Open Research Online

C IS FOR COLLABORATION:

A DEVELOPMENTAL PERSPECTIVE

Stanley J Oldfield
Department of Computing
The Open University
Walton Hall, Milton Keynes
MK7 6AA, UK
s.j.oldfield@open.ac.uk

David R Morse
Department of Computing
Walton Hall, Milton Keynes
MK7 6AA, UK
d.r.morse@open.ac.uk

ABSTRACT

Recent advances in the technology to support Computer-Mediated Interaction make it possible to include significant experience of online collaborative activity, ranging from simple conversational socialization to complex virtual teamworking projects, in undergraduate programs of study. To be of lasting value such experiences need to be developed progressively over a student's course of study. We introduce a model that provides a framework for taking an integrated overview of this developmental dimension, and discuss the nature of the increasingly sophisticated activities that might be undertaken at different stages in the process.

KEYWORDS

Cyclical Models, Online Interaction, Virtual Teamworking

1. INTRODUCTION

During the last three years we have been involved in the presentation of an online teamworking course. Through reflection on the practicalities of delivering this course [7], and on the theoretical issues underlying collaborative learning, we have developed a helical model [8] which attempts to capture the developmental aspect of the student collaborative experience. In this paper we discuss the nature and purpose of the collaborative activities undertaken as students progress through their course of study, and we show how the model can provide a framework for thinking about how the development should proceed. The connecting thread to the discussion is the extensive collection of words beginning with the letter **C** that are involved in this process - hence the title of the paper.

2. THE MEANING OF COLLABORATION

When reviewing the literature, it is difficult to find any consistent definition of the term **C**ollaboration, or of the associated term **C**ooperation, and they are often used interchangeably. Many authors, after attempting to define these two terms separately, end up making statements like 'Although the distinction is sometimes helpful, I will use the term cooperative learning to refer to both forms of learning' [4] or, going the other way,

'If there is a trend in clarifying the nomenclature of interactive group learning, however, it seems to be in the direction of using the term collaborative [rather than cooperative] learning in higher education' [1].

Insofar as there is a distinction to be made, this is encapsulated in the statement 'Genuine *interdependence*, that is collaboration, where the group can achieve more collectively than individually, as distinct from cooperation where the result is merely the sum of individual efforts - ganging up on the task' [10].

Perhaps a better way of thinking about the concept of collaboration is to consider what it is not. Traditionally undergraduate education has encouraged a sense of individual achievement and Competition, even of Confrontation and Conflict when taking part in interactive debate [15]. However, in preparing our students for the interconnectedness of modern working environments we need to downplay the role of the individual and put more emphasis on the ability to work in a team, accepting the view that 'The underlying premise of collaborative learning is based upon Consensus building through cooperation by group members, in contrast to competition in which individuals best other group members' [9].

Efforts to encourage group activity by making it a compulsory part of the curriculum are often viewed as Coercion by students not convinced of the benefits of working with others [15]. We therefore also need to convey to our students a sense of the benefits of collaboration, so that they are willing participants in the activities we write into their educational experience. To do this effectively, we need to plan and deliver an integrated sequence of interactive encounters, over their course of study, demonstrating Continuity of purpose and structure. In contrast, the collection of trivial, piecemeal and repetitive activities that often constitute the group-working element of many undergraduate programs is accreted more through a desire to conform to current educational fashion than because of a real belief in their relevance. We need to create a progression in the Challenges involved in the sequence of interactive activities which students experience. The *interdependence* of the participants in these activities should increase over time, as students build up the appropriate knowledge, skills and behaviors.

3. THE BENEFITS OF COLLABORATION

There are many different perspectives on why experience of collaboration is beneficial to students, for example:

From a social constructivism viewpoint it is argued that students need to build their own knowledge through personal, active engagement, and that this is aided by collaboration with others.

From the viewpoint of the potential employer it is argued that there is a need for interpersonal and teamwork skills in the workplace, and that these skills are developed through collaboration.

From the social viewpoint it is argued that there is a need to understand the multiple perspectives required for living in a multicultural society, and that one is made aware of these by engaging in collaboration.

From the viewpoint of many academic disciplines it is argued that, in order to develop a sense of professional identity, students need to acquire the appropriate professional discourse and also the implicit knowledge that is part of their Community of Practice, and that this can best be done through engaging in collaborative activity to share experiences.

From a more general viewpoint it is argued that when attempting to solve large-scale, complex problems there is a need to utilise a wider range of experience and ability than is generally in the possession of any one individual, and that this is only possible through collaboration, which also brings the associated benefit of sharing the workload which itself is too great for any one individual to undertake.

4. INTERACTION ONLINE

We have argued elsewhere [7] that even for students studying in a traditional university context, it would be expected that much of their collaboration would be undertaken in an online environment. The facilities for Computer Mediated Interaction are now so ubiquitous and powerful that it would be a mistake not to use them, especially for such activities as Co-authoring documents.

However, when we consider the way in which our students use modern communication technologies, we soon realize that there is a potential problem in harnessing this experience in an educational context. Much of their use is of a social and leisure nature, with interaction taking place in the social-networking environment often referred to as Web 2.0, engaging in instant chat, use of online services, online information seeking, or games-playing, rather than being directed towards collaboration with others on the solution of some specific real-world problem. There is little need for them to reflect on the interactions that they experience in such contexts. Their use of the technology is very much focused on the immediate results of using the technology itself, rather than the technology being a vehicle for an enterprise of longer duration and higher purpose.

When discussing what role technology *can* take and what role it *should* take in learning collaboratively, Voigt and Swatman [14] have advanced a persuasive argument for adopting a process model in which development of individual and group Media Competencies is set alongside development of individual and group Method Competencies. Students need to master the environment for interaction on a technological level, and also cognitively to master the use of the social interaction which the tools support in the context of subject-oriented activities.

5. THE HELICAL DEVELOPMENT MODEL

While engaged in the design and the initial presentations of our online, distance-learning teamworking course [7] we looked at a number of existing models for learning, both online and offline, individual and collaborative, (see for example [2], [3], [5], [11], [12], [13]) but felt that none of them adequately captured the progressive nature of the collaborative learning experience over time which we were attempting to deliver. In an earlier paper [8] we discuss what is lacking in these models and propose a new, helical model which attempts to capture both the repetitive and the developmental aspects of working interactively online.

Our initial concern was to visualize the repetitive, *iterative* nature of the activities that need to occur within any major collaborative experience. For this we took Kolb's experiential learning cycle [3] and modified it to represent the essential elements of collaborative activity (Figure 1).
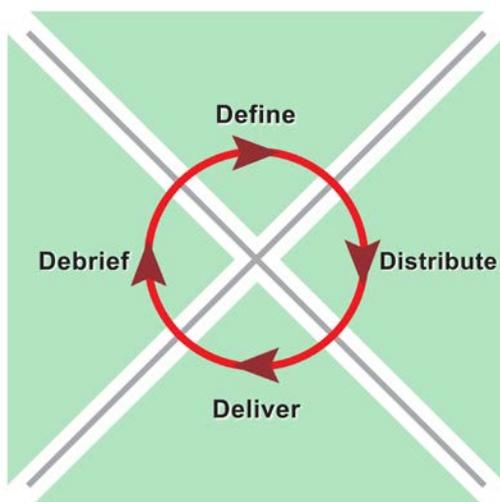

Figure 1: The teamworking cycle

Typical activities that need to take place in each stage of this cycle include:

Define: Identify and clarify the problem, discuss the approach to be taken, and decide on the rules of operation for your team

Distribute: Share out the identified roles, responsibilities and tasks amongst the team members and specify the required interactions and delivery schedules for the products of the current 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

Although one repetition of this **C**ycle can clearly cover the activities involved in a simple collaborative task, the real benefits arise when it is repeated several times, either within the same course or in subsequent courses. The debrief stage involves reflection, as a team and as individuals, on the processes undergone and the products delivered in the current cycle of activity, so that the application of what has been learned in each cycle can be applied in another cycle, preferably while it is still fresh in the memory.

Our other major concern therefore was to visualize the essentially *incremental*, developmental dimension of the students' collaborative experience over time and over a succession of activities. For this purpose we used a helix to represent the progress being made, in terms of the acquired knowledge, skills and behaviors (Figure 2).
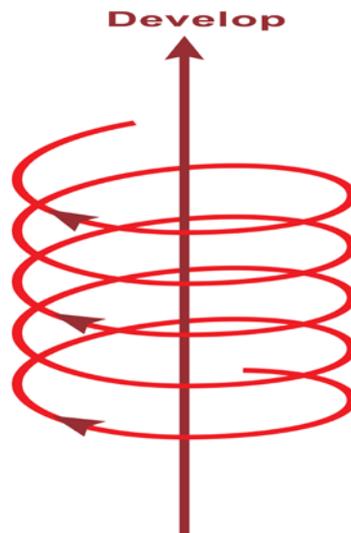

Figure 2: The developmental helix

Combining these two concepts of an iterative cycle and incremental development gives us the resulting helical model (Figure 3) which provides us with a framework for thinking about the design, delivery and assessment of collaborative activities both within a single module and across a complete program of study.
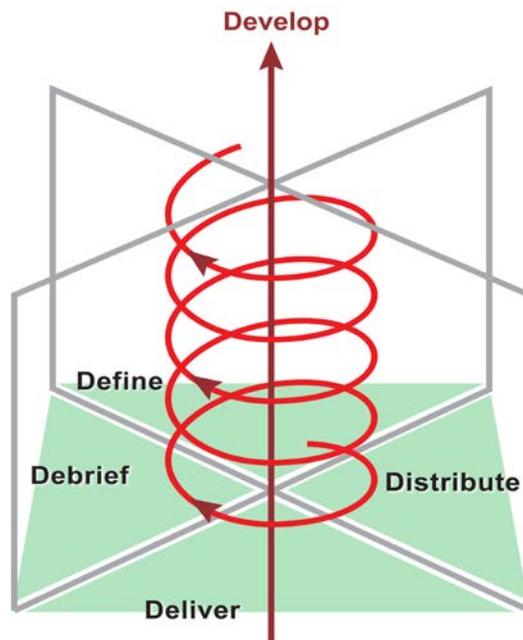
Figure 3: The helical model for development of teamworking skills

6. LEVELS OF INTERACTION

The benefits of collaboration discussed earlier should provide sufficient stimulus for us to ensure that our students engage Constructively in collaborative activity. However, our students come to us with little experience of working together and are often not initially prepared for the sophistication of the tasks we expect them to undertake. We should not throw students in at the deep end. We need to introduce them to collaborative activities gently, and to increase the pressure slowly over a sequence of activities, but this is difficult to achieve if we try to cram everything into each separate course because we do not have an integrating overview of the whole collaborative curriculum.

We can think of the interaction as a hierarchy of levels of increasing interdependence (Figure 4) as we move along the developmental dimension of the helix. We need to incorporate higher levels of interactivity into successive cycles, in terms of the complexity of the tasks to be undertaken, the intensity of the interaction necessary to carry out those tasks, the nature of the collective decision-making this involves, the sophistication of the software tools used to support the activity, and the degree of co-authoring of any artifacts constructed and documents delivered.
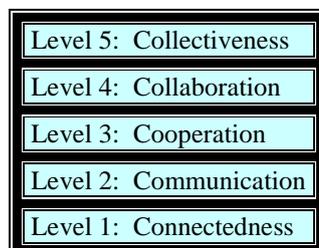

Figure 4: Levels of interaction

At the lowest level we need to ensure that students are able to establish a Connection with each other and are Comfortable using the enabling technology. This can involve very simple activities Chatting with each other online - for example Contributing to a forum - without really interacting with anyone else, or responding to the contributions of other participants.

The first valuable interactive level is establishing basic patterns of Communication - Commenting on the Content of other participants' contributions, possibly even suggesting Corrections to such content and, overall, building up a sense of what it means to be a member of an online Community. Possibly this level is where we begin to include advice and practice in the art of giving and receiving Constructive Criticism.

The next level is Cooperation, in the group-working sense, and could involve collecting information on specific ideas and issues, analysis of articles, etc, followed by discussion to develop some awareness of skills in Critical Thinking. The product of such discussions would probably be an individual take on the topic(s) under consideration, or possibly a Collation of individual contributions into a larger document, for example a group Wiki. A well-structured, small-scale example of this in a supportive environment is described in [6]. At this level we can begin to address the question of what degree of Consistency and Coherence is needed in any jointly produced deliverables. Also, in this context, we might expect Cultural differences to become apparent as varying approaches and values are evidenced in the individual contributions, providing opportunities for learning through Contradiction [14].

The next level is where we begin to get interactions to which we can justifiably apply the term Collaboration. They involve genuinely *interdependent* team-working activities, undertaking Complex analytical tasks which require a Collective response, and result in Co-authored products based on Consensus. To achieve consensus there is clearly a need to establish Consent to Common Criteria on which to base team decisions, and to work with Common Values towards collective goals. There is also a need for early agreement on the Conventions (rules, roles, responsibilities and relationships, etc) and the Coordination mechanisms (Conferencing, Calendars, schedules, etc) by which the team will attempt to operate. Issues like how to handle Collective Decision Making, Conflict Resolution, and Crisis Management arise at this level.

Individual team members have to appreciate the need for Commitment to the team, to recognize the Constraints that working collaboratively places on the participants, and to be willing to relinquish any notions of individual Control. In this context the Construction of Shared Meaning [14] becomes important, as teams worked to establish a Common Culture and to develop a sense of Community and even Collegiality.

Increasingly at each stage there needs to be some element of Contemplation (that is to say, reflection) on what has been undertaken and what has been experienced, and we need to ensure that learning occurs *about* collaboration, rather than just learning *through* collaboration, since this understanding of the process is critical to improving the effectiveness of future collaborative activity.

The term Collectiveness used as the final level in Figure 4, is intended to represent the Culmination of the interactive experiences over a period of several years of increasingly sophisticated collaborative activities, which have resulted in the acquisition of a Cumulative set of skills, knowledge and behaviors which can be put to some Constructive use. We envisage this as participation in a discipline-dependent final year team project providing an opportunity for team members to work together collectively, applying everything that has been learned previously to the creation of a solution to a significant real-life problem.

At the end of any major teamworking task - in what Bruce Tuckman's extended model [13] would refer to as the Adjourning stage - the final reflective activity needs to provide an opportunity for Closure, in the sense that there is a pulling together of all the threads from the current experience in such a way that it is possible for participants to articulate how what they have learned will allow them better to undertake any subsequent collaborative activity required of them. Hopefully also, insofar as the experience of working together has been generally positive and enjoyable, it should also be possible for participants to engage in Celebration of what has been achieved, both as a team and individually!

Our course is structured so that students work through four successive cycles of this spiral model during their 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 summatively assessed on both a team and an individual basis. More detailed descriptions of the activities involved are given in our earlier paper [7]. There is an assumption that several 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 tasks undertaken, 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. What students have learned on this course should provide a springboard for their participation in a major teamworking project, in our case the design and development of a significant software product.

7. CONCLUSION

Students' experience of collaboration needs to be managed and structured to ensure that their collaborative skills and understanding are developed over time. Development needs to occur not only within individual modules, but also across their full program of study. Our model, by explicitly incorporating the development dimension, and the increasing levels of interaction and interdependence involved, allows visualization of the structure around which to design collaborative activities within modules, and supports the planning and management of students' overall collaborative experience.

ACKNOWLEDGEMENT

REFERENCES

[1] Barkley E.F. et al, 2005. *Collaborative Learning Techniques: A Handbook for College Faculty*, Jossey-Bass, San Francisco, CA.

[2] Boehm B, 1988. A Spiral Model of Software Development and Enhancement, IEEE Computer, May 1988, pp 61-72.

[3] Kolb D.A, 1984. *Experiential Learning: Experience as the source of learning and development*, Englewood Cliffs, NJ: Prentice Hall.

[4] McConnell D, 2000. *Implementing Computer Supported Collaborative Learning* (2nd edition) Kogan Page.

[5] Moule P, 2007. *Challenging the 5-stage model for e-learning: a new approach*, ALT-J Research in Learning Technology, Vol. 15, No. 1.

[6] Northedge A, 2006. Designing a fail-safe online group project work environment, *Proceedings of International Conference on e-Learning: Learning Theories vs. Technologies,* 14–16 December, 2006, Ramkhamhaeng University, Thailand, pp 12.1-7.

[7] Oldfield S.J. & Morse D.R, 2007. Exploiting Connectedness in the Informatics Curriculum, *ITALICS,* Vol. 6 No. 3, pp 27-45. http://www.ics.heacademy.ac.uk/italics/vol6iss3/oldfield_morse.pdf

[8] Oldfield S.J. & Morse D.R, 2007. Designing Courses to Develop Online Teamworking Skills: A Helical Model, *Proceedings of the Informatics Education Europe II Conference (IEEII2007),* Thessaloniki, Greece, pp 276-285.

http://www.seerc.org/ieeii2007/PDFs/p276-285.pdf

[9] Panitz T, 1997, Collaborative versus cooperative learning - a comparison of the two concepts which will help us understand the underlying nature of interactive learning, *Cooperative Learning and College Teaching*, Vol. 8 No.2. http://home.capecod.net/~tpanitz/tedsarticles/coopdefinition.htm

[10] Russell D.R, 2001. Looking Beyond the Interface: Activity Theory and Distributed Learning, *Understanding Distributed Learning*, ed. Lea M. London: Routledge, pp 64-82.

[11] Salmon G, 2002. *E-tivities: The key to active online learning*, Kogan Page

[12] Smith M.K, 2002. *Jerome S. Bruner and the process of education*, in the Encyclopedia of Informal Education, available at http://www.infed.org/thinkers/bruner.htm

[13] Smith M.K, 2005. *Bruce Tuckman - forming, storming,, norming and performing in groups*, in the Encyclopedia of Informal Education, available at http://www.infed.org/thinkers/tuckman.htm

[14] Voigt C. & Swatman P.M.C, 2006. From surface to meaningful collaboration: An activity-theory perspective. *Proceedings 4th IADIS Conference on the e-society,* Dublin, Ireland, July 13-16, 2006, pp 35-42. http://www.unisanet.unisa.edu.au/Resources/13420-O/Research/e-society_2006_Voigt.Swatman.pdf

[15] Waite M.W. et al, 2004. Student Culture vs. Group Work in Computer Science, *Proceedings SIGCSE 2004,* Norfolk, Virginia, USA, March 3-7, 2004, pp 12-16.