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Collaborative technologies, higher order thinking and self-sufficient learning: A case study of adult learners

Clare S. Johnson*

Faculty of Computing, Engineering and Science, University of South Wales, Pontypridd, UK

The inclusion of online elements in learning environments is becoming common-place in Post Compulsory Education. A variety of research into the value of such elements is available, and this study aims to add further evidence by looking specifically at the use of collaborative technologies such as online discussion forums and wikis to encourage higher order thinking and self-sufficient learning. In particular, the research examines existing pedagogical models including Salmon's five-stage model, along with other relevant literature. A case study of adult learners in community-based learning centres forms the basis of the research, and as a result of the findings, an arrow model is suggested as a framework for online collaboration that emphasises the learner, mentions pre-course preparation and then includes three main phases of activity: post, interact and critique. This builds on Salmon's five-stage model and has the benefit of being flexible and responsive, as well as allowing for further development beyond the model, particularly in a blended learning environment.

Keywords: critical thinking; self-sufficient learning; technology; adults; Salmon's five-stage model; arrow model

Introduction

Social networking and education

This paper examines the extent to which existing pedagogical models can encourage learners to develop higher order thinking skills and self-sufficiency in learning, focusing specifically on Salmon's five-stage model. It then presents a new model devised by the author, the arrow model, which can be applied in a blended learning environment. This work was presented at the Association for Learning Technology Conference 2016 (ALT-C), and requests for publication were made at this time.

Social interaction has long been identified as a vital ingredient of learning (Vygotsky 1978; Wenger 1998) and with the growth of the Internet, new opportunities for moving some of these interactions online have developed. The Office for National Statistics reports that almost 88% of adults in the United Kingdom used the Internet during a 3-month survey period in 2016 (ONS 2016), and many of our interactions are now online through social networking sites. This development permeates every aspect of our lives and no less so in our pursuit of education (Ausburn 2004; Falloon 2011; Gunawardena 2009). Indeed, according to an infographic compiled by Lynch (2011) from schools.com, 91% of college departments use social networking

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*Corresponding author: Email: clare.johnson@southwales.ac.uk

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in a work capacity, with 80% of teaching staff using social media for some aspect of a course they are teaching.

Many courses now use a blend of techniques to deliver content, with face-to-face learning supplemented by online materials, instructional videos, podcasts, screencasts, interactive online tools such as quizzes and tests, and in many cases collaborative online tools such as fora, wikis and blogs. However, the effectiveness of these tools as a way of developing higher order thinking is not always evaluated: Yaunkun (2012) and Ruey (2009) looked at student perceptions; there are a number of studies that looked at how course leaders should incorporate online learning into their course structure (e.g. Cornelius and Gordon 2009; Gareis 2006; Gunawardena 2009), whereas Mason (2011) discussed the categorisation of levels of learning. There are indicators that further research would be beneficial: Wickersham and Dooley (2006, p. 186) commented that whilst instructors assess the degree of participation, they may not consider how this participation contributes to the learning process, and Garrison and Arbaugh (2007) suggested that further analysis of success in quantitative terms with direct correlation with learning outcomes is required.

This research uses a case study approach to consider Salmon's five-stage model as a tool for underpinning online activities and examines the obstacles that can prevent adult learners from achieving the higher levels of critical thinking and self-sufficient learning. Emphasis was given to online collaborative areas such as fora and wikis, where asynchronous communication takes place between a group of learners through clearly focused tasks and activities.

Research questions

The main focus of the research questions included the following elements:

- What evidence is there that higher order thinking is taking place in online collaborative environments?
- What are the obstacles adults face in achieving higher order thinking in this environment?
- To what extent does the course design and structure of tasks provide opportunities for the development of higher order thinking?
- How effective is the five-stage model in supporting adult learners to achieve higher order thinking in online environments?

Brief course context

The groups involved in this case study were made up of three separate cohorts – two of these were level-two photoshop cohorts in two separate further education satellite centres based in the heart of their local communities, and the third was a web scripting cohort, based in the same centre as one of the photoshop courses. Each course ran for a duration of 2.5 h once a week for 12 weeks. Students on the courses are referred to as 'learners' throughout this research in line with the policy of the institution where the research took place. There were a total of 19 learners, with an age range of 23 to 71, though predominantly middle aged and older. The courses all made use of the college's virtual learning environment (VLE) – in this case, Moodle 2.0. In addition, the web scripting course made use of a Wikispaces site.

Related work

The research focused on three pedagogical models as a starting point for developing online activities that promote higher order thinking:

- Bloom's taxonomy,
- Garrison's communities of inquiry, and
- Salmon's five-stage model.

It also considered Gunawardena's social networking spiral (2009) and Maslow's hierarchy of needs, along with studies on student perceptions (Gosmire, Morrison, and Van Osdel 2009; Ruey 2009; Yaunkun 2012), teachers' perceptions (Salmon 2011), course design (Ausburn 2004; Garrison, Anderson, and Archer 2000; Rhoades and Rhoades 2013) and research discussing evidence of higher order thinking in an online environment (Mak, Williams, and Mackness 2010; McLoughlin and Mynard 2009).

In addition, studies into student engagement and the success or otherwise of getting learners to engage online (Mason 2011; Young and Bruce 2011) along with barriers to learners (Knowles 2011) were reviewed, along with studies providing recommendations on *how* course leaders should incorporate online learning into their course structure (Cornelius and Gordon 2009; Gareis 2006).

Bloom's taxonomy

Bloom's taxonomy (Bloom 1956) provides a useful theoretical model for the classification of educational goals and objectives leading towards higher order thinking. He classified thinking according to six cognitive levels of complexity. The lowest levels include knowledge, comprehension and application, and the three highest levels include analysis, synthesis and evaluation. These top three levels were later updated and reworded by Anderson and Krathwohl (2001) to analyse, evaluate and create as detailed below:

- Analyse: Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure or purpose through differentiating, organising and attributing.
- Evaluate: Making judgements based on criteria and standards through checking and critiquing.
- Create: Putting elements together to form a coherent or functional whole, and reorganising elements into a new pattern or structure through generating, planning or producing.

It is these top three levels that demonstrate evidence of higher order thinking and as such are important in this study.

Garrison's communities of inquiry

In contrast to Bloom, Garrison, Anderson and Archer (1999) provided us with a process model rather than a theoretical one. Garrison introduced the communities of inquiry (https://coi.athabascau.ca/coi-model/) as a model for the use of computer conferencing as a medium to support an educational experience (Garrison, Anderson, and Archer 1999), suggesting a practical model, with three core elements, namely

cognitive presence, social presence and teaching presence. These core elements are further developed with the main focus being that of social interaction as an aid to learning and ultimately to developing higher order thinking and self-sufficient learning.

Salmon's five-stage model

The five-stage model was created by Salmon as a tool for developing skills and confidence in online learning activities (or 'e-tivities'). Following the model ensures learners function and engage at the lower levels, and then become more effective and independent learners, building skills at the top level of the model where knowledge construction and responsibility for own learning takes place (Figure 1). At the higher stages, Salmon identifies that a range of different skills are utilised which are those of 'critical thinking and the ability to challenge the "givens"' (Salmon 2011, p. 53) (Figure 1).
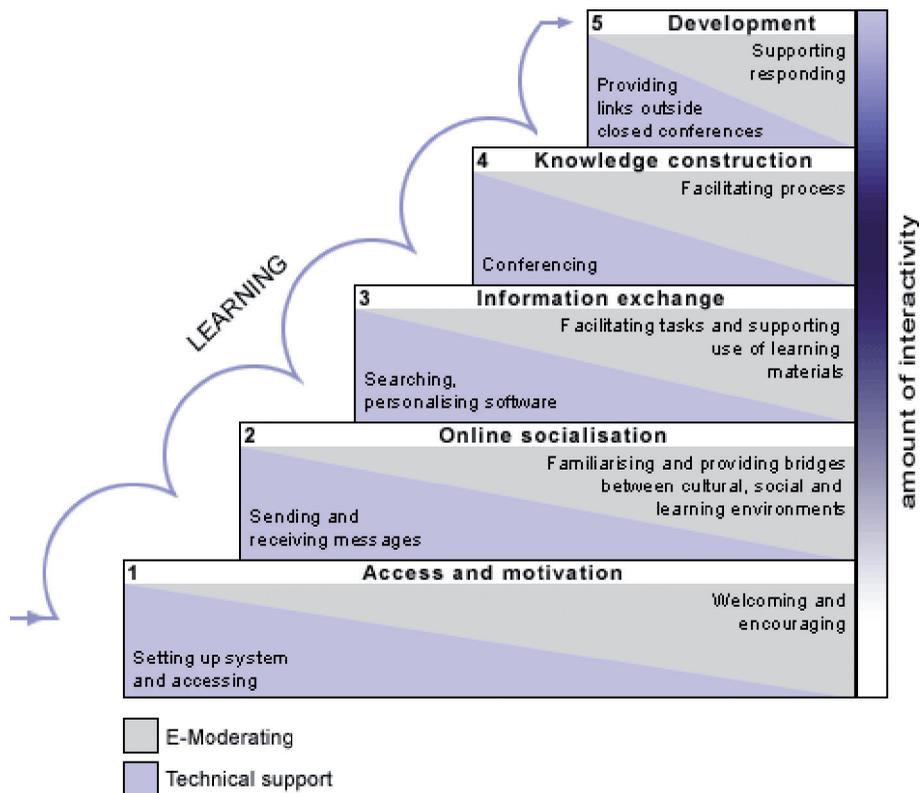
Figure 1.   Salmon's five-stage model. (Reproduced with permission Salmon 2011.)

Key to the success of the five-stage model is to ensure that physical, technical and basic needs are met at the early stages of the course. This echoes much earlier work by Maslow in his hierarchy of needs (Maslow 1943). The model concentrates mainly on the role of the 'e-moderator' – that is, the person who pushes the discussions along and steers the activities – rather than that of the learner. The popularity of the model for online learning has meant that there is tendency to use the model in a wider context than it was intended. Moule (2007, p. 39) critiques the model as being seen as a 'panacea' for all online course design, and that its focus on purely online learning means that

it fails to take advantage of opportunities to integrate with face-to-face delivery. Watts (2010) recognised the limitations of the model when trying to apply it to blended learning courses in higher education. Lisewski and Joyce (2003) noted that there is a temptation to enforce models such as the five-stage model too strictly, and that this has implications for developing learning technology for education.

This study focuses on Salmon's original model. A new image for this model has recently been created (Salmon 2017), which has a more fluid appearance in the shape of a tree. However, the staged process remains and the findings and discussions from this paper are still valid.

Methods

The research took the form of a case study as this format enables research in a real-life situation where there is no specific outcome expected (Cohen, Manion, and Morrison 2000). The researcher looked at the question of whether the use of collaborative online discussion areas promoted the development of higher order thinking in adults by identifying and colour coding themes that emerged from the data collected and analysing these themes further to see if conclusions could be drawn from them. Three cohorts were studied which adds to the reliability of the results, though it would be beneficial to repeat the activities with further cohorts.

Methods used to collect and evaluate data included qualitative data analysis, by way of surveys, a semi-structured group interview, and by analysing learner input into the collaborative online resources; and quantitative data analysis, by way of statistical data gathered from online logs such as VLE and wiki logs. This ensures that the findings are triangulated and therefore considered reasonably robust and reliable. Indicators relating to learner engagement and evidence of critical thinking were drawn out by analysing the data, and these indicators were subsequently formalised and moderated with a colleague to establish inter-rater reliability. Limitations identified include the small number of unique learners (16), which must be taken into account when interpreting the findings and the time-limited nature of the courses (12 weeks in duration) which are likely to have had an impact on the levels of critical thinking that the learners were able to achieve.

Ethical issues

Participants on the courses were informed about the research study and were asked to give written consent for their data to be included. They were given the opportunity to opt out at any time with no detrimental effect to their learning.

Results and findings

Data collection

The initial surveys conducted at the start of the course provided a mixture of quantitative data and qualitative data. Learner enrolment forms provided demographic information, the findings of which were deemed insignificant, whilst learner perception data were gathered via two surveys: an individual learning plan (ILP) which asked the learners how they perceived the way they learn, what they hoped to achieve from the course and what their experience of online collaboration was prior to the
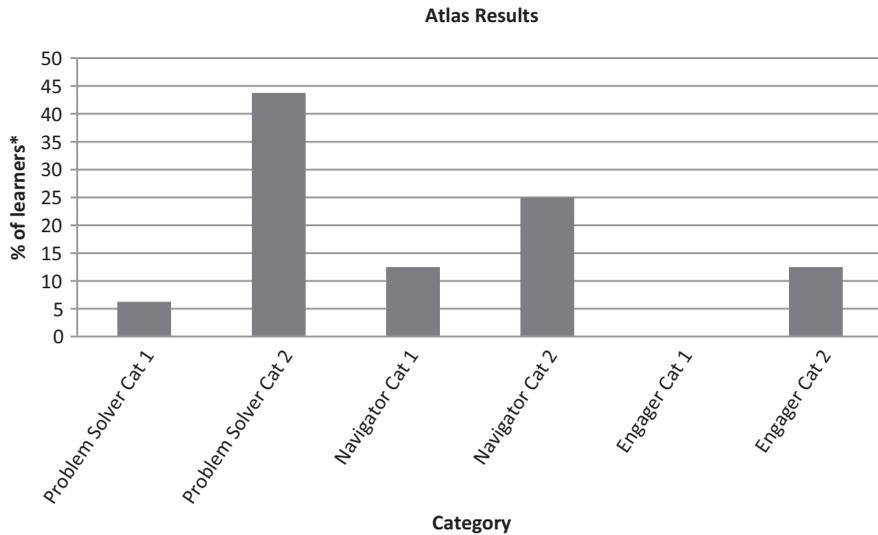
Atlas Results

*16 unique respondents in total

Figure 2. ATLAS results (chart).

start of the course, and an ATLAS (Assessing the Learning Strategies of Adults) self-test (Conti 2009). The results of the questionnaire showed that most learners were in the problem solver sub category 2, who demonstrate a preference for critical use of resources (Figure 2).

Of the 16 unique respondents (several of the learners were studying both courses), exactly half said that they had previously studied a course with an online element. Over 50% (9 learners) had 'moderate' to 'extensive' experience of specifically using a VLE. Fewer than 20% (3 learners) had no experience at all of using a VLE (Figure 3).

Experience of using a VLE at start of course

*16 learners in total
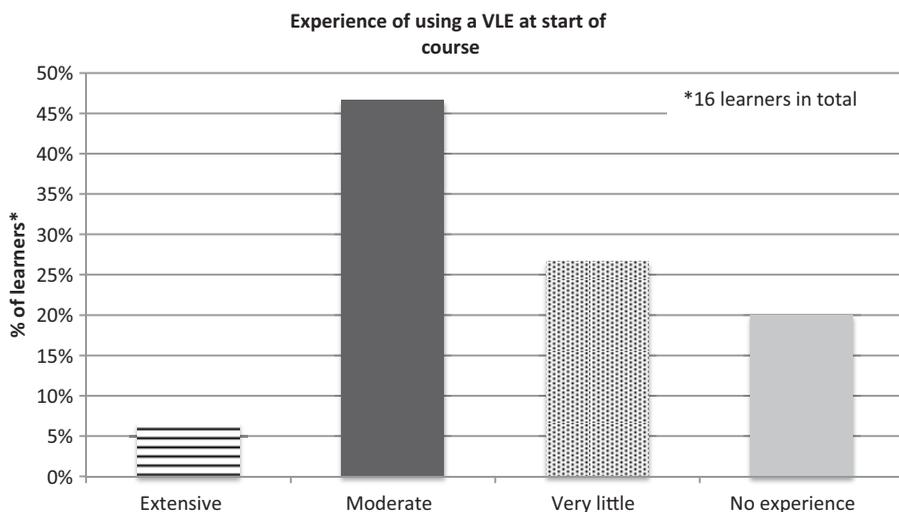
Figure 3. Experience of using a VLE at start of course (chart).

In terms of online fora, over 60% of the group (10 learners) had 'never' or 'not often' used an online forum, although those that did use them tended to use them 'very often' (30% – 5 learners). Further quantitative data were gathered on how frequently learners engaged with the online tasks and collaborative work areas, including data on the number of views and the number of interactions, but the findings are of less interest in than the findings from the qualitative data.

Qualitative data

At the end of the course, a focus group was held to gather qualitative data on the course activities and the development of higher order thinking. Semi-structured interview questions were asked, and these provided a basic structure from which to explore any interesting discussion points. Six learners took part in this activity, which was videoed and then transcribed. A coding analysis of the transcript was carried out where emergent themes were colour coded and highlighted at each appearance during the interview transcript. Further qualitative data were gathered from transcripts of the online tasks and collaborative work areas, which were also coded as above, and the following themes emerged:

- Evidence of higher order thinking and self-sufficient learning
- Prior knowledge and previous experience of using online resources
- Improvement seen by participation on the course, including elements which were motivational in getting the learners to participate
- Barriers to the use of the technology
- Action points for further course planning/pedagogical interest

Course structure and scaffolding

Salmon (2011) suggested that a number of elements need to be in place in order for participation to be forthcoming and also to develop that participation into higher order thinking. These are referred to as 'scaffolding'. The following elements were therefore considered important in setting up the course.

- An introductory forum – to ensure learners engaged as early as possible within a non-threatening, non-assessed format (Stage 1 of the five-stage model);
- Tutor support throughout – to ensure that learners' posts were acknowledged and encouraged wherever possible, and that discussions were developed;
- Motivation – by way of relating forum/wiki activities to criteria required for the completion of the course;
- Feedback to learners – done weekly via the discussions themselves and also through Moodle's gradebook.

Online environment

The VLE being used in this research was Moodle. Delays in creating the student log-ins at one centre had a noticeable impact on student participation in the online elements of the course. Once logged into Moodle, the courses were laid out in a weekly structure, with a clear subject heading for each week's activities. Each section contained resources

from the session such as class notes, links to other websites or resources, videos and quizzes, files for learners to download and use in their activities such as photographs or sample scripts, and an area for uploading completed work for marking. In addition, some weeks contained fora or links to wiki activities for the learners to participate in.

For the online interactions, preparatory work was typically carried out in the classroom, and then learners were tasked with specific activities to continue at home, thus creating a blended learning experience. For example in the 'Should Photoshopped images be banned in advertising' forum, a video was shown in class and also provided on Moodle, and learners were then asked to contribute their own views about this in an online forum. This helped strengthen scaffolding for the learners and fostered a blended learning approach.

Quantitative data

A total of 122 posts were made to the combined fora/discussion groups during the entire study period. The Introduction forums generated the most 'views' where visits to the forum were recorded, regardless of whether or not a post was made, suggesting that learners read and lurked before posting. This is reflective of the initial enthusiasm at the start of the course. These forums were also highly promoted by the tutor as an important part of becoming familiar with the online environment and so motivation is also a consideration here and reflects earlier findings on this by Salmon (2011) and Mason (2011). A possible fear of being seen to 'fail' at this stage by not managing to add to the introductions forum might also be a factor in the number of views.

The role of the tutor

Engaging the learners as quickly as possible in the online environment as per Salmon's model was encouraged by way of the introductory forum post, where all learners were asked to leave a sentence or two about themselves. Of the 19 learners, 16 made it to these fora although they later commented that they would have liked greater detail on what they should post, and where this should be done. This points to a lack of clarity from the tutor or from written instructions, which would fail to meet suggestions at Stage 1 (access and motivation) and Stage 2 (socialisation) of the five-stage model.

On some occasions, learners' posts were followed up by the tutor with developmental questions, which resulted in collaborative discussions between the tutor and learners showing evidence of critical thinking skills. For example, at the start a discussion forum about the purpose of web page 'cookies', one of the learners provided a brief description about what a cookie is. This was explored with the following comment from the tutor:

> Thanks xxx. Would you say then that a Cookie is Client Side? Would everyone else agree?

The initial poster responded with an answer, which mentioned another web technique known as 'sessions'. So he posed a question himself:

> So what are 'sessions?!'

Interaction with the tutor had led this learner to expand upon his initial answer, and then follow it up with a further, more in-depth question, in line with the analyse

stage identified by Bloom. Other learners joined in the discussion, which developed into the legal implications and ethics of cookies. A third student included a link to an external site for further information, indicating that this learner, amongst others, reviewed additional sources of information as part of the task. The role of the tutor in this example is clear: had the learners not been questioned on their initial posts, it is likely that the discussions would have been less meaningful. This echoes Salmon's theories on the importance of the e-moderator, as well as the social and cognitive functions of Garrison's community of inquiry. The tutor also ensured that almost all comments on fora/wikis got some sort of tutor feedback to help build the scaffolding. In later discussions, the tutor used this opportunity to probe the posters further – for example, 'Thanks xxx – you say that the majority of the population know Photoshop is being used... – does everyone else agree with this?'

During the focus group discussions at the end of this research project, learners commented that would have liked to have been given deadlines for posting on the discussions, and that this would have provided greater motivation for them to take part. This echoes Yaunken's findings (2012).

Evidence of higher order thinking and self-sufficient learning

Having built the appropriate scaffolding for learners, Salmon's model leads to Stage 4 (knowledge construction) and Stage 5 (development). There is evidence to show that these stages were reached by a number of learners and comments demonstrating higher order thinking as a direct result of these online collaborative activities can be seen.

Higher order thinking

For example, in the focus group itself, when discussing a flipped classroom activity, one of the learners noted that whilst he did not fully understand the topic he had been asked to write about on the wiki 'it doesn't matter, because you start to think about it', which demonstrates that the learner appreciates the importance of developing critical thinking skills. Another learner commented that 'we're adults and we should be trying to understand what we're doing'. Learners also identified the importance of being able to 'bridge the understanding between being able to "rotely" [sic] say what somebody else had said and understand exactly what's happening in the computer world' – an excellent example of the transition from rote learning to meaningful learning as discussed by Anderson and Krathwohl (2001, p. 64).

Collaboration

In one activity on the wiki, learners were asked to post up links to their own websites for review by other students. Evidence of higher order thinking emerges here, with comments like 'I think your shunting across the page problem you mention is because some of your pages fit completely in the screen and others don't', and suggestions of a solution. Another benefit of being able to share resources is identified by the post 'our sites are all equally very good, but isn't it interesting how different our websites are in style?' and include questions on technical aspects of posting messages – such as 'how have you made the links to your websites open as separate pages?'. This again reflects the earlier theories of Garrison and Arbaugh (2007).

In one discussion forum, learners were asked to assess the appropriateness of the use of photoshopped images in advertising, with direct reference to the banning of a mascara advert following the discovery that Photoshop had been used to enhance the eyelashes of the model used. The activity was introduced in class, and contributions to this forum were analytical and demonstrated thought into the subject. For example, one learner wrote 'Effort should be directed at lifting public awareness by adding a tag line "image photo shopped" [sic]', whilst another put 'People can be persuaded to part with hard earned cash by a false image which cannot deliver what is promised and therefore could be classed as fraudulent'. Follow-up questions from the tutor prompted further discussion, demonstrating that the collaborative nature of the forum provided an opportunity to debate a point.

Self-sufficiency

The focus group provides evidence of self-sufficient learning where one learner notes that 'I like to know how things work and not rely on others', and that this learner uses 'trial and error' as well as online resources from widely recognised sources. Another example of self-sufficiency can be demonstrated by the learner who realised his own self-development throughout the course: 'the online approach [meant] you had the thing [lesson] during the week and having the Dreamweaver meant you could go over the thing you'd done [at home].' Another learner stated that 'you start to think "how does that fit in to what I want to use it for"' which demonstrates a more reflective approach to thinking about the course work. Self-sufficiency was also evidenced within the online activities as shown by comments such as 'If you go to your Dreamweaver and look at "Help", then "Dreamweaver Exchange" you can actually add extensions into Dreamweaver'.

A question that was posed in the focus group was 'Do you think you'll continue to use online resources and to build up those skills independently now?' to which the entire group confirmed their agreement, with one learner saying 'I think we've been given more confidence…. It encourages you'.

Whilst the online elements were valuable, group discussions in class were still considered an important part of the course as a whole: 'We enjoyed the classroom interaction, discussion and sharing of experiences and knowledge. The online resources have supplemented this and added some value'. This highlights the need for a model that focuses not just on online interactions as with the five-stage model, but considers a blended learning approach for learning.

Barriers

A large number of comments were made about barriers to learning using the technology. This formed the greatest part of the discussions in the focus group.

Lack of understanding of how the systems worked were high amongst the main barriers to participating. Comments were made in the focus group about purely technical issues such as delays in getting passwords, expiring passwords that could only be reset whilst on college premises and so on, and these extended to more complex technical issues such as not fully understanding how to get to the fora and discussions, or not being fully aware of tools like the gradebook.

> It [Moodle] was a complete unknown for me and it took me some time to find my way around it at home

To a lesser extent, a number of comments were made about deeper issues of confidence and fear (social elements): 'you were worried that you were going to make yourself look an idiot'; 'I was a bit overwhelmed by the terminology', and 'I wouldn't have had the confidence to do that [i.e. search for information on a forum]'.

Other practical barriers were noted – such as lack of time to work at home, the overwhelming amount of information that is available online, and how to sift through it and find out what is reliable and safe to use. In fact, learners expressed significant concerns that using online resources would put them at risk of downloading viruses or that the resources may not be 'safe' or official, and certainly being asked to download information from recommended resources, and being guided to good quality websites was seen as a benefit of taking part in the course – 'it's given me a bit more confidence doing it here'. This relates to Stage 3 of the model (information exchange) where Salmon suggests looking for links with other media. Feedback suggests that this is an area where a great deal of support from the tutor is required, and again highlights the benefits of developing a model focusing on a blended learning approach.

Discussion and recommendations

Salmon's model

Salmon's model provides an excellent starting point when considering course design. Clear building blocks are described, which makes planning activities for the course much easier. During the early stages of the model (access, motivation and socialisation), it was evident that introductory forums were useful in order to familiarise the learner with the course-specific online environment. In addition, the tutor's involvement in the fora definitely encouraged the learners to become more critical during discussions and explore issues that they would otherwise have not considered. The model also comments on ironing out technical issues at these initial stages as well as throughout the duration of the course. In this case study, technical problems certainly had a detrimental effect on learners' engagement and achievement in the online environment, and this corroborates findings from Salmon's research.

There was good evidence of higher order thinking taking place as the learners progressed through the course. Learners were able to post messages – initially as simple stand-alone posts (Stage 3 – information exchange), and this progressed through to knowledge construction (Stage 4) by way of interactive posts between learners, through to development (Stage 5) where learners posted links to other sites and demonstrated critical thinking skills.

Thinking time

An observable benefit of the online activities is that they offer what could be considered 'thinking time'. Whilst learners often engage in verbal discussions at the start or end of a face-to-face session or in group study time, these interactions tend to be informal, and with little or no opportunity to revisit the points raised during them. Having written records of conversations that learners could revisit at their leisure meant that they became much more meaningful. It also provided an excellent opportunity for the tutor to review discussions that would otherwise have been missed, and to revisit relevant posts during class time.

Recommendations

Course induction

A more structured induction to the online resources would be beneficial to the learners regardless of their prior experience in this medium. Areas of value derived from the emergent themes in the qualitative data analysis, as well as through evaluation of the activities and learner engagement, include:

- Signposting – this was done to some degree using areas named 'upload', 'forum' and 'class notes,' but this could be developed by using visual icons and a handout of signposts at the start of the course;
- Guidelines on how to manage the volume of information – increasingly important once learners are approaching Stage 3 of Salmon's model, by signposting useful resources, providing suggestions as to how to identify reliable and 'safe' resources, or by starting with a set list of online resources;
- Scaffolding – learners suggested that a 'how to' guide on accessing the resources, from both a technical and structural point of view, would have been extremely useful. The 'introduction' forum proved insufficient in providing this scaffolding;
- Gradebook – this is an excellent way for the tutor to track learners progress, and also for learners to track their own progress and to review feedback; including this during induction would be highly beneficial;
- 'Homework' and Deadlines – rather than *suggesting* posts on a forum, learners requested that activities should be set as a required 'homework', with clear guidelines for the time required to complete the task, and with a review of the outcomes in the following face-to-face session;
- Digests and follow-up discussions – learners suggested that it would have been useful if the tutor had posted a digest of the most useful or interesting posts. Tutors should incorporate time for such activities into their lesson plans, to provide an opportunity to further explore issues identified, or to revisit questions that they feel have been left unanswered:

Maybe you could even take a look next lesson so anything which is pooled as a problem you could take it up and say well this what we've done.

- Push notifications – learners proposed that 'push' notifications of forum activities would be beneficial particularly when posts have received comments and responses, and noted that they would be very happy to receive them as a reminder that posts had been made.

if you had got an email every time I'd written on there then you'd be prompted… I remember now – there's that forum I can go on.

The arrow model

Evidence from this study agrees with Salmon that the role of the tutor is very important in steering discussion and prompting interaction and development in the online environment. However, the five-stage model was developed specifically for online activities and courses, and this study demonstrates that it is worth considering other models in a

blended learning environment, echoing the views of Watts (2010) and Moule (2007). Therefore, an alternative model, the arrow model, is suggested as a framework for blended learning courses. This takes on board elements of Salmon's model and takes into consideration the recommendations discussed in the previous section. The arrow model focuses more directly on learning outcomes rather than on e-moderator tasks and additionally allows for the backup of face-to-face sessions, which is highly regarded by learners. The model takes the form of an arrow head (Figure 4):
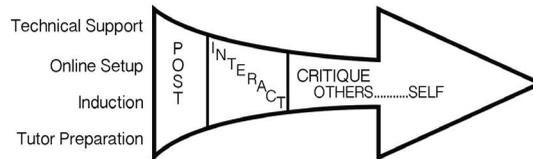
Figure 4. Arrow model.

This model is designed to be simple and flexible. There are three main areas within the arrow itself: the fundamental process of posting a message, an interaction phase and the critique phase.

Prior to the start of the course

Several areas need to be prepared leading up to the start of the course. These include sufficient technical backup in preparing user IDs for all learners, forethought into system requirements to facilitate online learning, such as passwords that will last for the duration of the course, and sufficient file size limits to enable learners to access and utilise all facilities without needing to make special requests.

The online course environment must be available from the very first face-to-face session, so that it may be introduced early on. This should help the online environment become integral to the course. In a study such as this, such set up would include the preparation and population of the Moodle pages and external sites such as Wikispaces.

Sufficient time should be allocated to online moderation tasks, as well as for preparing clear outlines for online collaborative discussions and a variety of 'safe' external resources (i.e. websites) that learners can visit for information as the course progresses.

In addition, a very important element of the early stages of course delivery include the induction activities – those of signposting activities, advice on managing the quantity of information available, scaffolding activities and online monitoring resources such as the gradebook.

'Post' phase

This relates to Stages 1 and 2 of Salmon's model (access and motivation), the early stages of the cognitive elements of Garrison's model (a triggering event and simple exploration of this), the starting point of Gunawardena's social networking spiral, as well as meeting Maslow's physiological and safety needs. Posting a message introduces the learner to the online environment, allowing them to deal with any technical issues given support as appropriate, and providing the tutor with evidence that they have successfully accessed the online activity areas.

'Interact' phase

At this phase, learner should be replying to each other's posts, or to tutor prompts, though perhaps with limited depth of comments. This links in with the middle stages of the previously mentioned models, but minimises the restrictions of order and type of interaction and avoids the rigidity of other models.

'Critique' phase

This latter stage should develop higher order thinking and critical thinking skills through interactions with other learners, other online resources and finally by critiquing the learner's own work, or challenging ideas of others. This has some similarities with the later stages of the existing models, but unlike Salmon's model, focuses directly on the learner and learning outcomes, rather than the role of the e-moderator, or the specific types of tasks that might be included. This permits the course instructors to mould the arrow head to suit the desired learning outcomes from the course, as well as being responsive to the needs of the particular cohort in question.

At all stages, it is suggested that online activities are introduced, backed up and reinforced with face-to-face activities. The arrow head itself indicates that there is not an end to the model, but that the learners will continue to develop their critical thinking skills and self-sufficiency beyond the course end.

Application of the arrow model

The following plan demonstrates how the arrow model could be implemented. Aside from the pre-course preparation and the introductory forum, each phase may blend into the next (or previous) and therefore the plan should not be viewed as a rigid process where one phase must be completed before the next starts. Examples of activities are given for illustrative purposes only, and will need to be designed according to the subject, medium of delivery and cohort (Figure 5).

Conclusions

This study shows that higher order thinking can definitely be achieved through online collaborative activities, even within a short-term courses such as the ones studied for this research. The role of the tutor is very important to this success, and in this study there is much clearer evidence of higher order thinking where the tutor is involved in the online interactions. In a blended learning environment, it is suggested that a more flexible pedagogical model, such as the arrow model, be used, as this takes into consideration many of the elements of the five-stage model, as well as including elements of Garrison's community of inquiry, Gunawardena's social networking spiral and Bloom's taxonomy. The benefits that such online interactions can bring to an educational experience are evident, and the opportunity for provision of thinking time through these activities are highly regarded by learners. Future work is suggested to develop the arrow model in more detail, and it would be interesting to gather data with a longitudinal study to evaluate whether learners continue to develop higher order thinking skills and self-sufficiency beyond the end of the course.

Before class:

- Build VLE outline
- Set up online activity areas, including first discussion forum (Introductions)
- Generate user IDs
- Create How To / Signposting guides
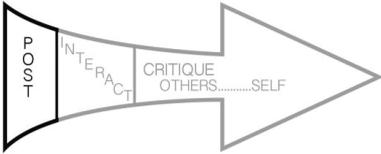
In class:

- Familiarisation with VLE
- Distribution of How To guides
- Learners add a message to the Introductions forum

For homework:

- Respond to a message in the Introductions forum: e.g. *Reply to at least one of your classmates' "Hello" messages and welcome them to the class by next session.*
- Add a new post to a discussion forum in response to a very simple question
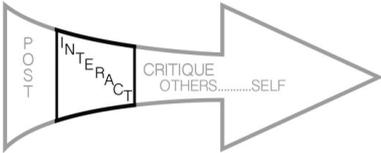
In class:

- Key topics covered
- Skills building
- Specific online activities and tasks introduced in each session

For homework:

- Topic relevant posts and activities online after each face-to-face session
- Specific questions to respond to such as *Explain how you would crop this image*
- Basic directed research activities: e.g. *Use [this site] to find out information on File Types and post it here*
- Each learner must comment on another learner's post
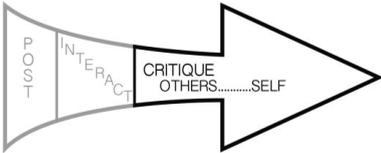
In class:

- Further skills development
- Critical skills development through in-class activities and discussions

For homework:
- More challenging online activities requiring independent thought
- Encourage dialogue between learners: e.g. *Joe says Cookies are a bad thing – can anyone give an example of where they might be beneficial?*
- Online group activities (collaboration)
- Research skills development: e.g. *Find out information about Online Forms – use a website of your choice or consult one from the list below*
- Debates or discussions of a more subjective nature
- Peer assessment activity

Figure 5.   Example application of Arrow Model (Table).

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