be difficult to

evidence as communities of learners may not be oriented to documentation (Hugo, 2002), and cohesive groupings may be empirically unobservable (Brookfield, 1983).

Smith (2001) suggests three historical phases in the development of learning communities in the American system, starting with Meiklejohn's Experimental College at the University of Wisconsin. Running from 1927 to 1932, a cross section of students participated in a living-learning community within a residential social experience, which promoted active learning, initiated facilitation roles and broke subject silos. Curricula and co-curricula activity were intertwined, professors were re-designated as advisors and many of the traditional educational structures such as required attendance, courses, electives, and departments abandoned. Participants used active and experiential learning with a variety of assessments to provide structure and accountability (Smith, MacGregor, Matthews, & Gabelnick, 2004). Despite the success of the graduates, the programme ended in 1932, due to organisational incompatibilities, internal politics, interference from the faculty and conflicts between participants and other students (Meiklejohn, 1932).

Many of these ideas continued in community college innovations during the 1960s, such as in programmes at the University of California and San Jose State College, where they experimented with structure, educational roles, curriculum content and pedagogy. Although modest, many of the initiatives failed due to organisational incompatibilities with issues of scale and cost, similar to those that had affected the Experimental College. The positive consequences of these programmes were that many of the innovations developed during the process entered mainstream practice, such as student-centred learning, active learning and interdisciplinary relevant curricula (Smith, 2001).

Despite these projects, the transmission model of teaching and learning was still dominant in the 1970's and 80's, with an underlying behavioural and cognitive model. Designating learning as a change in behaviour, suggested that reinforcing practice strategies would serve as a foundation for teaching practice where knowledge was transmitted to and then acquired by a learner. It was not until the success of the Evergreen State College project that learning communities had a widely acknowledged success (Jones, 1981), along with research advocating its advantages such as engagement, retention and enrichment (Tinto, 1995; 2000). Using a constructivist meaning making approach, the Evergreen project was heavily influenced by the Berkeley programme at the University of California and

used year long co-ordinated studies, organised around interdisciplinary themes (Smith et al., 2004). It also successfully addressed the scaling, cost and administrative integration problems that had stymied earlier attempts (Kuh, 1991). Evergreen became a leading advocate for learning communities, to the extent that the approach was described as a maturing movement twelve years later (Matthews et al., 2012).

Acknowledging the value or knowledge that can come from collaborative relationships achieved contemporary significance through the promotion of social capital theory in the works of Bourdieu, Coleman and Putnam, and the re-emergence, and exponential growth of interest in Vygotsky and Leont'ev's work on the Zone of Proximal Development (ZPD) and Activity Theory (Johnston, 2004; Roth & Lee, 2007). Vygotsky's Zone of Proximal Development (1980) emphasises that interaction with knowledgeable peers is a fundamental learning process and that the roots of cognition are social. Vygotsky's work is the key theoretical underpinning for social constructivism, the learning that can come about because of learning in a group. Dialogue, guidance, feedback and social interactions are drivers for transforming potential development into actual ability. The zone of proximal development is "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers" (Vygotsky, 1980, p. 86). In practice the most common related implementation of ZPD is scaffolding, where tutors set tasks which are just beyond a learners' capacity, guiding them through, gradually providing less assistance over time to fade the level of support away (Wood, Bruner, & Ross, 1976).

Wenger's community of practice model was a turning point before which Piagetian, constructivist, and information processing paradigms were pushed aside by the idea that "knowing and knowledgeability are better thought of as cultural practices that are exhibited by practitioners belonging to various communities" (Roth & Lee, 2006, p. 27). Described in two seminal texts (Lave & Wenger, 1991; Wenger, 1999), situated learning and communities of practice were popularised in the organisation management literature and dramatically changed educational research through the learning community ideal (Brown & Duguid, 1991). Although the notion of assessment is not explicitly addressed, Romer (2002) sees an implicit evaluation in the negotiation - participation process. Boud and Falchikov (2006) attempt to conceptualise this participation

in practice as self-assessment, where fostering reflexivity 'prompts self-monitoring and judging progression towards goals' (p. 409).

The community of practice model is frequently used as an analytical framework in networked learning, and is discussed in this context in the later discussion.

Types of learning communities

The increasing popularity of learning communities has highlighted their complex ontology. Ways to categorise them typically use a number of features such as

- characteristics of the participants;
- intentionality, or purpose of the learning community;
- type or strength of connection;
- domain or subject area that the community concerns;
- physical location of the learning community; and
- ability for the learning community to transform over time, adopting new customs or practices.

Intentionality is an indicator of whether the community was deliberately formed or emerged over time. Membership could be formal or informal, with fixed or fuzzy boundaries allowing or denying the entrance of new participants. Communities could be online, virtual and remote, or they could be face-to-face, situated in a single workplace with participants assigned to a particular project. All the models have feelings of belonging, shared resources, influence and emotional connections (McMillan & Chavis, 1986). Schwier's ten elements of community (2001) emphasise the importance of historicity, identity and mutuality in the community design, and the consequences these have in community initiation and growth.

Henri (2003) seeks to distinguish between learning communities by using the gathering intentionality, the strength of the social bond, the goal of the community and how the intention emerges. He also includes the methods that were used to create the group, if any, and the evolution of the goals and membership over time. He derives four types; communities of practice (COP), communities of inquiry (COI), generic learning communities and goal-oriented communities, which are close to the COP model but have a different intentionality of learning, where knowledge construction is for collective use rather than for appropriation of new practices. McConnell (2006) divides communities into three types derived from the intentionality of the participants

and situation, separating them into general learning communities, communities of practice and knowledge building communities. General learning communities embody a culture of learning where members are involved in a collective effort of understanding. This differentiates them from the COP model where members focus on the development of professional practice, typically situated in a shared, perhaps physical domain. McConnell's final category is that of knowledge building communities (Bereiter, 2005), which focuses on the advancement of knowledge rather than on tasks and projects.

Networked learning

Networked learning (NL) is learning in which information and communications technology is used to promote connections: between one learner and other learners, between learners and tutors; between a learning community and its learning resources (Jones et al., 2000). The definition of networked learning emerged from work on computer mediated communication (CMC) and computer supported collaborative learning (CSCL) where the convergence of technologies and telecommunications opened up a new range of educational designs breaking down the "barriers of time and space" (Steeples & Jones, 2002). Networked learning seeks to establish connections, rather than the shared practice promoted in communities of practice (Ryberg & Larsen, 2008). The definition has been remarkably robust despite rapid technological changes in the last fifteen years (Dirckinck-Holmfeld & Jones, 2009).

Networked learning sits in a socio-cultural tradition, where participation is achieved through communities of learners where meaning is both "negotiated and created through collaborative dialogue" (Dirckinck-Holmfeld et al., 2011, p. 293), and that knowledge emerges or is constructed in relational dialogue or collaborative interaction. In its early conception, networked learning was offered as a new paradigm (Jones et al., 2000), a way of increasing capacity (Hopkins & Jackson, 2009) and as a suggestion on how to organise students to overcome the tension between organisational requirements for tight structures with the looser structures used to promote learner independence (Jones et al., 2000). Focussing on the connectivity of participants has been shown to increase access to learning, people, diverse resources and artifacts (Haythornthwaite & De Laat, 2010). It can also explain meaning making and the complexity of identities, which are being continuously constructed through connections, where differing ties are used for different purposes. NL acknowledges the importance of weak ties along with the non-privileging of particular types of relationships (Jones & Esnault, 2004; Ryberg & Larsen, 2008), distinguishing networked learning from CSCL and

communities of practice, where strong relationships and human-human relations are emphasised (Jones et al., 2008). The variability of tie-features such as amount of time, emotional intensity, intimacy and reciprocal services (p. 91), brought about the realisation that pre-digital depictions of strong links failed to encapsulate the richness of relationships possible through networks (Granovetter, 1973).

There have been a variety of research approaches in NL. Much of the early research work used action research with multi methods and content analysis of messages and coding schemes (De Laat & Lally, 2004), or ethnography through case study and survey (Goodyear et al., 2004; Hodgson & Watland, 2004). The underlying frameworks used in networked learning have included communities of practice (COP), communities of inquiry (COI), cultural historical activity theory (CHAT) and actor network theory (ANT). Until recently COP and COI were the most frequently used, either through COP's three dimensions or COI's three presences. The three dimensions of Lave and Wenger's community of practice (mutual engagement, joint enterprise and a shared repertoire of actions), are often used for the analysis of the community (Guldberg & Pilkington, 2006), with Wenger's intense, active and peripheral levels of participation (2002) providing groupings for analysis (Henri & Pudelko, 2003).

In many instances early work focussed on levels of involvement and reasons for success or failure using textual analysis. The well-defined nature of the COI instruments and the many instances of its use, resulted in the cognitive, teaching, and social presence being applied in networked learning. Acknowledging the possible shortfalls of missing context, work after this point shifted to the nature of learning interactions and whether they fit with tutors' beliefs about 'good' learning (Goodyear, Jones, Asensio, & Hodgson, 2005). Ryberg argues that determining a unit of analysis is difficult, particularly where there may be interacting networks, multi-memberships and boundary crossing (Ryberg & Larsen, 2008). He suggests that understanding the meaning-making process is central to "identifying the parameters needed to judge whether relations count as weak or strong; and to unravelling the types of relations existing in the network" (p. 113). Both the COI and COP model are explained in further detail in the next section.

Frameworks used in networked learning

Communities of practice represent a more pragmatic version of community, compared to that in an idealised learning community (Quinn, 2010). Observed by

Wenger in anthropological studies in authentic real world situations, its ideas and concepts came from the situated learning that was taking place in apprenticeships, as the members became established participants of a group.

In its original form, Lave and Wenger described how legitimisation was achieved through participation (Lave et al., 1991). New entrants (novices), use simple tasks and peripheral activities in basic roles to become aware of the customs, practices and tasks in the community, where there is a shared practice requiring both space and time to collaborate (Jones & Esnault, 2004). As they observe the activity of the experts, they self-evaluate, gradually take on more complex task and roles and become more influential to the functioning of the community. New members move from peripheral participant to core member through this process of enculturation. Lave and Wenger (1991) saw legitimate peripheral participation as being key to community membership and as three inseparable aspects, of legitimate versus illegitimate, peripheral versus central and participation versus non-participation (p. 35) Wenger uses societal interpretations of Vygotsky's ZPD concept, placing more emphasis on "issues of sociocultural transformation … in the context of a changing shared practice" (p. 49). Communities of practices emerge and evolve from ill-structured problems situated in authentic settings, differentiating them from the simplified problems often seen in educational environments. Solving problems in this context is a shared goal, which when achieved, may cause the membership of the COP to evolve to tackle newer emerging problems.

In the later work Wenger (1998) moved away from the idea of legitimate peripheral participation and used sets of dualities "inseparable and mutually constitutive elements whose inherent tension and complementarity give the concept richness and dynamism" (p. 66). Wenger identifies fourteen indicators that reveal the presence of a community of practice, aligned to four interrelated dualities, Participation-reification, Designed-emergent, Identification-negotiability and Local-global, the broader context in which the practice is situated.

The participation-reification duality has particular relevance in knowledge management, where it is seen as key to solving the representation of implicit knowledge (Paul & Kimble, 2002). Wenger's concept of reification, where abstract representations are given form to enable sharing, are key to the nature of e-Portfolio artifacts in a community setting, and this is explained in section 2.4.

The three fundamental characteristics of a community of practice are:

- a domain of knowledge or joint enterprise which defines a set of issues, ground and identity;
- mutual engagement through interactions and relationships based on respect and trust; and
- a shared repertoire and developing practice with accompanying tools, ideas, language and documents.

'Mutual engagement' is the interaction between individuals leading to the creation of shared meaning on issues or a problem, where participants must engage the community to enhance their membership (Schwier, 2001). 'Joint enterprise' is the process in which people are engaged and working together toward a common goal and 'shared repertoire' are the common resources and jargon that members use to negotiate meaning and facilitate learning within the group (Wenger, 1999).

The usefulness of the COP model, for example in achieving competitive advantages (Liedtka, 1999), led to Wenger's evolution of the concept from individualised learning to a way for an organisation to manage knowledge (Wenger, 2002). The version introduces significant differences, such as the ability for an organisation to engineer a COP rather than for it to emerge; the introduction of a leader or champion typically in a management role; a facilitator who administers the group, and a redefinition of the three characteristics into domain, community and practice.

Using a community of practice in the classroom has been attempted at both primary (Brown, 1992) and secondary levels (Galbraith, Renshaw, & Goos, 1999; Goos, Galbraith, & Renshaw, 2003), socialising students into an emergent practice or situated learning (Pitri, 2004). Problems such as the lack of 'old-timers' can cause issues in the application of the model (Chang, Chen, & Li, 2008) and the misapplication of the framework outside of a practical domain, from where it emerged, are a frequent criticism (Gourlay, 1999). To counter this, classroom studies have investigated specific characteristics such as peripheral participation, or created derivatives, such as Boylan's notion of ecologies of participation (2010a; 2010b).

The community of inquiry framework (COI) evolved out of research into the processes and presences apparent in computer-mediated communication (CMC) by Garrison and Anderson (2003) and further by Garrison and Arbaugh (2007).

Through a sizable literature, COI has developed into a popular way of judging the quality and nature of critical discourse (Garrison, Anderson, & Archer, 2001), in part due to the well defined accompanying methodology and set of methods. It serves as a tool for conceptualising learning processes, that can be used both during a community's life by educators in optimising the dialogue taking place to promote good practice and retrospectively afterwards by researchers to investigate the growth, use and success factors in CMC. Garrison situates it in a collaborative constructivist view of teaching and learning (2011), using Dewey's idea of transactional communication where information is constructed as knowledge with personal application and value. This is then confirmed through collaboration within a community of learners.

COI uses the notion of three presences defined with categories and indicators. Garrison (2001) sees cognitive presence as an signal of the actual learning taking place using construction and meaning making through sustained discourse, reflection and discourse. Social presence is a measure of group identification along with how successfully personal and affective relationships progress. He directly links it to enhancing cognitive presence but acknowledges the challenges implicit in attempting to encourage it in a synchronous text based medium (Garrison, 2011). Teacher presence is indicated by facilitating discourse; instructional design and organisation; and direct instruction

Applying COI to e-Portfolios

In an e-Portfolio, the notion of social and cognitive presence are embedded in the artifacts and commentary, which can make the COI framework difficult to apply. Artifact representation varies by implementation, so coding video, audio and imagery falls outside the scope of the base COI model, which uses transcript analysis using a message as the unit of analysis (De Wever, Schellens, Valcke, & Van Keer, 2006). There have been investigations into using teaching presence separately from the other presences (Arbaugh & Hwang, 2006; Pawan, Paulus, Yalcin, & Chang, 2003; Shea, Pickett, & Pelz, 2003; Shea, Sau Li, & Pickett, 2006; Shea, 2010), and evidence that teaching presence can be evaluated around the use of an e-Portfolio, on the blogs and reflective statements surrounding the artifacts (Torras & Mayordomo, 2011).

The concept of teaching presence (TP) encapsulates the idea that a teacher's responsibility is to facilitate learning that has purpose and is focused on essential concepts and worthwhile goals by designing, facilitating and directing learning online (Anderson, Liam, Garrison, & Archer, 2001). The three TP characteristics of facilitating discourse, instructional design and direct instruction were derived

from literature reviews and student surveys and these combined with the indicators that signal each level serve to "understand, measure and improve" the teaching taking place (p. 15). The importance of teaching presence in e-Portfolios has been shown to be more important than the educational intentionality of the technology (Torras & Mayordomo, 2011).

Two of the teaching presence characteristics are directly applicable to traditional e-Portfolios. Instructional design indicators are:

- setting curriculum;
  designing methods;
- establishing time parameters and netiquette;
- utilizing medium effectively; and
- establishing netiquette

(Anderson et al., 2001).

The direct instruction indicators are applicable if an e-Portfolio system is used for assessment and instruction, where a tutor provides regular feedback, direction and focus through their commentary (p. 10):

- present content and questions;
- focus the discussion on specific issues;
- confirm understanding explanatory feedback;
- diagnose misconceptions;
- inject knowledge from diverse sources, e.g., textbook, articles, internet, personal experiences (includes pointers to resources); and
- responding to technical concerns.

Facilitating discourse is difficult to apply in portfolios based on the individual Kolb reflective learning cycle, but architectures that allow and promote discussions around artifacts make it applicable. If networked learning is used in an e-Portfolio context, tutors can use the artifacts and reflective statements in ways that would align with the indicators (p. 8):

- identifying areas of agreement or disagreement;
- seeking to reach consensus or understanding;
- encouraging, acknowledging, student contributions;
- setting climate for learning;
- reinforcing; and

- drawing in participants, prompting discussion.

The networked learning definition emphasises the use of ICT to promote connections between learners, between learners and tutors; between a learning community and its learning resources. An appropriate e-Portfolio design provides an appropriate architecture for the artifacts created by participants to serve in a dual role, as both learning resources for their peers and as assessment artifacts.

2.4 Artifacts and tutor roles in a collaborative environments

The transition from analogue to online digital e-Portfolio has not resulted in a change in the general description of artifacts in the portfolio literature – they are examples of work (Stevenson, 2006), collected for a particular audience and purpose (Diez, 1994). Artifacts are described in terms of use, such as an object created and then designed for presentation (Flanigan & Amirian, 2006), in terms of the surrounding container, such as in objects stored in a e-Portfolio (Walz, 2006), or by the actions of the learner, as a designation for the items created and collected which are organised, displayed and then connected (Gibson & Barrett, 2002).

In any configuration, reflection is acknowledged as key, with the description of an artifact serving to explain its significance (Walz, 2006), and that students need to learn to constructively reflect upon and write about artifacts, looking in the 'mirror' to see their own progress and then mapping out areas for development (Diez, 1994).

The rubrics used to guide artifact construction have been used to situate portfolio use in a particular paradigm, where rigid external criteria precisely describing the nature of the work to be produced has placed it in positivism (Lowenthal, White, & Cooley, 2011; Ring & Ramirez, 2012). Allowing learners choice in artifact design can be constructivist (Barrett & Carney, 2005) or interpretivistic, where approaches that suggest that truth is a matter of consensus allow a greater flexibility in the artifacts chosen and presented (Johnston, 2004). Barrett (2006) argues that this design choice can have a significant motivating effect.

The movement towards online e-Portfolios with extra abilities for sharing (Gibson & Barrett, 2002), should have ignited a discussion on the nature of shared artifacts or their conception, however the lack of community based

pedagogy is still implicit in many of the implementations or analysis. There are indications that artifacts can be used in collaborative ways, such as when created, tagged and shared to provide context allowing for discussion (Tosh et al., 2006). Perhaps because of the reliance on portfolios as individual assessment devices, there is an overarching assumption that artifacts are individual pieces of work (Barrett & Carney, 2005), used in an personal reflective learning cycle.

A solution lies in the community literature where a broader discussion of the nature of artifacts provides richer depictions. Bereiter and Scardamalia's knowledge-building communities and Wenger's community of practice model both address the nature of an artifact, situated in constructivism and social-constructivism respectively. Bereiter and Scardamalia's knowledge-building communities are learning communities whose goal is specifically knowledge construction. Contributions to a community knowledge base serve to create shared intellectual property (Scardamalia & Bereiter, 2003), using collective practices and activities using improvable artifacts (Bereiter & Scardamalia, 2005). They place artifacts in Popper's third world, which contains products of the human mind (Popper, 1979), although Bereiter and Scardamalia call them conceptual artifacts to acknowledge criticisms of the third world concept. Artifacts are key to the enculturation process "joining the ranks of those who are familiar with, understand, create, and work with the conceptual artifacts of their culture" (Bereiter, 2005, p. 237). Conceptual artifacts are different from cultural or material artifacts by the relationships between them, as one artifact may be derivable from or be part of another – but they may also contradict or support another (Bereiter, 2002).

For Wenger, artifacts are key to the duality of participation and reification and "tend to perpetuate the repertoires of practices beyond the circumstances that shaped them in the first place" (Wenger, 1999, p. 89). Reification, which he describes as the process of giving form to experience, describes the shared creation of artifacts which may or may not be material objects. The visibility of artifacts are complex, which is used to describe the degrees of accessibility of an artifact and also the level of encoding; what is revealed by the artifact representation (Lave et al., 1991). The creation of shared artifacts can induce engagement and alignment, implying "sustained intensity and relations of mutuality" (Wenger, 1999, p. 184), and are also the key to the progression of a community as a whole, where the historical traces of artifacts continue the lifecycle of a community and when used in a cultural practice carry the practice's

heritage (Lave et al., 1991).

The skill of artifact curation

With the rise of Web 2.0 technologies, information abundance has led to the acknowledgment of the new digital skill curation, for the creation and management of artifacts (Beagrie, 2006). Artifacts here are a sharable representation of practice (Goodyear & Steeples, 2008), which through distributed cloud storage come in diverse tacit forms such as links, snippets, images or blog posts. Creating, annotating and linking such artifacts is seen as a new digital pedagogy (Sharples et al., 2013). Digital artifacts can enhance the reputation of the participants in their community when they are seen to publicly create valuable artifacts that are of use to members of the group (Klamma et al., 2007). Placing these at the heart of networked learning, Seitzinger (2014) calls for the term social curation to be applied to the process of connecting to learning resources, managing information flow and information gathering, sharing, tagging and aggregation.

The skill of tagging using a folksonomy is common where there are shared digital artifacts, as seen on YouTube and sites that archive content such as Delicious or Evernote. Users attach subject descriptor keywords to content, creating new tags or reusing ones suggested by participants in the community that have already accessed the item (Smith, 2008). The emergent vocabulary tends to be domain specific and lowers cost and barriers to entry for new participants (Mathes, 2004).

Extending the artifact creation process to include social curation, acknowledges a new digital literacy, where the roles of producers and users becomes blurred and knowledge production involves reuse and remixing (Pachler & Daly, 2011), using the affordances of digital technologies. The common view of digital literacy focuses on individual skills or competences, one of encoding or decoding a particular artifact. Digital literacy can be viewed as an expanded concept involving social and cultural practices (Lankshear & Knobel, 2008), where it is similar to COPs conception of learning through participation, as the mimicry, use and production of artifacts is part of the enculturation process that novices experience as they become experts. Social and cultural definitions of digital literacies include:

- Working collaboratively in a multidisciplinary team to create useful, practical tools.

- Supporting learning communities to work collaboratively in problem solving and the co-construction of knowledge

(Gillen & Barton, 2010).

Some artifact creation processes may include reusing others' artifacts in a process similar to assemblage, remixing video and audio. This originated from the practice of creating texts built primarily from existing texts (Johnson-Eilola & Selber, 2007), which has been put forward as a valid practice alongside more traditional creative processes. There are positive correlations between an increase in the use of technology in education and plagiarism, typically through making it easier (Harper, 2006) and the belief that plagiarism is low risk (Szabo & Underwood, 2004). The remix culture and the academies traditional view of plagiarism conflict, where originality of student work is regarded as key.

The complexity of teacher, tutor and facilitator roles in an e-Portfolio community

In a traditional e-Portfolio architecture without a community aspect, the tutor facilitates the learning taking place by assisting participants in developing reflective skills (Doig, Illsley, McLuckie, & Parsons, 2006), using co-operative collaboration to support students in tasks and assessments (Kirkham et al., 2009; Lopez-Fernandez & Rodriguez-Illera, 2009). The artifacts produced by a learner are a visible representation of a student's progression (Pachler & Daly, 2011).

The attitude of the person "receiving, assessing or introducing the ... e-Portfolio such as a tutor, an assessor or a line manager" (Curant, 2009, p. 27) is key to the success of an e-Portfolio as tutors are provided with anytime, anyplace access to submissions (Lawson, Kiegaldie, & Jolly, 2006). The level and regularity of tutor feedback is a vital measurement of effectiveness (Butler, 2006; Mason et al., 2004) with tutor availability and engagement a high priority for e-Portfolio learners (Gray, 2008). This formative feedback is typically categorised into verification and elaboration, where verification is typically a simple comment on the validity of the work (Shute, 2008). Elaboration is more sophisticated and suggests the tutor addresses topics more fully, providing multi-layered responses and guidance.

Moving beyond Kolb's learning cycle to include a social component through community complicates the tutor role, because of the multitude of roles that are simultaneously required.

Networked learning, communities of inquiry and communities of practice have different conceptions of the role, depending on both the underlying pedagogy and desired outcomes of the community. Networked learning's definition of learning community has allowed fluidity in the role of the lecturer – as leader, facilitator or guide. In a peer based community, the roles of the individuals change and emerge over time (De Laat & Lally, 2004), so some of the traditional tutor roles may be shared amongst the participants (De Laat & Lally, 2003). Tutors can initially provide scaffolding, set up initial structures such as learning sets, introduce subjects, but should also be participant (McConnell, 2006). In many of the peer based community models used, the teacher moves towards a facilitation role, as a guide on the side (De Laat & Lally, 2004) or in an animator role (Jones & Esnault, 2004), where they manage issues of power, inhibit and mobilise features for balance, provide overviews, integration and distribution (p. 6). The implicit "riddle of liberating structures" is that the traditional tutor role is initially required to push for more equality in the participants' roles (Pedler, 1981, p. 77).

The earlier versions of the community of practice model suggest that roles emerge, rather than being deliberately created. In these, the notion of expert suggests a facilitation role, where initial instruction is equivalent to mirroring. Novices transition by association with experts, as the complexity of the tasks demonstrated increases over time, moving them from newcomer to old-timer (Lave et al., 1991). Old-timers induct novices, which introduces generational differences that then propels the practice forward (Wenger, 1999). In the third iteration, Wenger suggests that COPs can be built rather than emerge, typically in a professional, commercial context. This requires the introduction of more formal roles such as leader, champion and facilitator (Wenger, 2002), which because of the context suggests that the leader or champion role is likely to be in a more senior management position, with a separate facilitator acting as co-ordinator. The leader-champion is intended to assert Wenger's seven principles of successful community design (p. 69). He links the success or failure of the COP directly to these roles.

In the COI framework, the significant role of the tutor is to facilitate the growth of the community, through encouraging discourse, instructional design and direct instruction, with practices such as "identifying agreement and disagreement, sharing meaning, and seeking to reach consensus" (Garrison & Arbaugh, 2007, p. 164). The facilitator role is fulfilled by an instructor, teaching assistant or by

peers, which when facilitating discourse are more than simply a guide on the side (Garrison, 2011), as they encourage appropriate and relevant responses, model critical discourse and encourage participation (p. 58). Student interaction in these environments can vary depending on the level of presence of the facilitator, where excessive posting can inhibit levels of interaction (An, Shin, & Lim, 2009; Dennen, 2005). In cases where the presence of the instructor could be deemed intimidating, some studies suggest sharing the responsibilities of the role between student and instructor (Seo, 2007).

Criticisms of community based models and the dark side

Community based models have been criticised, through misapplication, lack of definition or for their ability to discourage dissent or encourage conformity. The ideal representations of collaborative participation in learning communities may mask the dark side of interaction, where the tyranny of the dominant may induce oppression and control or a failure to acknowledge the pressures to conform (Ferreday & Hodgson, 2008). Ferreday (2010) identifies themes from participants such as feeling unworthy to participate, incremental struggle with new modes of thought, a sense of lost innocence and possibilities of isolation exclusion. COPs can suffer from similar self-protective mechanisms, becoming repressive and exclusionary as their pragmatic practical nature may make "counter arguments and practices [to] become unthinkable" (Quinn, 2010, p. 50).

Eraut (2002) suggests that the COP model is an unrealistic ideal, and that actual working practices are not addressed, where it fails to acknowledge the variety of roles a person performs in a single job. He also highlights issues associated with the way in which part time and temporary staff move in and out of the COP boundary, the scope and demand for inventiveness in roles, along with the degree to which the structures allow staff to perform at their level of competence. Contu (2003) attacks the consensual connotation implicit in the language used to describe COPs, suggesting that it hides the challenges that arise from unfriendly or unsociable relationships. The COP literature is still exploring the wider acknowledgment of issues of boundary crossing where there may be individuals situated in overlapping COPs, or where there are poorly defined community edges (Fuller, 2013).

The evolution of ideas in COPs from legitimate peripheral participation to tensions, from evolutionary growth to specific created practices, has resulted in some authors suggesting that there are significant deficiencies in the whole model. The COP definition changes from version to version, which has led critics

to suggest that the definitions are unclear (Li et al., 2009) or that these are distinct, different models, with the earliest concerning identity, self-empowerment and participation, the later a management tool, with a focus on managing knowledge in organisations (Cox, 2005). The definition changes from a group that coheres through mutual engagement on an indigenous enterprise, into a group who deepen their knowledge and expertise in an area by interacting. This final definition suggests a change where "the purpose is specifically to learn and share knowledge, not to get the job done" (p. 534).

Garrison and Arbaugh self-critiqued COI in 2007, suggesting that it needed more quantitatively-oriented cross-disciplinary studies and further evidence to suggest the relationship between the framework's components and course outcomes (Garrison & Arbaugh, 2007). Others followed, including Rourke and Kanuka (2009) who used a literature review to suggest that the indicators do not capture deep and meaningful learning, and that as a consequence only surface learning is promoted. The presences themselves have been criticised as having weak interconnections (Annand, 2011) and by Krejins (2014), who criticised social presence suggesting that it may actually be two intertwined indicators in a greater level of complexity than suggested.

The criticisms that the underlying theoretical foundations lacked clarity (Jézégou, 2010), are rebutted by Garrison (2011) in the later version, which maintains the same presences and characteristics, but attempts to elevate the COI to become a credible model for e-learning. Despite these criticisms, COIs have remained an influential mechanism for researching and promoting community growth in an online context, with over 1700 journal articles citing the work published in 2014/15.

2.5 The research gap and the research questions

An appropriate portfolio pedagogy can promote best practices in assessment, such as authenticity, self-assessment and reflection, showcasing students' growth (Hansen, Stith, & Tesdell, 2011), particularly in programming (Carter, 1999). Portfolios are a way for students to demonstrate authentic learning processes over time, reducing the opportunities for plagiarism (Blair, 2011), "acculturating students into appropriate academic processes" (DeVoss & Rosati, 2002, p. 201). Unfortunately many of the existing studies lack rigour in the research methodology, with little more than an analysis of the student reflection on the process (Bryant & Chittum, 2013). The recent call for more mixed methods research into e-Portfolios acknowledges these weaknesses (Rhodes et al., 2014).

The use of a reflective cycle has been promoted as the optimal underlying e-Portfolio pedagogy, but as social technology has been added to allow peer and community support (Bhattacharya & Hartnett, 2007; Fitch, Peet, Reed, & Tolman, 2010; Stevenson, 2006), the details of the process and underlying architecture remain unclear (Chau, 2010). This, combined with the fact that much of the e-Portfolio software currently in use has not significantly addressed the call to the transition to Web 2.0 collaborative technologies (Clark & Eynon, 2009), indicates a gap in the literature on the nature of artifacts and the community that can exist in these environments.

The learning community literature points to a better explanation of how artifacts can be constructed in a social context, along with richer descriptions of the nature of the supporting community. Networked learning suggests promoting connections between learners and the learning resources in the community, which in an e-Portfolio, would be peer created artifacts. Both the e-Portfolio software and the tutor would act to promote connections between the participants and the resources, so the model proposed here would have the artifacts in a dual role as assessment artifacts and as learning resources for the collaborating peers.

The research questions ask what artifacts would emerge in such an environment, and how these artifacts would be used, shared and reused. Communities of practice and knowledge based communities provide a better explanation for the nature of an artifact created in this shared space, whilst both networked learning and the communities of inquiry model have well defined analytical frameworks to study the development, growth and actions of the participants and learning community, as discussed in the next chapter.

The final research question asks about the nature of the tutor role and the shape of the community formed. The learning community proposed is based on the COP model, but acknowledges that there are difficulties in using this in the classroom. The extended version used here follows in the NL tradition of acknowledging the variety of link strength that can occur (Ryberg & Larsen, 2008) and that the goal of a peer based community allows for the expert role to transition from tutor to student participant as the community progresses, as in Pedler's equifinality model (1981).

The next chapter details the research design, explaining how the research questions are explored in two action research cycles, using a multi method analytical framework derived from De Laat (2006b).

Chapter 3 Research design

This chapter explains the research methodology used in this project, in particular the ways in which two action research cycles have been used to create an e-Portfolio learning community alongside prototype e-Portfolio software. After explaining the ontological and epistemological positions taken in the work, the complexity of the mixed methods used are explored, with detail on the collection and analysis process. Finally, the validity criteria and ethical considerations are detailed.

3.1 Research methodology

This work is an action research project, in that it seeks to explore the use of applicable theory in practice, with changes being incorporated into subsequent cycles. Action Research (AR) seeks to transform aspects of work and research the process of this change (Kemmis, 1993), bridging the gap between research and practice (Somekh, 1995). This duality is core to the methodology – suggesting one without the other is not sufficient (Lewin, 1946). Lewin is widely credited as the originator of action research in its critical emancipatory form in his seminal paper on intergroup relations. After some initial successes its popularity waned in the 1960s due to the surge in positivistic educational approaches during the "space race". The teacher as researcher movement in the United Kingdom reinvigorated action research (Elliott, 1991; Stenhouse, 1975), spinning off an emancipatory branch in Australia under Kemmis (1993). The popularity and significance awarded to it in the research community has fluctuated, but with an increasing acknowledgment of situated research and mixed methods, its use has increased again (Dick, 2011).

Critical philosophical stances on action research suggest that it is undertaken to maximise social justice (Carr & Kemmis, 2003), improve one's own and others' identities (Kemmis, 1993; McNiff & Whitehead, 2002), or improve social conditions (Grundy, 1987; Kemmis, 1993; Somekh, 1995). This work is participatory action research, where the aim is for participants acting in a co-operative inquiry to consider the nature of assessment by constructing their own artifacts in a peer based learning community. Moving towards democratising assessment aligns with the emancipatory forms of action research, but the role of the academy and tutor as gatekeeper has to be acknowledged, as this places boundary conditions on possible outcomes. Ultimately, participants have to satisfy institutional conditions on the final assessment representations for internal processes such as moderation, exam boards and external inspection.

I have chosen action research for a number of reasons. The business faculty at Kingston University shares a campus and close links with the School of Education, which has a strong record of using AR in many of its research projects. This has informed my interpretation of AR, which aligns with my personal ontological and epistemological views that there are individual perceptions of truth and that knowledge is revealed by acting in the world. My original reason for beginning this work was a desire for an improvement in my own personal practice when using technology in my teaching, and AR offers the opportunity for embedding direct action into my day to day teaching activities. Lucas (1992) urges educators to allow the use of e-Portfolios to respond naturally to students' needs, curiosities and abilities and an action research methodology is the best way for this growth to occur.

The action research process in this work

Despite the splintering of action research into different types, there are shared characteristics:

- Action takes the form of activity, consisting of cycles, with reflection feeding forward into subsequent cycles.
- Participants have a common goal or shared ethical background, which may be emancipatory or participatory (Boog, 2003; Lewin, 1946).
- Knowledge is gained through a process of mutual undertaking.

Action research is typically depicted as a series of cycles, where theory is derived from reflection-on-action repeatedly attempting to improve some practice. In its most common form, participant's work in a peer based relationship sharing behaviour and practices, with reflective processes feeding forward.

The time and students available for this project allow for two cycles.

Table 3.1 - Cycles in the project

	Cycle One	*Cycle Two*
Purpose	Creating an e-Portfolio community	
Level of students involved	Undergraduates in a Web Scripting class	Postgraduates in a Business Internet Systems class
No of Participants	15 participants	17 participants
When	Five months into project	Nine months into project
Period	8 Weeks	8 Weeks

Prior to the beginning of the first cycle, I had the opportunity to run a small pilot which trialled various representations of online artifacts with second year, final year and postgraduate students as they approached the end of their academic year. This was also an opportunity to see if the work was practical within the confines of the academy, my own technical abilities, and to see if this was something that would engage possible participants.

Although the intention was for cycle one to run for an entire teaching period, the complexities involved in both initiating the technology and changing institutional practices whilst teaching, "Designing the plane whilst flying it" (Elliott, 1991; Herr & Anderson, 2005; Stenhouse, 1975), meant that the start was delayed till half way through the semester. Roughly half of the group volunteered to participate, requiring an alternative assessment process to be run in parallel. Feedback from the participants and my own reflections were then fed into cycle two, where all the members of a postgraduate class volunteered.

Participants in these cycles acted as co-researchers in a networked learning based community, but also acted as co-developers for the software that emerged from the process, created using the skills and tools that the students were themselves learning. The intent here was that by making the participants part of the open source development project, the resulting community would have the opportunity to fully engage with the research, the curriculum and the nature of software development, which in itself is one of the learning outcomes for both classes in cycle one and two. FLOSS (Free Libre Open Source Software) advocates suggest that software developed during open source development is more closely aligned with the feature set and facilities demanded by its users – as participants will be learning the tools and technologies that are used to create

the portfolio system itself, they will be able to directly influence the features and functionality of the software, either as users during the initial parts of the module, or as developers as their skill levels progress. Any software, tools or code produced during this process will be placed under the GNU General Public License for general reuse at the end of the project.

A majority of free software projects use this license, which originated from the Free Software Foundation (FSF), a not-for-profit organisation, founded by Richard Stallman in 1985. It creates, distributes and advocates free software, licensed under the GNU General Public License (GNU GPL), which enforces the foundation's political belief in free software. These are enshrined in a user's four essential freedoms - (0) to run a program, (1) to study and change a program in source code form, (2) to redistribute exact copies, and (3) to distribute modified versions (Stallman & Gay, 2009). The license ensures the continuity of development, in that any changes to a GPL program must also be similarly licensed and placed in the public domain for others to use, change or distribute. The introduction of the license is widely regarded as a pivotal moment in the free software movement.

The Open Source Initiative (OSI) has similar goals in that it advocates the development of freely available software and source code, but concerns itself with developmental processes rather than political aims. It was created in 1998, and differentiated itself by seeing software freedom as a practical rather than an ideological matter (Dick, 2011; OSI, 2013). Free software advocates decry the OSI for abandoning political aims (Carr & Kemmis, 2003; Stallman & Gay, 2009), but the differences between the two are frequently overlooked by most users, so the name Free Libre Open Source Software (FLOSS) has developed as a blanket term for software from either camp. This work will use the term FLOSS, but acknowledges that there are significant political and ideological differences between free and open source software.

It is claimed that FLOSS has advantages over the more typical closed software development model – the characteristics of such software are:

- a frequent release cycle – release early, release often;
- an engaged user base; and
- a feature set aligned with the demand of the users

(Raymond, 2008).

A more critical perspective of open source suggests that the software development process may only develop software that developers have an intrinsic self-interest in, that the traditional power roles are asserted through the popularity and use of the software, and that it has an underlying ideological agenda espoused by opposite ends of the political spectrum (Elliott, 1991; Selwyn, 2013; Stenhouse, 1975).

There are analogies between action research and the FLOSS development methodology, which for this particular project make the connection between the two useful. Both AR and FLOSS development use cycles of development, AR with Analysis-Planning-Acting-Reflecting (Lewin's original 4 step cycle), FLOSS with rapid software release cycles in the traditional waterfall steps of Analysis – Design – Testing – Implementation. Each cycle is repeated, integrating reflections and improvements into the next cycle. Emancipatory AR questions the nature of power and roles, the Free Software Foundation advocates the rights of a user to use software in any manner they wish, suggesting an equality between users, developers and corporations. OSDM promotes the idea that users of software should be treated as co-developers, even if they do not have the technical skills to code themselves. The rapid release cycle is used to ensure their engagement through incorporation of their experiences and change requests, which is similar to the action research process of asking participants to be co-researchers, using their reflections to change the environment, power relations or situations in subsequent cycles.

There are thousands of orphaned educational software projects, where the original author or company has abandoned selling and supporting software. Multiple web sites suggest ways in which this abandonware can continue to be of use in education (Dube, 2010). As software from this project will be developed using the FLOSS principles, the source code will be free and widely available, with the possibilities of continual development if it finds a supportive base of users.

Case study

Many action research projects are presented as case studies (Koshy, 2009). The case study is used where a specific instance is designed to illustrate a more general principle (Nisbet & Watt, 1984). They typically accept and recognise that there are many variables and use a variety of mechanisms for data collection and sources of data (Cohen, Manion, & Morrison, 2008). The non-privileging of specific methods in AR or case study research is coherent with both the

philosophical stance and approach taken in this work. The next section explains the role of the researcher in action research, along with my philosophical stance and its effect on the approach.

3.2 My role and philosophical stance in this research

In qualitative research the researcher has to explain their ontological and epistemological position, which has consequences for choices of methodology and method. This is also important in action research, where multiple traditions have evolved with differing philosophical stances.

The role of the researcher in an action research project situates the work in a continuum from insider to outsider research and associates it with a particular tradition and validity criteria (Herr & Anderson, 2005). This work sits in the insider and insider in collaboration with other insider position, "the second-person, inter-subjective inquiries of groups and communities of co-researchers engaged together in critical research and practice" (Reason & Torbert, 2001, p. 2), but has to acknowledge the contradiction in supporting peer based learning communities in an educational setting where there are implicit power relations in the tutor student relationship where there is a gatekeeper role (McNiff, 2013).

In action research, epistemology and ontology are intertwined; the nature of reality and how that nature is uncovered are combined by action in the world. Acknowledging that individuals create their own identities, values and truths, means that the action researcher has to find ways to accommodate the multiple values perspective (McNiff, 2013). Some authors suggest that action research has an objective ontology and subjective epistemology (Coghlan & Brannick, 2009; Sikes & Potts, 2008), but this work is situated in interpretivism, in that reality is the product of consciousness and there are individual conceptions of truth which are uncovered by action in the world. Knowledge is socially constructed, but informed by a pragmatism that suggests action through advocacy and participatory approaches - "Action researchers see knowledge as something they do, a living process" (McNiff, 2013, p. 18).

As this is insider action research, the philosophical position of the researcher directly influences the situation and it is important that this aligns with both the approach and the situation being explored. Denscombe (2010) suggests that making this 'public account' is an important aspect of AR.

Researcher's experience and perspective on teaching and learning

When I started teaching twenty-five years ago, I was one of the few staff to hold a

teaching qualification which had a specific focus on lecturing in the FE and HE sectors, from Garnett College, part of the University of Greenwich. The course had a profound effect on my teaching philosophy, as it emphasised a range of pedagogic practices that were largely unused in further and higher education at the time. For the second part of the course I was simultaneously student and teacher, a dual perspective that has always stayed with me.

During this time I taught programming and information systems to BTEC HNC, HND and undergraduate degree students. The vocational progressivism in BTECs pedagogic practices (Fisher, 2003) influenced my teaching; integration of theory into practice, learning objectives and learning outcomes characterised my teaching at the outset. For a long while I regarded Bigg's constructive alignment in assessment (2010) to be a key approach in my teaching.

The increasing popularity of technology enhanced learning resulted in Kingston investing heavily in the Blackboard learning management system (LMS) and the blended learning approach. Despite the resources allocated to the LMS, many of the more advanced features have not been widely used and until recently it did not address social components of learning. As it is a university-based resource structured around subject units (modules or classes), it lacks neither the course continuity, nor the ability for some of the administrative tasks to be shared by participating peers.

This and a dissatisfaction with the predominant lecturing pedagogy acted as a trigger for my registering for the PhD at Lancaster. This course has significantly transformed the way I regard the use of technology in education and has emphasised the importance of social constructivist based pedagogies in my work, where I view the social aspect in collaborative learning environments as vital. In smaller, initial projects, I experimented with creating online learning communities using the social networking site NING (2014) and mobile technologies. This shift in pedagogy is evidenced in my practice today, where I use exercises, tasks and communities to promote peer appraisal and reflective processes in lecture halls, tutorial groups, and practical labs.

My current teaching uses a learning community based on the networked learning philosophy to promote an equifinality model with collaborating peers, where the lecturer gradually transforms into a guide over the life of the community (Pedler, 1981). In this work I have used personal learning environment and personal learning network (PLN) techniques, both of which are particularly suited to always available working practices on mobile devices (van Harmelen, 2006).

Using various online tools, students are taught how to create customised homepages, use search tools and generate feeds around subjects of interest, such as internet marketing, retail marketing or project management. A micro blogging site is used for the PLN concept, where students are shown how to use the service to create a professional online identity, following, sharing and collaborating with professionals in a particular area of interest.

3.3 The participants

This thesis will document the first two cycles of the project, which use alternate undergraduate and postgraduate students as the cycles progress. Despite the difference in levels suggested, there are many similarities in the nature of the students and the material covered. Kingston University allows for lower undergraduate entry scores through a widening participation agenda; at postgraduate level lower IELTS grades are accepted. A focus on improving academic study skills is integrated into both programme structures and is achieved through distinct modules and drop in support sessions offered in the learning resource centre with dedicated academic staff.

Participants for both the second year undergraduate web scripting for applications class (WSA) and the postgraduate business internet systems class (BIS) are technically capable students, with varying levels of ICT and programming ability at the beginning of each module. Both sets of students attend full-time, with between 12-16 hours of contact time depending upon subject choice. The majority of students taking WSA and BIS have the subject as a core, with smaller percentages electing to take the course from a range of option choices. The undergraduate students are typically 20-21 years old, with the WSA class as one from six classes taken during the year. BIS students are older, 24-29 years old for this cohort and are taking three other subjects simultaneously.

Both modules cover web technologies, programming languages and the use of databases, which are then combined together to enable the construction of web based applications. The BIS module is an introductory module, so despite being a postgraduate level course much of the curricula are similar, with the exception that MBIT students have a more detailed introduction to database technologies. By the end of the module it is expected that students will have sufficient technical and practical experience to be able to either build, or manage the building of web application. Further detailed information about the participants is in chapters four and six, which cover cycle one and two respectively.

The next section explains the ways in which mixed methods were used to analyse and understand the use of e-Portfolios in the learning communities that emerged.

3.4 Research methods, techniques and procedure

Mixed methods have become increasingly popular, "a research design … in which the researcher collects, analyses, and mixes (integrates or connects) both quantitative and qualitative data in a single study or a multiphase program of inquiry" (Cresswell in Johnson, Onwuegbuzie, & Turner, 2007, p. 119). Its claimed advantages include:

- one method's strengths balancing against another's weaknesses (Johnson & Turner, 2003);
- investigating issues from different positions and then converging the results (Creswell, 2013); and
- illumination, precision and the investigation of more complex problems (Greene, Caracelli, & Graham, 1989).

The use of mixed methods strategies has been justified in networked learning. De Laat (2007; 2003; 2004; 2006a) argues for a rich range of data collection methods that reflect the complex nature of the praxis that exists in networked learning based communities, "More of this kind of triangulation work needs to be done before we can claim to have a rounded picture of networked learning in higher education" (Goodyear et al., 2005, p. 505).

There are a variety of data collection methods used in this project, with a multi-method framework, using social network analysis, content analysis and context analysis in cycles one and two.

Methodology and methods in cycle one and cycle two

Using a wider variety of methods adds complications for the researcher, with extensive data collection and complexity in analysis requiring technical, qualitative and quantitative skills. The methods used need be justified (Dick, 2011; Koshy, 2009) and how they will be mixed should be made clear (Creswell, 2013).

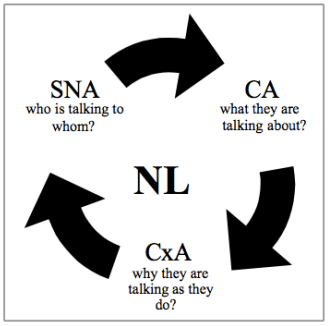


Figure 3.1 – De Laat's research framework

In a number of papers De Laat et al. developed a multi-method research framework to study networked learning processes, using Social Network Analysis (SNA), Content Analysis (CA) and Context

Analysis (CxA) to find out 'who is talking to whom... what they are talking about', and 'why they are talking as they do' (De Laat, Lally, Lipponen, & Simons, 2006b, p. 398). The three methods are combined (figure 3.1) to "triangulate and contextualise our findings and to stay close or connected to the first-hand experiences of the participants themselves" (p. 399).

A modified version applicable to assessment artifacts in an e-Portfolio based on networked learning principles is used here, with:

- SNA to see who is connecting to whom and the overall shape of the learning community, using activity tables and sociograms.

- CA to see what artifacts are being created, coded using thematic analysis.

- CxA to see why the participants behaved as they do during the cycle, using results from questionnaires, coded interviews and comments from within the e-Portfolio system.

Context Analysis was further enhanced with information from weekly logs, emails and in-cycle interactions with the participants.

In its original context, De Laat uses SNA to see who is talking to whom. In this context SNA will reveal the path that participants take through the portfolio learning community, showing activities in terms of using, commenting and viewing others' artifacts. Content analysis applied to forum text messages has a long proven history, for example in the community of inquiry model, but here the nature of an artifact's representation adds complexity. This analysis is formed by reviewing the image, reflective text and associated comments in place.

The next section details the data collection methods used in each cycle, and is followed by more information on the analytical processes used.

Cycle one

Cycle one begins five months into the project, with 15 students participating for an eight-week period. During this time, the participant's used the e-Portfolio to create artifacts, interacted with each other in the e-Portfolio community and contributed to artifact discussions. Participants were invited to provide feedback on the process every week and in a final online questionnaire at the end of the

eight-week cycle. Data collected during the cycle was used to both transform the process as it progressed and for a post cycle reflection that was then fed forward into the second cycle (table 3.2).

Table 3.2 – Data collection in cycle one

Description	Method	Means	Date	Sample
Reflections in the cycle	Weekly in class feedback / logbook	Collated in Word	Weekly for the eight weeks	
Activity in the portfolio	SNA social network analysis over activity records	Analysis using Excel	During the eight week cycle	e-Portfolio activity for each week
Reflections on the cycle	CxA final questionnaire	Online	At end of cycle	11 participants
Artifact analysis	CA thematic analysis over artifacts and discussions	In-vivo coding in Excel from reflective statement and tags	During/post the eight week cycle	381 artifacts
Comments analysis	CA coding using the COI teaching presence	Analysis using Excel	Post cycle	

De Laat examines the nature of the teaching presence over the time of a learning community by using the COI teaching presence indicators (De Laat, Lally, Lipponen, & Simons, 2006a). Here this has been applied to the tutor comments attached to the artifacts.

As participants use the portfolio, their activity was automatically recorded in an activity database table, which recorded the name of the participants; the date and time; and the details of their activity. The architecture of the e-Portfolio allows for the activity data to be easily processed with customised database queries in the programming language SQL, exported and then post processed in Excel and the data analysis software R. The artifacts, data analytics and feedback from the participants were used both inside the cycle in the tutor role and in the reflective phase.

At the end of the process participants were asked to complete an online questionnaire, which is fully detailed in chapter four. Topics covered included

how they decided to create an artifact, how they re-used other's work and their overall experiences of the learning community.

Cycle two

Cycle two occurred nine months into the project, with 17 students using the e-Portfolio for an eight-week period. As with cycle one, participants created artifacts and participated in the e-Portfolio learning community. Participants were invited to feedback every week and in final individual interviews. Data collected during the cycle was used to both transform the process as it progressed and for a post cycle reflection that was then fed into the interviews.

Table 3.3 – Data collection in cycle two

Description	Method	Means	Date	Sample
Reflections in the cycle	Weekly in class feedback / logbook	Collated in Word	Weekly for the eight weeks	
Activity in the e-Portfolio	SNA social network analysis over activity	Analysis using Excel and R	Weekly for the eight weeks	All e-Portfolio activity for each week
Reflections on the cycle	CxA Semi-structured interviews	Face to face	Post cycle	11 participants
Artifact analysis	CA thematic analysis over artifacts and discussions	In-vivo coding in Excel from reflective statement and tags	During/post the eight week cycle	1647 artifacts
Comments analysis	CA coding using the COI teaching presence	Analysis using Excel	Post cycle	

As well as continuing many of the in-process methods from cycle one, there was an opportunity for a more thorough examination of the participant's views. At the end of the cycle, 11 of the participants were interviewed in semi-structured sessions, with graphical representations of their activity used with the participants for triangulation.

How social network analysis, semi-structured interviews and coding techniques were used in cycle two is explored in more detail in the next section.

Data visualisation using social network analysis

It is easy to generate large amounts of activity data from online systems, but finding appropriate analysis techniques is a still an emerging field. Data mining has been demonstrated as a technique that has applicability for assessing participation (Dringus & Ellis, 2005) and for making class interaction visible (Baggs & Wu, 2010). In particular, social network analysis (SNA) has been applied to fields where the social connections between agents can be captured and measured. This can reveal both the individual connections and a whole network view, a perspective which "provides a view of the entire structure, and thus of the 'character' of the network to which an individual belongs" (Haythornthwaite & De Laat, 2010, p. 189).

SNA has been used to study the nature of interaction of learners in networked learning for dual purposes; for educators to improve connections and to foster collaboration between learners, and for researchers investigating learning relationships and their value (Cambridge & Perez-Lopez, 2012; Schreurs, Teplovs, Ferguson, De Laat, & Shum, 2013). De Laat (2006b) argues for the use of SNA to measure interaction patterns over time; it has also been suggested that SNA may provide an easier measure of social presence in a community of inquiry, over the more traditional coding and content analysis approach (Choi & Strobel, 2012; Mika, 2007; Shea et al., 2010).

Social network diagrams allow for the connections and relative placement of actors in a network to become visible in sociogram diagrams derived from data in graph theoretic notation (Wasserman & Faust, 1994), providing better visual representations of the actors and relationships. Generating sociograms from log files has been successfully used to examine the relationships between artifacts and participants in networked learning based communities (Suthers & Rosen, 2011).

SNA uses the following terminology (Wasserman & Faust, 1994):

- An actor or node is each social entity represented.
- A relational tie or edge is a directed link between actors.
- Dyads are pairs of actors and the relational tie between them.
- Relations encompass the nature of the tie in a group of Dyads.

The sociograms represent each actor with a circle with either the number of artifacts created over a learning period, or with a participant identifier (figure 3.2). A relational tie, (the connecting line) indicates a participant interacting with another user through browsing, commenting or replying.

These are valued directed graphs (Wasserman & Faust, 1994), where

- A -> B indicates A interacts with B's artifacts.
- B-> A indicates B interacts with A's artifacts.
- A <-> B indicates interaction in both directions.

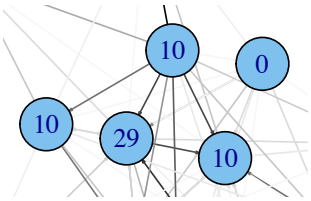


Figure 3.2 - Sociogram

A single line between two actors represents the strength of the relationship in both directions, with arrowheads indicating whether it was a single or multi direction relationship. All activities in the system have equal weight, so for example searching for a user, viewing another's work, or commenting are all valued equally.

The Fruchterman-Reingold algorithm (1990) is the most frequently used mechanism for deriving the optimal placement of actors. Actor placement is derived from interaction activity, i.e. actors placed more centrally in the diagram have stronger relational ties, having interacted more frequently. Actors placed at the edge of the diagram have interacted less frequently. Here, actor placement is derived from each user's activity history, as participants moving from activity to activity create records in the activity table. Rather than use the strong and weak binary divide, relational ties in the sociograms use a darker line to represent a more frequent number of interactions i.e. a stronger relational tie, as seen in Doran (2011) and Mazur (2010).

The sociogram diagrams used in this analysis were created with bespoke R scripts, after the cycle had completed. Sociograms were constructed using R Studio (http://www.rstudio.com/) and the graph-sociogram library (http://igraph.sourceforge.net) with a bespoke script written to

```
# Create adjacency sociogram
g<-graph.adjacency(m,mode="directed",weighted=TRUE)

if (edgeColor=="Gradient"){
        # Create a range of colours from gray to black, using the max value from the dataset
        # to determine the number of colours required
        colfunc <- colorRampPalette(c("white", "black"))
        colorRange<-colfunc(max(E(g)$weight)+1)

        # Function to return the colour that should go with an edge weight
        processCOLOR <- function (edgeWeight) {
                return (colorRange[edgeWeight+1])
                }

        exlist <- sapply (E(g)$weight, processCOLOR, simplify = TRUE, USE.NAMES = TRUE)
        } else {
        exlist <- "Black"
        }

if (vertexLabel == "ArtifactCount"){
        w<-as.matrix(artifactCreationResults)
        } else {
        w<-V(g)
        }
# vertex.label=w

# Plot sociogram
plot.igraph(g,layout=layout.fruchterman.reingold, edge.color=exlist, edge.arrow.size=0.1, vertex.label=w,
```

Figure 3.3 - Bespoke R script for sociogram production

generate coloured relational ties (figure 3.3). The strongest relational tie is depicted as black and the weakest as a light grey. Ties sitting between these two boundaries are then assigned colours derived from a value calculated from a ratio between the two outer points.

The example sociogram (figure 3.4), would indicate that participants on the outer edges have created few artifacts, indicated by the zero values. They have interacted less online, which can be deduced by the placement and by the lightness of the connecting relationships. A more active core group have uploaded more artifacts { 8, 3, 9, 10, 5}, have a higher centrality and were more active with each other, with the strongest number of interactions between {10} -> {9} and {1} -> {8}.

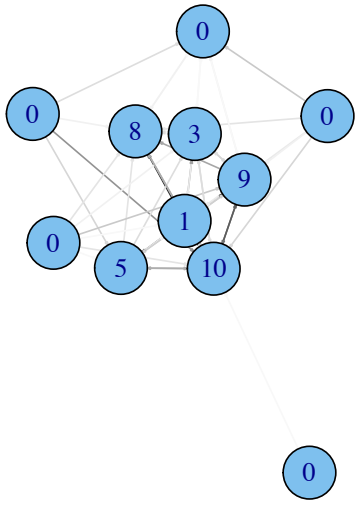


Figure 3.4 - Sociogram example

Various quantitative methods are available in SNA, although many of them are less applicable to valued directed graphs. Here the focus will be on sociogram use to strengthen the understanding of the network evolution over time. Rather than use the strong and weak binary divide, relational ties in the sociograms use a darker line to represent a more frequent number of interactions i.e. a stronger relational tie, as seen in Doran (2011) and Mazur (2010). The applicability of the statistical measures available to represent overall and individual activity in a social network are explored in further detail in cycle one and two.

A more detailed explanation of the data that is collated in the e-Portfolio activity tables is in section 4.2

Interviews, coding and interpretative analysis

There are a number of data collection opportunities that lend themselves to a coding process in this project, including data from artifacts, comments inside the e-Portfolio, questionnaire results from cycle one and semi-structured interview text from cycle two.

As participants from the first cycle were due to leave campus almost immediately after the sixth week, feedback was collected through an online questionnaire. This information has been combined with the weekly logs, emails, comments and

suggestions noted throughout the cycle. ATLAS.ti was used to collate the various documents and feedback together. Cycle one results were analysed between the two cycles, so that feedback from the first cycle could feed into the second, although sociogram representations were created after both cycles had completed.

Semi-structured individual interviews were conducted with eleven of the participants from cycle two, and were analysed with thematic analysis. These varied in lengths from 23 to 45 minutes and were recorded and then transcribed by a third-party. This has been combined with weekly feedback from the participants, logs, emails and notes made from in-situ conversations during the cycle. The questions are detailed in chapter six, but in summary they asked about the participant's individual experiences using the e-Portfolio, the interactions they had with others and their perception of the learning community as a whole.

Thematic analysis as a method for identifying, analysing and reporting patterns is widely used but is perhaps ill defined (Braun & Clarke, 2006) or not explicitly named in many studies (Boyatzis, 1998). To counter this, Braun suggests making the assumptions and processes used explicit, including the nature of codes, the themes and the methods used. This work uses an thematic analytical process derived from Braun and Clarke (2006) with recursive stages of familiarisation, generation of initial codes, theme abstraction, review and further definition using the 15-point checklist for 'good' coding. Codes represent a level of repeating pattern inductively determined across the whole dataset, but as these are derived from semi structured interviews, the role and pre-conceived researcher position must be acknowledged.

I applied Braun and Clarke's cycle as follows:

1. Familiarisation with the data – a degree of familiarisation was present as I was the person conducting the interviews. The interviews were listened to with the transcripts to reduce transcription errors and to make general notes, thoughts and ideas. ATLAS.ti allows audio and text to be linked together, which allowed the audio to be labelled in 5 minute chunks for quotes to be heard in context.

2. Generating initial codes – an inductive approach was used to generate codes, with a name and descriptive comment appended to parts of the

text. After the third interview was coded, codes from the first interviews could have introduced bias into the further coding processes, so to overcome this notes and breaks were taken. Each interview was parsed again to revalidate the coding process. Codes were identified using techniques suggested in Ryan (2003).

3. Searching for themes – the codes were then organised into themes using the family functionality in ATLAS.ti. The codes, comments and quotes were then exported to a spreadsheet for ease of sorting, searching and manipulating.

4. Reviewing themes – themes were refined, reviewed and (if necessary) collapsed, with adjustments made if required.

5. Defining and naming themes – themes were aligned with the research questions and then categorised into sub domain areas

6. Producing the report – the themes and linked codes were used to find appropriate signifying comments and evidence that were then embedded in the findings for cycle two.

Steps 3, 4 and 5 were repeated refining the themes and names as the process continued. As validation is an important part of the process, I discussed the process with my PhD cohort and reviewed the coding with a critical friend who works at Kingston University.

For both cycle one and cycle two, the comments associated with artifacts were extracted using a SQL query and then passed into ATLAS.ti and Excel for coding. Thematic analysis was used to code the responses, which could be analysed by time, participant and by artifact.

Coding portfolio entries

The variety of portfolio implementations has had a direct effect on the data collection method used in research studies. Although there is a large amount of research into the types, uses and effects of portfolios, there are few studies that directly analyse the content of the artifacts, perhaps because of the variety in style and representations of artifacts, along with differences in the domain knowledge covered.

Where the architecture supports a narrative flow of artifacts, then an analysis of the portfolio content has been used to reveal the rich picture in the transformation of the learner intertwined in with the portfolio use. Architectures where the artifacts are presented in more discrete units have been analysed using content analysis, with coding mechanisms aimed at revealing the nature of the learning taking place through taxonomic categories. De Laat uses content analysis with SNA (De Laat, Lally, Lipponen, & Simons, 2006b) to explore the changing nature of roles in a networked learning based community by using the community of inquiry (COI) coding scheme (Anderson et al., 2001). Using the COI teaching presence with e-Portfolios has been successfully used to show the levels of teacher interaction from emails and reflective blog entries (Torras & Mayordomo, 2011), although the e-Portfolio architecture in the Torres study is different to that suggested here.

Determining the level of coding in an e-Portfolio is difficult, similar to issues of coding a forum message in COI. An e-Portfolio artifact with comments could fall in many coding categories, so an assumption has to be made about the atomicity of the coding that can be applied. Existing e-Portfolios coding schemes tend to avoid the social activity inside the portfolio, focussing on the artifacts themselves.

This work will use thematic analysis to reveal the general themes in cycle one and cycle two by reviewing the artifacts in place, through the image, reflective text and tags associated with each item. More specific coding of the comments is used to reveal the nature of the teaching presence in the artifacts formed using COI.

3.5 Quality, validity and reliability

In action research, participants are both the object of study, initiators of change and researchers. Researcher as participant has implications for validity criteria (Heikkinen, Huttunen, & Syrjälä, 2007), which is one of the frequent criticisms of the methodology, along with the suggestion that the outcomes are neither valid nor generalisable. To rebut this, validity and reliability in the project context need to be clear (Koshy, 2009). This work will uses the term “validity” which despite its positivistic roots can be used in action research projects to differentiate from the concept of trustworthiness which dominates in naturalistic inquiries (Herr & Anderson, 2005).

Heikkinen et al's quality indicators (2007) on AR pose a number of principles that need to be addressed:

Principle of historical continuity and evocativeness - how is the evolution of the action research evolved historically and in context? Somewhat similar to Herr and Anderson's outcome and process validity (2005), this argues for a narrative that evokes both the historical context and the process itself, which it has been suggested can be used to suggest interpretavistic validity. Here this is attempted by the initial context description and the dedication of successive sections to the in-cycle and post-cycle reflective stages. Influenced by Davis (2007), this work does not abandon the traditional linear approach for the whole thesis structure, but it does frame the presentation and analysis sections around the action research cycles that took place in this project.

Principle of reflexivity, dialectics and evocativeness – are the nature of the relations, the clarity of the ontology and epistemology clear? The ontology and epistemology of this work are explained earlier in this chapter, with the relations evoked through the use of participant narratives from the interviews and in the use of SNA.

Principle of workability - does the research create workable practices, with appropriate ethics, empowerment? The ethical practices deployed in this project are discussed in the subsequent section and it is hoped that both the software and practices developed in this process are shown to be a catalyst for future work (after Herr's catalytic validity).

In action research, validity is achieved by sound and robust data collection (Koshy, 2009), but these also serve as indicators of reliability. Kemmis, McTaggart and Nixon (2013) argue that 'to do action research is to plan, act, observe and reflect more carefully, more systematically, and more rigorously than one usually does in everyday life' (p. 210) and demonstrating these processes is needed to add to the authenticity of the account.

The reliability in the generation of the social network analysis was performed by matching each grid and diagram against raw values generated from the activity table. Any inconsistency in diagrams or activity was clear from the number of artifacts produced by each participant each week. A backup routine was developed to archive the entire e-Portfolio as a snapshot twice a week, ensuring that if any fault occurred, the portfolio could be restored. This backup was never

required.

The reliability of the interviews and questionnaire was ensured by using pilots and consistency in question type and approach. Interviews were recorded on multiple devices and the audio was listened to multiple times during the coding process. Participants were asked for permission for follow up emails as part of the ethical agreement, should any issues of clarification arise. The reliability in the coding of interviews or of information from the portfolio system (comments and artifacts), was ensured by applying pre-existing schemes or by asking a critical friend to validate the appropriateness of the coding being applied.

3.6 Ethical considerations

Action research raises complex ethical issues (Nolen & Vander Putten, 2007) due to the dual observer-participant role, particularly in educational settings where participation, or non-participation may be perceived as having side affects on "grades, access to resources and enriching experiences" (p. 402). Herr (2005) argues that there is no guaranteed way to avoid ethical dilemmas in an action research project, and that therefore "much is asked of the action researchers in terms of continuously exercising professional judgment" (p. 112). The importance of addressing possible ethical issues is also an important validity indicator for AR (Heikkinen et al., 2007).

Ethical issues for this project were complicated by the nature of the assessment community the students were to participate in. All participants were given the choice to participate with non-prejudicing alternatives for those students who do not wish to take part. In cycle one approximately half the students did not wish to take part and were given an alternative assessment that covered the same learning outcomes presenting their work in a more traditional manner, inside the institutional learning management system. This ensured that the workload amongst students in and outside the project remained consistent and was validated by Kingston's internal quality process, which consists of module leader reports, feedback processes from module leaders to boards of study, student feedback and external examiner reports. No issues were reported.

All participants available for cycle two elected to take part in the process, which may be due to more clarity being available on what participation would entail and the steps taken to introduce the nature of the community, as detailed in chapter six. Kingston's internal quality process for postgraduate modules has the

same process as used with the undergraduates in cycle one and there were no issues reported.

Participants for both cycles were asked to sign informed consent and confidentiality letters, which covered that:

- every effort would be made to preserve the confidentiality of the participants, with pseudonyms used for any work, activities or feedback reported in this work;

- participants could withdraw at any time, with alternative assessments available to cover any missing opportunities to demonstrate their skills; and

- contact details for staff (both at Kingston and Lancaster) in the event of any issues that could not be resolved in the process itself.

Students who participated in the questionnaires and interviews were asked to sign specific ethics statements, with text explaining the context and purpose of the particular data collection method. Interviewees were given the opportunity to review the transcripts from the recorded session.

Online activity can bring out a new set of ethical issues (Anderson & Simpson, 2007), such as:

- the nature of hierarchical power relations in online courses,
- the value ascribed to participation, and
- surveillance.

Participants using the learning community were sacrificing a level of privacy, as the peer-to-peer nature of the work necessitated their online identities to be known to each other. This was made clear during the sign up phase, during the introduction to the project and before each student began participating in the e-Portfolio. This initially seemed to satisfy the participants in cycle one, until the surveillance aspect became an issue with one of the participants, as described in the analysis of cycle one. Participants in cycle two did not raise these issues.

Any examples or results from this project have been carefully selected to ensure that the identity of the participants is protected. Aliases chosen for the work presented here are random, although they do reflect the gender of the original participant. Material in this work has been presented in such a way that no identifying information is available, which has required some slight alteration in artifact images where there may have been identifying information, such as participant names inside screenshots or embedded in comments. Participants agreed to the inclusion of artifacts created during this process in the ethics agreement.

Ethical processes have been approved by both Lancaster University and Kingston University.

Chapter 4 Cycle one

4.1 Introduction to the first cycle

The module chosen for the first action research cycle runs in the first semester of an academic year, where assessment elements have to be completed before the second semester starts. Students are expected to attend for an 11 week term, with later assessments allowed to run past the end of the taught period for four weeks. The second year undergraduate students taking this module have all worked together in previous courses and in the first five weeks of the module.

The undergraduates in this study are typically 20-21, and will have a range of IT knowledge and skills as a result of their entry qualifications and the differing first year IT modules available. Some of the students may have coding experience; in this cohort three of the students have previously studied a different programming language to the one used here. Roughly half of the students taking the module have to take the subject as a core requirement for their degree, with the remaining opting into the subject as a second year choice. There tend to be variable levels of attendance for undergraduate level five students, which has in the past had negative consequences for the student outcomes.

Following student feedback from previous cohorts, the delivery of this module has recently changed to two 2-hour labs using demonstrations, guided tutorials, examples and exercises. Students are expected to attend both sessions, which for this academic year are timetabled on the same day, early in the morning and then later in the afternoon. For the five weeks before the cycle had begun, students had covered subjects common to these modules such as an introduction to programming, the basics of using variables, form processing, control structures and ways to use functions with arrays.

Assessment in the first part of the module consisted of a single report containing exercises, tasks and activities that had been attempted during the first five weeks. As well as acting as a natural breakpoint for the introduction of the e-Portfolio, it also had the aim of introducing students to the practicalities of collecting evidence as they progressed. There were few opportunities for collaboration in this initial assessment, although students did confirm that there was informal discussion between them about the content, such as the number of items, their nature and how the work should be presented.

The cycle began in the sixth week of term and ran for an eight-week period, with the last three weeks occurring after the formal attendance period. Following a briefing session on the nature of the project, students were allowed to opt-in to the use of the e-Portfolio system. Those students wishing to sit outside the project were asked to continue gathering and collating artifacts, which would be presented in a similar style to the work from the first half of the module.

Previous grades	No of students in class	No of students in the study
70+	8	5
60-69	13	8
50-59	6	1
40-49	2	1

Table 4.1 - Grade profile for participants

From the 29 students on the module, 17 students initially chose to participate, although two completed the initial sign-up and then did not contribute in the e-Portfolio or in the data collection processes. Nine male students and six female students chose to participate. The grades awarded for work in the first part of the module suggested that the volunteers were those with a higher level of ability (table 4.1); a more reflective sample of the class as a whole would require two more students in the 50-59% range.

4.2 Designs of the learning community and e-Portfolio

As discussed in the research design chapter, a modified version of De Laat's multi method research framework for studying networked learning processes is used here, applied to the study of e-Portfolio artifacts in a community. Both the artifacts and the activity are collected through the use of a networked learning based community with a bespoke e-Portfolio designed to facilitate the creation and collation of artifacts.

The design of the e-Portfolio learning community

A key characteristic of more successful learning communities is the careful consideration of the term community along with a design that supports the pedagogy, making explicit the embodied values (McConnell, 2006). As indicated in the literature review, the features that are commonly used to categorise them vary, but typically include:

- characteristics of the participants;
- intentionality, or purpose of the learning community;
- type or strength of connection;

- the domain, and location of the learning community; and
- the degree to which the learning community can transform over time, adopting new customs or practices.

Wenger's third community of practice model suggests that "mapping the domain and specifying their concept and scope is an art" (Wenger, 2002, p. 70). Here the domain is well specified and the community for cycle one will be formed from a subset of the available module cohort. Practice and the shared knowledge are also well defined by the curriculum, but letting participants form their own paths allows for flexible boundaries.

The networked learning philosophy entails purposively promoting links between the learners and the artifacts inside the community. Here the artifacts will be created by the participants themselves and will be in a variety of forms; work they have created, links to resources they have used; discussions of their own and others' artifacts in a scrapbook style. Networked learning acknowledges the strength in both weak and strong ties (Ryberg & Larsen, 2008), although this will not be explicit amongst the participants or in the portfolio design. The learning community will be peer based with an implicit equality ideology where every participant, including the tutor, has equal 'weight', which moves beyond simple portfolio models that stratify users, such as those suggested by Love's maturation table (2004).

Curated artifacts and information about participation will be collected in an e-Portfolio and will form the evidence for the assessment at the end of the process. As the learning community is situated in an action research cycle, feedback from the participants will be used to transform the community over time, both during and after the cycle.

The design of the e-Portfolio

The review of the existing portfolio implementations suggested that none of the existing architectures would allow for the collation, sharing, discussion and promotion of artifacts in a networked learning style. The decision was taken to implement a new design with all new code, with the advantage that the system could then be rapidly changed during and between the cycles, reflecting the feedback and successful processes that occurred. Writing this turned out to be non-trivial and took five months. The software was created using open source technologies (PHP, MySQL), with an internet facing interface, which students can

access through any web browser or mobile device. The choice of technologies used here aligns with those that the students will be learning in the cycle, attempting to ensure the possibility of their participation in the development and for the code to be used in classroom examples and activities. The name 'foliocube' was chosen for the domain and project name.

The e-Portfolio literature emphasises the importance of attractive and relatively simple interface designs that require little or no training (Jafari, 2004). This philosophy underpins the design and functionality of the e-Portfolio, so no knowledge of mark-up languages or requirements for users to design the overarching context for artifacts is required. Through its structure, the architecture of an e-Portfolio signals what is important (Yancey, 2009b). Here the primary activity is the representation and collation of artifacts, a visible representation of the learning taking place. The system does not include any of the personalisation features seen on social networking sites.

The core of the application is the representation of an artifact, which here, for implementation simplicity are images, consisting of screenshots of user generated content, snapshots of web pages, eBooks, links or other forms of information that the participants have used and wish to share in the community.

The name of the artifact creator, date of creation and date of last update are automatically attached to the artifact. Each artifact is accompanied by a number of attributes to enhance their use to others:

- a reflective commentary;
- a discussion thread;
- categorisation using folksonomy tags, taxonomy; and
- a URL, for external resources.

An online representation of an artifact is shown in figure 4.1.

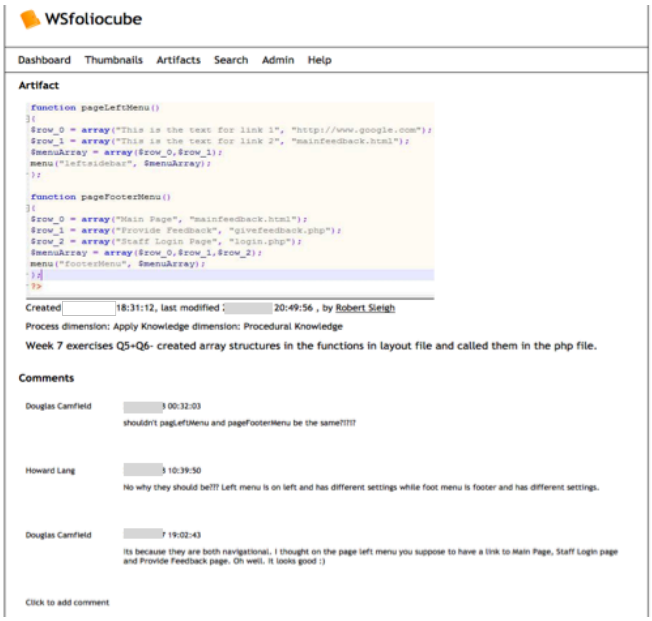


Figure 4.1 - An example artifact representation

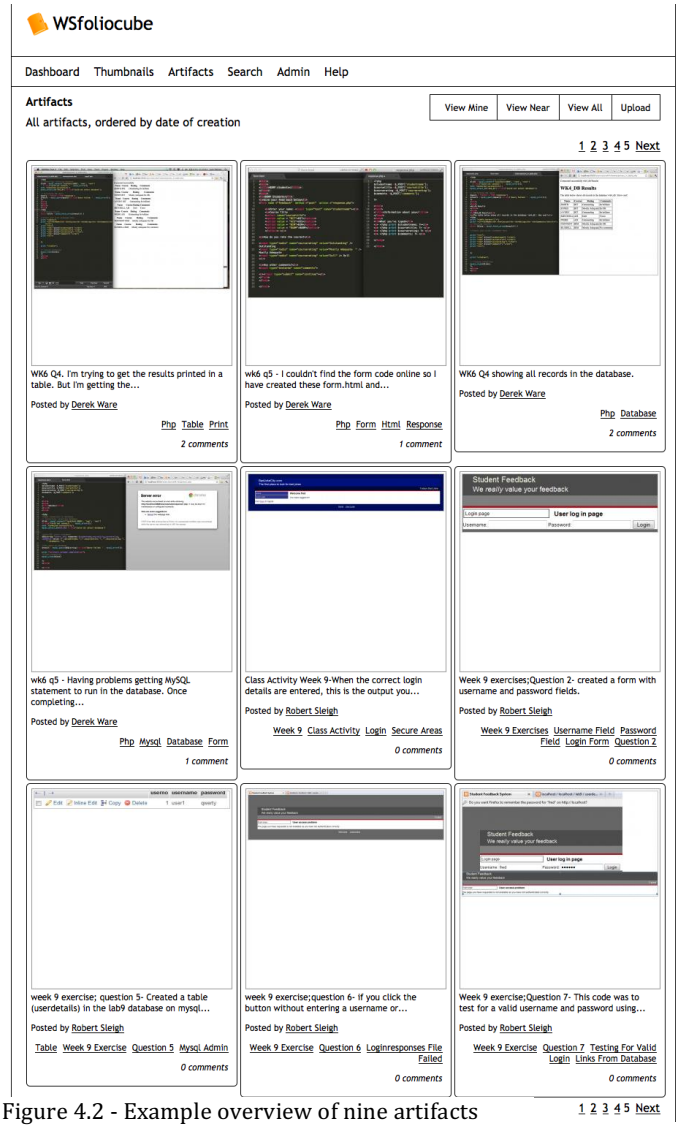


Figure 4.2 - Example overview of nine artifacts

When navigating through many artifacts the portfolio system uses an overview, with nine smaller views of the artifacts arranged in a three by three grid (figure 4.2). These smaller views (figure 4.3) can be ordered by creation date, update date, number of comments or by number of views. Artifacts can also be viewed in thumbnails presented through a taxonomy grid.

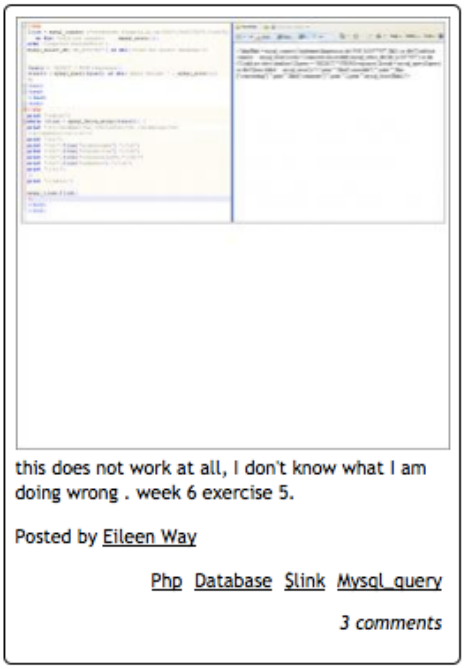


Figure 4.3 - Example artifact

Artifacts, commentary and participation 'inside' the portfolio can only be seen by authenticated users and are protected by username and password. All artifacts and comments are visible to all participants, which was highlighted in the ethic statement and made clear before sign-up process. The principal reason for this is to promote equality and restrict the possibilities of stratification and dependence (Wenger, 2002), which may happen if participants elect to share work amongst subsets of users, which would have consequences on the structure of the community as a whole.

Promoting the connections between learners and artifacts will be performed in three ways:

- by the tutor,
- by embedded co-operation and collaboration activities that are designed for the participants by the tutor, and
- in the design of the portfolio itself.

Connections between users and artifacts will be embedded in the interface in a number of ways. When a participant's name is shown in any artifact, comment or summary page, it is a clickable link that will take the viewer to the artifacts associated with that participant. Clicking on tags or categories reveals artifacts that have been similarly tagged, either from the same user or from the context of the sub-selection at that time.

There have been attempts at developing classification systems for the descriptors of multimedia objects used in a community of practice, where the

sharable representation was aimed at creating discussion and reflection (Steeples & Goodyear, 1999). Despite the lack of correlation shown in the pilot, it was decided to see if assigning artifacts to domains in a taxonomy may still be useful when created over time in a learning community. To support the use of this system, the thumbnail overview page uses a tile metaphor (figure 4.4), with small summary pictures of artifacts in piles pegged to each domain. These are clickable and then reveal fuller details of the artifacts using either the overview pages, or the full artifact details.

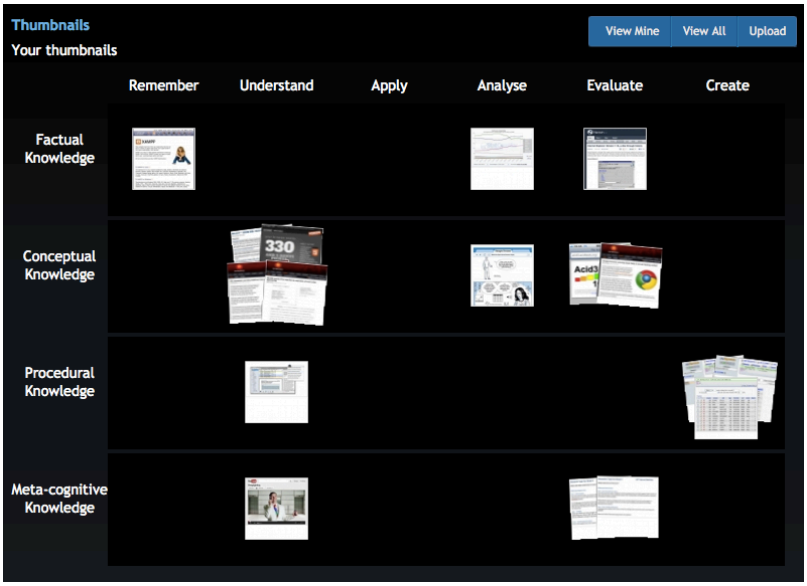


Figure 4.4 - Example thumbnail grid

The landing page (dashboard) is the first place shown upon login, and as explained in the cycle summary and discussion, changes many times during the process because of its importance as a signal of the amount of activity that is taking place and as a way to promote connections. This is also the page that users return to after using other features on the site, so its use is a signal of overall activity.

During the research cycles the e-Portfolio code will be shared and used with the participants, initially as in class examples and later as actual shared code. After the project completes the e-Portfolio will be placed under an open source license, an approach taken with many open projects, to ensure that enough of the project works before releasing it into the public domain. There are overheads to managing a fully public project, which are too costly to attempt whilst simultaneously managing this work.

Because of the complexity inherent in using different methods of data collection, the use of each method, the means, analysis period and sample is explained in detail in the next section.

Method, sample and analysis

There are a number of data collection opportunities, detailed in table 4.2.

Table 4.2 - Methods, means and sample

Description	Method	Means	Date	Sample
Activity in the portfolio	SNA Social Network Analysis over activity records	Analysis using Excel	During the eight week cycle	Derived from all activity shown in activity tables
Artifact analysis	CA Thematic analysis over artifacts and discussions	In-vivo coding in Excel	During/post the eight week cycle	All artifacts in the e-Portfolio
Reflections on the cycle	CxA Final questionnaire	Online	At end of cycle	11 students
Reflections in the cycle	Weekly in class feedback / logbook	Collated in Word	Weekly for the eight weeks	

Social network and activity analysis

As participants interact with the system, information about their activities is recorded in an activity table using a code indicating the possible actions, such as creating an artifact, commenting, viewing others' work or visiting the dashboard (figure 4.5).

activitycode	activity
1	Artifact upload
2	Comment on an artifact
3	View all our own artifacts (with sub selections po...
4	View a specific set of others artifacts (by tag, L...
5	View a specific set of near artifacts (not ours)
6	View all artifacts (excluding ours)
7	Viewing one of our own artifacts
8	Viewing one of someone elses artifacts
9	View our thumbnails
10	View all thumbnails
11	View Dashboard/Recent activity
12	View Dashboard/Recently Viewed Artifacts
13	View Dashboard/Recently Commented Artifacts
14	View help - general
15	View help - artifacts
16	View help - thumbnails
17	View help - search

Figure 4.5 - Assigned activity codes

The activity table records date and time; the owner of the artifact that is in use; categorisation tags; and artifact identifiers (figure 4.6). Information from this table forms the core of the network and activity analysis used both during the learning community and in the subsequent analysis after the cycle completed.

id	own_user_id	other_user_id	activityCode	tag	processDimension	knowledgeDimension	modified	artifact_id
1821	47	0	11				12:15:52	0
1822	47	44	8				12:15:59	40
1823	47	0	11				12:16:12	0
1824	52	42	8				12:16:57	27
1825	52	42	4				12:17:08	0
1826	52	42	8				12:18:49	27
1827	52	42	4				12:19:09	0
1828	52	42	8				12:19:11	30
1829	52	0	3				12:19:42	0
1830	52	0	11				12:19:43	0
1831	52	49	8				12:19:47	42
1832	52	0	11				12:19:52	0
1833	52	47	8				12:19:54	44
1834	52	0	11				12:20:00	0

Figure 4.6 - Snapshot of activity recorded in the activity table

The architecture of the e-Portfolio allows for the activity data to be easily processed with customised database queries in the programming language SQL, exported and then post processed in Excel and the data analysis software R. The artifacts, data analytics and feedback from the participants were used both inside the cycle in the tutor role and in the reflective phase.

Three derived tables were used during the cycle:

- an analysis of activities by the community as a whole,
- an analysis of activities by individuals, and
- a grid showing the connections between participants.

activitycode	activity	Week1
1	Artifact upload	16
2	Comment on an artifact	9
3	View all our own artifacts (with sub selections possible)	221
4	View a specific set of others artifacts (by tag, LD and/or user search)	26
5	View a specific set of near artifacts (not ours)	13
6	View all artifacts (excluding ours)	168
7	Viewing one of our own artifacts	42
8	Viewing one of someone elses artifacts	106
9	View our thumbnails	66
10	View all thumbnails	10
11	View Dashboard/Recent activity	197
12	View Dashboard/Recently Viewed Artifacts	38
13	View Dashboard/Recently Commented Artifacts	37
14	View help - general	11
15	View help - artifacts	9
16	View help - thumbnails	5
17	View help - search	3

Figure 4.7 - Activity for week one by category

The whole class activity grid records e-Portfolio activities, along with the number of times each activity was performed each week. The week one grid (figure 4.7) reveals that the community created 16 artifacts, participated in nine comment threads and viewed others' artifacts 106 times.

Activity	Week 1	Week 2	Week 3
Upload an artifact	3	5	0
View all other artifacts	0	10	0
View all own artifacts	16	15	7
View dashboard	6	7	5
View dashboard - recently commented	4	0	0
View dashboard - recently viewed	1	0	0
View help	3	0	0
View near artifacts	0	1	0
View own artifact	7	7	5
View own thumbnails	3	2	0
View someone elses artifact	0	5	4
View subset other artifacts	0	3	0

Figure 4.8 – Example individual activity

The individual activity grid breaks this down for each individual participant by

week. For the example shown (figure 4.8) this participant did not interact with others' work in week one, but looked at an overview of others' artifacts ten times and individual artifacts five times in week two.

The connections grid shows the connections between participants, with each number indicating the number of times a participant interacts with another participant for that week – a higher number indicates more frequent interaction after the binary matrix of Daniel, McCalla and Schweir (2008). This is triggered by:

- viewing another's work,
- commenting or replying to a comment on another's work,
- replying to someone's comment on their own artifact, or
- searching for an individual.

own	BAv	BNe	BSa	DCa	DWa	DWh	EBl	EWa
BAv	0	0	0	0	35	0	31	14
BNe	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
BSa	0	0	0	0	0	0	0	0
DCa	0	0	0	0	0	0	2	0
DWa	4	0	0	0	0	0	13	5
DWh	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
EBl	0	0	0	0	0	0	0	1
EWa	3	0	0	0	6	0	5	0

Figure 4.9 - Interaction between participants in a week

In the example grid (figure 4.9), Derek (DWa) interacted with Elizabeth's work (EBl) 13 times, whilst Elizabeth did not reciprocate, interacting with his work zero times. A row of null values indicates no interaction for the week.

Social network analysis statistical measures and the sociogram diagrams are generated from the activity tables. Results for the different SNA measures are shown in section 4.4 and the appropriateness of each measure is discussed in the post discussion reflection.

Content analysis from artifacts, comments and notes

The artifacts created during the process were analysed by creation date and then by user inside the e-Portfolio system itself. Reflective statements and comments were processed inside a spreadsheet.

Each artifact was processed according to the following criteria:

- the nature of the image, collation or curation;
- reference to 'outside' resources; and
- the subject of the artifact – what subject area, the level of reflective comment, whether a request for help.

Further information for the content analysis was derived from in class notes taken during the cycle.

Context analysis from questionnaires and logs

The context analysis (CxA) is generated from a questionnaire and notes taken during the process. 11 of the 13 active participants responded to the questionnaire, which contained a mix of open and closed questions (table 4.3).

Table 4.3 - Questions used for context analysis

Question	Type	No of responses
How did you find using the portfolio?	Open	10
How did you decide what should be an artifact?	Open	8
What resources do you use for learning on this course?	Choice	11
In the portfolio system, how often did you look back on your own work?	5 point Likert scale	11
Why did you look back at your own work?	Open	9
How often did you use others' work?	5 point Likert scale	9
How do you think using the portfolio changed the group?	Open	7
Why did you look at others' work?	Open	7
How did you find tagging and using the thumbnail system?	Open	10
Other comments	Open	4

The analysis of responses for the questionnaire was performed in Excel, with statistical or thematic analysis as described in chapter three.

For the purposes of describing the activity in the cycle a number of assumptions have been taken, which enable the division of the cycle into analytical sections. A week has been defined to be the period running from the start of the first session where new taught material was introduced, for the next seven days. Students agreed with this definition, as many of them indicated that there was a shared expectation that content, exercises and discussion should take place between sessions.

In the following discussion of activities inside the cycle, the eight weeks have been divided into three, signifying the beginning, middle and end of the cycle, after divisions used by De Laat (2007; 2006a; 2006b). The first three weeks cover the introduction of the e-Portfolio and the steps taken to increase its use. The next two weeks run from there to the point where students leave for the Christmas break; the final three weeks occur with students collaborating off campus.

The following discussions leave out John and David, who neither attended nor participated in the cycle after signing on at the beginning. Neither supplied a response to the questionnaire.

4.3 The cycle

This section provides an overview of the activity over distinct phases, dividing the cycle into three. This provides the context for the specific data collected during the cycle, which is presented in the subsequent sections and analysed in chapter five.

Week one to week three

The induction session introduced the aims of the learning community, an overview of e-Portfolios, a demonstration of the platform along with a discussion on the nature of artifacts and how they are created and shared. Exercises, examples and other resources were shown as possible sources for artifacts.

For the first three weeks of portfolio use, a combination of programming and database techniques were demonstrated in class, with accompanying examples showing how to set up a connection between a web and database server. Examples and exercises asked students to create their own databases, write

queries and to display data extracted from the connection in a web page. Subsequent classes covered building a larger web application, using database and programming techniques from the earlier sessions.

Each student's first artifact was acknowledged with a comment to encourage further participation. Artifacts with missing reflective statements, tags or taxonomy placement were commented to reinforce the advantages in using these in the process. There are a number of factors that influence how long a facilitator should wait before responding to an unanswered request for help. Answering too quickly can discourage others from participating (Garrison & Cleveland-Innes, 2005; Vonderwell, 2003) leaving questions unanswered for too long could reduce confidence in the ability of the community to supply answers, particularly when the visible participation level is lower. Due to low levels of initial participation I replied within 24-36 hours for the first two weeks (figure 4.10).

Figure 4.10 - Example of initial tutor feedback

In the first two weeks, eight of the participants had explored the system, with only four creating artifacts. Despite general encouragement in class, participation levels in the portfolio only increased a little from week one to two, with many students yet to create an artifact or to participate in the online community. At the end of the second week I decided to explore the reasons why this was occurring.

Intervention

Participant feedback at the end of week two suggested that many of the students had not explored beyond the front page, which only contained a welcome message and no immediate visual indicators of activity. This had led them to conclude that little portfolio use was taking place. A demonstration in class confirmed this.

Six of the students agreed to attend a small focus group, which suggested four reasons for low participation:

- Confirmation that there was a lack of awareness of the level of activity occurring in the online community.
- A wariness of the different 'new' approach.
- An anxiety over sharing of artifacts.
- A hesitation due to the lack of clarity over the nature and shape of what participants should upload.

Feedback from the session divided into two categories, with immediate design changes for the e-Portfolio system that could more clearly signal the levels of activity occurring and suggestions for improving the initial induction, which is discussed in the post cycle reflection.

A new front design was brainstormed with the group, who suggested the inclusion of the following elements:

- Snapshots of the last five artifacts created.
- A list of the logged in participant's recent activity and comments.
- An easier way to see recent artifacts.

The designs for the new front page were implemented for the subsequent class (figure 4.11).

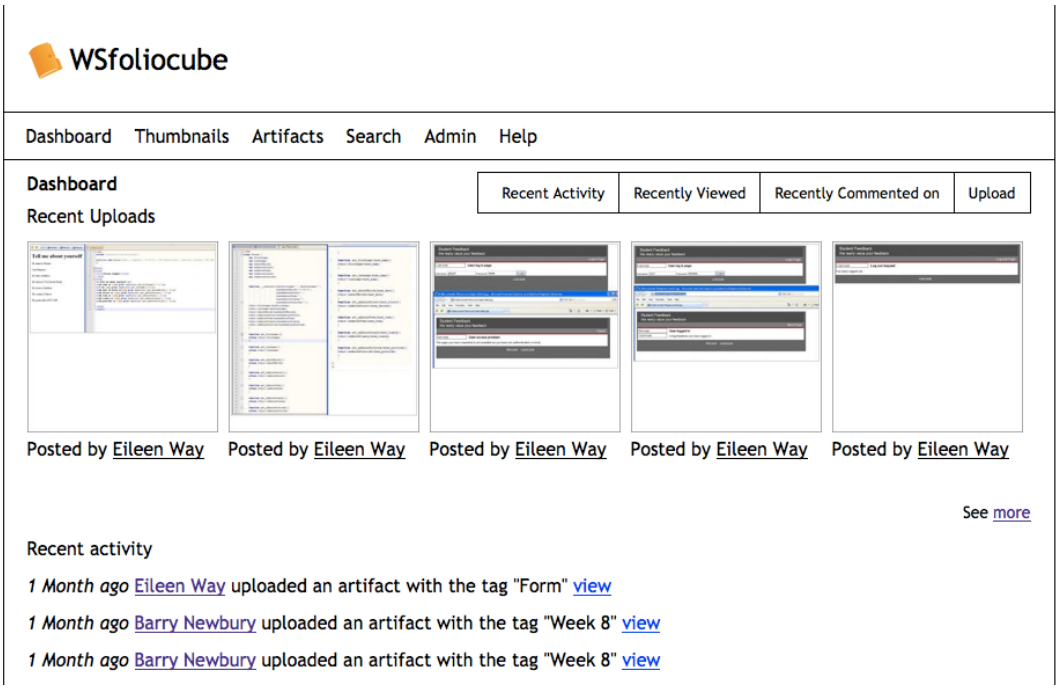


Figure 4.11 - Redesigned front page

During the discussion, it became apparent that the activity table could serve a dual purpose. Originally designed to generate social network analysis diagrams and tables for this research, the activity table tracks every interaction and activity that each participant performs as they move through the system. The realisation that it could also be used to reflect recent activity back to the participants on the dashboard was significant. It also forms the basis of the recommendation system developed in cycle two. The analytic literature refers to these as process traces, generated from log files, used to reveal recent activity (Suthers & Rosen, 2011).

At the start of the third week, the front page and some of the artifacts created were demonstrated to the whole group, along with a re-emphasis of the peer nature of the community. Following these changes and demonstration, there was an increase in activity for week three with double the number of created artifacts, and many more interactions inside the e-Portfolio.

Participants who were first using the system from weeks three onwards were responded to in a similar fashion to those in the first weeks. If the initial artifacts from a user lacked reflective statements and tags, a note highlighting the advantages of their use tended to encourage students in using them soon after.

Week four and five

Week four and five were the last two with specific timetabled classes. Subjects covered include writing authentication pages with scripts to make a site secure and an introduction to object oriented programming. By this week, students had covered many of the techniques used in the creation of the portfolio itself, so code from the authentication system and artifact objects were used in class and for exercises.

One of the participants, David, had not logged in to the system at all and had not attended class since the first week, so an email was sent asking for information, and his case was passed into the University tutor system which offers pastoral support.

As participants started commenting on work from four weeks earlier, student feedback in class suggested it became unfeasible to check all old artifacts for comments. A more visible indicator was scripted for weeks six to eight, highlighting popular comment threads and artifacts on the dashboard.

Week five was the final week of attendance and also fell on the final day of term. Attendance in class was low, as many of the participants had already returned home for their Christmas break. There was a significant amount of browsing around the system by the participants, with all of them logging in and looking at existing work. Feedback from those present in class suggested that they wanted to make sure that they could access the e-Portfolio before they left the campus. Despite higher levels of interaction in the system, with questions, comments and views, only four participants created new artifacts.

Week six to week eight

Week six spanned the Christmas holiday week and there was a drop in activity with a single student creating artifacts, with viewing, commenting and searching on artifacts by eight others. The overall level of use was significantly lower than in earlier weeks.

Week seven was the penultimate week of the cycle and sees the participants fall into three categories:

- Three participants continuing their regular patterns of activity and creating artifacts from material from week four and five.
- Three participants with irregular or little activity, starting to create artifacts.
- Participants interacting via comments, or exploring others' work but not creating any artifacts.

For the final week participants fall into slightly different categories:

- Four students who continue participating but don't create any new artifacts.
- Four participants who had irregular or little activity so far, starting to create artifacts.
- Two students creating covering material from many different weeks with little interaction with the others.
- Two students who continued with little or no participation.

4.4 Results

This section summarises the results from the first cycle, in three sections. The first details information generated from the activity tables and the social network analysis. The second concerns the content analysis over the artifact details and

the third comes from a questionnaire. These are then discussed in the next chapter.

Activity in the cycle

The summary activity table (table 4.6) is generated from the e-Portfolio which records the actions every participant performs inside the system. Activity in the e-Portfolio has been grouped into six categories:

- viewing help pages,
- creating or viewing one's own work,
- interacting with others' work,
- viewing thumbnails through the taxonomy grid,
- using the dashboard, and
- participating in comments.

The "view dashboard/recent activity" number is a general indicator of use, as it is the homepage that is shown after every requested activity is completed. Numbers in the table indicate how many times these events occur in each week for all users of the system, for example in week one:

- there were 16 artifacts created, and
- participants looked at others' work 106 times.

The low level of activity in the first two weeks is suggested by both the number of artifacts created (16 in week one, 18 in week two), and by the level of interaction with others' work (323 and 301 in weeks one and two respectively). After the intervention and redesign of the homepage to signal activity taking place, these numbers increase for week three with double the number of artifacts created and three times the level of interaction with others' work compared to week two. After this surge in activity, the number of artifacts created per week remains steady (36, 33, 46 in weeks three, four and five), whilst the interaction with others' work settles at 460-500 times a week. The lull in activity over the Christmas week (week six), is followed by a surge in activity in weeks seven and eight, with a large increase in both artifact creation, and interaction with others' work.

Participants uploaded a total of 381 artifacts over the eight week period, giving the following statistics - on average, a participant created one artifact every two

days, looked at their own work three times a day and looked at others' work seven times a day (table 4.4).

Table 4.4 - Own and others' use of artifacts

	Own	Others
View single artifact	688	2130
View overview of artifacts (all)	1847	2139
Searching on others' artifacts	-	1769
Total	2535	6038
	3 times a day	*7 times a day*

Table 4.5 - General graph measures

Week No	1	2	3	4	5	6	7	8
No of edges	15	24	48	31	53	14	72	73
No of islands	10	8	6	8	3	7	2	2
Graph density	0.063	0.100	0.200	0.129	0.221	0.058	0.300	0.304
Reciprocity	0.400	0.500	0.583	0.452	0.340	0.000	0.194	0.411

There are a number of general graph measures that can be calculated over all the activity in the community, on a week by week basis (table 4.5).

Number of edges is a measure of activity between participants, where multiple interactions between two nodes count as a single edge. A higher number is better, indicating success in promoting connections between participants. As the cycle progresses the number of connections steadily increases, apart from Christmas week (week six).

Islands are disconnected clusters, which in a community setting is better when smaller as larger values suggest non-interaction or cliques. During the cycle, this number steadily decreases, although the activity tables and sociograms reveal that some individuals in cycle one moved in and out of participation repeatedly.

Graph density indicates the proportion of connections and is calculated from the ratio of the number of edges to the total number possible. Higher values suggest more connections between nodes, with *zero* meaning no connections and *one* suggesting all nodes are connected to each other. The density has peaks and

troughs, with peaks corresponding to a surge in activity after week three, towards the end of formal attendance and at the end of the cycle.

Reciprocity defines the proportion of mutual connections, in a directed graph. It is defined as the probability that the opposite counterpart of a directed edge is included and has values between zero and one. *Zero* indicates no mutual connections whilst *one* indicates a balance between in and out connections. Higher numbers are better, indicating more balance between using others' work and a participant's work being used. There is a peak in week three, which drops away until week seven where it starts to increase.

Table 4.6 - Activity summary for the eight weeks of cycle one

View Help	***Week 1***	***Week 2***	***Week 3***	***Week 4***	***Week 5***	***Week 6***	***Week 7***	***Week 8***
View help - general	11	2	9	1	5	2	5	5
View help - artifacts	9	1	6	0	4	1	2	3
View help - thumbnails	5	0	4	0	0	0	0	0
View help - search	3	0	5	0	0	0	0	0
	28	***3***	***24***	***1***	***9***	***3***	***7***	***8***
Create or View Own work								
Artifact upload	16	18	36	33	46	4	68	158
View an overview of own artifacts	221	119	277	174	114	29	356	557
View one of own artifacts	42	42	110	69	41	12	144	228
	279	***179***	***423***	***276***	***201***	***45***	***568***	***943***
Interact with others' work								
View a subset of others' artifacts	26	27	162	94	81	109	692	525
View a specific set of near artifacts	13	7	9	7	3	2	9	3
View all artifacts (excluding own)	168	135	351	175	209	101	520	480
View someone else's artifact	106	115	390	175	208	79	567	490
View all thumbnails	10	17	14	9	2	3	6	3
	323	***301***	***926***	***460***	***503***	***294***	***1794***	***1501***
View thumbnails								
View our thumbnails	66	33	44	32	19	5	25	20
	66	***33***	***44***	***32***	***19***	***5***	***25***	***20***
Dashboard								
View Dashboard/Recent activity	197	165	430	197	202	51	227	267
View Dashboard/Recently Viewed Artifacts	38	11	27	11	7	6	16	5
View Dashboard/Recently Commented Artifacts	37	20	23	10	10	5	16	10
	272	***196***	***480***	***218***	***219***	***62***	***259***	***282***
Comment threads								
Comment on an artifact	9	9	16	10	15	2	13	18
	9	***9***	***16***	***10***	***15***	***2***	***13***	***18***

For degree, betweenness and eigenvector the values in the top 20% (green) and bottom 20% (red) have been highlighted (table 4.7, 4.9 and 4.10).

Table 4.7 - Degree values for participants

	BAv	BNe	BSa	DCa	DWa	DWh	EBl	EWa	GSh	HLa	JHo	MHe	NLo	RSl	TLe	WHu
Week 1	6	0	0	0	2	0	6	3	0	0	0	0	1	7	0	5
Week 2	9	1	1	3	0	0	7	5	0	0	0	0	3	11	0	8
Week 3	11	0	1	4	13	0	12	12	0	10	0	6	5	14	0	8
Week 4	8	0	2	6	10	0	10	3	0	6	0	0	0	9	0	8
Week 5	12	0	3	14	4	1	7	8	2	10	0	13	6	14	7	5
Week 6	3	4	1	7	1	0	2	1	0	0	0	3	0	4	2	0
Week 7	11	7	10	12	9	4	5	10	5	16	0	15	11	14	4	11
Week 8	11	12	4	7	16	0	4	18	10	3	8	7	15	20	6	5

Degree is the number of in/out links from a vertex (table 4.7). Higher numbers are better as they suggest more connections are occurring. This measure does not count repeat links (i.e. multiple vertices to the same node count as one). Figures in red are in the lowest 20%, figures in green are in the highest 20% on a week-by-week basis. The trend over subsequent weeks is for the degree to increase.

Table 4.8 - Degree distribution for participants

	Number of links																				
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Week 1	56%	6%	6%	6%		6%	13%	6%													
Week 2	44%	13%		13%		6%		6%	6%	6%		6%									
Week 3	31%	6%			6%	6%	6%		6%		6%	6%	13%	6%	6%						
Week 4	44%		6%	6%			13%		13%	6%	13%										
Week 5	13%	6%	6%	6%	6%	6%	6%	13%	6%		6%		6%	6%	13%						
Week 6	38%	19%	13%	13%	13%			6%													
Week 7	6%				13%	13%		6%		6%	13%	19%	6%		6%	6%	6%				
Week 8	6%			6%	13%	6%	6%	13%	6%		6%	6%	6%			6%	6%		6%		6%

Degree distribution suggests the number of each links as a proportion of the total. For week one 56% of the participants had no connections, 6% had 1, 2 and 3 links (table 4.8). Higher numbers are better, indicating more connections. As the cycle progresses there are peak connections in weeks 3, 5 and 8.

Table 4.9 - Betweenness figures for participants

Week No	BAv	BNe	BSa	DCa	DWa	DWh	EBl	EWa	GSh	HLa	JHo	MHe	NLo	RSl	TLe	WHu
1	2	0	0	0	0	0	8	0	0	0	0	0	0	3	0	0
2	2	0	0	0	0	0	8	4	0	0	0	0	0	10	0	4
3	0	0	0	0	5.5	0	8.5	20	0	0	0	0	0	6	0	17.5
4	13.5	0	0	1	8	0	9	6	0	0	0	0	0	2	0	21
5	27	0	0	33.25	0	0	0	19.33	0	5.083	0	25	0	25	0	0
6	0	0	0	9	0	0	0	0	0	0	0	3	0	5	0	0
7	23.5	0	0	6	28	0	0	45.5	0	31	0	18	0	11	0	4.5
8	11.5	17.55	4.333	2.667	50.33	0	0	45.2	0	0.5	16	6.667	12.05	49.82	22.33	0

Betweenness centrality gives a higher score to a node that sits on the shortest path of other node pairs and suggests those that are often found at the intersections of more densely connected network communities. A higher value suggests a participant performing a brokering role across clusters, connecting otherwise disconnected people. Figures in red are the lowest 20%, those in green are in the highest 20%, on a week by week basis (table 4.9). Eileen (EWa) has a consistently high score, but there are weeks where others have higher values – Waris (WHu) in weeks three and four, Douglas (DCa) in week five and Robert/Derek (RSl/DWa) in week eight.

Table 4.10 - Eigenvector centrality for participants

Week No	BAv	BNe	BSa	DCa	DWa	DWh	EBl	EWa	GSh	HLa	JHo	MHe	NLo	RSl	TLe	WHu
1	1	0.039	0.039	0.039	0.09	0.039	0.282	0.075	0.039	0.039	0.039	0.039	0.029	0.974	0.039	0.387
2	0.992	0.013	0.02	0.173	0.016	0.016	0.402	0.295	0.016	0.016	0.016	0.016	0.047	1	0.016	0.656
3	0.982	0.255	0.012	0.183	0.892	0.255	0.617	0.392	0.255	0.565	0.255	0.149	0.128	1	0.255	0.085
4	1	0.018	0.05	0.224	0.614	0.018	0.963	0.055	0.018	0.13	0.018	0.018	0.018	0.879	0.018	0.242
5	0.548	0.001	0.063	0.913	0.087	0.006	0.164	0.125	0.028	0.215	0.001	0.32	0.124	1	0.692	0.156
6	0.314	0.993	0.04	1	0.102	0.227	0.328	0.04	0.227	0.227	0.227	0.17	0.227	0.79	0.178	0.227
7	0.3	0.599	0.175	0.859	0.194	0.208	0.417	0.121	0.234	0.761	0.008	0.93	1	0.792	0.202	0.53
8	0.649	0.603	0.081	0.575	0.831	0.032	0.171	0.756	0.4	0.051	0.379	0.26	0.4	1	0.145	0.162

Eigenvector centrality gives a higher score to a node if it connects to many high score nodes and suggests higher influencers who disseminate information quickly. They do not always have the greatest local influence and may have limited brokering potential i.e. a lower betweenness value. RSl has a consistently high value and there are others with occasional highs such as Douglas (DCa) in week five/six, Edith (EBl) in week four and Norman (NLo) in week seven (table 4.10).

SNA diagrams

The sociograms for the first four weeks show a small core group of participants interacting (figure 4.12), with peak activity in week three after the redesign of the e-Portfolio front page.

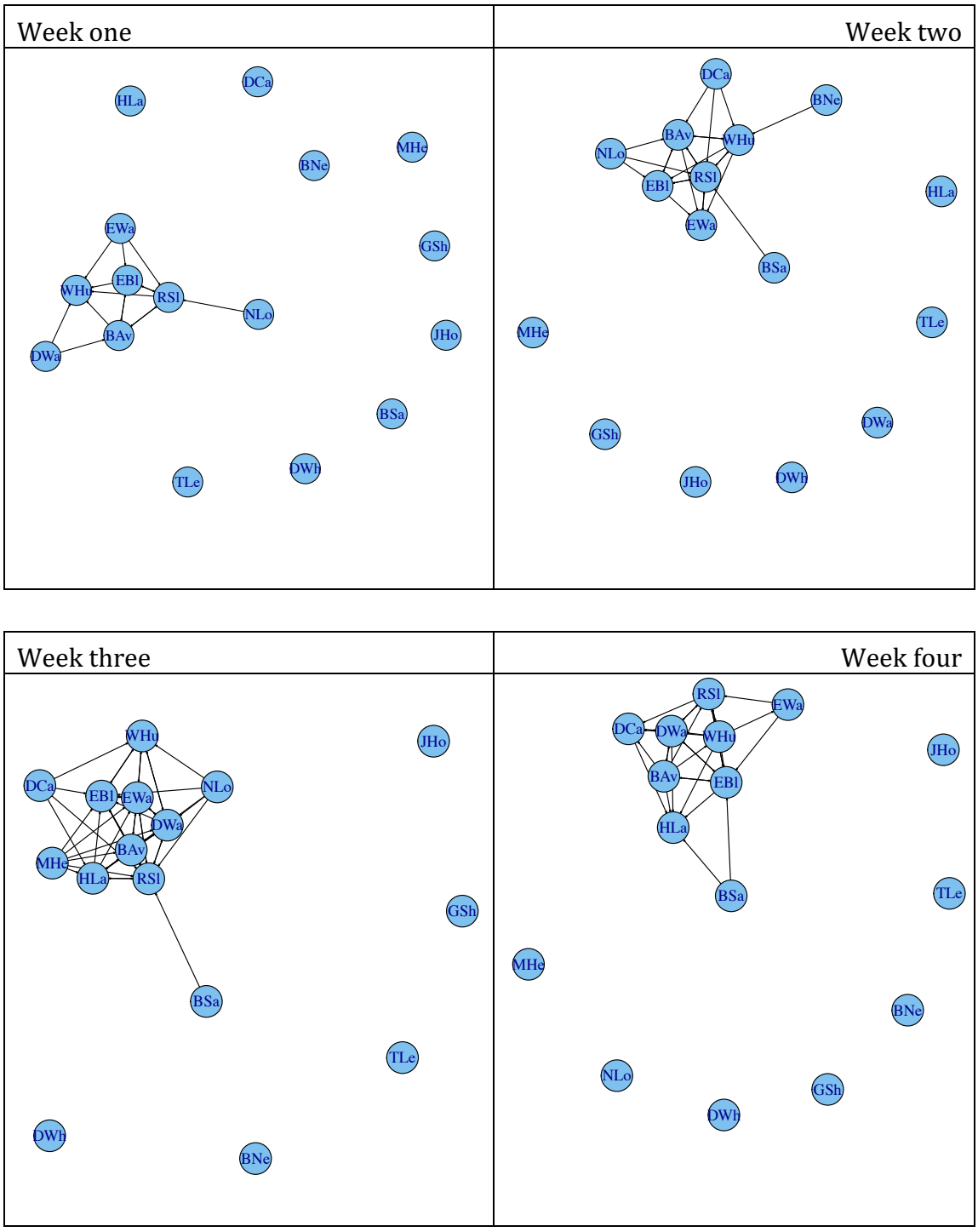


Figure 4.12 - Sociograms for weeks one to four

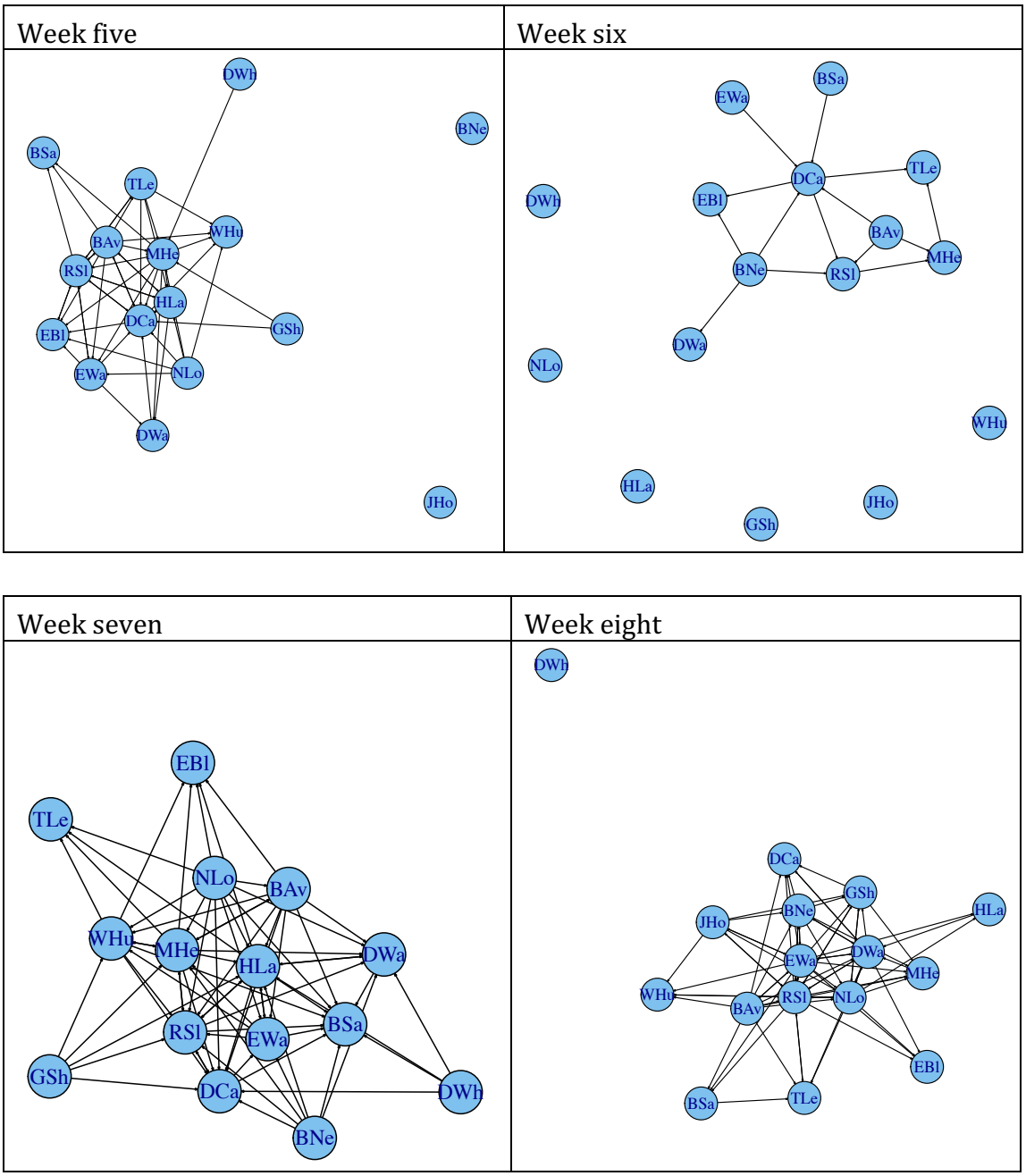


Figure 4.13 - Sociograms for weeks five to eight

The sociograms for weeks five to eight show fluctuating patterns of activity, with a lull in week six, and higher levels of activity towards the end of the cycle (figure 4.13).

Analysis of artifacts and comments

Only four artifacts could be classified as curation, containing links to online PHP tutorial sites or YouTube videos. These were created by those with more regular participation.

Table 4.11 - Artifact and comment creation

Week	1	2	3	4	5	6	7	8
No of artifacts	16	18	36	33	46	4	68	158
Comments	9	9	16	10	15	2	13	18
Requests for help	2	1	2	0	2	0	2	3

Participants who left artifact creation until weeks seven and eight tended to use tags which lacked a semantic context, but instead indicated the week or exercise number to suggest progression and completion. Participants naturally added supporting comments to their artifacts, but did not initially tag or position in the taxonomy. Nudge style comments in week two and three started the use of tags, but failed to increase the use of the taxonomy.

Weeks one to three

Six students used the system in the first week, with an even divide between those uploading work and those exploring the features available.

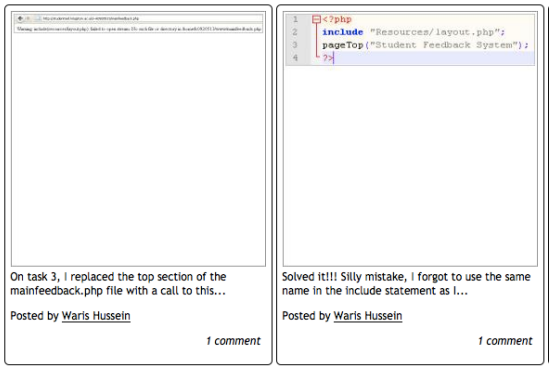


Figure 4.14 – Waris' artifact

Waris, Elizabeth and Robert uploaded 16 artifacts in total and looked at an overview of their own work approximately 70 times each. They reviewed each individual artifact roughly three times. Waris' first artifact was a request for help, which he in fact solved almost immediately, posting a solution without assistance (figure 4.14). During the first week Waris did not look at anyone else's work.

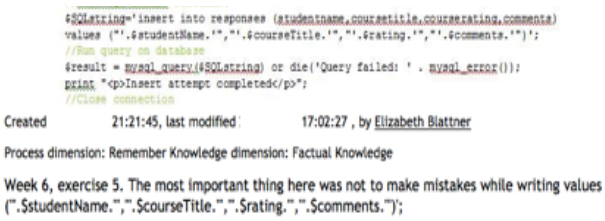


Figure 4.15 – Elizabeth's artifacts

Robert and Elizabeth's uploads were demonstrations of completed work and advice for others (figure 4.15), and these prompted questions from both Derek and Elaine on locations of sample code and suggestions of approaches. None of

the students used the folksonomy or taxonomy system, but they did add reflective text to their artifacts.

The second week's class covered building a larger web application, using database and programming techniques from the previous week. Despite general encouragement in class, participation levels in the portfolio only increased a little, with eight of the students interacting. Three of these participants created artifacts.

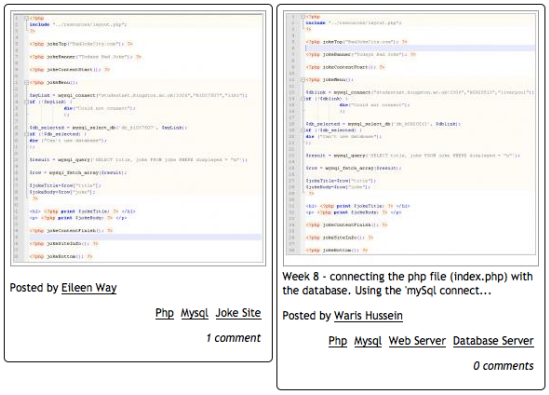


Figure 4.16 - Eileen and Waris' use of tags

Figure 4.17 – Robert's request for help

Each student's first artifact was acknowledged with a tutor comment to encourage further participation. Artifacts with missing reflective statements, tags or taxonomy were commented to reinforce the advantages of these to the process. Waris' artifact shows him using the tagging system. Eileen uses tags, but leaves out the reflective statements (figure 4.16).

At the start of the third week, the front page and some of the artifacts created were demonstrated to the whole group, along with a re-emphasis of the peer nature of the community. Following the changes and another demonstration, there was an increase in activity for week three.

The number of artifact uploaded in the week doubled, with many more interactions inside the portfolio. There was a significant surge in exploration of the artifacts with three times as many searches and views compared to week two. Five of the participants had still not used the system, but the others had a greater level of participation, with five participants creating artifacts and another five exploring, viewing or commenting.

Robert was the most prolific contributor creating ten artifacts over the three weeks. He, Derek and Elizabeth all demonstrated their willingness to share mistakes and to ask and answer questions (figure 4.17). Of the 70 artifacts posted, 49 were of valid code, with 21 showing code with errors and requests for help. Elizabeth and Robert uploaded and interacted with others' work, to a greater extent than Derek, Eileen and Norman, where interaction indicates viewing an artifact, commenting or using an overview of others' artifacts through any of the available search mechanisms.

Maureen, Douglas and Norman did not create any artifacts, but started exploring the system during the third week, either through the overview mechanism or by searching (table 4.12). They viewed specific artifacts many times and added comments to others' artifacts with questions about the code demonstrated. Beryl and Waris explored little, but did view the occasional artifact.

Table 4.12 - Activity for students not creating artifacts in weeks one to three

Participant	*No of times explored others' artifacts*	*No of times viewed another's specific artifact*	*Comments*
Maureen	43	20	1
Douglas	40	29	1
Norman	25	11	1
Beryl	0	1	0
Waris	0	4	0

Despite participants being allowed to create artifacts on any relevant subject, nearly all the artifacts created were aligned to examples, tasks or activities from class, indicating little curation and suggesting little use of 'outside' resources.

Week four and five

Week four and five were the last two with specific timetabled classes. Subjects covered include writing authentication pages with scripts to make a site secure and an introduction to object oriented programming.

Five of the participants (John, Tony, Barry, Geoff and David) continued their low level of online participation. All of these students had attended the face-to-face sessions and were working in class, but despite encouragement did not turn any of their work into artifacts to share. Elisabeth, Waris, Robert, Douglas and Derek uploaded 33 artifacts, with Waris and Douglas responding to encouragement and their own exploration of the existing artifacts in week three.

Table 4.13 – Catch up artifacts created in week four

Previous week no	4	3	2	1
No of participants	2	3	2	1
No of artifacts	8	13	7	4

For the 33 artifacts uploaded in week four, only eight were on the materials discussed in class that week. An analysis of the artifacts produced during this week indicated many of them were on previous topics, with one student attempting work from the first week (table 4.13). All the students were creating artifacts on material from multiple weeks, indicating a clear drag existing between the introduction of new concepts and the time it takes for students to work with it outside the classroom.

Week five was the final week of attendance. Despite higher levels of interaction in the system, with questions, comments and views, only four participants created new artifacts (Tony, Maureen, Howard, Douglas), with Tony and Douglas having significant uploads.

Douglas continued working his way through the subjects, uploading 17 artifacts on subjects from the previous three weeks. Tony also created 19 artifacts after not participating at all up to this point.

Because of the lag in created work, many of the students who had not participated in the first three weeks started to comment on older artifacts (figure 4.18).

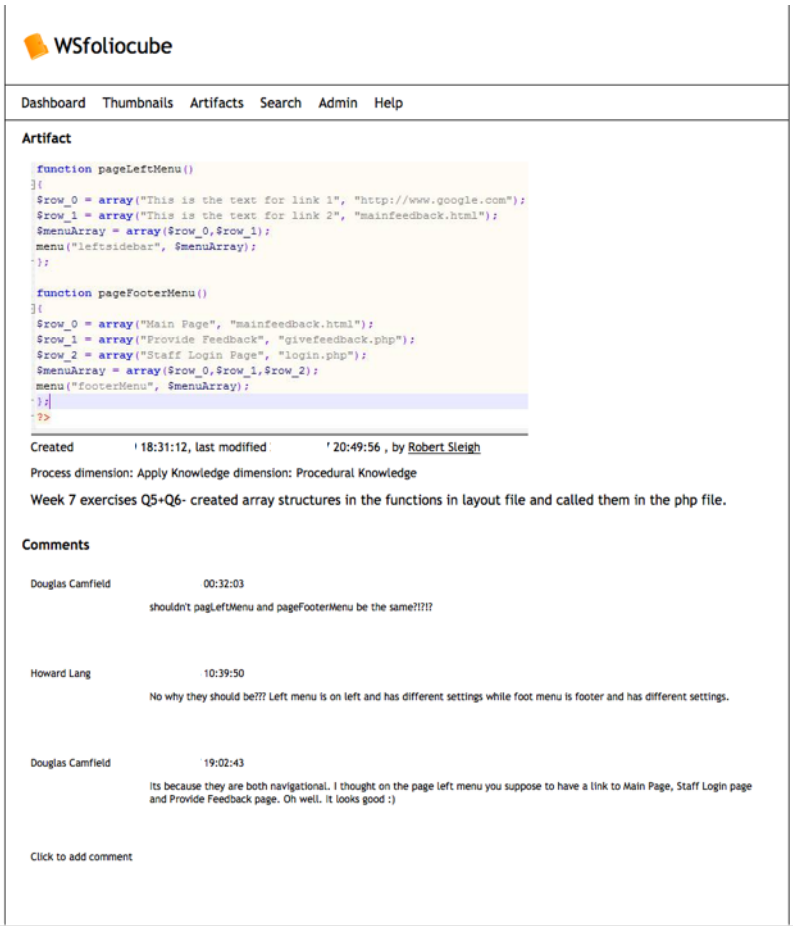


Figure 4.18 - An interaction with a "past" artifact, with comments added three weeks after creation

By this stage, the participants had progressed in the class material to see that the techniques used in the labs were the same as that used in the development of the portfolio itself. Students responded to seeing the portfolio code, with two students using samples of the code in artifacts themselves.

Week six to week eight

Week six spanned the Christmas holiday, so there was a drop in activity. Douglas was continuing his work from week five, creating four artifacts on material covered in the fourth week, and there was viewing, commenting and searching on artifacts by eight of the others.

Week seven was the penultimate week of the project and sees the students fall into three categories:

- Participants continuing their regular patterns of activity and creating artifacts from material from class, *Waris, Robert, Howard.*
- Participants who have had irregular or little activity so far, starting to create artifacts, *Maureen, Beryl and Norman.*

- Participants interacting via comments, or exploring others' work but not creating any artifacts.

Waris, Howard and Robert created artifacts on material from week five, continuing to use tags and reflective statements.

Maureen, Beryl and Norman posted artifacts on material from week one, with Beryl uploading pictures without accompanying text. The tags used on their artifacts used the folksonomy system to suggest the week they pegged the work to (*week_ x* or *weekx_tasky*), rather than using context specific tags (figure 4.19).

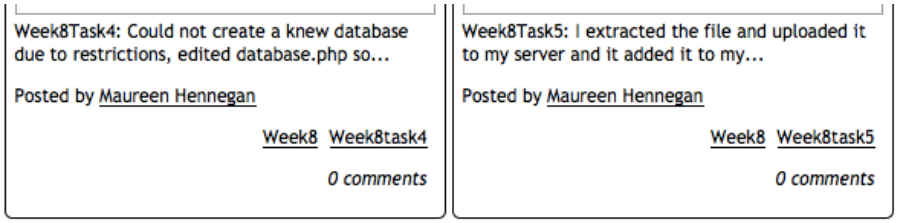


Figure 4.19 - Temporal based tags

For the final week participants' fall into these four categories, which are slightly different from week seven:

- Students who participate but don't create any new artifacts, indicating that they perceived that they had finished, *Waris, Howard, Maureen, Elizabeth.*
- Participants who have had irregular or little activity so far, starting to create artifacts covering material from all five weeks *Tony, Barry, Eileen, Geoff.*
- Students who either had participated little or not at all, creating artifacts on simple examples from the first week, *Derek, John.*
- Students creating catch-up artifacts with little interaction with the others, *Beryl and Tony.*

Beryl uploaded 19 artifacts, continuing the style she adopted in week seven, with no text and a restricted set of tags. Tony created seven, which like Beryl were on material from week three to five. Neither of them interacted with others' work in this period.

Coding comments for teaching presence

The teacher's comments attached to artifacts have been coded using the teaching presence coding scheme derived from the community of inquiry model. As in the other analysis, the cycle has been divided into three (figure 4.20).

Each participant received comments aimed towards *Instructional Design and organisation* and *Facilitating discourse*, as would be expected in the initial establishing part of a community. Statements encouraging more meaningful reflective statements and tags have been designated as utilising the medium effectively, as the reflective statements would be useful for both the participants and others' reflection. Advising about the use of the system more generally and asking for blank fields to be filled has been placed under the more general category of netiquette.

Facilitating discourse in this context mostly entails drawing in participants with further questions and the promotion of links between the students, encouraging them to look at and comment on others' artifacts. Fewer comments fall into the encouraging or reinforcing category.

Weeks one to three

	Elizabeth Blattner	Douglas Camfield	Maureen Hennegan	John House	Waris Hussein	Howard Lang	Tony Leighty	Norman Lodge	Barry Newbury	Beryl Sanderson	Geoff Shaw	Robert Sleigh	Derek Ware	Eileen Way	David Whitaker	
Instructional Design and organisation	1					1						3	1			6
Facilitating discourse	1				1	2						1	3	2		10
Direct instruction	3				3							3	4	1		14
	5	0	0	0	4	3	0	0	0	0	0	7	8	3	0	30

Weeks four and five

	Elizabeth Blattner	Douglas Camfield	Maureen Hennegan	John House	Waris Hussein	Howard Lang	Tony Leighty	Norman Lodge	Barry Newbury	Beryl Sanderson	Geoff Shaw	Robert Sleigh	Derek Ware	Eileen Way	David Whitaker	
Instructional Design and organisation	1															1
Facilitating discourse	1	1	1				1			1			1			6
Direct instruction	2	1					4									7
	4	2	1	0	0	0	5	0	0	1	0	0	1	0	0	14

Weeks six to eight

	Elizabeth Blattner	Douglas Camfield	Maureen Hennegan	John House	Waris Hussein	Howard Lang	Tony Leighty	Norman Lodge	Barry Newbury	Beryl Sanderson	Geoff Shaw	Robert Sleigh	Derek Ware	Eileen Way	David Whitaker	
Instructional Design and organisation										1						1
Facilitating discourse								1	1		1	1				4
Direct instruction			2									1	6			9
	0	0	2	0	0	0	0	1	1	1	1	2	6	0	0	14

Figure 4.20 - Coded teacher comments

Questionnaire responses and observations from the cycle

Responses in this section are generated from the questionnaire sent out to participants after the end of the cycle. Additional information has been included from field notes taken in class and in the focus group organised after the second week.

General comments about the process split between those participants suggesting the advantages they saw in the interaction and those who wanted specific detail on the nature of the artifacts that they perceived as being required:

> "I could see what code needed improving and what code was nicely coded" - Robert
>
> "I could get quicker feedback" - Geoff
>
> "Instantaneous feedback, and interaction with other students" - Norman
>
> "Allowed me to see where I went wrong and attain feedback and constructive criticism. Also helping others" - Waris

Those that wanted more clarity requested more information at the beginning of the process, specifically emphasising the role of the tutor in describing the nature of the artifacts to be created. Participants suggested that they took every suggested exercise as compulsory or used the artifacts of other participants as a to do list:

> "I worked through the exercises week by week" – Robert.
>
> "I looked at the others' answers and created similar solutions" - Elizabeth B.

Most participant's artifacts were representations of completed work. The trigger for posting was a self-determined completion point:

> "when I'd finished one of the tasks I posted it" – Derek.

Fewer students felt comfortable with posting incomplete or incorrect work:

"it never occurred to me that I could post work that wasn't right" – Geoff.

Participants reported a lack of engagement with resources outside tutor created teaching materials. Two of the students indicated that they used both videos and materials from other web sites, with seven reporting the use of only the tutor created teaching materials (table 4.14).

Table 4.14 - Participant reported resources

Teacher supplied materials	Books	Online videos	(external) Web sites	Other
11	4	3	3	2

The use of the overview mechanism is common after a gap in activity and allows the participants to place themselves at a point on a path:

"it enabled me to remember what I had done" - Robert
"… where I had got to" - Elizabeth.

Participants reported looking back on their own work two to four times a day, but lower levels in acknowledging the use of others' work (table 4.15).

Table 4.15 - Participant reported use of own and others' work

	0 to 3 times a week	**4 to 6 times a week**	**About once a day**	**2 to 4 times a day**	**More than 4 times a day**
How often did you look back on your own work?	0	1	3	6	1
How often did you use others' work?	3	3	2	1	0

Many different reasons are given for browsing others' work, from deducing the mechanics of what should be included through to the enrichment possibilities of motivation, conversation and learning:

"by looking at [others'] picture I could see what needed to be included" – Robert.

"Allowed to compare my work to others' different code which produced the same output" – Norman.

> "I could see different problem solving approaches of different people" – Douglas.

> "It acted as a motivator, I could see other people doing work, so I thought i'd better do the same :) That meant I was spending more time on the assignment than I usually would, hence learnt more stuff" – Derek.

> "I liked getting and giving comments" – Maureen.

> "read the comments to resolve the issue" – Elizabeth.

> "I think it just changed how we look at each others' work. Without foliocube we usually just show each other, but with foliocube you can look in more detail and actually learn. As opposed to just seeing if your work looks similar" – Waris.

> "Yes by seeing other peoples work, questions about the content of screen shots could be compared with everyone else so that I could upload a suitable one." – Howard.

Reasons reported for the lack of use of the taxonomy ranged from an unwillingness to engage with an unfamiliar terminology to a reluctance to use something which provided no immediate use to the participants, particularly when compared to the folksonomy system which they regarded as having immediate searching and categorising facilities.

Beryl and Eileen are participants with high attendance but low online participation, creating artifacts from their work at the end. Eileen has a social networking account, but posts infrequently. Drawing parallels to her lack of online social presence and engagement in Facebook, she decided to use the project as if a traditional portfolio, presenting her work at the end. Beryl is more engaged with social networking, but:

> "always leave [my] work to the very end"

She had mirrored her experience in submitting coursework in other classes, which she leaves until very close to the submission date. Both students rarely commented or asked for comments. Beryl acknowledged this:

> "I think if I was doing it again I would try and space the work out and interact a bit more"

> "I didn't see the point in working with others, but it would've made my life easier not leaving everything until the end"

Eileen did not see any need to change her process:

> "that's the way I work"

Neither student responded to tutor suggestions about creating artifacts on a more regular basis during the process.

Derek (and two others), suggested that their surge in activity at the end was due to a comparison process, looking for an overall picture of others' work to see if their own was similar:

> "I wanted to see if my work was like the others".

In an in class feedback session, Derek indicated that after the fourth week, he stopped searching and interacting with others' artifacts as he realised that the system (and the tutor) could see what he was doing could be tracked. Despite reassurances from the beginning of the process indicating that this interaction was being promoted, he did not change his stance. When asked about this he said that he had calculated that non-interaction would have no detrimental effects.

Howard suggested that the focus group at the end of week two altered the participation levels by making the purpose of the process clearer, which is a problem that could be addressed in a better induction or introductory phase of the next cycle. Eileen suggested using some actual examples in the induction process. Both she and Derek would allow their work to be used in this way.

This chapter has discussed cycle one; the design and implementation of the e-Portfolio and learning community; the results of cycle one; and an analysis of the

questionnaire. The next chapter discusses these results, examines the appropriateness of the data methods applied and reflects on the changes to be made going forward into cycle two.

Chapter 5 Discussion and reflection on cycle one

This chapter discusses the first cycle in the context of the three research questions and then reflects on the changes that can be made for the next cycle.

5.1 Discussion

Research question 1: What assessment artifacts emerge from co-operating participants in a learning community?

The content and number of artifacts created during the process was left to each participant to determine, an important differentiator in constructivist portfolios (Barrett & Carney, 2005; Paulson & Paulson, 1994). Despite the wide variety of evidence that could have been used, the majority of artifacts were created in response to exercises or activities suggested by the tutor, with a perception that this was work *set* by the tutor, a view reinforced by the participants looking at the nature of others' artifacts:

> "once I saw that what the others were doing I started posting solutions as well" – Douglas.

Given free choice of artifact content, there are examples of participants attempting all the work possible (Mason et al., 2004). Similarly here, participants took any hint of a task or activity as something that had to be completed, which when finished were posted. The participants extrapolated learning outcomes from the lecturer and teaching materials and then produced work that aligned with their perceptions of these outcomes, a student initiated form of constructive alignment (Biggs, 1996).

In the subject areas covered in these modules, the initial small low level tasks and activities frequently have a commonality to the solutions available. The medium and larger activities that occurred after the third week allowed for differentiation in the nature of artifacts produced, although most were still responses to the perceived notion of work that had to be completed. Participants responded positively to the use of code from the authentication system and artifact objects in class and for exercises, which aimed to add authenticity through suggesting resemblance to professional practice (Gulikers, 2006).

Few of the artifacts indicated broken code or were asking for help, despite this being suggested in the induction as a significant advantage of an e-Portfolio

community. Few students felt comfortable with posting incomplete or incorrect work, or even considered it:

> "it never occurred to me that I could post work that wasn't right" – Geoff.

The low level of requests for help connects with the emergent theme of artifacts as completed work. Showing incomplete or incorrect work can be personally revealing (Carney, 2002) and the nature of artifacts is influenced by the perceived audience of the work (Gibson, 2006). Derek suggested that his impulse for artifact creation was the completion of a task or activity "when I finished one of the tasks I posted it", a process that would bypass any opportunity for asking for help from the community.

There is a clear lack of engagement with resources outside the tutor created teaching materials, signalled by both the content analysis of artifacts and by the questionnaire responses. Only four artifacts could be classified as curation, containing links to online PHP tutorial sites or YouTube videos. These were created by those participating regularly online. Two of the students indicated that they used videos and materials from other web sites, with seven reporting the use of only the tutor created slides and hand-outs.

There is little literature linking curation practices with formative assessment, although the use of e-Portfolios in demonstrations of curation is an emerging field. By its nature, curation requires accessing, compiling and reproducing materials (Seitzinger, 2014) and there were a very low number of artifacts indicating this skill. Digital curation can be a signal of critical inquiry and engagement (Mihailidis & Cohen, 2013) so the limited demonstration of this is a concern.

The overview mechanism, showing participant's artifacts in a three by three grid, was commonly used after a gap in activity and allowed placement at a point on a path (table 5.1). This monitoring of their own development is part of the self-reflection process (Smith & Tillema, 1998) "it enabled me to remember what I had done" - Robert ; "where I had got to" - Elizabeth. This positioning of where the learner is now and where they are going is a key aspect in formative assessment (Black & Wiliam, 2009b), emphasising the activation of the learner as an agent making decisions on future actions (p.10).

Table 5.1 - Artifact upload compared to use of the overview mechanism

Week No	1	2	3	4	5	6	7	8
Artifact upload	16	18	36	33	46	4	68	158
View overview of own artifacts	221	119	277	174	114	29	356	557
View one of own artifacts	42	42	110	69	41	12	144	228
	279	***179***	***423***	***276***	***201***	***45***	***568***	***943***

Artifacts did serve as an initiator of discussion, where participants would search for artifacts covering similar areas and append questions to it.

Before the project, participants had rarely created tags, but had seen their use in bookmarking sites and YouTube. Students rapidly learned how to capture the context of their artifacts with semantically appropriate keywords and phrases, either on their own or after nudge style comments designed to encourage their use. Folksonomy systems lower barriers to co-operation and suggest an emergent vocabulary (Mathes, 2004). Here, as seen in section 4.4, the tags created by the participants regularly posting used context appropriate words and suggested a consistency in the terms, which were then used for searching.

Participants who uploaded large volumes of work at the end of the process used week and exercise numbers as tags, suggesting that their lack of earlier community participation had resulted in them missing the use of tagging as a practice that could add value. When seen in reflective statements, mechanical labelling in this style can be a signal of shallow learning (Jenson, 2011), but this has to be applied with caution, as the participant who hoarded her work and then published it all towards the end of the cycle would be wrongly categorised. Participants did not see any advantage to pinning artifacts in a taxonomy. Most participants used it initially; the activity table reveals that the use dropped off rapidly. Questionnaire responses suggested they saw little immediate value in its use, compared to the folksonomy tags, which were seen as adding context along with value in the searching and sorting facilities. The language in the taxonomy was described as off-putting.

Two of the participants, Robert and Elizabeth created and uploaded work as the cycle progressed, with a short time period between the labs and creation of artifacts representing this work. Both these students fully integrated folio thinking (Feng, 2006) into their working practices. Other participants tended to have irregular patterns of activity, dipping in or out. The time stamped artifacts make visible the differing working patterns with participant groupings possible dependent upon the amount of time elapsing between new material being introduced in class and how long it takes to appear in the portfolio. This gives:

- Participants who are triggered by new material and upload artifacts typically in the same week, for example Robert and Elizabeth.
- Participants who create artifacts some period behind, which can vary by two to three weeks.
- Participants who left artifact creation until the end of the in class activities (week five) or the end of the cycle (week eight), for example Eileen and Beryl.

Many of the participants did not transition away from the customary practice of submitting work at an end point, even if it had been completed many weeks earlier (table 5.2). This end point was either at the end of face-to-face classes (e.g. Tony), or at the end of the cycle.

Artifact creation has to be combined with activity to form a richer picture of behaviour, as many of the participants had peripheral participation by viewing, commenting or searching on existing artifacts, which would not be apparent from artifact creation figures alone.

Table 5.2 - Artifact creation by week number

	Week number								
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*TOTAL*
Students regularly creating artifacts									
Robert S.	8	10	10	6	0	0	2	6	42
Douglas C.	0	0	0	7	17	4	0	3	31
Waris H.	3	5	0	5	0	0	10	0	23
Elizabeth B.	5	0	8	8	0	0	0	0	21
Howard L.	0	0	5	0	5	0	10	0	20
Derek W.	0	0	9	7	0	0	0	6	22
Students presenting work at a perceived 'end'									
Barry N.	0	0	0	0	0	0	0	43	43
Geoff S.	0	0	0	0	0	0	0	37	37
Maureen H.	0	0	0	0	4	0	29	0	33
Beryl S.	0	0	0	0	1	0	7	19	27
Tony L.	0	0	0	0	19	0	0	7	26
Eileen W.	0	1	3	0	0	0	0	21	25
Norman L.	0	0	0	0	0	0	10	11	21

Students actively participating approached creating artifacts in a linear fashion, following the direction of the material in class. Students creating significant numbers of artifacts either in week five or week eight tended to have a more jumbled ordering to their work, suggesting a bulk uploading process rather than an integration of artifact creation into their working processes.

Eileen and Beryl treated the e-Portfolio as summative assessment, reporting a resistance to online participation and leaving artifact creation till the end. Eileen uploaded all the work she had been collating privately; Beryl created a large number of artifacts in the last three weeks, some from the work she had performed earlier, the rest by a surge in activity towards the end of the process. For these students, the focus audience for their work was the tutor (Gibson,

2006), so they considered little consequence in missing out on reflective and peer appraisal opportunities.

Prior experiences of assessment structures can directly influence the nature and process of artifact creation (Smith & Tillema, 1998) and these participants did not seek online feedback, with Eileen citing her dislike of group work and Beryl stating that she always left working on assessments until shortly before the due date. On reflection, Beryl said that she could see the value in collaborative activities, but this was after the process had completed.

Research question 2: How are artifacts shared, used and reused by the community?

There is a close relationship between using overviews of others' work and clicking through to see one of their individual artifacts. Participants underestimate how frequently they look back on their own and others' work, as suggested by the difference between what they report and the figures recorded by the analytics. Student's fear of plagiarism (Ashworth, Bannister, & Thorne, 1997; Gullifer & Tyson, 2013) aligns with these results, where they look at others' work twice as often as their own, yet fail to acknowledge it. This needs to be explicitly addressed in both the learning material design and the induction for the next cycle, as properly functioning learning communities with co-operative and collaborative learning encourage a sense of responsibility; make plagiarism visible (Palloff & Pratt, 1999) and reduce ways of "playing" the system (McConnell, 2002).

Derek's change in behaviour in week four, where he cited his realisation that the tracking system could reveal how he was using others' work is tied to a big-brother style concern (Campbell et al., 2007) and suggests a failing in the initial induction in making the process clear, advocating the advantages of the approach.

Others' work is interacted with twice as frequently as participant's own work; it provided solutions, suggestions on the nature of the artifacts to be included and the opportunity for discussion out of class. Participants suggested that they could not initially perceive the level of activity of the group, due to the opaque nature of the front page, the gateway into the community. After the redesign and demonstrations at the end of week two, the usage increases (table 5.3).

Table 5.3 - Viewing and interacting with others' work

Week No	1	2	3	4	5	6	7	8
View another's artifact	106	115	390	175	208	79	567	490
Interact with other work (sum)	323	301	926	460	503	294	1794	1501

The number of edges and number of islands are in an inverse relationship – in the weeks where there are more interactions, the number of participants with no activity decreases. The graph density and reciprocity follow the suggestions of activity levels from the sociogram, with a peak in week three followed by an increase in weeks six to eight. Both suggest the relationship between nodes over time, with the graph density peaking at 0.3, indicating the occurrence of a third of the theoretical connections possible between participants. Reciprocity is a measure of the mutualness of connections, the balance between interacting with others and being interacted with, or at a basic level, viewing or commenting on others' work in a ratio to how much their own work was viewed or commented on by others. Although individual optimal values for this are difficult to comment on, comparisons between it and the reciprocity reveal that there are weeks where there may be many connections with an imbalance in the mutualness, for example in week seven.

Table 5.4 - Thumbnail and folksonomy usage

Week No	1	2	3	4	5	6	7	8
View all thumbnails	10	17	14	9	2	3	6	3
View subset of others' artifacts	26	27	162	94	81	109	692	525
	279	***179***	***423***	***276***	***201***	***45***	***568***	***943***

Participants found the folksonomy system useful for exploring others' artifacts, particularly after the third week where a larger number of artifacts were tagged and available for searching – suggested here by the viewing of a 'subset' of others' work (table 5.4).

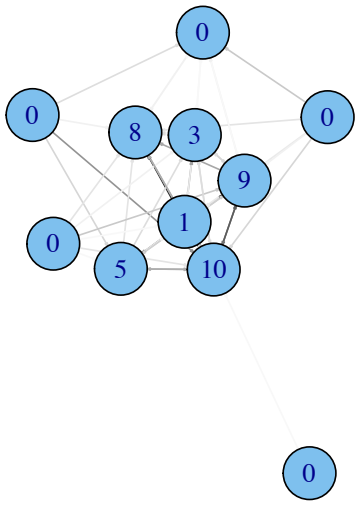


Figure 5.1 - Sociogram with artifact construction and participation for week three

Wenger and Lave (1991) suggest that peripherality is not physical, but the sociogram algorithm makes a representation of this possible. When the number of artifacts created in each week are overlaid on the SNA diagrams, a recurring pattern is indicated in that there is a relationship between artifact

creation and overall activity, where activity is a broader category encompassing viewing, reviewing and commenting. Participants who regularly construct work also navigate and participate more frequently, which results in a higher centrality value, more central placement in the diagram and echoes findings on strong relationships and shared resources (Dawson, 2008). Those that are not creating work participate less, typically reviewing others' work and occasionally commenting, represented by a ring of outer zero digits (figure 5.1).

For participants on the periphery, who are not creating artifacts, the most common activities are looking at overviews of others' work and then clicking through to see others' individual artifacts (table 5.5). In this view, artifacts are seen in a grid within the context of other artifacts, with possible searching on subsets by tag, keyword or date. In the community of practice model, peripheral participation suggests newcomers or new entrants observing and mimicking experts (Lave et al., 1991). Here this role is transitory and emergent, as more frequent reification increases the visibility of the participant's artifacts in the e-Portfolio. Robert, Elizabeth and Douglas' work was the most often searched for and viewed, aligning with eigenvector centrality scores that suggest their status as demonstrating perceived expertise.

Table 5.5 - Activities of participants on the periphery

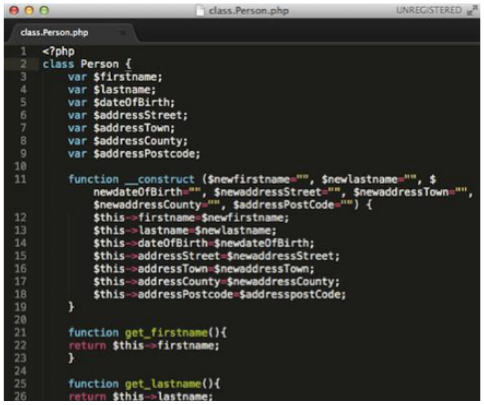
	Week 3	***Week 4***	***Week 5***	***Week 7***
No of peripheral participants	***6***	***3***	***8***	***7***
Participation in comment threads	8	4		4
View a specific set of near artifacts (not ours)	1			239
View a specific set of others artifacts (by tag, LD and/or user search)	45		47	
View all artifacts (excluding ours)	127	5	64	90
View all our own artifacts (with sub selections possible)	30	2	30	128
View Dashboard/Recent activity	73	14	53	63
View Dashboard/Recently Viewed Artifacts	7		1	8
View help	3		2	1
View our thumbnails	11		6	
Viewing one of our own artifacts	11		11	63
Viewing one of someone elses artifacts	107	8	76	160

The placement of the circles is derived from overall interaction with others' artifacts, so it is possible for a participant to comment, interact and view others' work many times, giving them a more central placement without having accompanying artifact uploads. This is typically a signal of the tutor role, the '1' in figure 5.1.

As participants made their work visible, the smaller initial examples tended to be similar across artifacts with more difficult concepts allowing for greater variability and individuality. Combining the analytics data with the artifacts reveal where demonstrations of techniques cascade through participants, for example, the transition of the Person class code between participants over time shows how Robert, who was the first to tackle this concept, influenced later participants. Robert's original code was enhanced by Derek to include extra features three weeks later. Maureen tries to reuse Derek's code, but introduces errors (figure 5.2).

Artifact from week four, by Robert S.

Artifact from week seven, by Derek W



Artifact from week eight, by Maureen H.

Figure 5.2 - Artifacts demonstrating knowledge cascade

A post by Elizabeth was the first to talk about style in the context of programming, an issue that is difficult to teach as the norms and values implicit in programming style can be subjective (Pieterse, 2008) and best practices are frequently ignored by students (Li & Prasad, 2005). Good style was positively

reinforced through comments and suggestions, and was the subject of an online discussion, echoing suggestions that peer review and collaborative interaction can be a better approach for learning programming style (Li & Prasad, 2005; Robins, Rountree, & Rountree, 2003; Roth, 1980).

In this cycle, participants were allowed to determine when they should create artifacts, along with the nature of the artifacts themselves. Five of the students engaged with embedding folio thinking into their working practices, suggested by a linear progression in the subjects of the artifacts and their presence online and in class.

Table 5.6 – Artifact creation by time and period

		Participant												
		Creating artifacts regularly						Creating artifacts at end						
		RS	DC	WH	DW	EB	HL	BN	GS	MH	BS	EW	TL	NL
Time	09:00										19			
	10:00											1		
	11:00											1		
	12:00			6	1	2	4			1		1		
	13:00	1						13		2		1		
	14:00						1	30		4	1	5		
	15:00	2		2	1	5	5			8				
	16:00	7		4	1	3				10		6		
	17:00	15		5	2	6				2		8	7	
	18:00	6		5	1					4		2		
	19:00	5		1	3				18	2				1
	20:00				3				19				9	4
	21:00	6			3	5	4				7		2	1
	22:00		12		1									5
	23:00		7		1								7	9
	00:00													1
	01:00		4		1		6						1	
	02:00		2		2									
	03:00		6											
	04:00				1									
	05:00				1									

Participants with a higher level of engagement created artifacts over a greater spread of time and the analysis (table 5.6) reveals that no artifacts were created in the first taught session.

Students with a less systematic activity tended to create artifacts on material from multiple weeks, with a clear drag existing between the introduction of new concepts in the class and the time it took for artifacts to appear on these areas in the portfolio. Although this temporal flexibility is presented as an advantage to the learner in e-Learning (Macpherson, Elliot, Harris, & Homan, 2004), the lack of

rhythm to their participation harms community growth (Wenger, 2001) and reduces the opportunity for formative feedback. This lag in participation was also apparent when many started to comment on older artifacts, which, if they were questions on the artifact content were more likely to go unanswered. This was particularly true for those students who had lower levels of participation until the end, who then uploaded large volumes of work in the final week.

Research question 3: What is the role of the tutor and the form of the community?

Tutor commenting on artifacts inside the e-Portfolio fall into the elaboration category of formative feedback (Shute, 2008) which tended to discuss errors, provide guidance (p.158) and promote connections between users / artifacts. The teaching presence indicators suggest low levels for the instructional design and organisation role which can be accounted for by the higher levels of this activity that occurred off-line in class, especially during the initial period of fragmented participant activity. There were higher levels of organising and instructing the participants in the first third of the cycle, with initial comments on netiquette and utilising the medium focussing on using tags and writing effective reflective statements. During the introduction, the nature and process of artifact creation was demonstrated, but despite this many of the initial artifacts lacked the meta-data that would enable their reuse. As the principal mechanisms for finding artifacts in the system uses a search system, those artifacts missing this information, and through these, the participant's activity would be less visible. Nudge style comments were attempted both online and in class, improving the use of the folksonomy but failing to ignite interest in the use of the taxonomy system.

In the cycle, the boundary of the curriculum was loosely defined by the nature of the teaching materials and the in class activities, although the content of artifacts was left to the students who could include anything thought relevant. As suggested in the first research question discussion, the majority of artifacts were created in response to teaching materials with the perception that these were *set* by the tutor and required solutions. The folksonomy tags emerging from the communities' artifacts provided simple abstractions that made visible the nature of the material being learnt to the tutor and the rest of the community – for example the term 'authentication' was rapidly associated with artifacts that covered material on building a logging in system.

Artifacts and posts were automatically labelled with a date stamp, making visible to their peers and the tutor each participant's level and pattern of work.

Participants were allowed to decide the nature and frequency of their postings with the tutor suggesting that interacting more regularly and frequently would be better. Despite this, there were varying levels of activity over the cycle, with the content and tags selected in weeks four to seven signalling differing temporal lags amongst the participants.

The analytics used to inform the actions of the facilitator require the cycle to be divided into periods, which in this instance have been aligned to seven day sequences. This can be problematic as some students exhibited drags or flurries of activity, interacting with artifacts out of the weekly sequence. Difficulties emerged when students with irregular activity started posting on artifacts from many weeks previously - these comments were unlikely to gain replies, requiring the tutor to intervene. The 'life' of an artifact continues beyond the period of its initial creation, which can create a reluctance for the original author to be engaged if they are required to revisit it many weeks later. Further analysis of the time and date stamps suggested that no artifacts were created in the morning session, indicating that there was too much tutor direction in this earlier class, with fewer explicit artifact creation opportunities.

In the facilitation role, the traditional COI model suggests promoting the community and influencing the behaviour of the participants through a social role, seeking consensus, identifying agreement and setting the climate for learning; this had mixed results in influencing the behaviour of the participants. According to the COI analysis, over the three cycles, there was a higher facilitation activity in the initial parts of the cycle which is to be expected during the formation of the community. This decreased over the next two thirds of the cycle. The social form of online tutor interaction comes through comments on others' work, which restricts this when participants have a reduced or irregular online activity. After the initial signup, participants had a low level of participation for the first two weeks, despite successive demonstrations in class. Because of this low level and the lack of visible indicators of use, the students did not engage until demonstrations of actual artifacts and the search facility were shown in the redesign of the front page at the end of week two. Students responded positively to the use of authentic data in the redesign and these factors together increased participation for approximately half of the group. Those treating the e-Portfolio as a traditional assessment, have little opportunity for this to take place, making it difficult to draw participants in.

The length of time left before a tutor response appears was complicated by the low activity in the first two weeks, which is a concern as, if left for too long, could limit the growth of the learning community. At the other extreme, excessive posting can shut down student interaction and inhibit higher levels of cognitive presence (An et al., 2009; Dennen, 2005; Mazzolini & Maddison, 2007). There were two approaches used:

- Increasing the time before responding over the life of the community dependant upon the volume of previous posting by the individual.
- A strategy of suggesting solutions through peer to peer communication, after the network learning philosophy.

For many the trigger for artifact creation was the perception of a completed task, which reduced the number of artifacts that were incomplete or demonstrated a participant seeking assistance. This is difficult to role model through tutor created artifacts, but was encouraged through the facilitating discourse role and by activities in class. Inducing the integration of artifact production into the student's learning process is key to this, but despite differing approaches used to encourage this, half the participants did not engage with this idea.

Student enquiry is encouraged through activity and feedback, but the practicalities of this were complicated by the nature of the community. The original conception of the peer based community in this work was for the tutor's artifacts and comments to have the same weight and validity as the other participants, and these would also serve as a way to introduce direct instruction. Unfortunately, the number of tutor created artifacts was lower, due to the time dedicated to moderating comment threads and monitoring others' artifacts, particularly in the middle and final third parts of the cycle. Those tutor artifacts created were indicators of correct code and curation style artifacts suggesting further reading and areas that could be explored. Direct Instruction peaks at the start and end of the cycle; at the beginning during the initial construction of the community it was important to engage with questions from the participants, balancing tutor responses with appropriate delays to encourage participation. In the final third of the cycle, participants were out of class, so there is a natural increase in the volume of tutor direct instruction to supplement the lack of face-to-face contact. The imbalance in participation levels across the eight weeks, with an increase in activity in the final part of the cycle resulted in orphaned comments, which the tutor had to answer due to their technical nature.

Garrison's indicator of "knowledge injection" is performed by artifact reification, done here through both tutor artifacts and the increasing prominence of artifacts created by participants demonstrating emerging expertise.

Despite indicating the idea of community support in the induction, there was reluctance amongst the participants to share incorrect work, or to create more curation style artifacts. Posting incorrect work was encouraged both in class and online, but at the end of the process some participants still reported a lack of enthusiasm for posting incorrect work, or surprise that they could. Two participants who were attending every week and had little online activity asked questions by email, including code for comment. These were encouraged to create artifacts or to search for an artifact covering the same material and to ask questions online. Confirming understanding and diagnosing misconceptions is performed by attaching comments to artifacts, which is dependant on both the regularity and nature of the artifacts being published. Participants who regularly post with folio thinking embedded in their working practices are clearly able to enjoy more interactions, receiving the advantages of formative feedback from peers and the tutor (Lin, 2008; Rickards, Diez, Ehley, & Guilbault, 2008; Wang, 2009). There was some success in facilitating the sharing out of the tutor feedback role amongst participants by using links and directions to other artifacts.

The teaching presence direct instructor role (DI) was high in all parts of the cycle and aligns with the typical indicators such as presenting questions, diagnosing misconceptions and introducing knowledge from diverse sources (Garrison, 2011). In the role of teacher, new material was introduced during the face to face session every week. The majority of artifacts created in response to this were demonstrations of small extracts of code or screen shots of programs running, with few examples of curation or accessing external materials. Once this theme emerged, the nature of the teaching material was changed, so that greater differentiation was possible, with more explicit use of external resources.

Examples included:

- View a YouTube video, and then use it to create a function which...
- Use the help system to find definitions of three built-in functions and then write small programs to demonstrate their use.

This succeeded in generating a wider diversity of artifacts, but did not increase the reported use of external resources.

Although satisfying two of Wenger's characteristics of community, both the domain of knowledge and a shared repertoire developing practice, levels of mutual engagement fall short. Despite tutor encouragement, allowing complete freedom in both artifact choice and frequency of activity resulted in half the community having low participation levels or a skew in activity towards the end of the cycle. Making the reification process visible does allow for the more active participants to demonstrate emerging expertise, as their artifacts are frequently viewed and attract questions. This can act to address one of the frequent critiques of the COP model in classroom based activities, which is the possible lack of experts.

The emergence of this expertise can be assisted by the tutor, who can suggest connections between participants and relevant artifacts, rather than using direct instruction. Without artifact construction, it becomes difficult for the tutor to differentiate lurking from legitimate peripheral participation, and those that remove themselves from mutual engagement can find it difficult to attract participation later in the cycle.

5.2 Reflection and feeding forward

This section reflects on cycle one and suggests changes going forward into cycle two, which include improvements to the induction process along with changes to the e-Portfolio design and the data collection methods.

The induction process

Participants suggested that one of the reasons for the initial low level of activity was the lack of formal guidance on artifact production and sharing. Rather than the approach to sharing evolving over time, it was suggested that the way to introduce these as community norms was through a more detailed, specific induction with demonstrations and explicit opportunities for artifact construction and commenting. The teaching presence indicator from the community of inquiry model is perhaps less useful where promoting an equality, participatory approach, as the aim of peer participation results in the teaching role being distributed amongst cooperating peers. It does reinforce the importance of an initial moderator role, such as that suggested in Salmon's e-moderator model. This and the feedback from the participants suggests the need for a stronger induction with more direction on artifact creation and curation,

which is key to making the formative feedback practice clearer and better defined (Strivens et al., 2009).

For the small proportion of students who don't use, or wish to use social networking sites, a special effort should be made to emphasise the advantages of the learning community approach during this process. There can be participant anxiety over sharing and receiving responses from peers (p. 13), but this can be addressed by emphasising the process of reification and the advantages inherent in participation.

'Low order' activities that typically feature demonstrations of repetitive learning push students towards the idea that there are single solutions to activities, and that artifacts are solutions to tutor designed activities that reinforce the power relation in each role. Starting with these and then broadening the activity types over time, along with more vivid demonstrations of what can be used to demonstrate learning taking place, should increase the variety of artifacts created. The value of making visible work in progress and community assistance should also be demonstrated with actual exercises during this process. Curation could be encouraged with specific activities, and more emphasis in the use of personal learning environments and personal learning networks should broaden the sources that are used by the participants.

Better immediate use of the analytics in real time may encourage participation levels, which would require changes in the interface. This, and a better description in the induction of what and how data is being collected from the system should address some of the surveillance concerns raised.

The e-Portfolio design

The analytics prove a rich source of raw data, but finding better ways of representing the information to make it more accessible for both participants and the tutor should be possible. During a cycle, there are three key indicators of participation, which are:

- the use of the dashboard;
- the level of artifact creation, view and review of own work; and
- the level of interaction with others, encompassing searching, viewing and commenting on others' work.

The dashboard is the main page which is displayed after login and is returned to after each activity, which serves as an indicator of the general level of participation. There are opportunities for using both artifacts and activity traces in the dashboard to increase links between the participants, using three mechanisms:

- using the meta data associated with each artifact, for example the tags;
- using analytics in real time; and
- using previous artifacts to recommend artifacts that may be of interest.

Tags attached to the artifacts signal both an emerging vocabulary and the types of activities that are being attempted, so it should be possible to reflect this back to the community and the tutor. Similarly, activity data should be able to be used to summarise what a participant has achieved, the rhythm of the community as a whole and to suggest artifacts that would be of future interest. These changes can all be implemented on the dashboard.

Data collection methods and analysis

Graph measures such as number of edges, islands and graph density can be used during the cycle as appropriate signals of the community performance over time, signalling peaks and troughs in class and online activity. Degree distribution is calculated by participant, but is also more useful as a measure of activity in the community, working as a measure of the number of connections being made. Although the use of density measures has been questioned when the network size becomes larger (Toikkanen & Lipponen, 2011), it is a useful measure here as a signal to the tutor of the proportion of connections being made on a week by week basis.

For the measures that are calculated by participant such as degree value, betweenness and eigenvector centrality, highlighting the top and bottom 20% are useful in identifying individuals that are underperforming or "highflying". These work less well in instances where the number of active participants is lower but does signal where the tutor and/or portfolio is failing to promote connections. Eigenvector centrality is a signal of dissemination, which is applicable to artifact creation and reuse by others, which when evaluated over longer periods may be suggestive of emerging expertise. Betweenness is less expressive in the context of assessment artifacts, as there is no immediate way for brokering across the network to be meaningful as the successful application of the networked learning philosophy should make this redundant.

Sociogram diagrams provided an immediate visualisation of non-participation and the degree of centrality by activity, but can be time consuming to create and require temporal boundaries to be set, which may not align with participant's actual practices. A more meaningful analysis of the behaviour of closer packed actors requires an analysis of artifact content to see the nature of the collaboration or reuse that is taking place; clique detection is easier to identify through this representation or by calculation, although it has not been applied here because of the smaller sample size. Although valid, the use of analytics has to be used cautiously as individuals may have activity patterns that don't align with the measures. Here for example, the statistics would report that two participants were not engaged at all, when in reality they had not integrated artifact production into their working practices so the work they were performing was not registered.

The next chapter takes this analysis forward by implementing the changes in a second cycle with postgraduate students on an equivalent module.

Chapter 6 Cycle two

This chapter details the second cycle, which follows on two months after the first. Participants were postgraduate students studying a business internet systems module.

After introducing the context, the changes suggested from cycle one are discussed, followed by implementation details and a return to the overarching methodology and methods. A summation of the data collected during the cycle is then presented. The three principle changes in cycle two concern; a refined induction process using an e-moderation model; an increase in the use of data analytics to reflect activity back to the participants; and a recommendation system for artifacts.

6.1 Introduction to the context of the second cycle

Although the cycle two participants are typically older than the undergraduates in cycle one, the international nature of the class results in a mixture of entry qualifications with a variability in their academic skills. The majority of the students have IELTS 5.5 or higher, and arrive with differing levels of technical ability. In this cohort, two of the students have previous programming experience, but neither describes themselves as proficient in the programming language and database technology used here. Five of the others describe themselves as being technically capable in web technologies.

Lower IELTS levels suggest a modest to competent level of English ("IELTS scoring in detail" 2016) and this aligns with the ability of the study skills that the students demonstrate, which is typically equivalent to that of a level five or level six undergraduate student. The majority of the students have English as their second language. Following an assessment during the induction process, those requiring extra assistance are asked to follow specific postgraduate add-on modules, covering academic writing, research and presentation skills.

The postgraduate business internet systems module is taught over a twelve-week period. Eight weeks taught material are followed by four weeks dedicated to cross module project work. Delivery consists of two sessions; a two-hour laboratory followed by a two-hour tutorial on a subsequent day. The postgraduate course has a higher expectation in the level of work students perform out of class in their self-study time. Most laboratory sessions cover practical material with some demonstrations, examples and exercises which are completed both in the session and in self-study time. The tutorial class is used for

more theoretical material, along with demonstrations and discussions. Following the pattern in cycle one, the initial laboratory is used as the start of a 'new' week, with the expectation that new material that will be covered in the subsequent seven days. Postgraduate students tend to attend more regularly compared to the undergraduate students described in cycle one.

For cycle two, I was pleased to discover that all 17 students wished to take part in the research, hence no alternative portfolio scheme was required. Demonstrating the nature of the process with anonymous examples from cycle one during the sign up encouraged participation. Only one of the students had prior experience of a portfolio and this was with a teacher-prescribed set of artifacts that he presented through a single word processed document.

6.2 Changes for cycle two

The three principle changes for the second cycle are a better induction for the process, a recommender system and more meaningful use of the analytics generated during the process. Each of these is discussed here, with implementation detail in the following section.

An e-moderation framework for e-Portfolios

Feedback from the students in the first cycle suggested there should be more clarity at the beginning, with more guidance on the nature of artifacts that participants could create. Salmon's five stage model (Salmon, 2003) provides a popular structure for the e-moderation of discussion style forums, routed in social constructivism (Salmon, 2007). Over a series of stages described as ladder rungs, the complexity of the participant's interactions increase, through an e-moderator's guidance and scaffolding (figure 6.1).

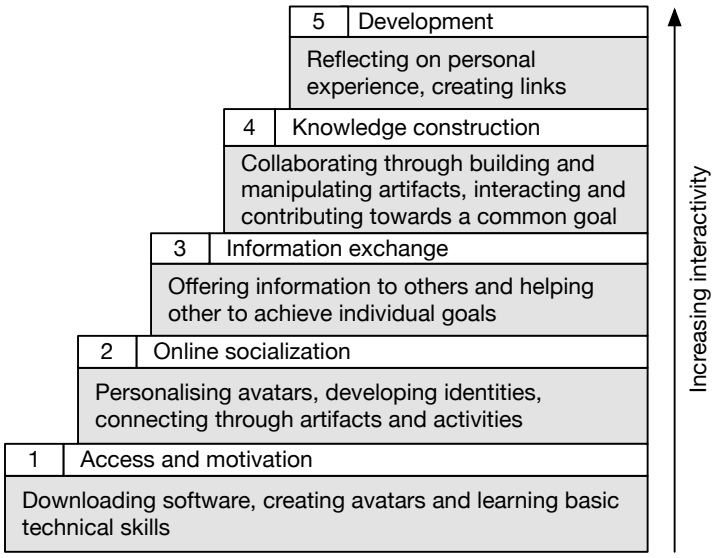


Figure 6.1 – Salmon's five stage e-moderation model

It has been criticised for being rigidly applied (Lisewski & Joyce, 2003), not taking into account mixed pedagogies and failing to acknowledge the effect that co-location of the learners may have on the earlier socialisation stages (Jones & Peachey, 2005). Despite this, it has been applied to create communities with a variety of different technologies such as podcasting, wikis or in virtual worlds (Salmon, 2011) and its popularity has spawned multiple derivations, for example Moule (2007).

When the original form is used with e-Portfolios, there can be problems with the placement of the fifth-rung, as participants reach a greater degree of autonomy and higher levels of reflective thinking earlier in the process (Ehiyazaryan-White, 2012). Traditional e-Portfolio implementations direct the moderator to set out "the tone of the community, attract and welcome new members to the community, and lay out the purpose and guidelines for participation with the group as it forms" (Schwier, 2001, p. 3), providing continuous and prompt feedback and promoting self reflection through reflective comments (Çimer, 2011). In this instance the use of the networked learning community model suggests that peer comments replace the necessity for the moderator to act throughout the process. Initially there will also need to be more direction on the nature of participation as the community aims to move from an equifinality model (Pedler, 1981) to a peer based learning community.

The version applied here will adjust for this and additionally provide structure and guidance on the nature of artifacts to promote collaboration. The framework and teaching materials used will initially prescribe the artifacts to be created, but

will gradually suggest the possibilities of greater diversity in artifact choice through open ended exercises and collaboration. There will also be an emphasis on ensuring that participants engage with learning activities and resources outside those supplied by the institution through a curation process.

Recommender systems

One of the consequences of the data gathered during cycle one was the realisation that the system put in place to provide data for an analysis of the community's growth over time could be additionally used inside the system itself, in real time, so that participants could see their work and workload in the context of the whole learning community. Every page, click and interaction is recorded (Clow, 2013) and is an opportunity to create actionable intelligence (Campbell et al., 2007). This data can be used in two ways – to create artifact recommendations based on previous activity and to reflect analytic data on performance back to the participants during the process.

Networked learning (NL) advocates growing a learning community by creating links between users and resources, a role which is traditionally built into the design of learning activities and is implicit in the NL tutor role. In the e-Portfolio community here, resources are distinct artifacts, which allows for links to be created through tutor recommendations. Rather than rely on these recommendations alone, the activity data can be used to automate the suggestion of links, increasing the possibility of connections.

To encourage the growth of community, Neilson (2010) suggests making participation in a recommendation system a side effect of activity and uses the example of Amazon gathering information about the books bought to suggest further purchases. The recommendation system trialled here is a content based collaborative system, where "items are recommended that are similar to items users preferred in the past" (Adomavicius & Tuzhilin, 2005, p. 5). There are disadvantages to such an approach, in that meta information associated with an artifact may not capture the rich aspects of its content and over-specialisation may occur, where only artifacts that align with previous searches may be suggested (Balabanovic & Shoham, 1997). A richer system would be based on collaborative recommendations, but this would require participants to grade each others' work and this has proved difficult to implement because of the volume of work required "an onerous task" (p. 67).

The recommendation system trialled here allows for links in the e-Portfolio to be derived from a recommendation system which uses existing artifacts, participant's browsing habits and search activities. When combined this should enable suggestions of artifacts to be partially automated, increasing the visibility of artifacts.

Data analytics

Data analytics is a relatively new field, with a definition suggested by the first international conference on learning analytics and knowledge of analytics as:

> "the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimising learning and the environments in which it occurs" (Siemens & Long, 2011, p. 3).

Successive Horizon reports have suggested that the application of data analytics in education has moved from an emerging field to a mature practice, as practitioners and administrators realised the wealth of data that was being inadvertently collected as students interacted with electronic resources (Kennedy et al., 2013). There have been initiatives to use analytics to identify potential at risk students although these typically use grades and achievements rather than participation for evidence (Campbell et al., 2007). This use of data analytics does not have an articulated epistemology of its own (Clow, 2013) but is a jigsaw of different techniques, tools and methodologies. Examples suggested include:

- Predictive modelling, generating statistical probabilities on success rates, for example, the course signals system at Purdue University (Purdue Research Foundation, 2013).

- Social network analysis and sociograms depicting activity between participants typically generated from LMS data.

- Usage tracking, recording what features or functions of software are being used over time.

- Content analysis, using natural language processing or semantic analysis to see how concepts are used and arise.

- Recommendation engines, although there is limited usage at the moment.

The metrics generated in such systems tend to be used in two ways, with students taking action in the light of their own activity compared to that of their peers or through a teacher initiated process identifying students requiring additional assistance (Clow, 2013). The process is typically described as a cycle (Campbell et al., 2007) with an emphasis on reflection such as in Kolb's model (Clow, 2012).

There are implications and concerns over the use of analytics. Surveillance could reinforce existing power relations to the detriment of the learner (Clow, 2012), learners may be uncomfortable with the mistakes that become visible with the openness of the data and it is possible that misclassification may occur (Campbell et al., 2007). Caution is also advised as students may become "more data-oriented about their learning process" (Bader-Natal & Lotze, 2011, p. 185).

Here, an appropriate use of real-time analytics derived from the activity table should encourage self reflection and increase self responsibility, as long as the metrics are carefully selected to optimise learning (Clow, 2012). Revealing the activity of individuals in the context of the group will make overall participation levels visible, which can be difficult to perceive online. The intention here is that this will also enable participants to see the immediate value possible in the use of the statistics gathered during their day-to-day usage of the system.

6.3 Methodology, methods and implementation changes

As discussed in chapter three and section 4.2, a modified version of De Laat's multi method research framework for studying networked learning processes is used here (De Laat, Lally, Lipponen, & Simons, 2006b), applied to the study of e-Portfolio artifacts in a community, where context analysis is performed to see why participants behave as they do. The significant change to the data collection method in cycle two is the use of individual interviews at the end of the process, which was possible due to the placement of the cycle in the second half of the academic year.

Methods and their use

As with cycle one, the data collected came from activity data recorded by the system as it was used, along with the artifacts, notes, logs and feedback from the participants made during the cycle (table 6.1). This is supplemented with the addition of 11 semi-structured interviews, from the 17 participants available.

These were chosen to reflect the broad spread of participation levels demonstrated.

Table 6.1 - Methods, means and sample

Description	Method	Means	Date	Sample
Activity in the portfolio	SNA Social Network Analysis over activity records	Analysis using Excel and R	During the eight week cycle	Derived from all activity shown in activity tables
Reflections on the cycle	CA Semi-structured interviews	Face to face	Post cycle	11 participants
Artifact analysis	CA Thematic analysis over artifacts and discussions	In-vivo coding in Excel	During/post the eight week cycle	All artifacts in the e-Portfolio
Reflections in the cycle	Weekly in class feedback / logbook	Collated in Word	Weekly for the eight weeks	

The analysis process for much of this information is the same as in cycle one, as detailed in the methods section of chapter five. The process used in the analysis of the interview results is detailed in section 3.4 of the research design chapter.

The design of the e-Portfolio learning community

There is a greater focus on the development of the community in cycle two, with Wenger's principals of community design (2002) and Schwier's elements of community (2001) used in an attempt at encouraging both initial and regular participation.

Some of Wenger's principals are embedded in the existing model, for example designing for evolution, which here is an acknowledgement of the changing role of the moderator, as the teacher moves more towards facilitation over the life of the community. Different levels of participation are suggested in the non-privileging of strong connections through networked learning principles.

Wenger suggests combining familiarity with excitement and a transition at the entrance. This can be harder to achieve, but a redesign of the landing page of the e-Portfolio should allow for more explicit changes and activities to be visible, through recent and recommended posts of interest. His suggestion for creating a rhythm for the community should be addressed by the design of the e-Portfolio moderation framework, which is designed to have step levels of activity involving increasing complexity.

The e-Portfolio moderation framework

The structure used here is derived from Salmon's five stages, but acknowledges that there will be flexibility in the spacing and less rigidity in the processes taking

place (figure 6.2). Ownership is moved up several rungs from its original placement, which is common in e-Portfolio activities (Ehiyazaryan-White, 2012).

Stage one – Initiating activity

McConnell (2006) suggests initiating activity with invitations, welcoming messages and an explicit agenda setting with scaffolding. Similar to Salmon's access and motivation rung one, this stage covers practical issues such as signing up and familiarising the participants with the functionality of the e-Portfolio. As some cycle one students delayed uploading any work, a specific induction task will ask students to create and upload an artifact, with appropriate tags and reflective statement. Participants are then directed to look at each others' work and to try the commenting system

Participants are then encouraged to create artifacts from work performed outside the designated lab time, which will be small, closed problems from lab work and exercises. Folio thinking, where artifact creation is embedded into the learning process is introduced at this stage and the students are asked to try this out with an exercise in the lab.

As in cycle one, the moderator will issue welcome style messages, reinforcing the importance in the use of the meta information attached to the artifacts.

Stage two – Online socialisation

Schwier (2001) indicates the importance of creating a shared history and culture in the emergence of a learning community, but here the participants already know each other from previous modules, so the need for the socialisation rung was changed from a getting to know each other process to acknowledging that others' work would be visible in the system and the possibilities inherent in artifact reuse (Jones & Peachey, 2005). This is an attempt at addressing the issue that some participants in cycle one had not explored the system and realised the nature of the visibility present in the uploaded work.

Tasks and activities which the participants can use as the source of artifacts are still well defined at this stage and participants are asked to comment or ask questions inside the e-Portfolio itself. This is to address some of the hesitation issues associated with weaker social cues that can occur in networked learning community formation (De Laat, Lally, Lipponen, & Simons, 2006a).

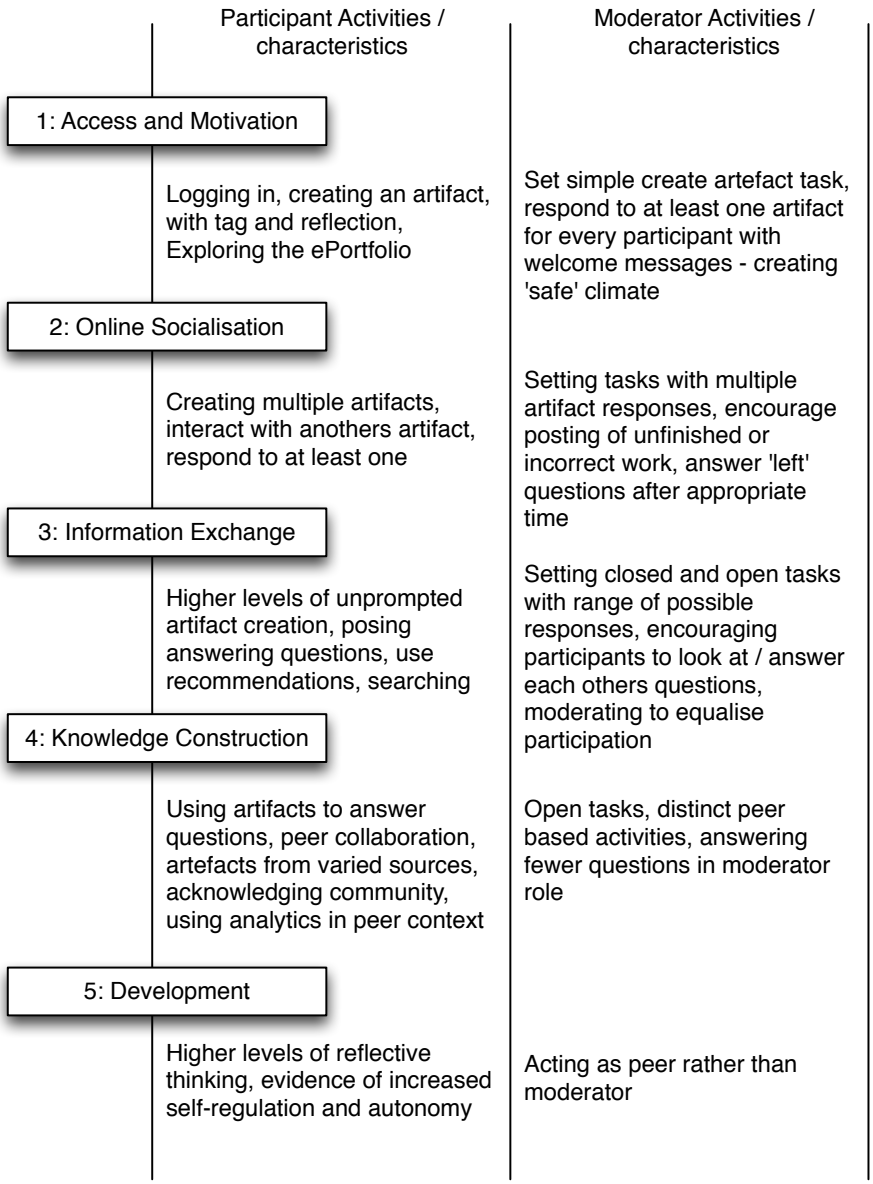


Figure 6.2 - e-Portfolio moderator framework derived from Salmon (2003)

Stage three – Information Exchange

This stage is designed to encourage participants to realise the advantages inherent in making visible draft work and to seek solutions from others by uploading work with errors. The e-moderation role places more emphasis on directing students to others' artifacts and asking them to comment on others' work rather than on supplying answers.

The nature of the task and activities is changed here with open-ended problems that broaden out the nature of the work that can be submitted. For example, rather than setting prescribed exercises using programming language functions, students participate in demonstrations of a range of function, the location of the help system and how to read online manuals. They are then given the freedom to choose and write examples to demonstrate their use from the wide number available.

Stage four – Knowledge construction

This stage consists of peer activities with choice of artifact creation driven by the participants themselves. Commenting is free flowing and the levels of participation should be balanced and distributed. At this stage, there will be an emphasis on the curation role, where participants will be encouraged to use and bring in resources from outside the formal domain of class resources. The Personal Learning Environment and Personal Learning Network concepts will have been introduced in the initial parts of the course, but the use of these as a source of research and learning will be demonstrated both in class and in exercises suggesting their use.

Stage five - Development

This stage suggests a level of maturity, where the concept of leader has been de-emphasised, purposes and activity are settled with regular patterns of behaviour (Schwier, 2001). There should be regular peer-to-peer collaboration, and a broader set of artifacts produced, which suggest evidence of creation and curation activities.

Algorithm for the recommender system

Recommend participant X's artifact to Y if

- *X's artifacts have been regularly visited by Y*
- *A new artifact uses a tag or Blooms partition that Y has recently searched on*
- *Y has uploaded an artifact with similar tags to a new artifact*

For events over the last two weeks, sorted by most recent

Figure 6.3 - Recommender system algorithm

The recommender system and the landing page

Tags associated with artifacts, participant's browsing habits and search activities can be combined to create a recommender system which suggests items that may be of interest.

This information is retrieved from the activity data, serving the dual purpose of source of information for the recommender system data and as data for the analytical part of this work. There are a number of ways that a recommendation can be calculated – if a participant regularly visits another's artifacts, it seems likely that they may be interested in new artifacts from that person. If a search on a particular term has occurred, for example on a particular tag, then any artifacts with that tag can be recommended. Finally, if a participant has uploaded an artifact which has tags that match another artifact, that artifact can be recommended (figure 6.3). Recommended artifacts are presented in chronological order from most recent, but only for results generated over the last two weeks. A prototype written using the cycle one data demonstrated that at peak moments, an overwhelming number of results could be returned, but limiting results to 14 days made the results accessible.

One of the participants from cycle one indicated concern over the nature of tracking taking place and this aligns with the literature which suggests that mishandling tracking can have serious consequences, with extreme disruptions possible to the learning process (Boyd, 2008). The guiding principals used here emphasise transparency, so it will be made clear that a person's activities are being tracked (Duval, 2011) and extended to include how the information will be used in the recommendation engine. It is hoped that any anxiety over this issue would be dispelled by revealing the nature of the activity recording that is taking place, during the beginning of the course and by showing the value for the participants themselves in both the recommender system and in the data analytics that are possible.

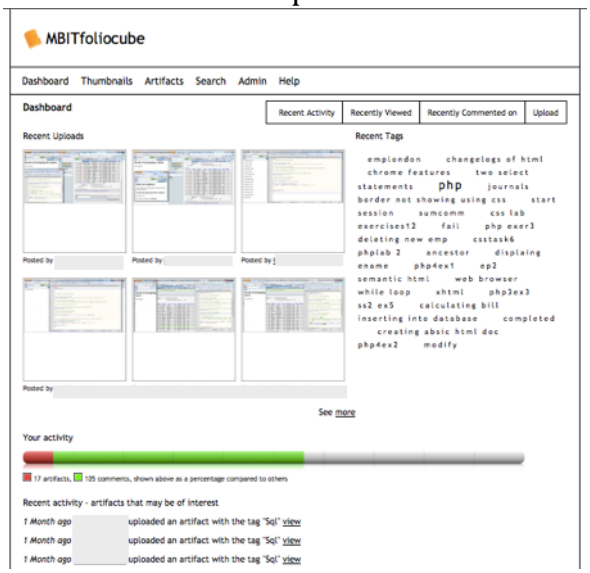


Figure 6.4 – the redesigned front panel

Folksonomy tag clouds can aid content indexing (Harvey, Baillie, Ruthven, & Elsweiler, 2009), which in this context provides another way for participants to see the keywords attached to recently created artifacts. The tag cloud placed on the landing page is designed to show the tags associated with artifacts in the last 14 days. As is traditional, more frequently used tags are displayed in larger font sizes, and clicking on a tag reveals a view showing artifacts associated with that keyword in descending date order. Like the most recent uploads and the folksonomy tag cloud, artifacts that are recommended are visible on the landing page for participants (figure 6.4).

A gauge style bar indicates the total number of artifacts and comments for the logged in user (only). Here the analytics will act as an early warning system (Macfadyen & Dawson, 2010), and provide benefits by reflecting information back for both the students and tutor (Bader-Natal & Lotze, 2011). Although it was initially planned for both groups to use the same indicators, it became easier to code a summary analytic specifically for the tutor soon after the student version was implemented.

The methods, sample and analysis used in cycle two are explained in detail in the next section.

6.4 The cycle

This section briefly provides an overview of the activity in the cycle over distinct phases, dividing the cycle into three. This provides the context for the specific data collected during the cycle, which is presented here and analysed in the next chapter.

Week one to week three

Weeks one to three cover database design and the use of the programming language SQL, with discussions on the architecture of the internet. Following a general induction and introduction to e-Portfolios, the first week followed level one and two of the e-Portfolio moderator framework, with a much wider demonstration of the system.

The nature of artifacts, the way that the reflective statements can be written and the folksonomy and taxonomy system were explored with (anonymous) examples from cycle one. Each participant was asked to create and upload artifacts in class, ensuring that every student had experienced the way that artifact creation could be embedded in a working practice. This initial data allowed the recommender system and ways in which others' work could be used to be demonstrated. Initial activities in the teaching materials contained closed exercises suggesting distinct answers that were simplistic in nature and required little discussion. This promoted the idea of reification with short reflective text and opportunity for tagging (figure 6.5). Students used tags from the beginning, with nudge style comments used to suggest the advantages of using more meaningful words or phrases. There was a more rapid uptake in the use of the folksonomy from the beginning, compared to cycle one.

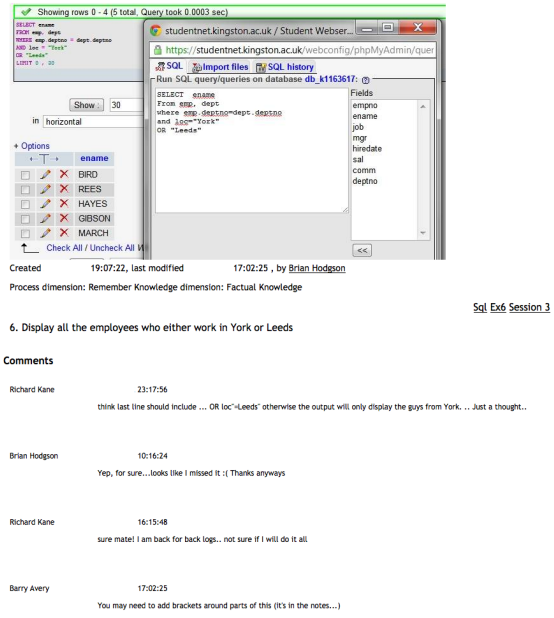


Figure 6.5 – example artifact and comments

Activities from the second week onwards were designed to facilitate level two and three of the model, with an increase in the number of open exercises and promotion of collaboration between the participants. The second session of week two introduced the notion of curation, with a mini research project where students were asked to seek and share online resources on subjects relevant to material being covered in the more formal taught periods. Small summations and URLs linking to web pages or videos initiated discussions around subjects such as the "control" of the internet.

Week three sees all the participants using the system, with four sitting at the edge with a lower number of artifact uploads and fewer connections to an inner core. Folksonomy tags become looser, less bound to the names of a series of perceived exercises and more open, reflecting the nature of the artifacts encouraged in class. The introduction of the front page analytic was introduced at this point, following discussion in week two on its nature.

Week four and five

Weeks four and five cover the way that web pages are designed and implemented as the front end and interface to the systems running over the internet and then moves into the use of web based programming languages. This change of subject material saw a decrease in participation levels, with many of the artifacts switching from database material to programming, with the wider variety of open activities and solutions allowing more opportunities for participants to offer advice and corrections on each others' artifacts. Discussions attached to curation style artifacts continued around cutting edge web technologies, comparisons of browsers and software running on different types of mobile phone. These weeks see the end of the application of levels four and five of the e-Portfolio model, with less requirement for tutor direction.

Week six to eight

The final three weeks of the cycle concentrate on programming material, where participants could write a wider range of artifacts encouraged with open exercises. There was an increase in the number of requests for help, specifically concerned with debugging code, which were answered both by the tutor and the participants. In week seven the number of threads and discussions halved compared to the previous week, whilst the number of artifacts and interaction with others' work increased after the low of week six.

For the final week the number of discussions, the majority of which were concerned with PHP issues, increased from 7 to 34, but with a decrease in the volume of artifacts being created and a lessening in the connectivity between participants who went directly to conversations they were involved with from the dashboard.

6.5 Results

The following section details results derived from the cycle, including various graph measures, SNA diagrams and interview responses. The nature of these measures is fully explained in chapter four, and in cycle one section 4.4.

This is structured into three sections, with activity in the cycle described first, using summary tables, statistics, and social network activity diagrams. The analysis of the content and comments follow, using thematic analysis and the teaching presence indicators from the community of inquiry model. Finally, the interview responses are presented, organised by themes.

Activity in the cycle

The summary activity table (table 6.4) records the actions every participant performs inside the system in grouped categories. Numbers in the table indicate how many times these events occurred in each week for all users of the system, so dashboard numbers are a general indicator of use.

There is a high level of activity in the first three weeks signalled by both the number of artifacts created (239 in week one, 169 in week two, 243 in week three), and by the level of interaction with others' work (1090, 878, 1456 in weeks one, two and three respectively). These numbers start to decrease in week four with lows in week five and six, before they climb in the last two weeks. Participants uploaded a total of 1247 artifacts over the eight-week period, giving the following statistics - on average, a participant created four artifacts every three days, reviewing their own work between three and four times a day, interacting with others' work six times a day (table 6.2).

Table 6.2 – General statistics

	Own	Others
View single artifact	919	2667
View overview of artifacts (all)	2520	1606
Searching on others' artifacts	-	1469
Total	3439	5742
	3.6 times a day	*6.0 times a day*

As in cycle one, various general graph measures have been calculated from the activity tables including number of edges, number of island, graph density and reciprocity, as explained in section 4.4.

Number of edges suggests connections between participants and starts high in the first three weeks, before decreasing in week four down to a steady level in weeks five to seven. There is a drop in the final week. Number of islands is the number of disconnected clusters, which when smaller is better as it in an indicator of non-interaction. During the cycle, this number remains low, although the activity tables and sociograms reveal that it can be different participants moving in and out of connection. There is a peak value of five in the final week (table 6.3).

Table 6.3 - General graph measures

Week No	1	2	3	4	5	6	7	8
No of edges	104	110	150	81	64	54	55	32
No of islands	2	2	1	3	1	2	2	5
Graph density	0.340	0.359	0.490	0.264	0.209	0.176	0.179	0.104
Reciprocity	0.519	0.472	0.56	0.469	0.281	0.222	0.145	0.063

Graph density indicates the proportion of connections present calculated from the ratio of the number of edges to the number of possible edges. Higher values suggest more connections between nodes, *zero* indicates no connection, *one* suggests all nodes are connected to each other. The density has peak values in the first three weeks and then gradually decreases.

Reciprocity defines the proportion of mutual connections, in a directed graph, with *zero* indicating no mutual connections, *one* indicating a balance between in and out connections. Higher is better, indicating more balance between using others' work and a participant's work being used. This is calculated from existing ties in the graph, so actors with no connection do not affect the value. There are strong values in weeks one to four, but the reciprocity decreases in weeks five to eight.

Table 6.4 - Activity summary for the eight weeks of cycle two

View Help	***Week 1***	***Week 2***	***Week 3***	***Week 4***	***Week 5***	***Week 6***	***Week 7***	***Week 8***
View help - general	7	2	2	1	0	0	0	0
View help - artifacts	3	0	1	1	0	0	0	0
View help - thumbnails	1	0	2	1	0	0	0	0
View help - search	1	0	2	1	0	0	0	0
	12	***2***	***7***	***4***	***0***	***0***	***0***	***0***
Create or View Own work								
Artifact upload	239	169	243	179	99	91	109	118
View an overview of own artifacts	411	430	521	370	192	117	252	227
View one of own artifacts	101	152	172	146	81	52	128	87
	751	***751***	***936***	***695***	***372***	***260***	***489***	***432***
Interact with others' work								
View a subset of others' artifacts	167	100	376	152	82	61	292	138
View a specific set of near artifacts	47	11	13	4	5	0	15	6
View all artifacts (excluding own)	485	314	377	134	81	132	37	46
View someone else's artifact	386	445	689	317	196	165	318	151
View all thumbnails	5	8	1	3	0	3	2	0
	1090	***878***	***1456***	***610***	***364***	***361***	***664***	***341***
View thumbnails								
View own thumbnails	64	58	30	28	9	9	16	6
	64	***58***	***30***	***28***	***9***	***9***	***16***	***6***
Dashboard								
View Dashboard/Recent activity	435	562	576	499	279	193	246	186
View Dashboard/Recently Viewed Artifacts	33	34	30	12	8	5	5	4
View Dashboard/Recently Commented Artifacts	36	37	23	15	5	2	4	3
	504	***633***	***629***	***526***	***292***	***200***	***255***	***193***
Comment threads								
Comment on an artifact	24	50	59	42	22	12	7	34
	24	***50***	***59***	***42***	***22***	***12***	***7***	***34***

For degree, betweenness and eigenvector the values in the top 20% (green) and bottom 20% (red) have been highlighted (table 6.5, 6.7 and 6.8).

Table 6.5 - Degree values for participants

Degree																		
	BAv	BBr	BHo	CBa	GDa	GJa	HSu	JCo	JLa	KLl	MBr	NHa	PDa	RKa	SSc	SSi	SYo	TCa
Week 1	22	10	16	3	8	14	13	18	13	1	5	20	8	13	19	12	13	0
Week 2	19	8	6	4	17	7	18	10	13	17	18	16	15	0	23	15	12	2
Week 3	26	24	8	22	10	13	22	18	13	15	14	26	18	13	20	14	19	5
Week 4	19	8	8	8	15	2	18	7	10	3	0	19	3	8	11	13	10	0
Week 5	14	5	5	11	14	5	14	4	1	1	3	13	6	4	11	9	7	1
Week 6	10	5	4	12	4	2	12	2	1	3	15	11	7	1	7	5	7	0
Week 7	14	4	1	7	0	10	10	8	10	2	1	10	8	8	5	4	7	1
Week 8	10	6	0	6	11	4	2	4	2	4	0	6	4	2	1	0	2	0

Degree is the number of in/out links from a vertex (node). Higher numbers are better as they suggest more connections are occurring. This measure does not count repeat links (i.e. multiple vertices to the same node count as one). Nicholas H. and Hannah S. maintain a high degree value over the eight weeks; many of the others have fluctuating values. Tristan C. has lower values than the others (table 6.5).

Table 6.6 - Degree distribution for participants

	Number of links																										
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Week 1	6%	6%		6%		6%			11%		6%		6%	22%	6%		6%		6%	6%	6%		6%				
Week 2	6%		6%		6%		6%	6%	6%		6%		6%	6%		11%	6%	11%	11%	6%				6%			
Week 3						6%			6%		6%			17%	11%	6%			11%	6%	6%		11%		6%		11%
Week 4	11%		6%	11%				6%	22%		11%	6%		6%		6%			6%	11%							
Week 5		17%		6%	11%	17%	6%	6%		6%		11%		6%	17%												
Week 6	6%	11%	11%	6%	11%	11%		17%			6%	6%	11%			6%											
Week 7	6%	17%	6%		11%	6%		11%	17%		22%				6%												
Week 8	22%	6%	22%		22%		17%				6%	6%															

Degree distribution suggests the number of links as a proportion of the total, hence for week one 6% of the participants had no connections, 6% had 1, 3 and 5 links. Higher numbers are better, indicating more connections between more people. After a peak number of links in week three, the number of links decreases (table 6.6).

Table 6.7 - Betweenness figures for participants

Betweenness																		
Week No	BAv	BBr	BHo	CBa	GDa	GJa	HSu	JCo	JLa	KLl	MBr	NHa	PDa	RKa	SSc	SSi	SYo	TCa
1	36.87	2.583	19.17	0	10.25	0.5	31.72	21.9	6.9	0	0	30.03	3.083	28.58	23.87	16.57	11.52	0
2	23.15	1.433	2.211	0	10.57	0	26.48	9.398	19.4	4.736	31.72	31.7	13.63	0	33.72	9.506	31.77	0
3	9.371	35.8	27.03	16.57	21.13	6.85	31.79	29.33	10.4	56.92	20.55	11.52	4.837	28.76	10.3	11.54	3	1.2
4	57.25	20.75	0	7.417	23.83	0	23.75	26.42	12	3	0	9.333	0	1.75	4	45.92	17.42	0
5	20.67	0	9.2	18.9	54.53	0	27.37	9	0	0	11	30.87	0	3	31.57	27	0	0
6	0.5	19.83	0	49.33	0	0	15.33	0	0	0	27.33	68.33	36	0	0	0	29.33	0
7	52.83	0	0	2.667	0	14.17	21.5	0	58.67	0	0	78.5	1.833	20.17	14	0	27.5	0
8	0	0	0	10	30	0.5	0	0	0	9.5	0	31	0	0	0	0	0	0

Betweenness centrality gives a higher score to a node that sits on the shortest paths of other node pairs. It suggests those that are often found at the intersections of more densely connected network communities, where they perform brokering roles across clusters connecting otherwise disconnected people. Hannah and Nicholas have strong values for many of the weeks, mirroring their degree values, with many of the other participants having fluctuating values (table 6.7).

Table 6.8 - Eigenvector centrality for participants

Eigenvector centrality																		
Week No	BAv	BBr	BHo	CBa	GDa	GJa	HSu	JCo	JLa	KLl	MBr	NHa	PDa	RKa	SSc	SSi	SYo	TCa
1	0.964	0.728	0.639	0.308	0.24	0.759	0.329	0.857	0.515	0.03	0.138	1	0.54	0.568	0.856	0.467	0.644	0.166
2	1	0.138	0.125	0.045	0.444	0.191	0.735	0.498	0.554	0.665	0.483	0.342	0.574	0.008	0.725	0.642	0.192	0.036
3	0.699	0.701	0.074	0.917	0.082	0.414	0.446	0.698	0.152	0.129	0.483	1	0.778	0.101	0.544	0.28	0.317	0.047
4	1	0.09	0.177	0.182	0.362	0.171	0.71	0.202	0.182	0.058	0.003	0.591	0.064	0.154	0.509	0.341	0.721	0.003
5	0.377	0.145	0.107	0.494	0.919	0.353	1	0.096	1E-03	0.049	0.036	0.608	0.409	0.126	0.242	0.23	0.47	0.027
6	0.936	0.126	0.24	1	0.115	0.087	0.956	0.125	0.056	0.057	0.908	0.797	0.725	0.014	0.284	0.436	0.449	0.044
7	0.185	0.095	0.002	0.054	0.002	0.367	0.07	0.934	0.494	0.003	0.004	0.093	1	0.236	0.041	0.016	0.074	0.001
8	0.909	0.579	0.016	0.923	0.537	0.167	0.041	0.385	0.124	0.093	0.016	0.139	1	0.447	0.107	0.016	0.108	0.016

Eigenvector centrality gives a higher score to a node if it connects to many high score nodes and suggests higher influencers who disseminate information quickly. They do not always have the greatest local influence and may have limited brokering potential, i.e. a lower betweenness value. Six of the participants have high values for three weeks or more (CBa, GDa, HSu, JCo, NHa, and PDa), although the numbers vary frequently over the cycle (table 6.8).

SNA diagrams

The sociograms for the first four weeks show the high level of participation (figure 6.6), with one or two disconnected islands in each week.

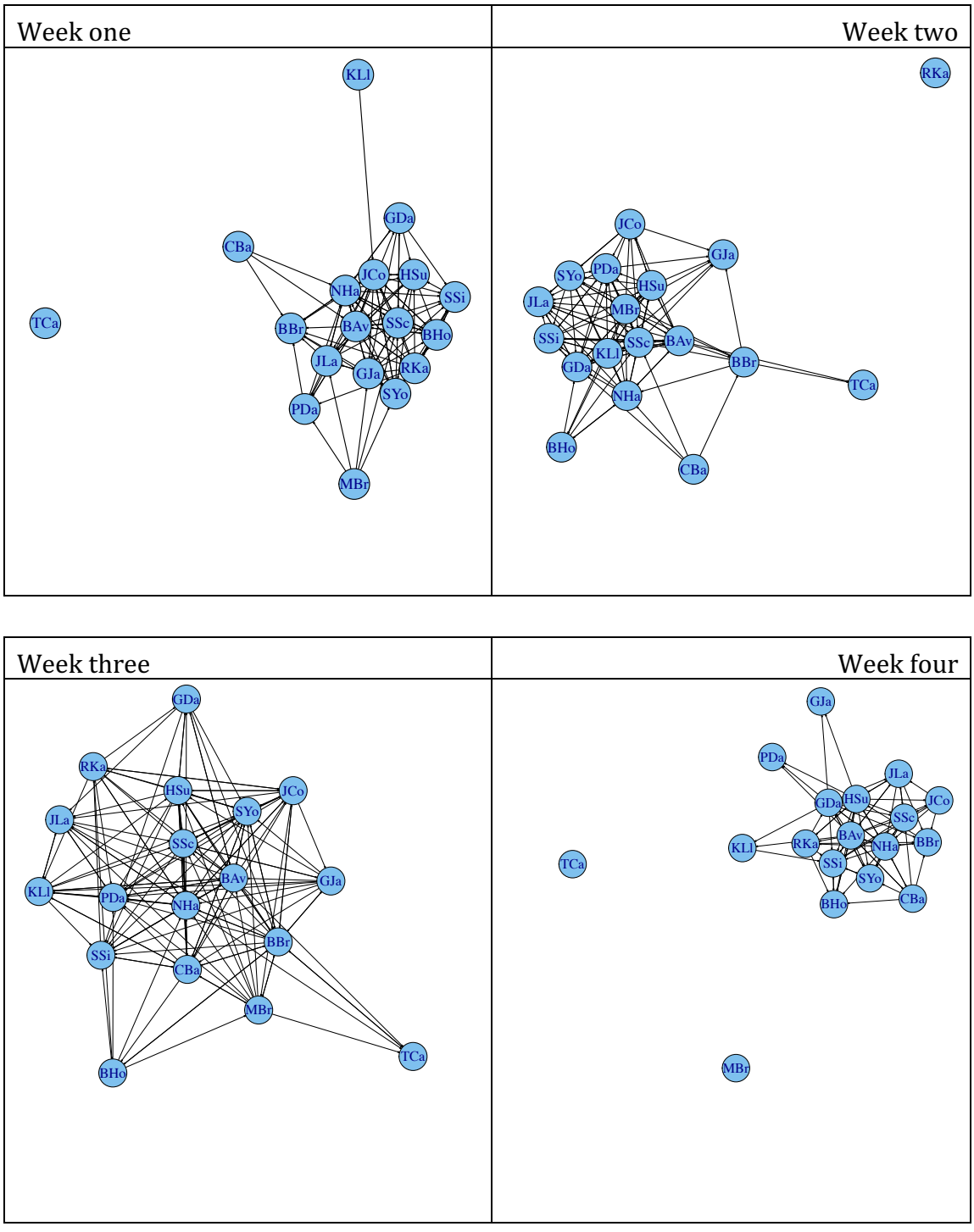


Figure 6.6 - Sociograms for weeks one to four

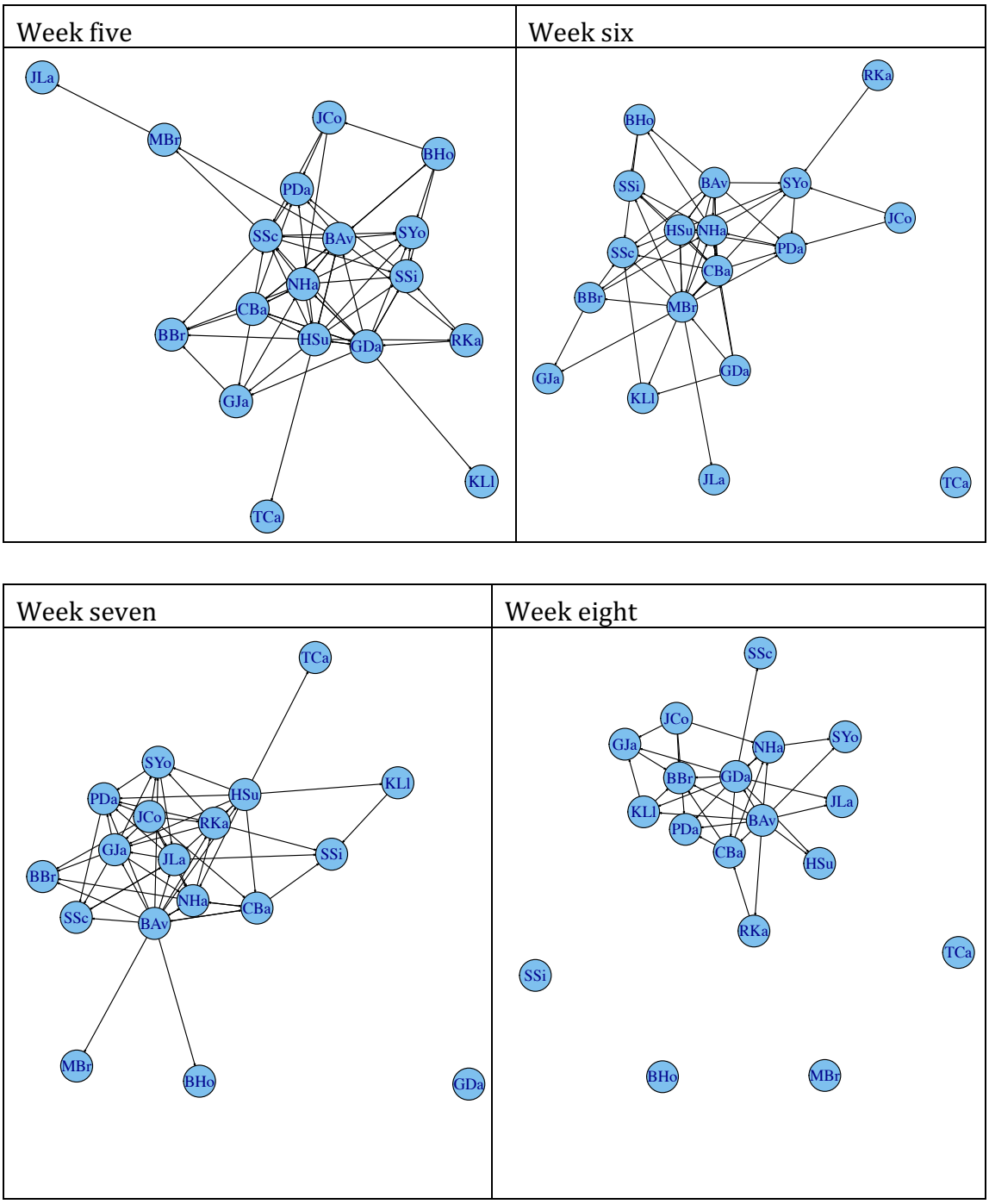


Figure 6.7 - Sociograms for weeks five to eight

The sociograms for weeks five to eight reveals those have a greater centrality and those that sit at the edge of the network, such as Brian H., Sanjay S. and Tristan C. (figure 6.7).

The next section presents the analysis of the artifact content and comments, using thematic analysis and the teaching presence indicators from the community of inquiry model.

Analysis of artifacts and comments

There were many more curation artifacts created in cycle two, including links to external web pages, demonstrations of applications running on mobile phones and links to videos on YouTube. The number of artifacts created was high in the first three weeks, with a decrease in the middle of the cycle and an increase in activity again towards the end (table 6.9).

Table 6.9 - Artifact creation by week

Week	1	2	3	4	5	6	7	8
No of Artifacts	239	169	243	179	99	91	109	118
Curation Artifacts	15	47	23	29	35	0	0	0
Comments	24	50	59	42	22	12	7	34

From the beginning of the cycle, the majority of the artifacts created had reflective statements and tags after demonstrations in the induction. The small number of participants failing to do this started using them after nudge style comments towards the end of the first week.

Weeks one - three

The first week saw a surge in activity from five participants with 93 artifacts created in the first two days.

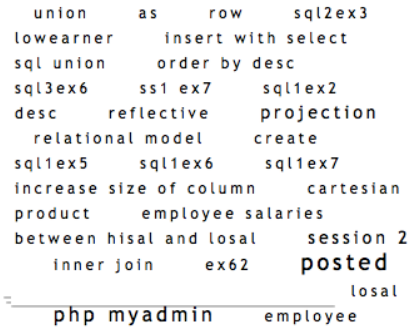


Figure 6.8 - Tags for week one

The other participants started creating artifacts after the second session of the week, with fewer artifacts per day, but a greater spread out over the next four days. There were 11 examples of supportive comments where participants offered suggestions or corrections in three threads, concerning process - how to upload, make reflective comments or on corrections to the artifacts uploaded. The tags used in the first week are balanced between those with an appropriate semantic meaning aligned to the artifact content and those suggested by the ordering of the teaching materials, such as ex6, ex7 (figure 6.8). Despite not formally introducing the curation process, fifteen

curation style artifacts were created by five students linking to the taught material in various ways, including links to external web pages and a YouTube video.

The second week saw half the participants create artifacts in a steady flow, suggesting that they had integrated artifact creation into their working practices. Kevin, Sanjay and Susan are centrally based in the network, despite having a lower number of published artifacts, indicating that the work they created early in the week was viewed and interacted with more. A second set of five students uploaded work later in the week, with the time stamps suggesting that they were collating work offline before uploading it all at once.

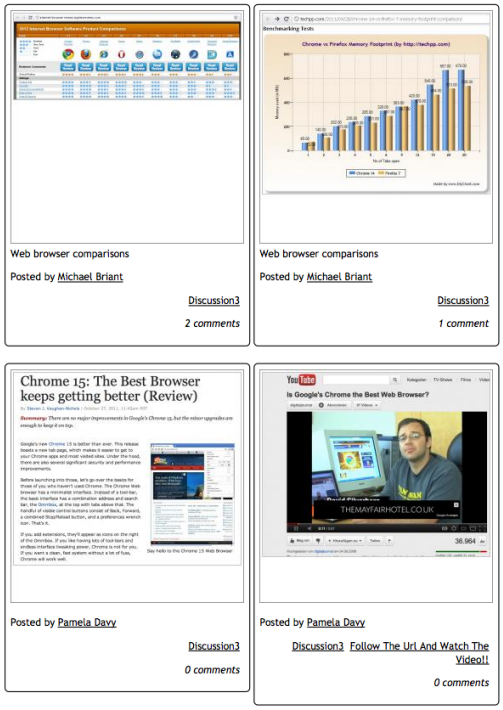


Figure 6.9 - Curation artifacts in week two

There are a strong set of links between many of the participants, except for Tristan who for the second week has a low participation level, creating ten artifacts. He failed to use tags or longer reflective statements, despite the tutor 'nudges' and their use by the others. Both Brian and Chris sit on the edge of the network, uploading and interacting less.

There are a mixture of artifacts in week two, with taught material on web technologies resulting in a surge in work pointing to various comparison surveys and demonstrations. 47 curation style artifacts were created by participants, using external resources, YouTube videos, web pages and reviews (figure 6.9). The curation style artifacts were more likely to promote comments.

The majority of the remaining artifacts followed the pattern from the previous week by demonstrating small solutions to activities, which align with the small activities and tasks suggested by the teaching material (figure 6.10).

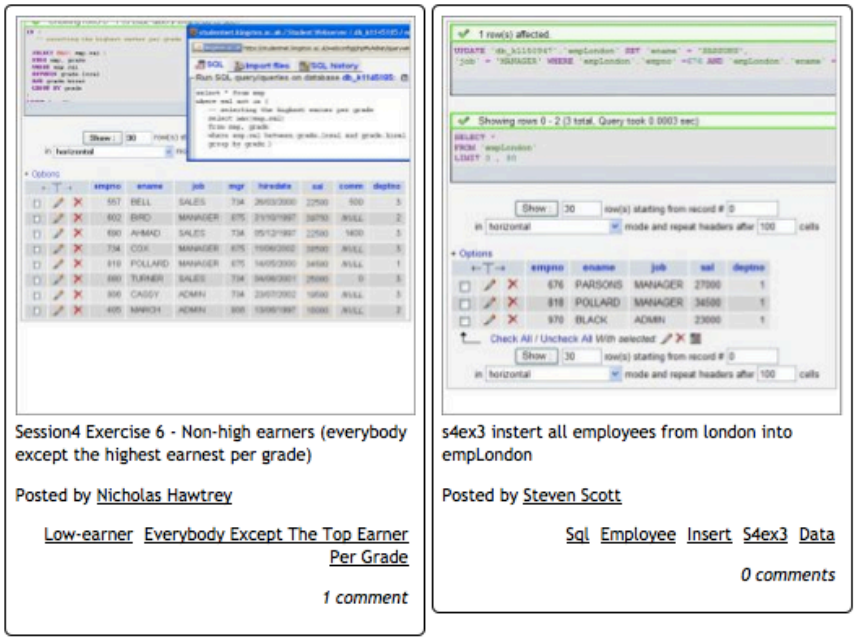


Figure 6.10 - Small task solutions as artifacts

The third week sees a change in subject, away from database work to creating web pages. All students interact, however four sit at the edge, with a lower number of artifact uploads and fewer connections to a prolific inner set who have higher participation levels. For Brian this represents a second week of low participation, so noting this he was encouraged to be more active in the next week.

From this week the folksonomy tags become looser, less bound to the names of a series of perceived exercises and more open, reflecting the more open nature of the artifacts posted and encouraged in class. The number of thread comments peaks in week two and three with participants offering advice and corrections on others' work.

The breakdown of artifact creation by day (table 6.10), reveals a spread of activity

Table 6.10 - Artifact creation by day

		Mon	Tue	Wed	Thr	Fri	Sat	Sun
Barry	Avery			3	1			
Chris	Barry		1	5				
Michael	Briant					6		
Barbara	Bruce	9						
Tristan	Cary		9					
Jim	Cole		1			6		7
Gerry	Davis		3					
Pamela	Davy		1			8		11
Nicholas	Hawtrey	9		1		8		4
Brian	Hodgson							
Gillian	James							5
Richard	Kane			1				8
James	Latham				5			
Kevin	Lloyd				14			2
Steven	Scott	2				15		3
Sanjay	Singh	10		6				
Hannah	Summers	5		4				
Susan	Yorke	7		1				16
		42	15	21	20	43	0	56

compared to the previous two weeks, with the majority of participants creating work on multiple days. Barbara B. breaks this pattern by having significant uploads on the Monday morning, “catching up” before class.

Examples of artifacts from week three included the use of camera phones to create images (figure 6.11), demonstrating standards in web clients, prompting a discussion where participants compared test results on various phones and tablets.

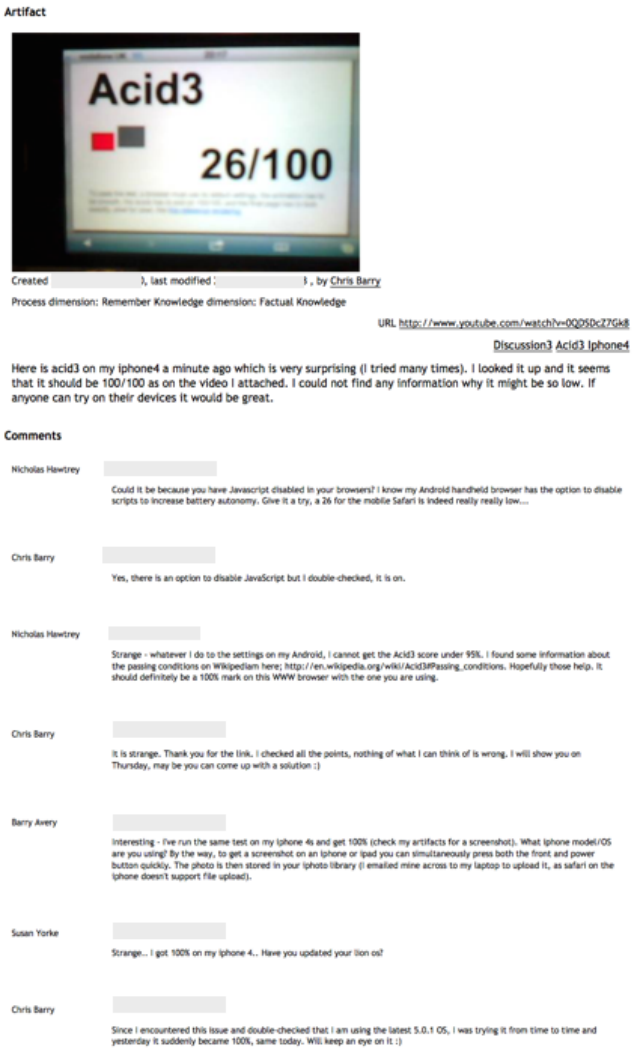


Figure 6.11 - Curation artifact with comments

Weeks four and five

Weeks four and five continue the transition away from the database material to more complex web design using HTML and CSS. Lecture and lab time covered a full range of activities and exercises ranging from simple web page creation to a complete web site redesign. As participants moved through the material, the artifacts reflect students catching up on work from previous weeks (Chris B.), attempting simpler web design activities (Sanjay S., James L.), or showing the intermediate steps that were required to complete a larger project (Pamela D., Nicholas H.).

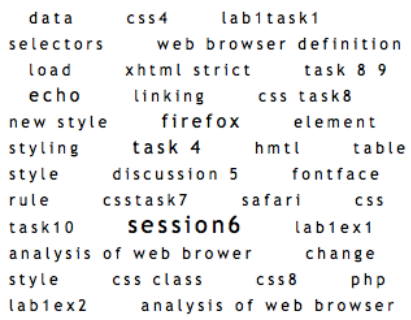


Figure 6.12 - Tags for week four

The switch in subjects is reflected in the tag cloud, where the descriptive labels start using HTML and CSS terminology. These are combined with tags that suggest sequencing (css4, css8), although these emerge from the participants rather than the tutor (figure 6.12).

Compared to the first three weeks, the overall level of activity decreases over these two weeks. The majority of participants create artifacts, but these are created with less distribution over the week. Artifacts reflect longer and more complex activities suggested by the in class materials.

There is greater variability in participation level in these two weeks. Brian H. was encouraged to increase his participation more towards the end of week three and responded by creating 21 artifacts, although the analytics suggest that both he and Chris had participated less, situating them on the edge of the community. Kevin L. continued his low level of interaction with others and created few artifacts compared to his work in week three.

The creation of curation style artifacts continued, aligning with material covering the theory of web design and browser architecture (figure 6.13). As before, these were more likely to promote comments and discussion on their content.

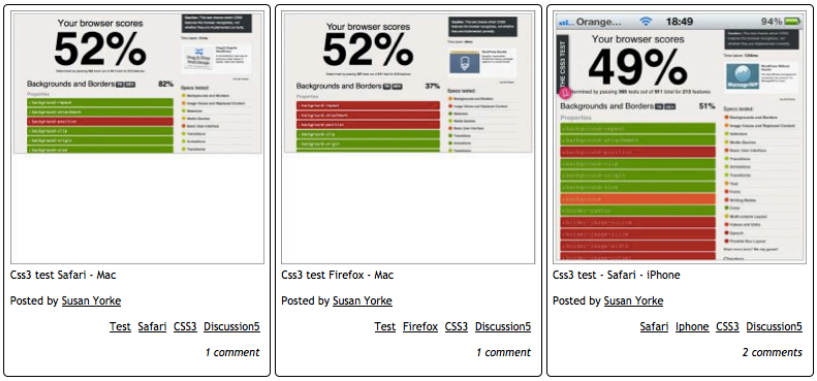


Figure 6.13 - Susan creating artifacts using browser tests

Week five introduces web programming, so many of the artifacts start to reflect the smaller activities that are typical when starting a programming language. Other participants continue posting CSS artifacts from the previous week. There is a lower level of activity over the week, after an initial surge of 57 artifacts created on the day of the first session. Many of the curation artifacts were on web technologies attracting more comments than the programming artifacts, similar to week four. The timestamps and activities in class suggest more compression of artifact construction around the lab class in this period.

Michael B. and Tristan C. were disconnected outliers in week four, but increased their activity levels slightly in week five following a nudge. Jim C., Brian H., James L. and Kevin L. continue their low levels of participation with small numbers of artifacts created. This separates them from a core group of seven participants who from this week on attend, post and interact regularly.

Weeks six to eight

Week six sees the majority of the participants focus on problem solving activities in programming, with no curation style artifacts being created. Chris B. and Brian H. have bursts of activity catching up on previous works material, with Brian having minimal interaction with others, whilst Chris B. interacts more (table 6.11).

		Mon	Tue	Wed	Thr	Fri	Sat
Chris	Barry	4	17				
Sanjay	Singh		1	6	4		
Brian	Hodgson			10			
Michael	Briant	7				2	
Barbara	Bruce	8					
Nicholas	Hawtrey	7					
Pamela	Davy		3	1	2		
Hannah	Summers		6				
Susan	Yorke	1			1	2	
Tristan	Cary	4					
Gillian	James	2					
Kevin	Lloyd	2					
Barry	Avery						1
Gerry	Davis						
Steven	Scott						
James	Latham						
Jim	Cole						
Richard	Kane						

Table 6.11 - Artifact creation by day

Tags used reflect semantics from the programming language e.g. uppercase, conditional, although Pamela D. mechanically labels her artifacts using sequences (table 6.14).

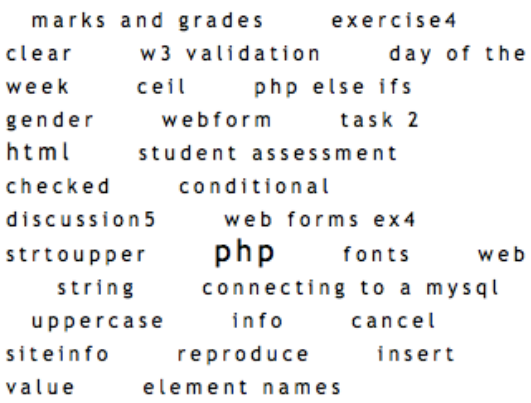


Figure 6.14 - Tag cloud for week six

Both Richard K. and Jim C. fail to create any artifacts this week, although they interact with others' work in a similar pattern of activity to their work in week five. Gillian J. and James L. have minimal input, although their work is looked at by others. A core group of Hannah S., Chris B. and Nicholas H. continue a tight interaction with each other.

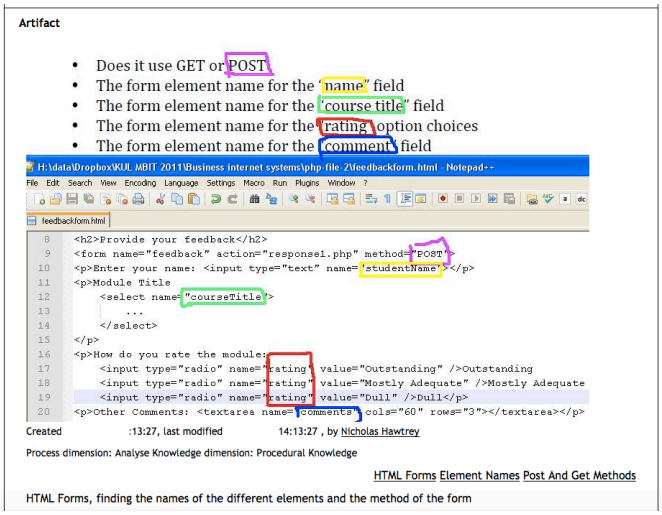


Figure 6.15 - Artifact framed with hints

The multiplicity of the artifacts produced decreases when demonstrating smaller programming tasks compared to the previous subject areas – typically a single artifact is created for a single activity, rather than many artifacts showing a series of problem solving stages. Some of the artifacts are framed with hints and tips for the wider group (figure 6.15).

The consequence of a burst of activity is a reduction in the number of comments or views of the work – Chris B. creates 21 artifacts this week but much of his work is not interacted with. There is also a lack in variety in his tags, and terse reflective statements.

In week seven (table 6.12), many of the artifacts are created on the day of the first taught session, a pattern which continues on into the last week of the cycle.

Table 6.12 - Artifact creation for week seven

		Mon	Tue	Wed	Thr	Fri	Sat	Sun	Mon	
Jim	Cole								23	23
James	Latham			11	5					16
Gillian	James	7			4					11
Steven	Scott				9					9
Richard	Kane	1						7	1	9
Pamela	Davy	5	2							7
Tristan	Cary	7								7
Sanjay	Singh	6								6
Chris	Barry	6								6
Nicholas	Hawtrey	4								4
Kevin	Lloyd	4								4
Barbara	Bruce	3								3
Susan	Yorke					2				2
Hannah	Summers	2								2
Gerry	Davis									0
Barry	Avery									0
Michael	Briant									0
Brian	Hodgson									0
		45	2	11	18	2	0	7	24	

Figure 6.16 - Artifact seeking help

Jim C. creates 23 artifacts after little interaction or activity for nearly three weeks. James L. creates artifacts over two days seeking help, to which the online community responds with suggestions (figure 6.16).

The final week of the cycle sees many of the participants continuing with the creation of artifacts after the taught session with little activity for the rest of the week. Only four participants create any work at later times, with five of them not participating and Jim C. interacting with others but creating no new work. Pamela D., Richard K. and Susan Y. create work on different days, but of these three, only Richard K. interacts with others' work. The remaining students reduce their online activity to a minimum, with most of the interaction being at the start of the week. Chris B. has a last surge in activity creating 22 artifacts at the end of the cycle.

The next section presents the analysis of the teacher's comments attached to each artifact, analysed using teaching presence derived from the community of inquiry model.

Coding comments for teaching presence

For the first third of cycle two, a greater proportion of the tutor comments were directed towards instructional design, organisation and facilitating discourse. This is to be expected in the initial developing phase for an online community, with the instructional design support evenly split between establishing netiquette and utilising the medium effectively. Comments encouraging more meaningful reflective statements and tags have been designated as utilising the medium effectively, as the reflective statements would be useful for both the participants and others' reflection on action by looking back at own and others'

artifacts. Advising about the use of the system more generally, such as asking for fields to be filled, has been placed under the more general category of netiquette (table 6.13).

Table 6.13 - Coded teaching presence for weeks one to three

	Chris Barry	Gillian James	Pamela Davy	Steven Scott	James Lathem	Jim Cole	Kevin Lloyd	Sanjay Singh	Gerry Davis	Tritan Cary	Nicholas Hawtrey	Barbara Bruce	Hannah Summers	
Instructional Design and organisation		1	2	1		1	2		3	1	2		3	16
Facilitating discourse	1	1	2		2		1	2			1	4	2	16
Direct instruction				1				4					1	6
	1	2	4	2	2	1	3	6	3	1	3	4	6	38

Facilitating discourse in this context mostly entails drawing in participants with further questions and the promotion of links, encouraging students to look at and comment on others' artifacts. Fewer comments fall in to the encouraging or reinforcing category.

Instructional design in the middle third of the cycle drops away, with more comments in other categories. The direct instruction codes show a variety of comments ranging from feedback, through to summarising and pointing to knowledge from other sources. The facilitating discourse category, which is key to the networked learning philosophy, is used here to promote connections between the participants and to reinforce the work demonstrated (table 6.14).

Table 6.14 - Coded teaching presence for weeks four and five

	Chris Barry	Gillian James	Pamela Davy	Steven Scott	James Lathem	Jim Cole	Kevin Lloyd	Sanjay Singh	Gerry Davis	Tritan Cary	Nicholas Hawtrey	Barbara Bruce	Richard Kane	Susan York	Hannah Summers	
Instructional Design and organisation				1					1						1	3
Facilitating discourse	1		2	1	1			1	1		5		2	2	3	19
Direct instruction	2		1	2			1	1					1	1	1	10
	3	0	3	4	1	0	1	2	2	0	5	0	3	3	5	32

The final third of the cycle indicates a decrease in discourse comments, although this is a small drop. The comments from the second phase continue, with the increase in participant activity offsetting the tutor's role to some extent (table 6.15).

Table 6.15 - Coded teaching presence for weeks four and five

	Chris Barry	Gillian James	Pamela Davy	Steven Scott	James Latham	Jim Cole	Kevin Lloyd	Sanjay Singh	Gerry Davis	Tritan Cary	Nicholas Hawtrey	Barbara Bruce	Richard Kane	Susan York	Hannah Summers	
Instructional Design and organisation																0
Facilitating discourse	1		4		1						3		2	1	1	13
Direct instruction		1	2		2				1		1			3		10
	1	1	6	0	3	0	0	0	1	0	4	0	2	4	1	23

The difference in facilitating discourse between the three parts of the cycle does not seem to be significantly different, but the underlying code reveal a greater number of comments designed to draw in the contributors in the first weeks, with a greater number of comments acknowledging and reinforcing contributions over the last two thirds of the cycle.

The next section presents the interview responses, from eleven of the cycle two participants.

Interview responses

Responses in this section are generated from eleven semi-structured interviews conducted after the end of the cycle. During the interviews, participants were shown graphical representations of their activity and asked questions about their work, how they interacted with others and their perception of the group's activity as a whole. The process used to qualitatively analyse the responses is detailed in the research design, section 3.4.

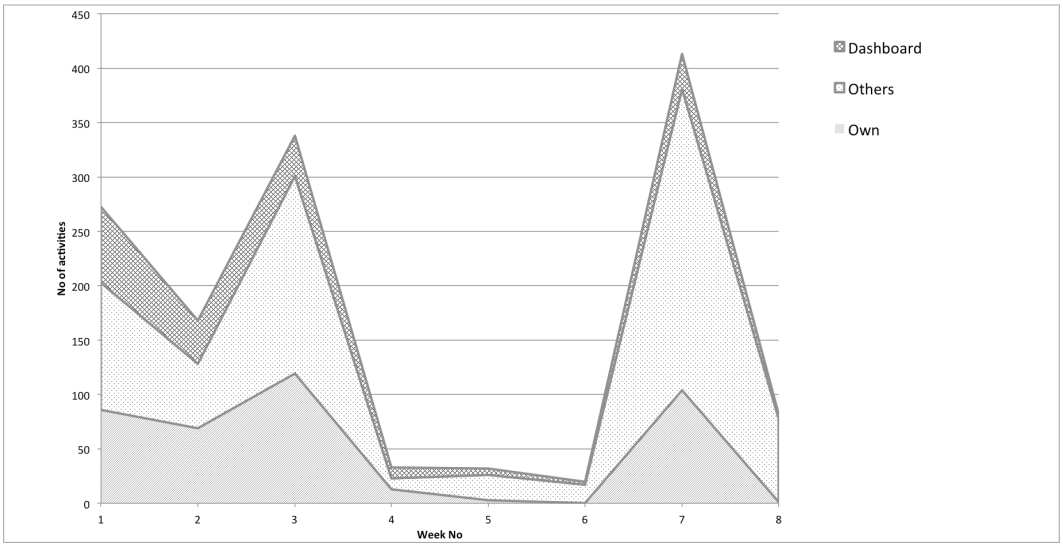


Figure 6.17 - Activity by week, for an individual participant

In the activity representation shown to each participant (figure 6.17), activities are grouped into:

- interaction with the dashboard/the landing page, which gives an indication of the amount of online activity;
- interaction with others' work – viewing, searching, commenting; and
- interaction with 'own' work – creating artifacts, viewing, searching or commenting on own work.

Artifact trigger

Participants were free to choose what they uploaded as an artifact. The trigger for uploading work varied, but for the programming parts of the curriculum a clear success moment initiated artifact creation:

> "solve the problem and then upload it" – Nicholas.
> "If something goes right, it's always a good one" – Steven.
> "if it was something hard that I did right!" – Susan.

Artifacts containing code with errors were posted with requests for help:

> "When it wasn't working, it was a trigger. I'll upload it." – Susan.
> "It was either things I was stuck on and couldn't figure out" – Michael.

For the curation and broader based artifacts, it was links to materials that had been useful in their learning process, for their own and by extrapolation what they thought would be useful for others:

> "For me, it was just uploading anything that I learned or anything" – Tristan.
> "I ran the tests on my phone and when they didn't work thought it would be interesting to see what the others got" – Chris.
> "I used the YouTube videos on the bits I got stuck on and thought they might be useful for the others" – Nicholas.

Few curation artifacts were created towards the end of the cycle.

Failing in public

All the participants declared that they had no issues with uploading work that needed help and could see the advantages of peer support when it came to

seeking assistance. Despite this, four of the participants did not take any opportunity to upload work like this, with two saying that they preferred to resolve issues in class. When interviewed they suggested that upon reflection they wished they had acted differently:

> "I didn't upload them, to be honest I think I should have" – Tristan

Enculturisation

Most of the students looked at others' artifacts to deduce what they should upload and how the reflective statement should be phrased. This also encouraged the use of the folksonomy tags, which were successfully used to tag artifacts "I remember looking at other people's stuff and saw the key [words]" – Tristan.

The immediate use of the keywords for searching also encouraged their use:

> "I could see how the key words could be useful" – Tristan.
> "other people putting text in encouraged me to do it" – Susan.

However - the taxonomy labelling failed:

> "I didn't see the point of it" – Brian.
> "I tried it but couldn't see the relevance to me" – Susan.
> "I gave up after a while" – Pamela.

Activity

Seven of the participants suggested that the real-time presentation of artifacts encouraged more frequent regular working practices compared to other modules, although the frequency of this work was not necessarily weekly:

> "you had to do a bit of work every week to keep up" – Hannah.
> "I just divided it. I was a week working, a week not" – Chris.

As creating artifacts became part of their workflow, the peaks and troughs indicated by the activity graph do align with the work undertaken by the participants:

> "I was really active over the last two weeks" [indicates the picture] - Hannah.

"I became regimented in what I do" – Pamela.

The analytics make gaps in the activity pattern visible, although six of the students did not identify smaller gaps in their own activity until presented with the analytics. Aside from suggesting it was other assignments taking their time, they found it difficult to articulate why the decrease in activity was there:

"I was at home, just eating" – Nicholas.

Three of the participants with longer gaps were reluctant to be drawn into a conversation about the period:

"I can't remember what I was doing during those weeks" [of inactivity] – Michael.

Visibility

All the work in the e-Portfolio is visible to all. Participants had no issues with this, with the advantages regarded as obvious:

"I could see examples of how it's done properly" – Tristan.
"yes - I knew who to ask" [for help] – Kevin.
"It was more open to help everyone. It was very helpful" - Nicholas.

One participant claimed that he wasn't interested in others' work and said that it made no difference to his usage of the system, "even if it did bother you - you can brush it off and just see your own work" – Chris.

Perception of activity

Students think about workload and derive how much work they should be doing from a complex interplay of signals from the tutor and the amount of work they perceive that others are doing. Making work in a trusted group is seen as a motivating positive process:

"I think it shows my learning process" – Pamela.
"I had to prove myself as well – an obligation" – Nicholas.
[I worked] "because of the general volume of work" [of others] – Steven.
"helps tell a story" – Tristan.

Despite interacting with others' work, they have little perception of how much their work was viewed or used by the others. Participants suggest that they have an idea of where they would sit in terms of activity compared to others and in relation to the whole group, although they are hesitant to reveal this placement. Nine participants position themselves roughly in the correct third in terms of top, middle or bottom levels of activity.

Participation and commenting

Participants liked the collaboration, but there was an emphasis of quid pro quo:

> "I don't really mind sharing what I do, as long as everybody else is willing to do the same, at least offer comments" – Sanjay.
> "I got immediate feedback which was good" – Chris.
> "I wasn't sure whether other people would be interested in it or not" – Michael.

Interacting with others encouraged the feeling of working in a team:

> "You just have the feeling of teamwork a bit" – Chris.
> "we're the same team" – Gillian.

Searching and looking

The e-Portfolio provides a variety of ways to interact with others' artifacts, including using links from the dashboard/landing page, viewing recommended artifacts or by participating in a comment chain attached to an artifact. When asked about navigating through the archive of artifacts, the participants suggested that they had different ways of exploring the system, some by browsing backwards through time, others by keyword searching on the folksonomy system.

Seven of the interviewees suggested that a common way to find artifacts was by searching through the artifacts of a named participant. Eight of the participants correctly identified the most prolific participant by name, and looked at her work regularly suggesting her developing reputation and perceived strength:

> "she was always first to post" – Gillian J.
> "[she was] prolific" – Steven.
> "it's [their] reputation isn't it" – Hannah.

One participant said that having the same people being the first to post can have a negative effect “it was annoying”, although it meant “her reports [artifacts] are quite easy to find” – Chris.

The idea of online reputation influenced Gillian, “I looked for the strong people”, whilst another claimed that “I used them all fairly equally” – Chris. The notion of style or usability was another factor, “I looked for people whose style I could follow” – Gillian.

After the initial activity Pamela, the most active participant, rarely searched for others’ work because of her perception that she was “in front” of the others:

> “a lot of other people didn't have anything uploaded on those things yet, so I couldn't even look up and see what did they do"

Despite this, she readily commented on others’ artifacts and replied to comments on her own work.

Analytics

Three weeks into the cycle, the analytic was introduced onto the front page representing the number of artifacts and comments for the logged in user, in the context of whole group activity levels.

Most saw the measure as a positive representation of their own work:

> “It kind of kept me on track" – Tristan.
> “It was good because it was a motivation factor for me. In a different way” – Kevin.

It did not introduce a competitive aspect for the majority of despite them sharing the number with each other. Some students compared numbers:

> “my friend asked me, ‘How many have you done?’ I said, ‘108’” [laughs], "I have done 40 or 45” – Hannah.
> “we talked about the line” – Steven.
> “we discussed how many posts were uploading” – Susan.

The analytic showing work in relation to the group as a whole was less satisfactory, as it resulted in rapid recalculations:

> "I found it a bit annoying, to be honest" – Chris.

Pamela expressed little interest in it:

> "No, and I think would never ask, people never ask me how many artifacts, or how many uploads do you have, and I would never ask other people, about a number, because for me, it is not only about the amount of stuff you upload, but it's the learning process"

Monitoring and Privacy

Despite the explanation of the way in which activity was recorded in the e-Portfolio during the induction, three participants were surprised at the level of activity detail that could be derived from the history of interactions:

> "My goodness. You've really been keeping track of a lot of things" – Steven.

Although surprised, they did not seem to find this aspect objectionable. Four participants enquired as to how the information was used in real time to show others' work and would like to see more detail in the level of information recorded and the calculations used in the analytic.

This chapter has discussed cycle two, the changes introduced since cycle one, the results of cycle two and an analysis of the interviews. The next chapter discusses these results and reflects on the changes that could be taken forward into further work.

Chapter 7 Discussion and reflection on cycle two

This chapter discusses the second cycle in the context of the three research questions and then reflects on the outcomes from both cycles, with suggestions and improvements that can be made for the next iteration.

7.1 Discussion

Research question 1: What assessment artifacts emerge from co-operating participants in a learning community?

As in cycle one, many of the artifacts created were in response to materials created by the tutor, and consisted of demonstrations, solutions and requests for help. There was a significant increase in the number of artifacts and comments compared to the first cycle, with a greater level of engagement with the process indicated through both regularity of posting and content. Artifacts created in cycle two fall into four categories:

- Artifacts representing a completed activity, following a tutor set exercise.
- Artifacts demonstrating the application or use of a technique initiated by participants themselves.
- Artifacts asking for help or guidance on an activity.
- Curation style artifacts representing external learning resources that have been of use.

There is an increase in the number of artifacts requesting help or demonstrating curation, although the majority of artifacts are still created in response to tutor set exercises and activities. In cycle one, little guidance was provided on the nature of artifacts, which influenced the types of artifacts created and resulted in an initial hesitation to publish. The direct guidance provided during the induction resulted in a higher number of both solution style artifacts and curation artifacts, from the beginning of the cycle.

Discussion threads were more likely to form around requests for help or curation, although there is a divide in the nature of these as the cycle progresses. During the first five weeks, threads formed around curation artifacts, with online discussion on the web sites, videos and news stories that had been referenced. In the final three weeks with the initiation of the programming material, the number of curation artifacts dropped to zero (table 7.1) and the discussions changed to asking and answering questions about programming. Many of these

offered formative corrective feedback indicating the usefulness of errors (Stefani et al., 2007); two of the participants suggested in interview that the increased complexity of the subject matter reduced their inclination to demonstrate curation although others could not articulate why this occurred.

The nature of curation was discussed during the induction and then demonstrated in greater detail in the second week. The timestamp and content of the curation artifacts created suggest a wider, more ingrained engagement with other sources of relevant educational material, which is also reflected in the discussions that formed around these items.

Table 7.1 - Curation artifact production in cycle two

Week	1	2	3	4	5	6	7	8
Curation Artifacts	15	47	23	29	35	0	0	0

The usefulness of external resources to the rest of the community is a key determining factor when choosing whether to create a curation artifact:

> "I posted things that were useful" [to others] – Steven S.

The majority of these artifacts contained clippings and links to other web pages that were relevant to the subject being discussed in class at the time. Six of the artifacts contained multiple links and text descriptions, akin to a mini literature review of useful links to a subject area. Other types of artifact demonstrated various web tests on tablets and mobile phones, which encouraged other participants to run the same test on their devices.

There is a far tighter cohesiveness to the group compared to cycle one, with the majority of the participants working through the same subjects together, visible through the folksonomy tag cloud on the dashboard (figure 7.1), and the artifacts produced. There were fewer orphaned comments in cycle two and when they did occur they were on artifacts out of the general subject flow of the community, for example a question about web design two weeks into the programming material. The other instances of this occurred where the participant had created many artifacts after a lull in activity, for example, Chris in week seven.

This module covers a wider range of materials compared to cycle one, which have a different flow of artifact creation depending on the nature of the subject and the teaching material used. The introductory database material has many small opportunities for demonstrating learning, which results in larger numbers of artifacts, posted more frequently, covering one activity per artifact. The web page design and implementation material has longer activities, which results in many artifacts showing more complex snapshots of a single project in progress. The three distinct phases of database, web and programming material were introduced in sequence and the flow of artifact creation changes when the subject changes, with a drop in activity, which then starts to increase again as the newer subject progresses.

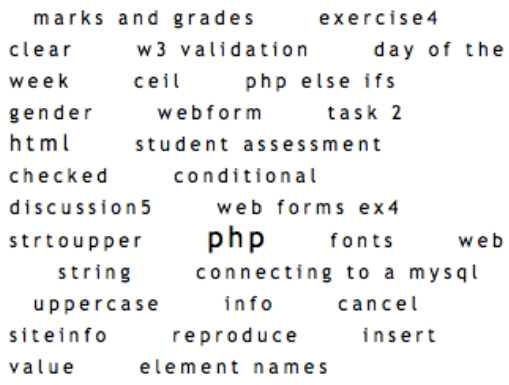


Figure 7.1 - Richer folksonomy tags

The majority of the participants integrated the creation of artifacts into their working practices, revealed by the regularity of their posting and the artifact creation time and date stamps. Only two students bulk upload work, and this was after a short break in activity, typically measured in days of "catch-up" work rather than in weeks. The analytics and artifacts in the e-Portfolio make such gaps in activity visible when circumstances, such as other assessments, reduce the focus on this module's work. Participants could not, or would not articulate why these gaps in activity occur.

There is less mechanical folksonomy labelling on artifacts in cycle two (figure 7.1). The taxonomy system was promoted and explained in the induction along with interface changes that embedded suggestions and help as artifacts were created. Despite this the usage patterns were very similar to those in cycle one, where after a few attempts, the use of the taxonomy dropped away very quickly. Similar to cycle one, participants suggested that the lack of an immediate obvious value to their learning process limited its use.

Participants responded positively to the changes introduced through the stepped induction process, by integrating the construction of artifacts into their working practices, along with the use of tags and fuller reflective statements. There is a relationship between edge placement in the community and failing to attach information to the artifacts, which suggests that a lack of participation results in

fewer opportunities to accept the rites and practices of the community. Tristan, who was slow to start creating artifacts, is an edge participant who didn't follow the community in using tags and fuller reflective statements, despite encouragement from the tutor.

Research question 2: How are artifacts shared, used and reused by the community?

Using others' work

Participants in cycle two reported no issues with the way in which the portfolio community made visible their artifacts and participation levels. The number of isolated nodes (islands), is less on a week by week basis compared to cycle one. In this case, however, participants move in and out of isolation between weeks four to seven, so it is frequently not the same inactive person suggested by the island count measure, supporting the importance of triangulating this data with the sociograms. The values for reciprocity and graph density (table 7.2), highlight a change in the activity level that occurred at the switch in subject after week four. The drop in reciprocity and density in week seven corresponds with an increase in the number of interactions with others' work. This and the data from the activity tables reveals that there were particularly popular artifacts being viewed and interacted with. Search records and the interviews suggest that this was driven by a perception of expertise of the author.

Table 7.2 – Density, reciprocity values with artifact creation

Week No	1	2	3	4	5	6	7	8
Graph Density	0.340	0.359	0.490	0.264	0.209	0.176	0.179	0.104
Reciprocity	0.519	0.472	0.56	0.469	0.281	0.222	0.145	0.063
Create or view own work	751	751	936	695	372	260	489	432
Interact with others' work	1090	878	1456	610	364	361	664	341

Even though the activity patterns are different between the cycles with larger number of artifacts and comments produced in cycle two, averaged individual activity is around the same level as cycle one, with individuals looking back on their own work four times a day and interacting with others' work six times a day (table 7.3). The significant increase in the interaction with others' artifacts (table 7.4) resulted from many of the artifact being presented on the dashboard, suggesting a change in the way that work was discovered.

Table 7.3 – Activity and artifacts created in cycle one and two

	Cycle One	Cycle Two
Artifacts created	370	1247
View another's artifact	2130	2667
View overview of others' work	2139	1606
Searching on another's artifacts	1769	1469
Total	6038	5742
	7.1 times a day	6.0 times a day

Participants who sit at the edge of the network because of a low level of activity or interactivity, typically bulk upload, although this was not to the same extent shown in cycle one. They often had questions or queries left dangling, suggesting that the notion of quid pro quo and visibility of a participant's activity was a contributing factor as to the likelihood that a question would get a response. In some cases this may also be because of their out of sequence uploading, compared to the flow of the rest of the community. The majority of the participants regarded the visibility of others' work as a positive motivating factor, but two said that they felt *obligated* to create work and that they could then see when they fell behind, despite the fact that participants were not given guidance about frequency of posting. For many of the participants, the perception of a level of required work induced a regularity to their posting "you had to do a bit of work every week to keep up" – Hannah.

There were fewer islands and consistently higher degree values in cycle two, which indicates better connectedness, popularity and influence. Those participants identified in the interviews as being most influential in the group have higher eigenvector centrality values (Pamela, Hannah and Nicholas), which is a measure of how well a person disseminates information, through the popularity of their artifacts. Participants acknowledged the motivating effect of seeing others' artifacts, and in the visibility of the group's level of activity. The shorter closed style activities at the beginning of the cycle provided solutions that work could be checked against, whereas the more complex open exercises from subsequent weeks, provided hints, suggestions and opportunities for discussion.

Those that were first to post in each week used others' work less, as there would not be any artifacts of relevance at that time. There is the possibility of a negative

effect associated with becoming the frequent 'first to post' participant, which was described as annoying by one student.

Table 7.4 – Interaction with others' work

Week No	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***
View another's artifact	386	445	689	317	196	165	318	151
Interact with other work (sum)	1090	878	1456	610	364	361	664	341

Students with higher levels of artifact creation are more likely to be central to the network as they have high participation levels. Analysing actor placement in each sociogram reveals patterns of participation where participants with higher levels of activity are centrally placed; those with lower levels are on the periphery. Combining interaction levels with number of artifacts produced by week (figure 7.2), confirms a relationship between these two. In cycle one actors on the periphery generally created one or two artifacts. This trend can be observed here, although the higher levels of overall activity mean that participants can be peripheral with a higher number of artifacts (for example 3, 9, 5 and 16).

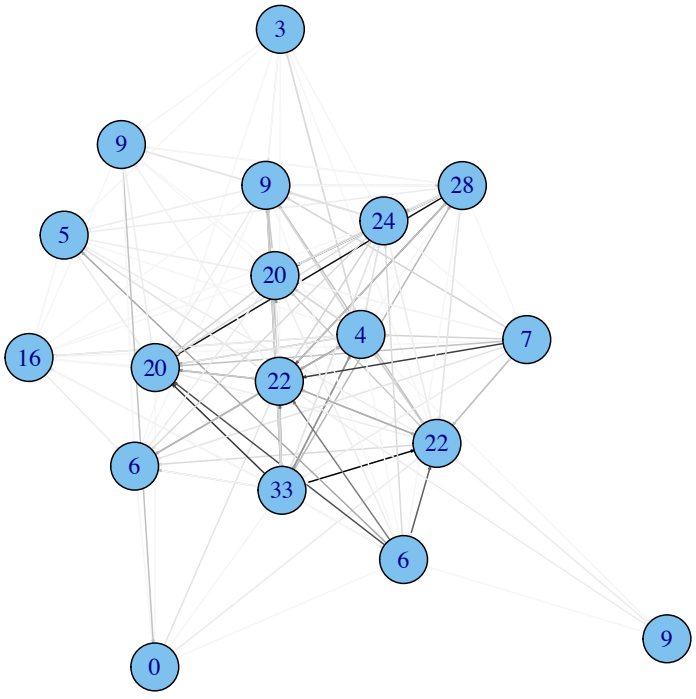


Figure 7.2 – Sociogram for week three with overlaid artifact creation levels

There are occasional outliers, with larger volumes of artifact creation and low levels of interaction, which can signal a participant returning to activity after a

gap, for example Jim C. with 28 artifacts. Lulls in participation in this cycle tend to be shorter than in the first cycle and last five to ten days.

The sociograms can be used to deduce the number of times that each participant is on the periphery of activity (table 7.5), which has been used to categorise the students into three bands of activity, after peripheral, active and intense levels of participation (Wenger, 2002):

- High peripheral activity – more likely to be placed at the edge, five to eight times over the eight weeks.
- Medium peripheral activity – occasionally at the edge, three to four times over the eight weeks.
- Low peripheral activity – infrequently at the edge, zero, one or two times.

This categorisation corresponds with the eigenvector centrality score; high peripheral activity places the participants at the lower end of the scale as they are less likely to connect to higher influencers. A red zero indicates no participation and no artifact creation, which is shown as an island on the sociogram. At the extreme ends sit Tristan (TCA) and Nicholas (NHA); Tristan has four weeks of no participation or artifact creation, whilst Nicholas actively participates every week and is never on the periphery. Pamela (PDa) is correctly identified as one of the most active participants by the others, although she was on the periphery in week four where she created five artifacts and interacted with others' work less.

Table 7.5 – Artifact creation levels for participants on the periphery

		Week No								*Peripheral Participation level*
		wk1	*wk2*	*wk3*	*wk4*	*wk5*	*wk6*	*wk7*	*wk8*	
Participant	TCA	0	10	9	0	0	0	7	0	High
	KLI	0		16	3	0	2	4		High
	BHO		3	0		1		0	0	High
	JLA			5	7	0	0		4	High
	MBR	0		6	0			0	0	High
	GDA	1		3			0	0		Medium
	RKA		0	9		2	0			Medium
	CBA	0	0					6		Medium
	GJA		8		11		2			Medium
	JCO				0	0	0			Medium
	SSI			6				6	0	Medium
	BBR		7		6					Low
	HSU							2	0	Low
	PDA				5					Low
	SSC								5	Low
	SYO								6	Low
	NHA									Low
No of artifacts		239	169	243	179	99	91	109	118	
Average no artifacts		14.1	9.9	14.3	10.5	5.8	5.4	6.4	6.9	

Low levels of artifact creation by peripheral participants can be seen from the numbers of artifacts produced compared to the total; for example, the eight peripheral students in week three produced 54 artifacts, with the other 189 produced by more active central actors. This clearly indicates that those on the periphery are creating fewer artifacts.

Participants engage with feedback in a number of forms with comments on artifacts providing formative opportunities for reflection; the visible reification process amongst the peers suggests levels of appropriate activity; the nature of the artifacts indicates the overall types of activities that are being followed. The activities for students inside each band of peripherality can be calculated, shown as a raw score and as a ratio to the number of students in each group, so for example, on average 45 artifacts per student were created in weeks one to eight by those with high peripheral participation (table 7.6).

Table 7.6 – Activity of the participants by band

	Peripheral participation					
	High		*Medium*		*Low*	
Activity	No	Per person	No	Per person	No	Per person
Create/View own work						
Artifact upload	225	45.0	472	78.7	538	89.7
View overview of own work	369	73.8	867	144.5	1064	177.3
Viewing one of own artifacts	145	29.0	355	59.2	384	64.0
Interact with others work						
View a subset of others artifacts	93	18.6	897	149.5	277	46.2
View a specific set of near artifacts	16	3.2	56	9.3	10	1.7
View all artifacts (excluding own)	375	75.0	404	67.3	389	64.8
Viewing someone else's artifact	390	78.0	1017	169.5	758	126.3
View all thumbnails	4	0.8	1	0.2	2	0.3
View thumbnails						
View own thumbnails	28	5.6	63	10.5	77	12.8
Dashboard						
View Dashboard/Recent activity	375	75.0	817	136.2	1082	180.3
View Dashboard/Recently Commented Artifacts	19	3.8	23	3.8	47	7.8
View Dashboard/Recently Viewed Artifacts	19	3.8	32	5.3	35	5.8
Comment Threads						
Comment on an artifact	36	7.2	84	14.0	98	16.3

The pattern of activity for participants interacting with their own work is as would be expected, with those on the periphery uploading and reflecting on their own work half as frequently as those in the middle. Very active students in the low category have the highest values for both this and for dashboard use.

In most modules the level of work others are doing can be difficult to perceive and students have little ability to gauge their own activity compared to this. Here, all participants use the overview mechanism equally indicated by the view all artifacts (other) value. This allows others' activity levels to be deduced, "You could get a perception of who was actually doing loads of work." – Kevin.

Table 7.7 – Search popularity vs peripherality

Firstname	Lastname	Search count	Periphery band
Pamela	Davy	296	Low
Nicholas	Hawtrey	226	Low
Barbara	Bruce	124	Low
Gillian	James	86	Medium
Steven	Scott	64	Low
Sanjay	Singh	48	Medium
Susan	Yorke	48	Low
Gerry	Davis	48	Medium
James	Latham	48	High
Chris	Barry	34	Medium
Jim	Cole	34	Medium
Richard	Kane	29	Medium
Tristan	Cary	28	High
Brian	Hodgson	28	High
Kevin	Lloyd	24	High
Hannah	Summers	22	Low
Michael	Briant	6	Medium

Participants with medium levels of participation search and view others' work far more frequently that those on the edge or with high activity levels. Highly active participants who created work early in each week, were less likely to interact with others as there wouldn't be any artifacts on the subjects they were working on, which aligns with Pamela's interview comments.

Actors with high levels of artifact creation tend to sit more centrally, develop an online reputation and have work viewed more frequently. Similar to studies by Cho (2002) and Beck (2003), participants are more influential if they are centrally placed and are more likely to be searched for by name. The five most frequently searched for people, are more centrally located actors, while the least searched are more likely to be on the periphery (table 7.7).

Plotting periphery placement and numbers of artifacts created reveals that the relationship is complex as prolifically creating artifacts does not guarantee high levels of centrality (table 7.8). Many of those frequently cited as demonstrating expertise had higher levels of artifact creation, but were cited in the interviews because of their regular early in the week posting.

Table 7.8 Artifact creation vs peripherality

Firstname	Lastname	Artifacts	Periphery band
Chris	Barry	137	Medium
Sanjay	Singh	128	Medium
Barbara	Bruce	123	Low
Hannah	Summers	120	Low
Gillian	James	119	Medium
Susan	Yorke	113	Low
Jim	Cole	112	Medium
Pamela	Davy	104	Low
Steven	Scott	89	Low
Tristan	Cary	88	High
Gerry	Davis	87	Medium
Richard	Kane	77	Medium
Nicholas	Hawtrey	75	Low
Brian	Hodgson	73	High
Michael	Briant	67	Medium
James	Latham	65	High
Kevin	Lloyd	53	High

The greater number of comments, question and participation in cycle two offered more opportunities for knowledge sharing and cascade, with the participants tending to more closely follow paths through the same subject areas at the same time. Analysis of the artifact content by time (figure 7.3) reveals the alignment between the participant's work, with many of them producing artifacts in the same subject areas at the same time.

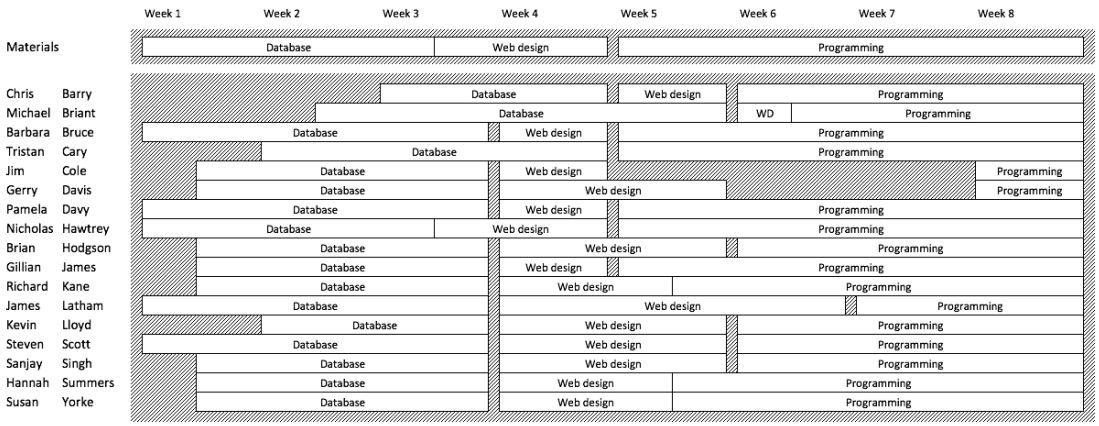


Figure 7.3 – Artifact creation for subjects over time

Research question 3: What is the role of the tutor and the form of the community?

This section breaks the research question down into three parts, analysing the role of the tutor as teacher providing direct instruction, and tutor as facilitator

shaping and forming the community. This is followed by a discussion on the nature of the learning community present in cycle two.

Tutor as teacher

Despite a greater amount of time demonstrating and explaining the nature of artifacts during the stepped induction process, some of the participants still needed to be guided 'in cycle' during the first few weeks in attaching reflective statements and tags, similar to behaviour in cycle one. Participants had a free choice in the nature and frequency of artifact production, but they were taken through the process of artifact creation in class, along with the way in which it could be embedded inside working practices, suggesting the advantages of creating as they progressed. The activity tables and artifacts created indicate that this succeeded, with the majority of the participants regularly posting compared to cycle one.

Encouraging folio-thinking was done here by explicitly demonstrating the approach in class, with participants following along and publishing their own artifacts, embedding the creation of artifacts in an active learning approach. Particular activities were also designed to show the advantages of posting questions and queries in the e-Portfolio, by asking participants to comment on artifact examples requiring help or with errors.

Following on from the suggested pattern of activity in the e-Portfolio moderation model the first set of exercises were short, tended to be closed in style, had definitive answers and were designed to encourage participation. Curation style artifacts were fostered through the use of discussion topics, which participants responded to by creating links to YouTube videos, links to other resources and reading lists.

Different subject areas create opportunities for different styles of activities, which have different rates of artifact creation. Example included:

> *Closed short activities*
> Write a query to find the first names
> Increase everyone's salary by 10%
> Create a database table with particular columns
> Print "hello world"

Open activities
Design and implement a table to record information on employees
Write demonstration programs to explain the use of four functions of your won choosing
Create a web page to display your results
Create a web form and response page to print the results

Curation style activities
What are the features of the new HTML standard?
Is the infrastructure of the Internet controlled?

The tutor has to blend these, attempting to balance the opportunities for creating different artifacts across the teaching period. Initial closed, short activities are more likely to result in one artifact per activity, but enable an introduction to the process of reification. Gradually segueing into open activities, can result in fewer artifacts being created, but these tend to be multiple artifacts covering the same project material, reflecting the activities larger size and scope. In subject areas that can be more exploratory in nature, such as design or programming, the different solutions possible prompted discussions of best practice and opportunities for queries to be solved by peers. Curation style activities are more likely to promote discussion and engagement with external resources, but this has a prerequisite that the participants have appropriate researching skills and tools.

The importance of attaching meta-data to created artifacts was emphasised in the induction and suggested as appropriate netiquette by the tutor online in the first two weeks. Many of the participants responded to the tutor comments by tagging and adding reflective texts, but despite this, two of the students did not add reflective statements regularly. Promoting the use of tags resulted in rapid adoption, but as in cycle one, the tutor advocating the use of the taxonomy failed to engage the students.

As in the previous cycle, the original intent was for the tutor to create artifacts in a peer role and there was more success in this cycle. Most of these artifacts were curation artifacts, adding content by using artifacts that linked to external material, with some offering part solutions on the more complex parts of the programming material.

Tutor as facilitator

Participants in online communities develop behaviours over time and the tutor can significantly impact on these by their presence and responses, directly affecting the density of networks (Martínez, Dimitriadis, Rubia, Gómez, & la Fuente, 2003). Participants were informed that the pace and nature of artifacts they created was of their own choosing, but the facilitator role was used to encourage activity and particular behaviours, such as regular posting.

For those students working out of the general flow of the community, the tutor has to ensure that comments and requests for help are spotted and addressed by linking to other artifacts or by transitioning the question onto another artifact that would be relevant. The switch from web design to programming was fragmented, which required extra vigilance in the tutor role when participants tackled the subject out of sync with the rest of the class or who were sat at the edge of the network (Michael B.), resulting in fewer responses to their queries. There were also parts of the cycle where participants sat at the edge of the network with minimal activity; many of the participants responded to tutor hints or tips here but there were occasions when they stepped back from creating work and tutor comments on this had little immediate effect (Jim and Gerry).

The analytics system was used to provide relevant information on individual participation, along with general levels of community activity. There are issues with the abstractions that are required to create this information, as activity graphs have time boundaries which may not correlate with the working practices of the students. A student may elect to create artifacts every other week, or may work out of the general flow of the other students by choice, which may create initial concern in the tutor. Participants may regard this as their normal working practice and may be reluctant on being drawn on gaps in this activity as suggested in the interview responses.

The initial design for the analytic system used a peer based philosophy, in that every participant including the tutor saw the same interface. Participants could only see information on their own performance in the context of the whole group, without any ranking information. Activity and discussions in the interviews suggested that this approach was accepted,

> "It kept me on track" – Tristan.

Although students expressed a desire to see how the analytics were being generated. Using the same analytic for the tutor role revealed too little information about the whole group activity, so a new 'tutor' perspective was created to enable edge cases to be more easily spotted.

The importance of determining possible artifact construction opportunities is a key design role, allowing participants freedom but creating more directed suggestions for those who find the process initially difficult falls into the facilitation role. The analytics and interview responses for Kevin L. indicate the higher levels of support he required from the tutor:

> "I come from a very minimal experience in IT. The first day it was a bit OK, what am I going to do, I panicked... I didn't have any clue when I started. So I learned a lot from others"

He was also the only student who had not collaborated with the others before as he was taking the module as an option from another course. He attributes his lower activity to both factors, followed by the switch in subject just as he was starting to create artifacts in the web design material.

The combination of sitting at the edge of participation and being out of the general flow of the community suggests high risk students where tutor facilitation should be focussed, as these participants are less likely to have their work looked at and integrated into the use of the community as a whole. As participants with weak social ties are less likely to share resources (Dawson, 2008), the tutor goal of facilitating the transition from weak to strong social ties is vital.

The learning community

The optimal version of the learning community in networked learning suggests that participants have a greater autonomy in the subject areas that they cover and that each individual determines their own path through the field. Situating NL in the traditional university setting, where courses have prescribed learning outcomes is at odds with this ideal where the traditional role of tutor as teacher, introduces materials each week using a variety of 'delivery' mechanisms.

Here, participants were allowed to make the decision about the nature of the artifacts that they wished to produce and the rate at which they produced them,

which enables them to move off a notional prescribed path. Boud (2006) argues that constructive alignment is a strategy that is unrepresentative of the types of unstructured learning that occurs in lifelong post academy experiences, where outcomes are rarely explicitly specified. Here, participants were allowed to make the decision about the nature of the artifacts that they wished to produce and the rate at which they produced them, after the equifinality community model (Pedler, 1981). Despite this freedom, the nature of the artifacts produced are heavily influenced by the taught subject; the nature of exercises and activities in the teaching materials; and by other artifacts produced by the group.

The regularity of posting is influenced by the subject and the activity of the group, which develops a rhythm of participation, as is typical of groups in a community context (Wenger, 2002). Prompting the initial creation of artifacts during the extended induction resulted in the majority of the participants creating artifacts at the same time. As the cycle progressed the general flow of activity followed on from the tutor introduced materials, with short delays between the material being introduced and the artifact creation beginning. This more regular posting continued through the cycle, with follow up individual activity measured in days rather than in weeks.

Participating in the community was seen as a positive way to share practice, and it was acknowledged that this was a way to get validation of their own work. A level of quid pro quo was present:

> "if I comment on others' work maybe they'll help me" – Susan.

In the second half of the course peer feedback was more likely to provide simple elaboration, particularly where artifacts were created indicating issues or problems. The tutor has to provide more sophisticated formative feedback to alter forward direction, for example using artifacts or comments to suggest areas for further exploration. Despite the peer-based design, artifacts produced by the tutor were viewed many more times than those from students. Sociograms suggest that despite attempts to reduce the 'presence' of the tutor, it was still a role regarded with significance and frequently ended up centrally placed.

Networked learning emphasises the promotion of links, between users and between users to resources. The suggestion that connections have to be promoted prompts the question of who will be suggesting the links and ensuring

that all participants have an equality of opportunity. As noted by critical stances, the possibilities of exclusion and bullying are just as possible in online scenarios. Despite emphasising a peer based community, the tutor and facilitator has to stand apart to some extent, promoting the connections and policing the community. Although many of the connections were suggested through the design of the e-Portfolio system, there were instances where direct action was required, such as to address orphaned comments or to encourage those on the periphery.

Another critique of community models exists in the possibility of conformity through community consensus and peer pressure (Hodgson & Reynolds, 2005). Although some of the personal and collective history of a community can be seen in the artifacts which perpetuate the repertoires of community practices, there is the possibility that conformity may repress a wider set of artifacts. It is also possible that a malformed notion may become regular practice if unregulated, for example a poor style or an inefficient implementation in coding. Open source advocates would suggest that "all bugs are shallow to many eyes" but this requires participants who are prepared to speak out, which may run against community pressure. It is possible that a recommender system built on a participant's work and activity history could reinforce these perspectives, only showing artifacts that mirror the artifacts that the participant has created themselves, analogous to the filter bubble possible in search engine results (Pariser, 2011). These factors together highlight the importance of the guide on the side acting outside the peer role, both to redirect incorrect paths through the learning community and to suggest alternatives and differentiation possibilities.

7.2 Reflection

The three significant changes introduced in cycle two were the use of the moderator framework, the recommender system and the more detailed dashboard.

The moderator framework increased participation and the regularity of posting, with although the highly structured induction may have delayed the opportunities for the evolution of customs and practices. Despite having well defined layers of activity, different participants progressed at differing rates making the formal application of the framework in the teaching materials unnecessary for some. Using cycle one examples in the induction for cycle two worked well, although some of the contexts were missing due to the different syllabus. Allowing participants flexibility in artifact creation allows for an

individual's 'continuum of learning' to be visible to the tutor in real time. The learning progression can then be influenced by informed action, through formative feedback by the tutor, the peers and by the activity of the group as a whole.

The analytics suggest that more artifacts were viewed after visiting the redesigned dashboard, with participants clicking through from the tag cloud and the recommended artifacts. A key theme that came out of analysing participant interviews was that they would like to know more details on the underlying mechanics used here, which would require:

- a way to examine why an artifact was recommended,
- how the analytics on the dashboard were calculated, and
- the ability to see who was using their work.

Both in class and during interview, participants expressed surprise over the level of activity detail that was recorded, despite the effort that was made to explain this in cycle two. Having the ability to trace *into* recommendations and analytic calculations should mitigate this to some extent.

Here the in-cycle activity was perceived by exporting raw activity tables into a spreadsheet, using ad-hoc calculations. Real time generation of the network measures and the sociograms would help with monitoring the activity in the cycle and the mechanisms produced will enable this process to be automated.

The graph measures shown in chapter six were calculated in a similar fashion to those in cycle one. The general measures are useful in deducing broad levels of activity, but making comparisons to other cycles is difficult and would require like-to-like comparisons where the subjects taught were the same and in the same sequence. As in cycle one, betweenness centrality seems less meaningful in this context, whereas eigenvector centrally is useful as it suggests dissemination i.e. artifact sharing across the network. This measure supports the evidence seen in the thematic analysis of the artifacts and interviews, where the high scoring participants are creating and sharing artifacts regularly (table 6.8). Degree distribution is a useful measure in networked learning, if success is measured through the number of connections being promoted between the learners. It reveals the overall pattern of activity, but needs to be combined with an analysis of the nature of the connection and the artifact content to be meaningful.

The next chapter summarises these findings against the research questions, along with a reflection on the use and success of using open source and action research.

Chapter 8 Discussion, conclusions and further work

This chapter will summarise the findings against the research questions and discuss the implications for others wishing to use the portfolio framework in their own contexts. This is followed by a reflection on the experience of conducting the study to identify the contribution, limitations of the work and suggest potential areas for further research.

8.1 Addressing the research questions

The overarching question was: What would a community based portfolio based on networked learning principles look like if developed in co-operation with the learners? The three research questions discuss the nature of the artifacts produced; how they are used by the rest of the group; and the nature of the tutor role and the community.

Research question 1: What assessment artifacts emerge from co-operating participants in a learning community?

Analysis of the artifacts and interview responses suggest that artifact representations with image, reflective text and folksonomy tags has worked in both cycles, with participants finding the mechanics of reification straightforward. Where little initial guidance or structure is provided, as in cycle one, artifacts tend to be created in response to a perception that tutor *set* activities have to be completed, limiting their range. They are also likely to only show correct work, emphasising preconceptions in the nature of assessment practices.

Categorising artifacts suggest they fall into these types:

- Artifacts representing a solution to a completed activity, following a tutor set exercise.
- Artifacts demonstrating a technique thought useful to the group as a whole.
- Artifacts asking for help or guidance.
- Curation style artifacts.

Network analysis and participant feedback suggest that an induction containing a stepped introduction and examples to demonstrate the advantages of peer feedback will increase initial participation. This needs to be combined with activities that broaden the type of artifacts that can be demonstrated, to ensure that participants integrate folio-thinking into their working practices. This is also

required to promote the value in the idea that mistakes, broken code and curation style artifacts can be shared with a broader community. Differing subject areas can produce different flows of artifact creation, depending on the nature of the exercises and activities that are used during the learning process. Shorter, closed style activities with distinct answers encourage one artifact per exercise; longer projects create opportunities for many artifacts, showing work in progress. Curation artifacts can provide a view of engagement and use of external resources, or, as in cycle one, the lack of it. Discussion threads are more likely to form around curation artifacts and where participants are seeking assistance from the community.

With a degree of initial guidance, participants engage with tagging artifacts, resulting in an emergent shared vocabulary with names and phrases that closely align with a movement through various subject areas. The analytics show that folksonomy tags are regarded as a valuable way to search and sort artifacts and participants deemed it useful when asked about it in interviews.

Participants who have irregular patterns of work are more likely to have less innovative artifacts in the types they produce, and typically produce solutions to examples and exercises in a mechanical fashion. The reflective statement used in these artifacts are likely to be shorter and less detailed, suggesting a "catch-up" process and lack of engagement with the idea of community support.

Research question 2: How are artifacts, shared, used and reused by a community?

Students are willing to share artifacts in a collaborative fashion and to provide feedback and comment on others' work, with an understanding of quid pro quo. In cycle one where little guidance was provided on the nature of artifacts to be produced, many of the participants used others' artifacts as a suggestion as to the work that they should be producing reinforcing the notion that tutor sets work that has to be completed.

The analytics and patterns of activity show that generally, others' work was viewed more often than a participant's own work, providing solutions to common problems, opportunities for discussion and a suggestion of the level of work to be produced. Most suggest that the visibility of artifacts can be motivating, but it may produce an *obligation* to work, which is less positively viewed.

The way that knowledge can cascade through a community can be traced through viewing patterns and successive artifacts. Tag clouds, recommended artifacts and recent work displayed on the dashboard or gateway to the portfolio successfully promote sharing and reuse, increasing the number of connections between learners and the learning resources.

More popular artifacts are associated with participants who post early and regularly; these participants tend to occupy a central position in the community and have higher levels of activity. Those in the middle activity band tend to search and reflect much more than those on the edge or those that are more centrally placed. Participants who post first and regularly can find it difficult to use the community meaningfully, as there won't be others' work to review and collaborate on. There is a relationship between artifact creation and activity, with those sitting on the edge of the community typically producing fewer artifacts. If combined with irregular reification, the community may fail to provide help or guidance so the tutor may have to intervene.

Research question 3: What is the role of the tutor and the form of the community?

The lecturer has a multiplicity of roles, acting as learning designer; tutor facilitating online behaviour; and teacher providing direct instruction online.

As demonstrated in cycle two, activities and exercises in the learning material form the basis for many of the artifacts. The tutor in the learning designer role has to carefully construct these so as to allow a progression from small closed activities towards more open activities that allow for greater differentiation and peer sharing. A more tightly specified induction suggesting more regular activity has here resulted in more of the participants creating artifacts around the same subjects at the same time, which is important as out of flow activity may result in less support from the community.

Using networked learning as an underlying philosophy requires the tutor to ensure there are opportunities for connections to form, which can be achieved by directing participants to others' artifacts, rather than by direct instruction. The construction and nature of curation style artifacts can be demonstrated by the tutor, but encouraging the community to post and respond to requests for help may require extra tutor vigilance as participants with regular outlier placement may have difficulty getting responses to their questions or activities. Outliers

with lower level of participation can easily be identified in this system as activity is visible, but there is the possibility that participants are working 'off line' if they have not integrated artifact construction into their working practices.

Both cycles show that participant's who create artifacts that lack reflective statements or meaningful tags can be nudged into attaching appropriate meta information, which is also helped when it develops as a custom and practice by the other participants in the community.

Analytics can provide valuable information about both community growth and individual activity, but this has to used carefully as a perception of surveillance demotivated a participant in cycle one, resulting in a change in behaviour. The evidence presented here suggests that a carefully constructed induction and visible advantages in the use of the data in a recommendation system can allay these worries.

There is a positive relationship between artifact production and overall activity, with those producing work regularly having higher visibility, more central placement in the community and a suggestion of expertise in the field. Creating artifacts early and regularly is a determining factor in the group's perception of proficiency. If a student is regularly the first to post, there can be a fall off in that person's perception of the usefulness of participation as there are few artifacts available on the same material. Here it can fall to the tutor to maintain levels of engagement by direct instruction, setting extra work; or by manually creating connections by asking participants to check, or help out on someone else's work.

The original intention was for activity and implementation inside the portfolio learning community to be fully peer based, with the interactions and interface for the tutor to be the same as that of the student participants. In practice the facilitation role required both actions and reporting tools to ensure the initial growth and monitoring of the community.

8.2 Implications for practice

The e-Portfolio and framework allow for the progression of participants in a learning community to be made visible, both for the tutor and the members. When reproducing this activity, care must be taken to ensure that the design of the learning materials reflect opportunities for different kinds of activity, which are suitable for sharing and encourage peer collaboration.

Analytics are a useful indicator of activity, but there are a number of issues to be

aware of when using them in a tutor role:

- Participants have to integrate artifact production into their working processes for the reported data to be meaningful.
- The weekly (or otherwise) cycle of activity will mark out start and end points for analytic calculations that have to match with participant's cycle.
- A natural rhythm of participation will develop, but this will be affected by the nature of the activities in the teaching materials and the group behaviour.
- Overuse or lack of information about how analytics are calculated may raise concerns amongst the participants.

The way that teaching materials are provided and the nature of the interaction directly effects the nature of the artifacts provided by the students. If the tutor acts as lecturer, the participants are more likely to respond in a traditional way, supplying artifacts that they perceive as solutions. If an attempt is made to break the learning process out of this pattern so the participants are encouraged to take more control of their own learning, the depth and variety of artifacts will increase.

8.3 Reflections on the research and limitations of the approach

There are well defined guides to the nature of summative assessment in networked learning (Goodyear, Jones, Asensio, Hodgson, & Steeples, 2001), typically emphasising a constructive approach where students have a greater determination in the nature of the assessment and peer feedback is used to feedback on the initial plan, the draft and the marking scheme (McConnell, 2006). The nature of the tutor and the feedback processes in these communities has also been thoroughly researched; the community of practice model defines the nature of the expert and the relationship to novices; the community of inquiry model demonstrates best practices and allows an analysis of the interactions between these groups.

What has been missing is an exploration of the practical mechanisms of formative feedback in the NL context. The different form of e-Portfolio shown here provides further evidence that richer formative representations are possible compared to summative measures (Yorke, 2005) and has proved to be an effective way of encouraging these responses in networked learning. The key characteristic of formative feedback is that of a path, where students become owners of their own learning and forward directions are influenced by

interactions with peers and the tutor (Wiliam, 2011). Wenger's conception of artifacts enables a rich depiction of this path, where the negotiation - participation process fosters reflection and progression (Romer, 2002). Allowing participants flexibility in artifact creation after the equifinality community model (Pedler, 1981) allows for an individual's 'continuum of learning' to be visible to the tutor in real time, enabling the learning progression to be influenced by informed action. The positioning of where the learner is and where they are going is a key aspect in formative assessment (Black & Wiliam, 2009b), and the e-Portfolio makes this 'location' visible to both the participants and the tutor.

Formative feedback is typically categorised into verification and elaboration, where verification is a simple comment on the validity of the work (Shute, 2008). The popularity of an artifact provides implicit verification from the community as a whole; comments inside the e-Portfolio fall into the elaboration category with rapid and frequent replies providing multi-layered responses and guidance, suggesting validity through improved action (Harlen & James, 1997), discussing errors, providing guidance and promoting connections. The tutor feedback role can be shared out amongst participants by using links and directions to other artifacts if facilitated through a structured induction process.

Participants engage with other forms of feedback inside the e-Portfolio community with the visible reification process amongst the peers suggesting levels of appropriate activity; the nature of the artifacts indicates the overall types of activities that are being followed by the group as a whole; participants tend to align their learning by seeing the nature of the work being created by the community, even if it is out of sequence with the tutor driven interactions (figure 7.3, p. 179).

This research focusses on a narrow field of study, where there are opportunities for practical skills and theoretical topics to be blended in the learning design and through that into the artifact construction process. The standard critiques of action research apply here; there are inherent issues in the lecturer researching their own practice as discussed in the research design chapter. It is hoped that there is an appropriate level of detail here to support Heikkinen's quality indicators (2007) such as an evocative account and workable practices.

Aligning action research with an open source philosophy can work, but only in particular domains where there are particular technical skill sets in evidence.

There can be differences between code generated in an educational environment and production code; code which is readable in class and suitable for teaching and learning may not be scalable and safe to use in a production environment. The rapid creation and implementation required to adjust the software as the cycle progresses can also be challenging, particularly as changes are made live to the software in use.

It is also possible that processes or activities that seem desirable, may take a long time to implement and then fail in practice, for example the graphical taxonomic representations. It is the nature of open source software for features to be developed that subsequently fail due to lack of demand, but this can be difficult where there are limited resources and the tutor is simultaneously developer.

The recommendation system is used to create connections between the learners and the electronic resources (artifacts), supporting the networked learning philosophy. There are issues with such systems; there exists the possibility that only artifacts from a limited set are returned, reflecting artifacts from a narrow selection that match and reinforce the participant's own views and work similar to the 'filter bubble' that has been identified as an issue in news sites and search engines. To counter this, it is important to add a degree of randomness to recommendation results, acknowledging the advantages of designed serendipity (Acosta, 2012; Saadatmand & Kumpulainen, 2013).

A more recent, potentially unethical experiment was conducted by Facebook, where the behaviours of participants were influenced by returning positive or negative news stories to separate classes of users (Kramer, Guillory, & Hancock, 2014). Facebook does not allow users to see the algorithm that suggests stories, so this manipulation was only discovered when it was announced in an academic journal. To counter possibilities of this, recommendation systems should be examinable in place, that is, it should be possible to query the mechanics of *why* an item was recommended.

Despite the fact that the use of analytics was directly integrated and used to reflect work back to the students, it was only in the post reflective period that students expressed surprise over the degree of tracking possible, reflecting a wider trend of general public disinterest. It is only when directly confronted with the evidence of what is recorded that participants acknowledged the level of activity detail possible. It is not widely understood that every interaction in online educational systems are being stored and are available for analysis,

perhaps because the results from these interactions are not currently analysed or used inside most academic institutions.

Analytical information has to be used cautiously, as without a rich picture of participant activity, incorrect conclusions could be drawn. De Laat's (2006b) original mixed methods framework reflects the complex nature of praxis that exists in NL. Similarly, the use of analytics to create sociograms for real-time community monitoring is valid, but a richer picture about the depth of individual participation requires it to be mixed with detailed content from actual interactions.

8.4 Contribution and suggestions of further research

The implicit assumption at the heart of networked learning is that promoting interaction between participants and learning resources will result in better outcomes. This work supports that claim and demonstrates that networked learning can be the community pedagogy used in the design of a learning community centred around an e-Portfolio.

This work has also produced an e-Portfolio framework consisting of a series of stages that can be followed to build a community where artifact construction is integrated into the working practices of the members.

Campbell and Debloise (2007) raise a number of concerns about the use of analytics in teaching and learning projects; concerns over the notion of big brother tracking, the simplification of complex holistic situations to mathematical representations, privacy and the use of profiling. This work shows that these concerns are real, but that the anxieties associated with these issues can be alleviated by demonstrating the value of these calculations by reflecting them back to the participants in real time and by having an open approach about where this information is used.

The source code for the project will be placed under a full open source community licence (GPL3) so that others may use, refine and improve the software.

Further work

As indicated in the limitations section, the use of the portfolio framework has been demonstrated in a particular subject based domain, where the nature of the learning taking place is technical and practical, with lower numbers of participants. Further work could use the portfolio in a different subject area

and/or with larger numbers of participants. The next study will take the model into a marketing subject area, where the nature of the self-produced artifacts will likely be a different form.

After an institutional initiative to refresh the curriculum and course structures across Kingston University, the portfolio use has been embedded in the documentation for the MSc Business Internet Technology course. This is being used as a major differentiator in the course marketing and should give the opportunity to investigate the possibilities for a larger number of participants across a wider range of subjects.

Currently the artifacts, comments and analytics are automatically exported into electronic documents at the end of the process to satisfy institutional requirements for portfolios of evidence to be visible for external examiners. It would be valuable for participants to have a more direct hand in this process, selecting their own work in some way. It should be possible for a group to collaboratively construct their own learning outcomes retrospectively, and then pin artifacts to them to demonstrate individual learning. This may be an opportunity to revisit the use of a taxonomies that allow for levels or stages of learning to be demonstrated.

There are examples of deep analysis of reflective statements to suggest the nature of the learning taking place, typically in e-Portfolio systems where the delineation between artifact entries is not as clear as here (Jenson, 2011). The addition of such an analytical frame may prove useful in improving the tutors understanding of participant progression during the life of a portfolio practice.

There is some indication that programming style, which can be difficult to teach through tutor led demonstrations may be better disseminated through good practice amongst the peers in such a collaborative system, suggesting that style is implicit knowledge better learnt through a community based pedagogy. It would be straightforward to investigate this through a change to learning materials and artifact analysis over time.

Finally, this work was driven by a desire to improve practice. It is hoped that by placing the practices, processes and e-Portfolio prototype in the public domain, it will be used to further that goal.

References

Acosta, A. (2012). Using serendipity to advance knowledge building activities. Presented at the 16th Annual Knowledge Building Summer Institute. Retrieved August 20, 2015 from http://ikit.org/SummerInstitute2012/

Acosta, T., & Lui, Y. (2006). ePortfolios - beyond assessment. In A. Jafari & C. Kaufman (Eds.), *Handbook of Research on ePortfolios* (pp. 15–23). Hershey, PA: Idea Group Publishing.

Adam, S. (2002). The use of European credits (ECTS) to record prior learning (APEL) - a contribution to the Bologna process and the creation of the European higher education area by 2010. Retrieved August 20, 2014, from http://webworld.unesco.org/gcexhibition2003/121/content/ebook/Chapter_10/2365.html0,5

Adomavicius, G., & Tuzhilin, A. (2005). Toward the next generation of recommender systems: a survey of the state-of-the-art and possible extensions. *IEEE Transactions on Knowledge and Data Engineering*, *17*(6), 734–749.

Altbach, P. G., Reisberg, L., & Rumbley, L. (2010). *Trends in Global Higher Education*. Paris: Sense Publishers.

An, H., Shin, S., & Lim, K. (2009). The effects of different instructor facilitation approaches on students' interactions during asynchronous online discussions. *Computers & Education*, *53*(3), 749–760.

Anderson, B., & Simpson, M. (2007). Ethical issues in online education. *Open Learning: The Journal of Open and Distance Learning*, *22*(2), 129–138.

Anderson, L. W., Krathwohl, D. R., Airasian, P. W., Cruikshank, K. A., Mayer, R. E., & Pintrich, P. R. (2000). *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives*. New York: Pearson.

Anderson, T., Liam, R., Garrison, D. R., & Archer, W. (2001). Assessing teacher presence in a computer conferencing context. *Journal of Asynchronous Learning Networks*, *5*(2), 1–17.

Andrade, H. G. (1997). Understanding rubrics. *Educational Leadership*, *54*(4), 14–17.

Annand, D. (2011). Social presence within the community of inquiry framework. *International Review of Research in Open and Distance Learning*, *12*(5), 40–56.

Arbaugh, J. B., & Hwang, A. (2006). Does "teaching presence" exist in online MBA courses? *The Internet and Higher Education*, *9*(1), 9–21.

Ashford-Rowe, K. A. S. C. (2013). A qualitative analysis of an LMS usage by staff (pp. 1–10). Presented at the THETA13 conference. Retrieved from

http://eprints.utas.edu.au/16511/

Ashworth, P., Bannister, P., & Thorne, P. (1997). Guilty in whose eyes? University students' perceptions of cheating and plagiarism in academic work and assessment. *Studies in Higher Education*, *22*(2), 187–203.

Attwell, G. (2008, August 21). What is the difference between an e-Portfolio and a Personal

Learning Environment? *www.pontydysgu.org*. Retrieved September 16, 2014, from http://www.pontydysgu.org/2008/04/what-is-the-difference-between-an-e-

portfolio-and-a-personal-learning-environment/

Bader-Natal, A., & Lotze, T. (2011). Evolving a learning analytics platform (pp. 180–185). Proceedings of the LAK '11: International Conference on Learning Analytics and Knowledge, Alberta, Canada.

Baggs, R., & Wu, C. W. (2010). Exploration of asynchronous online teaching with a network analysis of class interaction (pp. 355–362). Proceedings of the IEEE Second International Conference on Social Computing, Minneapolis, MN.

Balabanovic, M., & Shoham, Y. (1997). Fab: content-based, collaborative recommendation. *Communications of the ACM*, *40*(3), 66–72.

Barrett, H. C. (1998). Strategic questions: what to consider when planning for electronic portfolios. *Learning & Leading with Technology*, *26*(2), 6–13.

Barrett, H. C. (2005). White paper: researching electronic portfolios and learner engagement. *Retrieved June*. Retrieved March 15, 2013, from https://www.helenbarrett.com/reflect/whitepaper.pdf

Barrett, H. C. (2006). Using electronic portfolios for formative/classroom-based assessment. *Classroom Connect Connected Newsletter*, *13*(2), 4–6.

Barrett, H. C. (2008). Multiple purposes of digital stories in ePortfolios. Retrieved August 20, 2014, from electronicportfolios.com/portfolios/SITE2008DSpaper.pdf

Barrett, H. C. (2010). Balancing the two faces of ePortfolios. *Educação, Formação & Tecnologias*, *3*(1), 6–14.

Barrett, H. C., & Carney, J. (2005). Conflicting paradigms and competing purposes in electronic portfolio development. *TaskStream*. Retrieved May 12, 2013, from http://helenbarrett.com/portfolios/LEAJournal-BarrettCarney.pdf

Barrett, H. C., & Wilkerson, J. (2006, March 18). Conflicting paradigms in electronic portfolio approaches. *electronicportfolios.org*. Retrieved January 18, 2014, from http://electronicportfolios.org/systems/paradigms.html

Batson, T. (2002). The electronic portfolio boom: what's it all about. *Campus Technology*. Retrieved August 25, 2013, from

http://www.msmc.la.edu/include/learning_resources/emerging_technologies/eportfolio/ePortfolio_boom.pdf

Batson, T. (2011). Situated learning: a theoretical frame to guide transformational change using electronic portfolio technology. *International Journal of ePortfolio*, *1*(1), 107–114.

Beagrie, N. (2006). Digital curation for science, digital libraries, and individuals. *International Journal of Digital Curation*, *1*(1), 3–16.

Bean, W. (2005). Part I: Why rubrics? *peta.edu.au*. Retrieved August 27, 2008, from http://www.peta.edu.au/mediaLibrary/documents/pens/PEN148.pdf

Beauvoir, P. (2010). The personal learning environments blog. *Cetis project website*. Retrieved October 9, 2014, from http://zope.cetis.ac.uk/members/ple/

Beck, R. J., Fitzgerald, W. J., & Pauksztat, B. (2003). Individual behaviors and social structure in the development of communication networks of self-organizing online discussion groups. In B. Wasson, S. Ludvigsen, & U. Hoppe (Eds.), *Designing for Change in Networked Learning Environments* (pp. 313–322). Dordrecht: Springer Netherlands.

Beetham, H., & Sharpe, R. (2007). *Rethinking Pedagogy for a Digital Age: Designing and Delivering E-learning*. New York: Routledge.

Ben K Daniel, McCalla, G. I., & Schwier, R. A. (2008). Social Network Analysis techniques: implications for information and knowledge sharing in virtual learning communities. *International Journal of Advanced Media and Communication*, *2*(1), 20–34.

Bereiter, C. (2002). Artifacts, canons, and the progress of pedagogy: a response to contributors. In B. Smith (Ed.), *Liberal education in a knowledge society* (pp. 223–244). Chicago, IL: Open Court.

Bereiter, C. (2005). *Education and Mind in the Knowledge Age*. New York: Routledge.

Bereiter, C., & Scardamalia, M. (2005). Beyond Bloom's taxonomy: rethinking knowledge for the knowledge age. In M. Fullan (Ed.), *The International Handbook of Educational Change* (pp. 5–22). Dordrecht: Kluwer Academic Publishers.

Bhattacharya, M., & Hartnett, M. (2007). E-portfolio assessment in higher education (pp. 19–24). Proceedings of the IEEE Frontiers in Education Conference, Milwaukee, WI.

Biggs, J. (1996). Enhancing teaching through constructive alignment. *Higher Education*, *32*(3), 347–364.

Biggs, J. (2014, April 9). Constructive Alignment. *johnbiggs.com.au*. Retrieved

April 9, 2014, from http://www.johnbiggs.com.au/academic/constructive-alignment/

Biggs, J., & Tang, C. (2010). *Teaching for Quality Learning at University* (3rd ed.). New York: Society for Research into Higher Education & Open University Press.

Black, P., & Wiliam, D. (1998). Assessment and classroom learning. *Assessment in Education: Principles, Policy and Practice*, *5*(1), 7–74.

Black, P., & Wiliam, D. (2009). Developing the theory of formative assessment. *Educational Assessment, Evaluation and Accountability*, *21*(1), 5–31.

Blair, C. H. (2011). Panic and plagiarism: authorship and academic dishonesty in a remix culture. *MediaTropes*, *2*(1), 159–192.

Blignaut, S., Blignaut, S., & Trollip, S. R. (2003). Developing a taxonomy of faculty participation in asynchronous learning environments—an exploratory investigation. *Computers & Education*, *41*(2), 149–172.

Boog, B. W. M. (2003). The emancipatory character of action research, its history and the present state of the art. *Journal of Community & Applied Social Psychology*, *13*(6), 426–438.

Bostock, S. (2000). Student peer assessment. *Learning Technology*. Retrieved August 27, 2008, from http://www.reading.ac.uk/web/FILES/engageinassessment/Student_peer_assessment_-_Stephen_Bostock.pdf

Boud, D. J. (1995). Assessment and learning: contradictory or complementary. In P. Knight (Ed.), *Assessment for Learning in Higher Education* (pp. 35–48). London: Kogan Press.

Boud, D. J. (2000). Sustainable assessment: rethinking assessment for the learning society. *Studies in Continuing Education*, *22*(2), 151–167.

Boud, D. J., & Falchikov, N. (2006). Aligning assessment with long-term learning. *Assessment & Evaluation in Higher Education*, *31*(4), 399–413.

Boud, D. J., & Walker, D. (1998). Promoting reflection in professional courses: the challenge of context. *Studies in Higher Education*, *23*(2), 191–206.

Boud, D. J., Cohen, R., & Sampson, J. (2001). Peer learning and assessment. *Assessment & Evaluation in Higher Education*, *24*(4), 413–426.

Boud, D. J., Keogh, R., & Walker, D. (1985). *Reflection: Turning Experience Into Learning*. Philadelphia: Kogan Page.

Boyatzis, R. E. (1998). *Transforming Qualitative Information*. London: SAGE.

Boyd, D. (2008). Facebook's privacy train wreck: exposure, invasion, and social Convergence. *Convergence: The International Journal of Research into New Media Technologies*, *14*(1), 13–20.

Boylan, M. (2010a). Ecologies of participation in school classrooms. *Teaching and Teacher Education*, *26*(1), 61–70.

Boylan, M. (2010b). School classrooms: communities of practice or ecologies of practice. *Teaching and Teacher Education*, *26*(1), 61–70.

Brackley, A. (2013, August 16). Whatever happened to hybrid managers? The short history of the hybrids. *BCS Archive*. Retrieved August 16, 2013, from http://itnow.oxfordjournals.org/content/38/6/22.short

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101.

Brookfield, S. (1983). *Adult learners, adult education and the community*. Milton Keynes: Open University Press.

Brown, A. L. (1992). Design experiments: theoretical and methodological challenges in creating complex interventions in classroom settings. *Journal of the Learning Sciences*, *2*(2), 141–178.

Brown, J. S., & Duguid, P. (1991). Organizational learning and communities-of-practice: toward a unified view of working, learning, and innovation. *Organization Science*, *2*(1), 40–57.

Bruns, A., & Humphreys, S. (2005). Wikis in teaching and assessment: the M/Cyclopedia project (pp. 25–32). Proceedings of the International Wiki Symposium, San Diego.

Bryant, L. H., & Chittum, J. R. (2013). ePortfolio effectiveness: A (n ill-fated) search for empirical support. *International Journal of ePortfolio*, *3*(2), 189–198.

Butler, P. (2006). A review of the literature on portfolios and electronic portfolios. *Techreport*, 1–23. Massey University College of Education. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.175.4678

Cambridge, D. R. (2006). Integral ePortfolio interoperability with the IMS ePortfolio specification. In A. Jafari & C. Kaufman (Eds.), *Handbook of Research on ePortfolios* (pp. 234–246). Hershey, PA: Idea Group Publishing.

Cambridge, D. R. (2009). Two faces of integrative learning online. In D. R. Cambridge, B. L. Cambridge, & K. B. Yancey (Eds.), *Electronic Portfolios 2.0* (pp. 41–49). Sterling: Stylus Publishers.

Cambridge, D. R., & Perez-Lopez, K. (2012). First steps towards a social learning analytics for online communities of practice for educators (pp. 69–72). Proceedings of the LAK '12: International Conference on Learning Analytics and Knowledge, Vancouver.

Campbell, J. P., DeBlois, P. B., & Oblinger, D. G. (2007). Academic analytics: a new

tool for a new era. *Educause Review*. Retrieved September 17, 2013, from http://www.educause.edu/library/erm0742

Carmean, C., & Christie, A. (2006). ePortfolios: constructing meaning across, time, space and curriculum. In A. Jafari & C. Kaufman (Eds.), *Handbook of Research on ePortfolios* (pp. 33–43). Hershey, PA: Idea Group Publishing.

Carney, J. (2002). The intimacies of electronic portfolios: confronting preservice teachers' personal revelation dilemma (pp. 544–548). Proceedings of the Society for Information Technology Teacher Education International Conference, Nashville, Tennessee, USA.

Carr, W., & Kemmis, S. (2003). *Becoming Critical: Education Knowledge and Action Research*. London: Taylor & Francis.

Carter, J. (1999). Collaboration or plagiarism: what happens when students work together. *ACM SIGCHI Bulletin*, *31*(3), 52–55.

Chang, C. K., Chen, G. D., & Li, L. Y. (2008). Constructing a community of practice to improve coursework activity. *Computers & Education*, *50*(1), 235–247.

Chang, C.-C., & Tseng, K.-H. (2009). Use and performances of web-based portfolio assessment. *British Journal of Educational Technology*, *40*(2), 358–370.

Chau, J. (2010). ePortfolio, technology, and learning: a reality check. *Journal of Interactive Learning Research*, *21*(4), 465–482.

Chen, H. L., & Mazow, C. (2002, June 16). Electronic Learning Portfolios and Student Affairs. Retrieved April 18, 2014, from http://www.naspa.org/netresults/article.cfm?ID=825

Chen, H. L., Cannon, D., Gabrio, J., & Leifer, L. (2005). Using wikis and weblogs to support reflective learning in an introductory engineering design course (pp. 95–105). Proceedings of the Human Behaviour in Design Conference '05, Melbourne.

Cho, H., Stefanone, M., & Gay, G. (2002). Social network analysis of information sharing networks in a CSCL community (pp. 43–50). Proceedings of the Conference on Computer Support for Collaborative Learning, Hillsdate, NJ.

Choi, J. H., & Strobel, J. (2012). Validation of a modified instrument: using social network analysis to measure social presence (pp. 1–23). Proceedings of the Annual Meeting of the American Educational Research Association, Vancouver.

Clark, J. E., & Eynon, B. (2009). E-portfolios at 2.0 - surveying the field. *Peer Review*, *11*(1), 18–23.

Clow, D. (2012). The learning analytics cycle: closing the loop effectively (pp. 134–138). Proceedings of the LAK '12: International Conference on Learning Analytics and Knowledge, Vancouver, BC.

Clow, D. (2013). An overview of learning analytics. *Teaching in Higher Education*, *18*(6), 683–695.

Coghlan, D., & Brannick, T. (2009). *Doing Action Research in Your Own Organization*. London: SAGE.

Cohen, P. L., Manion, L., & Morrison, K. (2008). Action Research. In *Research Methods in Education* (6 ed., pp. 297–313). London: Routledge.

Conole, G. (2010). Theory and methodology in networked learning. Retrieved May 20, 2010, from http://www.slideshare.net/grainne/theory-and-methodology-in-networked-learning

Contu, A., & Willmott, H. (2003). Re-embedding situatedness: the importance of power relations in learning theory. *Organization Science*, *14*(3), 283–296.

Cox, A. (2005). What are communities of practice? A comparative review of four seminal works. *Journal of Information Science*, *31*(6), 527–540.

Creswell, J. W. (2013). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (4 ed.). London: SAGE Publications.

Cross, J. (2012). From the reflective e-practitioner: a pilot model of teacher preparation employing eportfolio. *International Journal of ePortfolio*, *2*, 39–48.

Curant, N. (2009). E-portfolios for staff development – using e-portfolios for an ITQ qualification. Retrieved May 1, 2013, from http://www.eife-l.org/publications/eportfolio/proceedings2/learning-forum-london-2009/LFL2009.pdf

Çimer, S. O. (2011). The effect of portfolios on students' learning: student teachers' views. *European Journal of Open, Distance and E-Learning*, *34*(2), 161–176.

Dalsgaard, C. (2006). Social software: e-learning beyond learning management systems. *European Journal of Open, Distance and E-Learning*, *2006*(2), 1–7.

Dalziel, C. (2008). Using ePortfolios to combat plagiarism (pp. 206–210). Proceedings of the Asciliate Conference, Melbourne.

Danielson, C., & Abrutyn, L. (1997). *An Introduction to Using Portfolios in The Classroom*. Alexandria: Association for Supervision and Curriculum Development.

Davis, J. (2007). Rethinking the architecture: an action researcher's resolution to writing and presenting their thesis. *Action Research*, *5*(2), 181–198.

Dawson, S. (2008). A study of the relationship between student social networks and sense of community. *Educational Technology & Society*, *11*(3).

De Laat, M. F. (2005, June 5). *Networked Learning*. Apeldoorn: Politie Academy.

De Laat, M. F., & Lally, V. (2003). Complexity, theory and praxis: researching

collaborative learning and tutoring processes in a networked learning community. *Instructional Science*, *31*(1), 7–39.

De Laat, M. F., & Lally, V. (2004). It's not so easy: researching the complexity of emergent participant roles and awareness in asynchronous networked learning discussions. *Journal of Computer Assisted Learning*, *20*(3), 165–171.

De Laat, M. F., Lally, V., Lipponen, L., & Simons, R.-J. (2006a). Online teaching in networked learning communities: a multi-method approach to studying the role of the teacher. *Instructional Science*, *35*(3), 257–286.

De Laat, M. F., Lally, V., Lipponen, L., & Simons, R.-J. (2006b). Analysing student engagement with learning and tutoring activities in networked learning communities: A multi-method approach. *International Journal of Web Based Communities*, *2*(4), 394–412.

De Laat, M. F., Lally, V., Lipponen, L., & Simons, R.-J. (2007). Investigating patterns of interaction in networked learning and computer-supported collaborative learning: A role for social network analysis. *International Journal of Computer-Supported Collaborative Learning*, *2*(1), 87–103.

De Wever, B., Schellens, T., Valcke, M., & Van Keer, H. (2006). Content analysis schemes to analyze transcripts of online asynchronous discussion groups: a review. *Computers & Education*, *46*(1), 6–28.

Delandshere, G. (2001). Implicit theories, unexamined assumptions and the status quo of educational assessment. *Assessment in Education: Principles*, *8*(2), 113–133.

Delandshere, G., & Arens, S. A. (2003). Examining the quality of the evidence in preservice teacher portfolios. *Journal of Teacher Education*, *54*(1), 57–73.

Dennen, V. P. (2005). From message posting to learning dialogues: factors affecting learner participation in asynchronous discussion. *Distance Education*, *26*(1), 127–148.

Denscombe, M. (2010). *The Good Research Guide* (4 ed.). New York: McGraw-Hill Education.

DeVoss, D., & Rosati, A. C. (2002). “It wasn’t me, was it?” Plagiarism and the web. *Computers and Composition*, *19*(2), 191–203.

Dewey, J. (1910). *How we think*. Boston, Mass.: D.C. Heath & Co.

Dick, B. (2011). Action research literature 2008--2010: themes and trends. *Action Research*, *9*(2), 122–143.

Diez, M. E. (1994). The portfolio: sonnet, mirror and map. (pp. 1–14). Proceedings of the Conference on Linking Liberal Arts and Teacher Education, San Diego, CA.

Dirckinck-Holmfeld, L., & Jones, C. (2009). Issues and concepts in Networked

Learning. In L. Dirckinck-Holmfeld, C. Jones, & B. Lindtröm (Eds.), *Analysing Networked Learning Practices in Higher Education and Continuing Professional Development* (pp. 259–285). Rotterdam: Sense Publishers.

Dirckinck-Holmfeld, L., Hodgson, V. E., & McConnell, D. (2011). *Exploring the Theory, Pedagogy and Practice of Networked Learning*. New York: Springer.

Dochy, F., Segers, M., & Sluijsmans, D. (1999). The use of self-, peer and co-assessment in higher education: a review. *Studies in Higher Education*, *24*(3), 331–350.

Doig, B., Illsley, B., McLuckie, J., & Parsons, R. (2006). Using ePortfolios to enhance reflective learning and development. In A. Jafari & C. Kaufman (Eds.), *Handbook of Research on ePortfolios* (pp. 158–167). Hershey, PA: Idea Group Publishing.

Doran, P., Doran, C., & Mazur, A. (2011). Social network analysis as a method for analyzing interaction in collaborative online learning environments. *Journal of Systemics, Cybernetics & Informatics*, *9*(7), 10–16.

Draaijer, S., & van Boxel, P. (2006). Summative peer assessment using "Turnitin" and a large cohort of students: a case study. Retrieved October 4, 2014, from https://dspace.lboro.ac.uk/dspace/handle/2134/4559

Dringus, L. P., & Ellis, T. (2005). Using data mining as a strategy for assessing asynchronous discussion forums. *Computers & Education*, *45*(1), 141–160.

Dube, R. (2010, August 30). Educational abandonware - free and useful software or illegal piracy? *educational-freeware.com*. Retrieved June 30, 2012, from http://www.educational-freeware.com/news/educational-abandonware.aspx

Duval, E. (2011). Attention please!: learning analytics for visualization and recommendation (pp. 9–17). Proceedings of the LAK '11: International Conference on Learning Analytics and Knowledge, Banff, AB, Canada: ACM.

Ehiyazaryan-White, E. (2012). The dialogic potential of ePortfolios: formative feedback and communities of learning within a personal learning environment. *International Journal of ePortfolio*, *2*(2), 173–185.

Eisner, E. (2003). Reshaping assessment in education: some criteria in search of practice. *Journal of Curriculum Studies*, *3*, 219–233.

Elliott, J. (1991). *Action Research for Educational Change*. Buckingham: McGraw-Hill International.

Entwistle, N. (2005). Learning outcomes and ways of thinking across contrasting disciplines and settings in higher education. *Curriculum journal*, *16*(1), 67–82.

Eraut, M. (1995). Schon shock: a case for refraining reflection-in-action? *Teachers and Teaching theory and practice*, *1*(1), 9–22.

Eraut, M. (2002). Conceptual analysis and research questions: do the concepts of "Learning Community" and “Community of Practice” provide added value? (pp. 1–12). Proceedings of the Annual Meeting of the American Educational Research Association, New Orleans.

Feng, F. (2006). Toward a framework/data model: from ePortfolio thinking to folio culture. In A. Jafari & C. Kaufman (Eds.), *Handbook of Research on ePortfolios* (pp. 217–232). Hershey, PA: Idea Group Publishing.

Ferreday, D., & Hodgson, V. (2008). The tyranny of participation and collaboration in networked learning (pp. 640–647). In V.Hodgson, C. Jones, T. Kargidis, D. McConnell (Eds.) Proceedings of the 6th International Conference on Networked Learning, Halkidiki, Greece.

Ferreday, D., & Hodgson, V. (2010, December 17). Heterotopia in networked learning: beyond the shadow side of participation in learning communities. Lancaster University Management School Working Papers. Retrieved April 10, 2014, from http://eprints.lancs.ac.uk/49033/

Fisher, R. (2003). The golden age of BTEC: the business education curriculum in 1980s further education. *The Curriculum Journal*, *14*(2), 253–277.

Fitch, D., Peet, M., Reed, B. G., & Tolman, R. (2010). The use of ePortfolios in evaluating the curriculum and student learning. *Journal of social work education*, *44*(3), 37–54.

Flanigan, E., & Amirian, S. (2006). ePortfolios: pathway from classroom to career. In A. Jafari & C. Kaufman (Eds.), *Handbook of Research on ePortfolios* (pp. 102–111). Hershey, PA: Idea Group Publishing.

Fruchterman, T., & Reingold, E. (1990). Graph drawing by force-directed placement. *Software - Practice and Experience*, *21*(1), 1129–1164.

Fuller, A. (2013). Critiquing theories of learning and communities of practice. In J. Hughes, N. Jewson, & L. Unwin (Eds.), *Communities of practice: Critical perspectives* (pp. 17–29). London: Routledge.

Galbraith, P., Renshaw, P., & Goos, M. (1999). Technology, mathematics, and people: interactions in a community of practice (pp. 4–7). Proceedings of the 22nd Annual Conference of the Mathematics Education Research Group of Australasia, Adelaide.

Garrett, N., Thoms, B., Alrushiedat, N., & Ryan, T. (2009). Social e-portfolios as the new course management system. *On the Horizon*, *17*(3), 197–207.

Garrison, D. R. (2011). *E-Learning in the 21st Century* (2nd ed.). London: Routledge.

Garrison, D. R., & Anderson, T. (2003). *E–Learning in the 21st century* (1st ed.). London: Routledge/Falmer.

Garrison, D. R., & Arbaugh, J. B. (2007). Researching the community of inquiry framework: review, issues, and future directions. *The Internet and Higher Education*, *10*(3), 157–172.

Garrison, D. R., & Cleveland-Innes, M. (2005). Facilitating cognitive presence in online learning: interaction is not enough. *American Journal of Distance Education*, *19*(3), 133–148.

Garrison, D. R., & Kanuka, H. (2004). Blended learning: uncovering its transformative potential in higher education. *The Internet and Higher Education*, *7*(2), 95–105.

Garrison, D. R., Anderson, T., & Archer, W. (2001). Critical thinking, cognitive presence, and computer conferencing in distance education. *American Journal of Distance Education*, *15*(1), 7–23.

Gibbs, G., & Simpson, C. (2004). Conditions under which assessment supports students' learning. *Learning and Teaching in Higher Education*, *1*(1), 3–31.

Gibson, D. (2006). ePortfolio decisions and dilemmas. In A. Jafari & C. Kaufman (Eds.), *Handbook of Research on ePortfolios* (pp. 134–144). Hershey, PA: Idea Group Publishing.

Gibson, D., & Barrett, H. C. (2002). Directions in electronic portfolio development. *Contemporary Issues in Technology and Teacher Education*, *2*(4), 556–573.

Gielen, S., Dochy, F., & Dierick, S. (2003). Evaluating the consequential validity of new modes of assessment: the influence of assessment on learning, including pre-, post-, and true assessment effects. In M. Segers, F. Dochy, & E. Cascaller (Eds.), *Optimising New Modes of Assessment: In Search of Qualities and Standards* (Vol. 1, pp. 37–54). Netherlands: Springer.

Gielen, S., Dochy, F., & Onghena, P. (2011). An inventory of peer assessment diversity. *Assessment & Evaluation in Higher Education*, *36*(2), 137–155.

Gillen, J., & Barton, D. (2010). Digital literacies. TLRP. Retrieved August 20, 2013, from http://www.tlrp.org/docs/DigitalLiteracies.pdf

Goldschmid, B., & Goldschmid, M. (1973). Modular instruction in higher education: a review. *Higher Education*, *2*(1), 15–32.

Goodyear, P., & Steeples, C. (2008). Creating shareable representations of practice. *ALT-J, Research in Learning Technology*, *6*(3), 16–23.

Goodyear, P., Jones, C., Asensio, M., & Hodgson, V. (2005). Networked learning in higher education: students' expectations and experiences. *Higher Education*, *50*, 473–508.

Goodyear, P., Jones, C., Asensio, M., Hodgson, V., & Steeples, C. (2001). Effective networked learning in higher education: notes and guidelines. Retrieved May, 17, 2006 from http://www.csalt.lancs.ac.uk/jisc/guidelines_final.doc.

Goodyear, P., Jones, C., Asensio, M., Hodgson, V., & Steeples, C. (2004). Undergraduate students' experiences of networked learning in UK higher education: a survey-based study. In P. Goodyear, S. Banks, V. Hodgson, & D. McConnell (Eds.), *Advances in Research on Networked Learning* (pp. 91–121). New York: Springer.

Goos, M., Galbraith, P., & Renshaw, P. (2003). Establishing a community of practice in a secondary mathematics classroom. In L. Burton (Ed.), *Learning Mathematics* (pp. 36–61). New York: Taylor & Francis.

Gourlay, S. (1999). Communities of practice: a new concept for the millenium, or the rediscovery of the wheel? *Business Faculty Papers Repository*. Retrieved March 1, 2013, from http://eprints.kingston.ac.uk/3719/1/Gourlay%201999%20CoP.pdf

Granovetter, M. S. (1973). The strength of weak ties. *American Journal of Sociology*, *78*(6), 1360–1380.

Grant, S. (2009). e-Portfolio portability. *leapspecs.org*. Retrieved April 14, 2014, from http://www.leapspecs.org/2A/introduction

Graves, D. (1994). Help children to revise their work. In D. Graves (Ed.), *A Fresh Look at Writing*, *A fresh look at writing* (pp. 23–36). Portsmouth, NH: Heinemann.

Gray, L. (2008). *Effective Practice with e-Portfolios. Supporting 21st century learning*. *JISC Innovation Group*. JISC.

Greene, J. C., Caracelli, V. J., & Graham, W. F. (1989). Toward a conceptual framework for mixed-method evaluation designs. *Educational Evaluation and Policy Analysis*, *11*(3), 255–274.

Grundy, S. (1987). *Curriculum: Product Or Praxis?* London: Falmer Press.

Guldberg, K., & Pilkington, R. (2006). A community of practice approach to the development of non-traditional learners through networked learning. *Journal of Computer Assisted Learning*, *22*(3), 159–171.

Gulikers, J. (2006). *Authenticity is in the eye of the beholder: beliefs and perceptions of authentic assessment and the influence on student learning*. Heerlen: Open University of the Netherlands. Retrieved August 20, 2014, from http://hdl.handle.net/1820/1043

Gulikers, J., Bastiaens, T. J., & Kirschner, P. A. (2004). A five-dimensional framework for authentic assessment. *Educational Technology Research and Development*, *52*(3), 67–86.

Gulikers, J., Bastiaens, T., Kirschner, P., & Kester, L. (2006). Relations between student perceptions of assessment, authenticy, study approaches and learning outcome. *Studies in Educational Evaluation*, *32*(4), 381–400.

Gullifer, J. M., & Tyson, G. A. (2013). Who has read the policy on plagiarism? Unpacking students' understanding of plagiarism. *Studies in Higher Education*, *39*(7), 1202–1218.

Hansen, B., Stith, D., & Tesdell, L. S. (2011). Plagiarism: what's the big deal? *Business Communication Quarterly*, *74*(2), 188–191.

Harasim, L. M. (1995). *Learning Networks: A Field Guide to Teaching and Learning Online*. Cambridge, MA: MIT Press.

Harlen, W., & James, M. (1997). Assessment and learning: differences and relationships between formative and summative assessment. *Assessment in Education: Principles, Policy and Practice*, *4*(3), 365–379.

Harper, M. G. (2006). High tech cheating. *Nurse Education Today*, *6*(6), 364–371.

Hartnell-Young, E. (2007, August 26). Impact study of e-portfolios on learning. Becta. Retrieved May 26, 2012, from http://partners.becta.org.uk/upload-dir/downloads/page_documents/research/impact_study_ eportfolios.pdf

Harvey, M., Baillie, M., Ruthven, I., & Elsweiler, D. (2009). Folksonomic tag clouds as an aid to content indexing. *arXiv.org*. Retrieved November 20, 2013, from http://core.ac.uk/download/pdf/11551454.pdf

Haythornthwaite, C., & De Laat, M. F. (2010). Social networks and learning networks: using social network perspectives to understand social learning. In V. Hodgson, C. Jones, M. F. De Laat, & T. Ryberg (Eds.), (pp. 183–190). Proceedings of the 7th International Conference on Networked Learning, Aalborg, Denmark.

Heaton Shrestha, C., Edirisingha, P., Burke, L., & Linsey, T. (2005). Introducing a VLE into campus-based undergraduate teaching: Staff perspectives on its impact on teaching. *International Journal of Educational Research*, *43*(6), 370–386.

Heikkinen, H. L. T., Huttunen, R., & Syrjälä, L. (2007). Action research as narrative: five principles for validation. *Educational Action Research*, *15*(1), 5–19.

Henri, F., & Pudelko, B. (2003). Understanding and analysing activity and learning in virtual communities. *Journal of Computer Assisted Learning*, *19*(4), 474–487.

Herr, K., & Anderson, G. L. (2005). *The Action Research Dissertation: A Guide for Students and Faculty*. London: SAGE Publications.

Hodgson, V., & Reynolds, M. (2005). Consensus, difference and “multiple communities” in networked learning. *Studies in Higher Education*, *30*(1), 11–24.

Hodgson, V., & Watland, P. (2004). Researching networked management learning.

Management Learning, *35*(2), 99–116.

Hopkins, D., & Jackson, D. (2009, July 28). Networked learning communities: capacity building, networking and leadership for learning. *National College for School Leadership, Nottingham*. Retrieved July 28, 2009, from http://networkedlearning.ncsl.org.uk/knowledge-base/research-papers/networked-learning-communities-capacity-building.doc

Hugo, J. M. (2002). Learning community history. *New directions for adult and continuing education*, *2002*(95), 5–26.

Huot, B., & Williamson, M. (1997). Rethinking portfolios for evaluating writing: issues of assessment and power. In K. B. Yancey, & I. Weiser (Eds.), *Situating Portfolios: Four Perspectives* (pp. 43–56). Logan, Utah: Utah State University Press.

Hussey, T., & Smith, P. (2008). Learning outcomes: a conceptual analysis. *Teaching in Higher Education*, *13*(1), 107–115.

IELTS scoring in detail. (2016). Retrieved from https://www.ielts.org/ielts-for-organisations/ielts-scoring-in-detail

Illeris, K. (2007). *How We Learn: Learning and Non-Learning in School and Beyond*. London: Taylor & Francis.

Jafari, A. (2004). The "sticky" ePortfolio system: tackling challenges and identifying attributes. *Educause Review*, *39*(4), 38–48.

Jenson, J. D. (2011). Promoting self-regulation and critical reflection through writing students' use of electronic portfolio. *International Journal of ePortfolio*, *1*(1), 49–60.

Jézégou, A. (2010). Community of inquiry in e-learning: a critical analysis of the Garrison and Anderson model. *Journal of Distance Education*, *24*(3), 1–18.

JISC. (2008). Learning processes. Retrieved July 17, 2010, from https://www.jisc.ac.uk/guides/e-portfolios/learning-processes

JISC. (2010). Effective assessment in a digital age. *Effective Assessment in a Digital Age*. Retrieved June 1, 2013, from http://www.jisc.ac.uk/whatwedo/programmes/elearning/assessment/digiassess.aspx

Johnsen, H. L. (2012). Making learning visible with e-Portfolios: coupling the right pedagogy with the right technology. *International Journal of ePortfolio*, *2*(2), 139–148.

Johnson, L., Adams, S., Cummins, M., Estrada, V., Freeman, A., & Ludgat, H. (2013). *NMC Horizon Project Short List* (Vol. 43). New Media Consortium. Retrieved from http://www.nmc.org/pdf/2013-horizon-k12-shortlist.pdf

Johnson, R. B., & Turner, L. A. (2003). Data collection strategies in mixed method

research. In A. Tashakkori, C. Teddlie, & C (Eds.), *Handbook of mixed methods in social and behavioral research* (pp. 297–319). Thousand Oaks: Sage.

Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a definition of mixed methods research. *Journal of mixed methods research*, *1*(2), 112–133.

Johnson-Eilola, J., & Selber, S. A. (2007). Plagiarism, originality, assemblage. *Computers and Composition*, *24*(4), 375–403.

Johnston, B. (2004). Summative assessment of portfolios: an examination of different approaches to agreement over outcomes. *Studies in Higher Education*, *29*(3), 395–412.

Jones, C., & Esnault, L. (2004). The metaphor of networks in learning: communities, collaboration and practice. In S. Banks, P. Goodyear, V. E. Hodgson, C. Jones, V. Lally, D. McConnell, & C. Steeples (Eds.), Proceedings of the Fourth International Conference on Networked Learning (pp. 317–323), Lancaster.

Jones, C., Asensio, M., & Goodyear, P. (2000). Networked learning in higher education: practitioners' perspectives. *ALT-J, Research in Learning Technology*, *8*(2), 18–28.

Jones, C., Ferreday, D., & Hodgson, V. (2008). Networked learning a relational approach: weak and strong ties. *Journal of Computer Assisted Learning*, *24*(2), 90–102.

Jones, N., & Peachey, P. (2005). The development of socialization in an on-line learning environment. *Journal of Interactive Online Learning*, *3*(3), 1–20.

Jones, R. M. (1981). *Experiment at Evergreen*. Cambridge, Mass: Schenkman Publishing Company.

Kemmis, S. (1993). Action research and social movement: a challenge for policy research. *Education Policy Analysis Archives*, *1*(1), 1–6.

Kemmis, S., McTaggart, R., & Nixon, R. (2013). *The Action Research Planner: Doing Critical Participatory Action Research*. London: Springer.

Kennedy, G., Ioannou, I., Zhou, Y., Bailey, J., & O'Leary, S. (2013). Mining interactions in immersive learning environments for real-time student feedback. *Australasian Journal of Educational Technology*, *29*(2), 172–183.

Kenny, D. (2007). Student plagiarism and professional practice. *Nurse Education Today*, *27*(1), 14–18.

Kirkham, T., Winfield, S., Smallwood, A., Coolin, K., Wood, S., & Searchwell, L. (2009). Introducing live e-Portfolios to support self organised learning. *Educational Technology & Society*, *12*(3), 107–114.

Klamma, R., Chatti, M. A., Duval, E., Hummel, H., Hvannberg, E. T., Kravcik, M., Law, E., et al. (2007). Social software for life-long learning. *Educational*

Technology & Society, (3), 72–83.
Klein, L. F. (2013). The social ePortfolio: integrating social media and models of learning in academic ePortfolios. In K. Wills & R. Rice (Eds.), *ePortfolio Performance Support Systems Constructing, Presenting, and Assessing Portfolios* (pp. 57–74). Fort Collins, Colorado: Perspectives on Writing.
Knapper, C., & Cropley, A. J. (2000). *Lifelong Learning in Higher Education*. London: Kogan Page.
Knight, P. (2002). Summative assessment in higher education: practices in disarray. *Studies in Higher Education*, *27*(3), 275–286.
Kolb, D. (2005). *Experiential learning: experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice-Hall.
Koshy, V. (2009). *Action Research for Improving Educational Practice: A Step-by-Step Guide*. London: SAGE Publications.
Kotzee, B. (2012). Private practice: exploring the missing social dimension in "reflective practice." *Studies in Continuing Education*, *34*(1), 5–16.
Kramer, A. D. I., Guillory, J. E., & Hancock, J. T. (2014). Experimental evidence of massive scale emotional contagion through social networks. *Proceedings of the National Academy of Sciences*, *111*(24), 8788–8790.
Kreijns, K., Van Acker, F., Vermeulen, M., & van Buren, H., III. (2014). Community of Inquiry: social presence revisited. *E-Learning and Digital Media*, *11*(1), 5–18.
Kuh, G. D. (1991). *Involving colleges: successful approaches to fostering student learning and development outside the classroom*. San Francisco: Jossey-Bass Publishers.
Lankshear, C., & Knobel, M. (2008). *Digital Literacies: Concepts, Policies and Practices*. New York: Peter Lang.
Lave, J., Wenger, E., & Wenger, E. (1991). *Situated Learning: Legitimate Peripheral Participation*. New York: Cambridge University Press.
Lawson, M., Kiegaldie, D., & Jolly, B. (2006). Developing an ePortfolio for health professional educators: a case study. In A. Jafari & C. Kaufman (Eds.), *Handbook of Research on ePortfolios* (pp. 273–282). Hershey, PA: Idea Group Publishing.
Ledwith, A., & Rísquez, A. (2008). Using anti-plagiarism software to promote academic honesty in the context of peer reviewed assignments. *Studies in Higher Education*, *33*(4), 371–384.
Lewin, K. (1946). Action research and minority problems. *Journal of Social Issues*, *2*(4), 34–46.
Li, L. C., Grimshaw, J. M., Nielsen, C., Judd, M., Coyte, P. C., & Graham, I. D. (2009).

Evolution of Wenger's concept of community of practice. *Implementation Science*, *4*(1), 1–8.

Li, X., & Prasad, C. (2005). Effectively teaching coding standards in programming. In R. Friedman (Ed.), (pp. 239–244). Proceedings of the SIGITE Conference on Information Technology Education, New York, USA: ACM.

Liedtka, J. (1999). Linking competitive advantage with communities of practice. *Journal of Management Inquiry*, *8*(1), 5–16.

Lin, Q. (2008). Preservice teachers' learning experiences of constructing e-portfolios online. *The Internet and Higher Education*, *11*(3-4), 194–200.

Lisewski, B., & Joyce, P. (2003). Examining the five-stage e-moderating model: designed and emergent practice in the learning technology profession. *Research in Learning Technology*, *11*(1), 55–66.

Littlejohn, A., & Pegler, C. (2004). *Preparing for Blended E-learning*. Oxford: Taylor & Francis.

Liyanagunawardena, T. R., & Adams, A. A. (2013). MOOCs: a systematic study of the published literature 2008-2012. *The International Review of Research in Open and Distributed Learning*, *14*(3), 202–227.

Lopez-Fernandez, O., & Rodriguez-Illera, J. L. (2009). Investigating university students' adaptation to a digital learner course portfolio. *Computers & Education*, *52*(3), 608–616.

Lorenzo, G., & Ittelson, J. (2005). An overview of e-portfolios. *Educause Learning Initiative*. Retrieved July 15, 2013, from http://www.case.edu/artsci/cosi/cspl/documents/eportfolio-Educausedocument.pdf

Love, D., McKean, G., & Gathercoal, P. (2004). Portfolios to webfolios and beyond: levels of maturation. *Educause Quarterly*, *27*(2), 24–38.

Lowenthal, P., White, J. W., & Cooley, K. (2011). Remake/remodel: using eportfolios and a system of gates to improve student assessment and program evaluation. *International Journal of ePortfolio*, *1*(1), 61–70.

Lucas, C. (1992). Writing portfolios—changes and challenges. In K. B. Yancey (Ed.), *Portfolios in the writing classroom: An introduction* (pp. 1–17). Urbana, IL: National Council of Teachers of English.

Macdonald, J., & Twining, P. (2002). Assessing activity-based learning for a networked course. *British Journal of Educational Technology*, *33*(5), 603–618.

Macfadyen, L. P., & Dawson, S. (2010). Mining LMS data to develop an ‘‘early warning system” for educators: A proof of concept. *Computers & Education*, *54*(2), 588–599.

Macpherson, A., Elliot, M., Harris, I., & Homan, G. (2004). E-learning: reflections

and evaluation of corporate programmes. *Human Resource Development International*, *7*(3), 295–313.

Margaryan, A., Littlejohn, A., & Vojt, G. (2011). Are digital natives a myth or reality? University students' use of digital technologies. *Computers & Education*, *56*(2), 429–440.

Martyn, M. (2003). The hybrid online model: good practice. *Educause Quarterly*, *26*(1), 18–23.

Martínez, A., Dimitriadis, Y., Rubia, B., Gómez, E., & la Fuente, de, P. (2003). Combining qualitative evaluation and social network analysis for the study of classroom social interactions. *Computers & Education*, *41*(4), 353–368.

Mason, R., Pegler, C., & Weller, M. (2004). E-portfolios: an assessment tool for online courses. *British Journal of Educational Technology*, *35*(6), 717–727.

Mathes, A. (2004). Folksonomies-cooperative classification and communication through shared metadata. Retrieved April 10, 2010, from http://adammathes.com/academic/computer-mediated-communication/folksonomies.pdf

Matthews, R. S., Smith, B. L., & MacGregor, J. (2012). The evolution of learning communities: a retrospective. *New Directions for Teaching and Learning*, *2012*(132), 99–111.

Mazur, A., Doran, C., & Doran, P. (2010). The use of social network analysis software to analyze communication patterns and interaction in online collaborative environments. Proceedings of the International Conference on Education, Training and Informatics, Orlando, FL.

Mazzolini, M., & Maddison, S. (2007). When to jump in: the role of the instructor in online discussion forums. *Computers & Education*, *49*(2), 193–213.

McConnell, D. (2000). *Implementing Computer Supported Cooperative Learning* (2nd ed.). London: Kogan Press.

McConnell, D. (2002). The experience of collaborative assessment in e-learning. *Studies in Continuing Education*, *24*(1), 73–92.

McConnell, D. (2006). *E-Learning Groups And Communities*. McGraw-Hill Education (UK).

McDuff, N., & Marcelline, C. (2012). Equality annual report 2013. Kingston University. Retrieved August 19, 2013, from http://www.kingston.ac.uk/aboutkingstonuniversity/equality-diversity-and-inclusion/equality-reports/

McMillan, D. W., & Chavis, D. M. (1986). Sense of community: a definition and theory. *Journal of Community Psychology*, *14*(1), 6–23.

McNiff, J. (2013). *Action Research: Principles and Practice*. London: Taylor &

Francis.
McNiff, J., & Whitehead, J. (2002). *Action Research in Organisations*. London: Routledge.
Meiklejohn, A. (1932). *The Experimental College*. New York: Harper and Row.
Mihailidis, P., & Cohen, J. N. (2013). Exploring curation as a core competency in digital and media literacy education. *Journal of Interactive Media in Education*, *2013*(1), 1–19.
Mika, P. (2007). *Social Networks and the Semantic Web*. Boston: Springer.
Miller, J. P. (2007). *The Holistic Curriculum*. Ontario: University of Toronto Press.
Moule, P. (2007). Challenging the five-stage model for e-learning: a new approach. *ALT-J, Research in Learning Technology*, *15*(1), 37–50.
Nielson, J. (2010). "90-9-1" Rule for participation inequality: lurkers vs. contributors in internet communities (Jakob Nielsen's Alertbox). Retrieved October 21, 2011, from http://www.useit.com/alertbox/participation_inequality.html
NING. (2014). Build and cultivate your own community. *www.ning.com*. Retrieved October 4, 2014, from http://www.ning.com
Nisbet, J., & Watt, J. (1984). Case study. In J. Bell, T. Bush, & A. Fox (Eds.), *Conducting Small-Scale Investigations in Educational Management*. London: Harper and Row.
Nolen, A. L., & Vander Putten, J. (2007). Action research in education: addressing gaps in ethical principles and practices. *Educational Researcher*, *36*(7), 401–407.
Ooms, A., Burke, L., Linsey, T., & Heaton Shrestha, C. (2008). Introducing e-developers to support a university's blended learning developments. *ALT-J, Research in Learning Technology*, *16*(2), 111–122.
OpenSchool. (n.d.). OpenSchool ePortfolio Tour. *OpenSchool ePortfolio*. Retrieved August 1, 2013, from http://www.openschooleportfolio.com/tour/
Orsmond, P., Merry, S., & Reiling, K. (2000). The use of student derived marking criteria in peer and self-assessment. *Assessment & Evaluation in Higher Education*, *25*(1), 23–38.
OSI. (2013, August 19). Open Source Initiative FAQ. *Open Source Initiative*. Retrieved January 31, 2014, from http://opensource.org/faq
Pachler, N., & Daly, C. (2011). *Key Issues in E-Learning*. London: Continuum.
Palloff, R., & Pratt, K. (1999). *Building learning communities in cyberspace*. San Francisco: Wiley.
Palmer, C., & Ottley, S. (1990). *From potential to reality: "hybrids" - a critical force in the application of information technology in the 1990s*. London: British

Computer Society.
Pariser, E. (2011). *The Filter Bubble: How the New Personalized Web Is Changing What We Read and How We Think*. London: Penguin.
Parkes, K. A. (2013). ePortfolio as a measure of reflective practice. *International Journal of ePortfolio*, *3*, 99–115.
Paul, H., & Kimble, C. (2002). The duality of knowledge. *Information Research*, *8*(1), 1–18.
Paulson, F. L., & Paulson, P. R. (1994). Assessing portfolios using the constructivist paradigm. Proceedings of the Annual Meeting of the American Educational Research Association, New Orleans.
Paulson, F. L., Paulson, P. R., & Meyer, C. A. (1991). What makes a portfolio a portfolio. *Educational Leadership*, *48*(5), 60–63.
Pawan, F., Paulus, T. M., Yalcin, S., & Chang, C. (2003). Online learning: patterns of engagement and interaction among in-service teachers. *Language Learning & Technology*, *7*(3), 119–140.
Pedler, M. (1981). Developing the learning community. In T. Boydell & M. J. Pedler (Eds.), *Management of Self-Development: Concepts and Practices* (pp. 68–94). Aldershot, England.
Pieterse, V. (2008). Reflections on coding standards in tertiary Computer Science education. *South African Computer Journal*, *49*, 29–37.
Pitri, E. (2004). Situated learning in a classroom community. *Art Education*, *57*(6), 6–12.
Pitts, W., & Ruggirello, R. (2012). Using the e-Portfolio to document and evaluate growth in reflective practice: the development and application of a conceptual framework. *International Journal of ePortfolio*, *2*(1), 49–74.
Popper, K. R. (1979). Three worlds. The Tanner lecture on human values at the University of Michigan. *Michigan Quarterly*, *2*, 140–167.
Price, M., Carroll, J., O'Donovan, B., & Rust, C. (2011). If I was going there I wouldn't start from here: a critical commentary on current assessment practice. *Assessment & Evaluation in Higher Education*, *36*(4), 479–492.
Purdue Research Foundation. (2013). Course signals system at Purdue University. Retrieved August 10, 2014, from http://www.itap.purdue.edu/studio/signals/
QAA. (2004). *Guidelines on the*
accreditation of prior learning (p. 25). Quality Assurance Agency for Higher Education. Retrieved from http://www.qaa.ac.uk/Publications/InformationAndGuidance/Documents/APL.pdf

Quinn, J. (2010). *Learning Communities and Imagined Social Capital: Learning to Belong*. London: Bloomsbury.

Raymond, E. S. (2008). *The Cathedral and the Bazaar*. New York: O'Reilly Media, Inc.

Reason, P., & Torbert, W. R. (2001). The action turn: toward a transformational social science. *International Journal of Action Research and Organisational Renewal*, *6*(1), 1–37.

Rhodes, T., Chen, H. L., Watson, C. E., & Garrison, W. (2014). Editorial: a call for more rigorous e-Portfolio research. *International Journal of ePortfolio*, *4*(1), 1–5.

Rickards, W. H., Diez, M. E., Ehley, L., & Guilbault, L. F. (2008). Learning, reflection, and electronic portfolios: stepping toward an assessment practice. *The Journal of General Education*, *57*(1), 31–50.

Ring, G., & Ramirez, B. (2012). Implementing ePortfolios for the assessment of general education competencies. *International Journal of ePortfolio*, *2*(1), 87–97.

Robins, A., Rountree, J., & Rountree, N. (2003). Learning and teaching programming: a review and discussion. *Computer Science Education*, *13*(2), 137–172.

Rodgers, C. (2002). Defining reflection: another look at John Dewey and reflective thinking. *Teachers College Record*, *104*(4), 842–866.

Romer, T. A. (2002). Situated learning and assessment. *Assessment & Evaluation in Higher Education*, *27*(3), 233–241.

Roth, R. W. (1980). The teaching of documentation and good programming style in a liberal arts computer science program (Vol. 12, pp. 139–153). Proceedings of the 4th Annual Conference on Innovation and Technology in Computer Science Education, Krakow, Poland.

Roth, W., & Lee, Y. (2007). "Vygotsky's Neglected Legacy": Cultural-Historical Activity Theory. *Review of Educational Research*, *77*(2), 186–231.

Roth, W.-M., & Lee, Y.-J. (2006). Contradictions in theorizing and implementing communities in education. *Educational Research Review*, *1*(1), 27–40.

Rourke, L. (2009). Learning in communities of inquiry: a review of the literature. *Journal of Distance Education*, *23*(1), 19–48.

Rust, C., Price, M., & O'Donovan, B. (2003). Improving students' learning by developing their understanding of assessment criteria and processes. *Assessment & Evaluation in Higher Education*, *28*, 147–164.

Ryan, G. W., & Bernard, H. R. (2003). Techniques to identify themes. *Field Methods*, *15*(1), 85–109.

Ryberg, T., & Larsen, M. C. (2008). Networked identities: understanding relationships between strong and weak ties in networked environments. *Journal of Computer Assisted Learning*, *24*(2), 103–115.

Saadatmand, M., & Kumpulainen, K. (2013). Content aggregation and knowledge sharing in a personal learning environment: serendipity in open online networks. *International Journal of Emerging Technologies in Learning (iJET)*, *8*(1), 1–8.

Salmon, G. (2003). *E-Moderating: The Key to Teaching and Learning Online*. London: Routledge, Chapman and Hall.

Salmon, G. (2007). The tipping point. *ALT-J, Research in Learning Technology*, *15*(2), 171–172.

Salmon, G. (2011). *E-moderating: The key to online teaching and learning* (3rd ed.). New York: Routledge.

Scardamalia, M., & Bereiter, C. (2003). Knowledge Building. In *Encyclopedia of Education* (2nd ed., pp. 1370–1373). New York: Macmillan Reference.

Schon, D. A. (1983). *The Reflective Practitioner*. New York: Basic Books.

Schon, D. A. (1990). *Educating the Reflective Practitioner: Toward a New Design for Teaching and Learning in the Professions*. San Francisco: Jossey-Bass.

Schreurs, B., Teplovs, C., Ferguson, R., De Laat, M. F., & Shum, S. B. (2013). Visualizing social learning ties by type and topic: rationale and concept demonstrator (pp. 33–37). Proceedings of the LAK '13: International Conference on Learning Analytics and Knowledge, Leuven, Belgium.

Schwier, R. A. (2001). Catalysts, emphases, and elements of virtual learning communities: implications for research and practice. *Quarterly Review of Distance Education*, *2*(1), 5–18.

Scouller, K. (1998). The influence of assessment method on students' learning approaches: multiple choice question examination versus assignment essay. *Higher Education*, *35*(4), 453–472.

Scriven, M. (1966). *The Methodology of Evaluation*. Social Science Education Consortium. Retrieved April 9, 2014, from http://www.comp.dit.ie/dgordon/Courses/ILT/ILT0005/TheMethodologyOfEvaluation.pdf

Seitzinger, J. (2014). Curate Me! Exploring online identity through social curation in networked learning (pp. 412–419). In S. Bayne, C. Jones, M. De Laat, T. Ryberg & C. Sinclair (Eds.) Proceedings of the 9th International Conference on Networked Learning, Edinburgh.

Selwyn, N. (2007). The use of computer technology in university teaching and learning: a critical perspective. *Journal of Computer Assisted Learning*, *23*(2),

83–94.

Selwyn, N. (2013). *Distrusting Educational Technology: The Questions We Should Be Asking, But Are Not: Critical Questions for Changing Times*. New York: Taylor & Francis.

Seo, K. K. (2007). Utilizing peer moderating in online discussions: addressing the controversy between teacher moderation and nonmoderation. *American Journal of Distance Education*, *21*(1), 21–36.

Sharples, M., McAndrew, P., Weller, M., Ferguson, R., Fitzgerald, E., Hirst, T., & Gavid, M. (2013). *Innovating Pedagogy 2013: Open University Innovation Report 2*. Milton Keynes: The Open University.

Shea, P. J., Pickett, A. M., & Pelz, W. E. (2003). A follow-up investigation of "teaching presence" in the SUNY Learning Network. *Journal of Asynchronous Learning Networks*, *7*(2), 61–80.

Shea, P., Hayes, S., Vickers, J., Gozza-Cohen, M., Uzuner, S., Mehta, R., Valchova, A., et al. (2010). A re-examination of the community of inquiry framework: Social network and content analysis. *The Internet and Higher Education*, *13*(1), 10–21.

Shea, P., Sau Li, C., & Pickett, A. (2006). A study of teaching presence and student sense of learning community in fully online and web-enhanced college courses. *The Internet and Higher Education*, *9*(3), 175–190.

Shea, V. A. H. (2010). Online instructional effort measured through the lens of teaching presence in the community of inquiry framework: a re-examination of measures and approach. *International Review of Research in Open and Distance Learning*, *11*(3), 127–154.

Sherman, G. (2006). Instructional roles of electronic portfolios. In A. Jafari & C. Kaufman (Eds.), *Handbook of Research on ePortfolios* (pp. 1–14). Hershey, PA: Idea Group Publishing.

Sherry, A., & Bartlett, A. (2005). Worth of electronic portfolios to education majors: a "two by four" perspective. *Journal of Educational Technology Systems*, *33*(4), 399–419.

Shulman, L. S. (1998). Teacher portfolios: a theoretical activity. In N. M. Lyons (Ed.), *With portfolio in hand*. New York: Teachers College Press.

Shute, V. J. (2008). Focus on formative feedback. *Review of Educational Research*, *78*(1), 153–189.

Siemens, G., & Long, P. (2011). Penetrating the fog: analytics in learning and education. *Educause Review*. Retrieved September 17, 2013, from http://www.elmhurst.edu/~richs/EC/OnlineMaterials/SPS102/Teaching%20and%20Learning/Penetrating%20the%20Fog.pdf

Sikes, P. P., & Potts, A. (2008). *Researching Education from the Inside: Investigations from Within*. Oxford: Routledge.

Singh, H. (2003). Building effective blended learning programs. *Educational Technology*, *43*(6), 51–54.

Smith, B. L. (2001). The challenge of learning communities as a growing national movement. *Peer Review*, *4*(1), 4–8.

Smith, B. L., MacGregor, J., Matthews, R., & Gabelnick, F. (2004). *Learning Communities: Reforming Undergraduate Education*. San Francisco: Wiley.

Smith, G. (2008). Information architecture: tagging - emerging trends. *Bulletin of the American Society for Information Science and Technology*, *34*(6), 14–17.

Smith, K., & Tillema, H. (1998). Evaluating portfolio use as a learning tool for professionals. *Scandinavian Journal of Educational Research*, *42*(2), 193–205.

Snyder, B. R. (1971). *The Hidden Curriculum*. New York: Knopf.

Somekh, B. (1995). The contribution of action research to development in social endeavours: a position paper on action research methodology. *British Educational Research Journal*, *21*(3), 339–355.

Stallman, R. M., & Gay, J. (2009). *Free software, free society: Selected essays of Richard M. Stallman*. CreateSpace. Retrieved from https://www.gnu.org/philosophy/fsfs/rms-essays.pdf

Steeples, C., & Goodyear, P. (1999). Enabling professional learning in distributed communities of practice: descriptors for multimedia objects. *Journal of Network and Computer Applications*, *22*(2), 133–145.

Steeples, C., Jones, C., & Goodyear, P. (2002). Beyond E-learning. In C. Steeples & C. Jones (Eds.), *Networked Learning: Perspectives and Issues* (pp. 323–341). London: Springer.

Stefani, L., Mason, R., & Pegler, C. (2007). *The educational potential of e-portfolios: supporting personal development and reflective learning*. London: Routledge.

Stenhouse, L. (1975). *An Introduction to Curriculum Research and Development*. London: Heinemann.

Stevenson, H. J. (2006). Using ePortfolios to foster peer assessment, critical thinking, and collaboration. In A. Jafari & C. Kaufman (Eds.), *Handbook of Research on ePortfolios* (pp. 112–124). Hershey, PA: Idea Group Publishing.

Stödberg, U. (2012). A research review of e-assessment. *Assessment & Evaluation in Higher Education*, *37*(5), 591–604.

Strivens, J., Baume, D., Owen, C., Grant, S., & Ward, R. (2009). The role of e-Portfolios in formative and summative assessment. Centre for Recording Achievement for JISC (pp. 1–66). JISC. Retrieved August 10, 2010 from http://www.jisc.ac.uk/media/documents/programmes/elearning/eportfinal

report.doc.
Suthers, D., & Rosen, D. (2011). A unified framework for multi-level analysis of distributed learning (pp. 64–74). Proceedings of the LAK 11: International Conference on Learning Analytics and Knowledge, New York.
Szabo, A., & Underwood, J. (2004). Cybercheats: is information and communication technology fuelling academic dishonesty? *Journal of Research in International Education*, *5*(2), 180–199.
Taras, M. (2008). Summative and formative assessment: perceptions and realities. *Active Learning in Higher Education*, *9*(2), 172–192.
Tinto, V. (1995). Taking student retention seriously. *Syracuse University*.
Tinto, V. (2000). Learning better together: the impact of learning communities on student success. *Higher Education monograph series*, *8*(1), 1–8.
Toikkanen, T., & Lipponen, L. (2011). The applicability of social network analysis to the study of networked learning. *Interactive Learning Environments*, *19*(4), 365–379.
Torras, M. E., & Mayordomo, R. (2011). Teaching presence and regulation in an electronic portfolio. *Computers in Human Behavior*, *27*(6), 2284–2291.
Tosh, D., Werdmuller, B., Chen, H. L., Light, T. P., & Haywood, J. (2006). The learning landscape: a conceptual framework for ePortfolios. In A. Jafari & C. Kaufman (Eds.), *Handbook of Research on ePortfolios* (pp. 24–32). Hershey, PA: Idea Group Publishing.
University of Queensland. (2013, August 19). eLearning statistics report. *University of Queensland eLearning Statistics report*. Retrieved August 19, 2013, from http://www.elearning.uq.edu.au/content/elearning-statistics-report-april-2013.
Valentine, K. (2006). Plagiarism as literacy practice: recognizing and rethinking ethical binaries. *College Composition and Communication*, *58*(1), 89–109.
van Harmelen, M. (2006). Personal Learning Environments (pp. 815–816). Proceedings of the Sixth International Conference on Advanced Learning Technologies, Kerkrade, The Netherlands: IEEE.
Vonderwell, S. (2003). An examination of asynchronous communication experiences and perspectives of students in an online course: a case study. *The Internet and Higher Education*, *6*(1), 77–90.
Vygotsky, L. S. (1980). *Mind in Society: The Development of Higher Psychological Processes*. Cambridge, Mass.: Harvard University Press.
Walz, P. (2006). An overview of student ePortfolio functions. In A. Jafari & C. Kaufman (Eds.), *Handbook of Research on ePortfolios* (pp. 193–204). Hershey, PA: Idea Group Publishing.

Wang, C. X. (2009). Comprehensive assessment of student collaboration in electronic portfolio construction: an evaluation research. *TechTrends*, *53*(1), 58–66.

Wasserman, S., & Faust, K. (1994). *Social Network Analysis: Methods And Applications* (19th ed.). New York: Cambridge University Press.

Watson, D. (2006). *How to think about widening participation in UK higher education*. Bristol: HEFCE.

Wenger, E. (1998). Communities of practice: learning as a social system. *Systems Thinker*, *9*(5), 1–10.

Wenger, E. (1999). *Communities of Practice: Learning, Meaning, and Identity*. New York: Cambridge University Press.

Wenger, E. (2001). Supporting communities of practice: a survey of community-oriented technologies. Retrieved September 16, 2015, from https://guard.canberra.edu.au/opus/copyright_register/repository/53/153/01_03_CP_technology_survey_v3.pdf

Wenger, E. (2002). *Cultivating Communities of Practice: A Guide to Managing Knowledge*. Boston: Harvard Business School Press.

Wenger, E. (2010). Communities of practice and social learning systems: the career of a concept. Retrieved January 31, 2012, from http://wenger-trayner.com/wp-content/uploads/2012/01/09-10-27-CoPs-and-systems-v2.0.pdf

Whitelock, D. (2009). Editorial: e-assessment: developing new dialogues for the digital age. *British Journal of Educational Technology*, *40*(2), 199–202.

Wiggins, G. P. (1999). *Assessing Student Performance: Exploring the Purpose and Limits of Testing*. San Francisco: Wiley.

Wiliam, D. (2006). Formative assessment: getting the focus right. *Educational Assessment*, *11*(3-4), 283–289.

Wiliam, D. (2011). What is assessment for learning? *Studies in Educational Evaluation*, *37*(1), 3–14.

Williams, J. B., & Jacobs, J. (2004). Exploring the use of blogs as learning spaces in the higher education sector. *Australasian Journal of Educational Technology*, *20*(2), 232–247.

Wong, A. (2008). Assessment of experiential learning: supporting or subverting the promise of RPL at the university level. Proceedings of the Saskatchewan RPL Conference, Saskatchewan.

Wood, D., Bruner, J., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Psychiatry*, *17*(2), 89–100.

Woodford, K., & Bancroft, P. (2005). Multiple choice questions not considered

harmful. Proceedings of the Australasian conference on Computing education, Darlinghurst.

Yancey, K. B. (2009a). Electronic portfolio technology and design for learning. In D. R. Cambridge, B. L. Cambridge, & K. B. Yancey (Eds.), *Electronic Portfolios 2.0* (pp. 5–16). Sterling: Stylus Publishers.

Yancey, K. B. (2009b). Reflection and electronic portfolios. In D. R. Cambridge, B. L. Cambridge, & K. B. Yancey (Eds.), *Electronic Portfolios 2.0* (pp. 5–16). Sterling: Stylus Publishers.

Yorke, M. (2005). Formative assessment in higher education: its significance for employability, and steps towards its enhancement. *Tertiary Education and Management*, *11*(3), 219–238.

Zeichner, K., & Wray, S. (2001). The teaching portfolio in US teacher education programs: what we know and what we need to know. *Teaching and Teacher Education*, *17*(5), 613–621.