Designing Courses to Develop Online Teamworking Skills: a Helical Model

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Experiences of online collaborative learning are increasingly part of what recent advances in technology to support computer-mediated interaction allow us to include in undergraduate courses. These experiences can range from simple conversations and socialisation to complex virtual teamworking projects. The sequence of such experiences needs to be structured and managed so that there is a developmental dimension both within a single course and also over a student's degree programme. When we consider existing models for learning, group working, and software process, none of them adequately incorporate a sense of development. In the light of reflection on our own experience of designing and delivering a virtual teamworking course, we present a new, helical model for online collaborative learning. This model, in addition to emphasising the cyclic nature of the collaborative activities undertaken by teams tasked with solving a complex problem, also incorporates a developmental dimension, based on reflection at the end of successive phases of the problem solving process.

Keywords

Cyclical models, Development, Online collaboration, Reflection, Teamworking

1. Introduction

Online collaboration - students working together at a distance - is potentially the most radical, innovative feature of Technology Enhanced Learning (TEL). It not only enhances learning through social interaction but also provides experiences of collaboration that help to develop students' teamworking skills to meet employers' expectations. It provides opportunities for students to engage in the appropriate discourse for their academic subject area, and to become part of a community of practice [1].

The move from an emphasis on issues of Human Computer Interaction (HCI) to issues of Computer Mediated Interaction (CMI) is emphasised by the recent publication of a book from the pattern community specifically aimed at CMI contexts [2]. Whereas HCI focuses on our technological relationship to the machine, be it hardware or software, CMI focuses on what the machine adds to our relationships with each other, whether these are in the social and recreational spheres of everyday life or, more importantly, in the pedagogical sphere of TEL.

Effective collaboration doesn't just happen by assigning students to groups, giving them some shared tasks, some communication media, and some collaborative tools. The whole student interaction experience needs to be structured and monitored, and students' collaborative skills have to be developed and assessed over an extended period of time. We have argued in more detail elsewhere [3] about the need for a phased development over the whole of a student's degree programme, in the use of, and understanding of, online

interaction. Students need to move from a range of early conversational usage, through cooperative activities and onto truly collaborative tasks, possibly culminating in a major discipline-based teamworking project. We have also argued that this progression is as relevant to campus-based students as it is to those working in a distance learning context.

From our experiences of designing and delivering an online teamworking course we have felt that it would be helpful to provide both students and tutors with a model of this progression, as it applies to their collaborative activity within our course, and also to the more general context of their degree programme. None of the existing models for learning, offline or online, collaborative or otherwise, seems to provide what we required. This paper presents a new model which represents our initial thoughts on what is required, and which we hope will be a useful tool for others engaged in developing collaborative activities for their students.

2. Existing Models

2.1 Why do we need a model?

There are a number of answers to this question. For example, models provide us with a framework for thinking about processes in which we are engaged. They provide a vehicle for discussing the nature and order of the major activities to be undertaken in carrying out a project, and a framework on which we can hang consideration of such issues as the transition criteria for moving from one activity to the next within the project. Perhaps most importantly they provide us with visual images or metaphors that we can manipulate so as to assist us in making sense of whatever phenomenon we are attempting to understand.

2.2 Salmon's online learning model

One of the most popular, process-based, online teaching and learning models is that proposed by Salmon [4,5] on the basis of her work as a tutor in the Open University Business School. This model is designed to show how learners progress through the stages of an online collaborative learning experience, and to indicate how the role of the tutor needs to be correspondingly adapted, becoming an online facilitator or e-moderator. It is a simple five-stage linear model (see Figure 1) which, in the absence of any alternatives at the time of its introduction, effectively became the standard model used when discussing the design and delivery of online collaborative activities for undergraduate students.

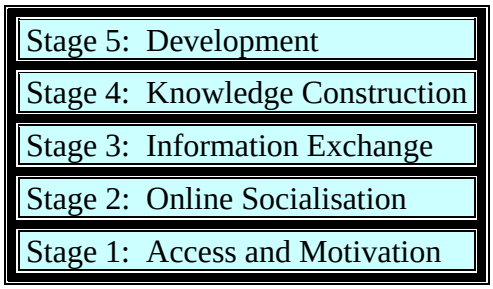

Figure 1 Salmon's five-stage model for e-learning and e-moderating.

A shortcoming of this model is that it tends to treat each collaborative experience in isolation, with each new e-tivity (e-activity) starting afresh from the beginning of the sequence.

Although the Development phase is where students reflect on the process of e-learning there is no real emphasis on students' understanding and skills developing over time as they move through a series of increasingly complex collaborative situations.

Another shortcoming is that it tends to focus on learning *through* collaboration, whereas - particularly in the context of developing online teamworking skills - one of the more important outcomes is learning *about* collaboration.

Relatively recently the relevance of applying Salmon's model to the generality of e-learning situations has attracted some significant criticism. Authors like Moule [6] and Jefferies [7] have not only discussed its limitations but have also proposed alternative e-learning models.

Jefferies' model [7] is essentially an extension of Salmon's approach. It adds a Preparation phase at the beginning of the sequence and Assessment and Evaluation phases at the end, but remains essentially linear and one-off. A further shortcoming of the process described by Salmon is that it tends to remain tutor-focussed and tutor-led, and Jefferies notes that tutors acting as e-moderators tend to diminish the opportunities for students themselves to take greater responsibility for their learning. She goes on to argue for an e-monitoring rather than an e-moderating role.

Moule's alternative model [6] presents a more general e-learning 'ladder' which attempts to include a range of different learning theories, rather than just the social-constructivist approach on which Salmon's model is based. It also attempts to build-in the social and technological factors which affect students' ability to engage successfully in e-learning activities.

2.3 Kolb's experiential learning model

It is generally accepted that we learn through experience, but that deep learning does not take place unless there is some significant degree of reflection on that experience. The great educational philosopher John Dewey is said to have summed up this connection in the formula 'Experience plus Reflection equals Learning'. Many attempts have been made by educators to create structured learning sequences which build on this formula. They are usually represented in the form of experiential learning cycles, based on theoretical models, of which the Kolb four-stage version [8] is probably the best known and the most frequently cited.

Kolb's model (see Figure 2) consists of a cycle of four stages: Concrete Experience, Reflective Observation, Abstract Conceptualisation, and Active Experimentation. In theory this learning cycle can start with any one of the four stages. In practice, most people's view is that you start with an experience in some specific context and observe what happens. Through reflection you attempt to understand what happened in that context. You then attempt to generalise your understanding to a wider context. Finally you test your understanding in a new context in order to see if your generalisation appears to apply.

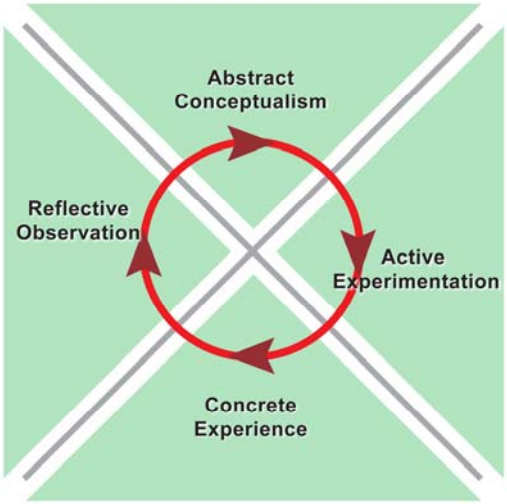

Figure 2 Kolb's experiential learning model.

The process is usually represented as a continuous loop, and if any learning has taken place then the experience from the Active Experimentation stage can form the basis for beginning another cycle, so the process is essentially repetitive.

Although it has been criticised as over-simplistic, Kolb's model provides a sensible framework for planning teaching and learning activities. There is, however, no great emphasis on *reflection*, in the sense of standing back and reflecting on the learning process itself, rather than on the concrete experiences and related information about which one is currently attempting to build a theory. The learning cycle appears to be an end in itself.

The result of progress around the cycle is usually presented in terms of the *product*, being about acquiring knowledge or understanding of some specific subject matter. However, in the context of teaching and learning, we are often more concerned about the *process* we have been through to deliver that product, about how our ability to learn and do has itself been developed by undergoing that process.

Greenaway takes up these, and other, issues in his review of experiential learning models [9, 10]. He sums up the vast array of cyclical models that have been put forward over the years, and ends up asking some questions, the most pertinent of which is how they relate to the concept of *development* rather than learning. He notes that Kolb himself acknowledges that his learning cycle model and his associated learning styles model concern learning rather than development.

Greenaway asks, but does not answer, the question 'Why is it that development training brochures generally show just one model - a cyclical learning model? Is there not a *developmental* model that would be more suitable? Would a developmental model describe more accurately what learners experience?'.

2.4 Boehm's software process model

Software Engineers have long been familiar with the idea that an essentially linear sequence of activities (such as the waterfall model) is not adequate to represent the complexity of the

software development process. Boehm introduced his Spiral Model [11] in order to visually represent the iterative and incremental nature of the process which is the reality of software development. A simplified version of Boehm's four-stage model is illustrated in Figure 3.

In this model the cycle opens up radially into an ever expanding two-dimensional spiral. Each complete cycle around the axis represents a phase of the software development process. There is, therefore, a repetition of the cycle of activities, applied to successive phases of the process. The increasing radial expansion of the cycle is intended to represent the cost dimension rising as the project progresses over time.

Figure 3 Boehm's software process model.

However, as you move round the spiral, from one cycle to the next, any sense of development is related to making progress on the software product. There is no provision for capturing what you have learned about the *process* from engaging in the current phase so that you can benefit from it in successive phases. The Review stage is more about establishing where you are, and where you are going next in terms of project deliverables, than about how you got there and what you are doing there, in terms of process skills and understanding. Also, perhaps more importantly, there is no explicit debrief cycle at the end of the project, dedicated to reflecting on, and capturing, what you have learned about the process overall, so that you can benefit from it in future projects.

2.5 Tuckman's small group development model

Another model, specifically related to collaborative working in small groups or teams, is Tuckman's classic group development model [12] which runs through the following stages: Forming, Norming, Storming, and Performing (and, in later versions of the model, a fifth stage: Adjourning).

This model is again presented as a four (or five) stage linear sequence (see Figure 4), with no real indication of how, if further group working activity is undertaken at a later date, and in another context, the understandings, skills and behaviours developed through earlier experiences might be applied and further developed in the new context.

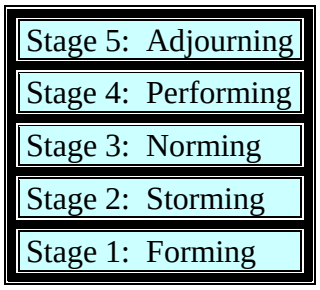

Figure 4 Tuckman's small group development model.

The Adjourning stage *could* be seen as providing an *opportunity* for reflection at the end of the project for which the group was brought together, but appears to be more related to 'mourning' in the sense of the termination of roles, the completion of tasks and the reduction of dependency, rather than being explicitly linked to what one might carry forward to the next group project in which one is involved [13].

All the models discussed so far are essentially linear and don't really seem to be going anywhere. Each new experience repeats the pattern of previous experiences. In reality learning is not only repetitive but also progressive. You don't just start again from the beginning; there must be some concept of building on previous experience. Equally, no major project just proceeds from start to finish in a simple linear sequence.

3. A New Model

3.1 Bruner's view of education

The view of education put forward by the influential psychologist Jerome Bruner [14], particularly in his 1960 book 'The Process of Education', argues for viewing education as a process with structure, sequence and reinforcement, and makes the case for a *spiral* curriculum - a curriculum which, as it develops, revisits basic ideas repeatedly, building upon them until the student has grasped the full formal apparatus that goes with them. Bruner also stresses that knowing is a process not a product and that to instruct someone is not a matter of getting them to commit results to mind, rather it is to teach them to participate in the process that makes possible the establishment of knowledge. Any learning and skills development that has taken place needs to be demonstrated by its re-use in another related, and possibly more complex, task.

3.2 The development dimension

What is missing in all the models discussed earlier is this sense of development. Even where they incorporate elements of reflection and repetition they lack a sense of purpose. They don't address the important question 'Where do we go from here?' The learning process must be seen as not only *iterative* but also *incremental*. At the end of each collaborative learning cycle there must be a significant element of reflection, an assessment not just of the products of that cycle but of what has been achieved in terms of the process itself during that cycle, and can be further developed.

3.3 The developmental helix

In order to recognise and emphasise this developmental aspect of our collaborative activity we need to add a third dimension to the existing models and make the spiral *explicitly* into a helix - visibly both iterative *and* incremental. We can combine the cyclical aspects of models like Kolb and the spiral aspect of Boehm, with the sequential aspects of models like Salmon and Tuckman. We can take the sequence of repeated cycles and stretch them upwards into a helix (see Figure 5) where the extra dimension represents the development of collaborative, teamworking, skills over time.

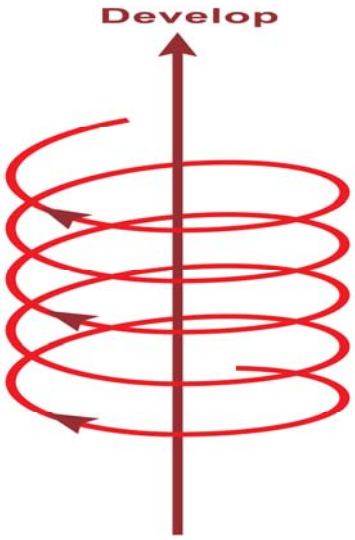

Figure 5 The developmental helix.

This developmental model can provide a valuable metaphor for thinking about designing and delivering collaborative experiences within a single course. Perhaps more importantly, it can provide a valuable metaphor for thinking about managing the progression and coherence of the totality of a student's collaborative experiences throughout their degree programme.

3.4 The teamworking cycle

In our particular context, we wanted to provide a model which could help us to design and visualize a course structure suitable for developing our students' teamworking skills, and which would also assist both students and tutors better to understand what we expected from them when they signed up for our course.

We therefore took Kolb's basic cyclic pattern, but modified it to reflect the main stages of activity that need to be repeated within a collaborative, teamworking context. Our modified cycle has the following four stages: Define, Distribute, Deliver, Debrief (see Figure 6).

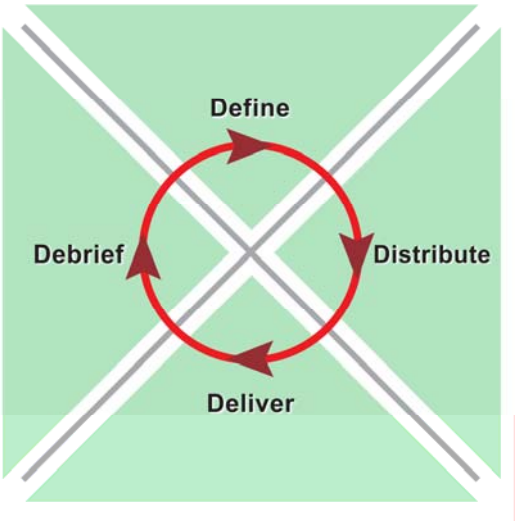

Figure 6 The teamworking cycle.

While there is not space here to fully spell out what each stage includes, the following indicates typical activities involved:

- Define: Identify and clarify your problem, discuss your approach, decide on the rules of operation for your team, etc.
- Distribute: Share out the identified roles, responsibilities, tasks, etc. amongst the team members and specify the required interactions, delivery schedules, etc. for the products of this cycle
- Deliver: Complete and deliver the individual products and combine these into the required team products for the current cycle
- Debrief: Reflect as a team, and as individuals, on the process undergone and the products delivered, in preparation for progressing to the next cycle of activity.

3.5 The full helical model

Although one repetition of this underlying teamworking cycle can clearly cover the activities involved in a simple task, the real benefits arise when it is repeated several times, either within the same course or in subsequent courses, so that the application of what has been learned in each cycle (in terms of acquired knowledge, skills, behaviours, etc) can be applied in another cycle, preferably while it is still fresh in the memory. Our final model combines the teamworking cycle with the developmental helix, as illustrated in Figure 7.

In designing our course, which is described in more detail in an earlier paper [3] we have structured the activities so that students work through four successive cycles of this spiral model within the course. The first cycle is of a formative nature, since any newly formed team needs to establish itself, both technically and socially. The remaining three cycles are assessed on both a team and an individual basis. There is an assumption that several preliminary cycles have already been undertaken in collaborative activities in earlier courses, but that the process and product in these earlier cycles have not been so tightly coupled, in terms of the complexity of the task, the degree of consensus required, or the degree to which products are co-authored and truly represent a collective response to the problem under consideration.

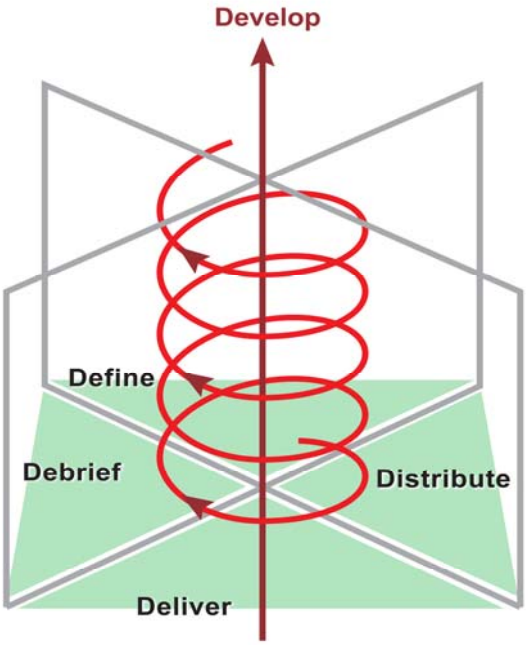

Figure 7 The helical model for development of teamworking skills.

As well as providing a framework for thinking about course design, delivery and assessment, the model can enhance students' awareness of the staged nature of their tasks and activities - for example emphasising the need to keep moving round the cycle rather than getting stuck discussing things in too great a detail or over too long a time, or reinforcing the concept of building on previous experience.

The model can also help tutors to appreciate what they might expect to see in their teams' activities, and how they might react. They need to decide when and where to judiciously intervene - for example if there is no observed movement through the stages of the current cycle, or if other activities appear to be diverting the teams from their main tasks, etc. Tutors also need to ensure that their feedback to the teams takes earlier achievement into account.

In the Debrief stage of each cycle the model specifically addresses the issue of reflection. This reflection includes both team-based and individual aspects, such as 'How have we worked as a team?' and 'How have I worked with the rest of the team?' In our course this is part of the assessment at the end of each cycle. The tutor's feedback on the assessment - in terms of how the individual and the team have performed - forms an integral part of the team's reflective activity, to be evaluated prior to attempting the tasks in the next cycle.

4. Conclusion

Students' experience of collaboration needs to be managed and structured to ensure that their collaborative skills and understanding are developed over time. The development needs to occur not only within single courses, but also over their full degree programme. We have presented a model which, by explicitly incorporating the development dimension, allows visualisation of the structure around which to design collaborative activities within a course,

and supports the planning and management of students' overall collaborative experience throughout their degree.

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