Asynchronous Collaborative Learning Using Project-Based Assignments

William Hafner¹ and Timothy J. Ellis²

Abstract - The value of collaboration as a tool to promote learning is becoming increasingly more evident. Students engaged in collaborative efforts are typically more actively engaged in the learning activity and retain the information being learned longer. Collaborative activities also parallel the work environment and prepare the student for life after school.

Promoting collaboration in a classroom setting is difficult and often resisted by both teachers and students. This difficulty is magnified for courses offered in an online learning environment. As a result, educators are faced with a dilemma: both students and academic institutions are flocking towards asynchronous learning networked courses, but there is no clear understanding of how to foster collaboration, one of the most promising pedagogical tools.

Asynchronous online environments can provide meaningful collaborative assignments. This paper details a five-step systems approach for fostering project-based, collaborative learning in an asynchronous learning environment. The steps are illustrated with examples from a graduate-level course in multimedia systems in which asynchronous collaboration was a featured assignment.

Index Terms — collaborative learning, asynchronous learning networks, project based learning

INTRODUCTION

Asynchronous learning networks (ALN) present several challenges in promoting learning, especially at the higher cognitive levels. Greater depth of learning has been successfully fostered in traditional classrooms settings by project-based, team assignments. It is difficult to plan, develop, and execute this type of assignment in an asynchronous learning environment. The goal of this paper is to present a systems approach to asynchronous project-based team assignments that has been successfully implemented in a graduate school of computer and information sciences.

Following the discussion of the problems associated with implementing project-based team assignments in classes delivered in an asynchronous environment and the goals for this study, the benefits of both group and project-based learning will be explored. The methodology followed in incorporating the project-based team assignments in asynchronous courses will be described. A summary of the results of that methodology is then presented. The paper concludes with a discussion of the results of the implementation and implications for future research.

Problem Statement

It is becoming evident that group work is a valuable tool to promote learning [1, 2]. Students engaged in group efforts typically retain the information being learned longer by becoming more actively engaged in the learning activity [3]. Evidence shows that team activities foster higher-order thinking skills such as analytical reasoning and synthesis of information into a whole that exceeds the sum of its parts [4, 5]. Students are introduced to an environment that better prepares them to meet the challenges inherent in succeeding in the workforce by more closely paralleling life experiences [6, 7].

Integrating collaborative team work in a classroom setting is not easy. Teachers are uncomfortable with collaborative learning; many have not worked in the environment as either a student or instructor. Not only are the techniques that enable collaborative learning foreign, many teachers are not even familiar with what types of learning outcomes could be facilitated in a collaborative environment [8].

When students are assigned collaborative learning activities, they too, are often uncomfortable with the collaborative environment. Students who have been successful in the more traditional, lecture-based environment frequently view collaborative assignments as a threat to their performance and, ultimately, their grade. Many students lack the social skills that are prerequisite to success in collaborative activities and, even for those who are socially adept, adapting to the new expectations and roles fostered by the environment can be threatening [9].

The problems associated with promoting a collaborative learning experience in an online course become magnified exponentially when the environment is limited to asynchronous interaction. The freedom from time and place constraints that attract many students to Web-based courses comes at a significant cost. The richness of multiple communication channels – tone of voice, body language, etc. – and the immediacy of question-response-follow-up available in fact-to-face (F2F) environments and somewhat simulated in synchronous online settings is largely not available in ALNs. As a result, educators are faced with a dilemma: both students and academic institu-

1 William Hafner, Nova Southeastern University, Graduate School of Computer and Information Sciences, 3301 College Ave, Fort Lauderdale, FL 33314, hafnerw@nova.edu
2 Timothy J. Ellis, Nova Southeastern University, Graduate School of Computer and Information Sciences, College Ave, Fort Lauderdale, FL 33314, ellis@nova.edu

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tions are flocking towards courses offered via an asynchronous learning network. However, one of the most promising pedagogical tools, collaboration, is quite difficult in this new environment.

Although asynchronous online environments lack the intimacy and immediacy inherent in F2F settings and simulated to an extent by synchronous applications, meaningful collaborative assignments are still possible [2]. Tools ranging from threaded discussion boards and email to dedicated systems have been developed to promote asynchronous collaborative learning activities. However, the instructor is still faced with the prospect of planning and developing project-based team activities and effectively weaving them into the fabric of the course.

**Goals**

The availability of tools to facilitate learning is not in itself adequate; the instructor must know how to effectively incorporate those tools in the design of the course [10]. The goal of this study was to develop and test a model for planning effective project-based, team assignments for delivery via an asynchronous learning network. The study defined “effective” by three components:

1. Facilitating the attainment of the learning outcome for which the assignment was designed.
2. Providing the instructor with a means to monitor and evaluate team-based assignments.
3. Alleviating student anxiety regarding team-based assignments.

**BACKGROUND**

The term and concept “learning” has a large number of definitions and interpretations. Some, for example, distinguish learning on the basis of level of cognitive engagement [11, 12, 13] while others focus on the type of activity in which the learner engages [14, 15], and still others on the learner’s preferred approach to the task [16, 17]. For the purposes of this discussion, Mezirow’s [18] classification of learning across three dimensions of reflection – content, process, and premise – seems particularly appropriate.

Content level reflection entails acquiring facts and building skills. This level of learning in, for example, a graduate course in multimedia systems, would include topics such as discussing the characteristics of various graphic file formats and video CODECs, and developing skills such as using authoring software to create a product that incorporates voice-over narration and streaming video. Didactic instruction supported by texts, guided laboratory sessions, and modeling has proven effective for promoting learning at the content reflection level.

Process level reflection entails developing problem solving ability. Learning at the process level of reflection in the multimedia systems course would include selecting the appropriate graphic file format or video CODEC to use in a given application. Inherent in that selection process would be an understanding of the strengths and weaknesses of each alternative and an in-depth appreciation of the requirements for the application.

Premise level reflection, the most cognitively demanding learning, entails an analysis and evaluation of the value and relevance of the subject matter. In the multimedia systems course, knowing when and why to use, or not use, voice over narration or streaming video – or any media enhancement at all – would be inherent in learning at the premise level of reflection.

The tools for promoting learning at the process and premise levels of reflection are neither clearly identified nor universally accepted; the specific tools to develop the necessary critical thinking and problem solving capabilities are not, unfortunately, clearly understood. There are, however, some general goals for learning within these levels of reflection, including organizing knowledge, building upon prior experiences, developing problem-solving strategies, and engaging in hindsight analysis [19].

Constructivism is a widely accepted learning theory that offers significant insight into the means of facilitating the development of the problem solving capacities inherent in process level reflection. Constructivism is a learner-centered approach that emphasizes the importance of the active involvement of the student in the building of knowledge by integrating new information with her or his existing experiences [20].

The theory underlying constructivism [21] focuses more on the environment in which learning can occur than on any particular pedagogical technique. It is vital to create a supportive context in which learning can occur [22]. For many college-level courses, that context often is problem-centered and activity-based. Multiple tools and resources that the learner can manipulate and use for exploration are important, as is support for reflection and self-assessment. In effect, the environment should provide a firm foundation for scaffolding learning through coaching, modeling, and a forum for sharing problem solving strategies.

The ability to accurately assess value and relevance inherent in premise level reflection is typically developed only over time and as a result of life experiences. This type of longitudinal learning is usually promoted through collaborative projects. The value of collaboration as a tool to promote rich learning opportunities is well recognized [3, 23, 24] as is the importance of reality-based projects [25].

**METHODOLOGY**

A five-step model for planning and developing project-based team assignments for delivery via an asynchronous learning network was developed and implemented in a graduate level course in multimedia systems. The steps are summarized in the following discussion..

1. **Develop Learning Outcomes.** The planning process for any course must start with identifying learning outcomes. In order for collaborative learning activities to be meaningful, they must be associated with one or more appropriate learning outcomes. Examples of learning outcomes necessitating collaborative activities for the multimedia systems course include: 1) Collaboratively develop a project schedule, requirements document, navigation map, and storyboards to document a
well-integrated, media-enhanced product; 2) Collectively produce the media-enhanced product.

2. Match Assignments to Learning Outcomes. Again, as with any course, assignments must be designed to promote attainment of learning outcomes. For the multimedia systems course, five assignment deliverables were indicated: a media enhanced product, and four associated planning documents – project schedule, requirements document, navigation map, and storyboards.

3. Determine Team Composition. For collaborative assignments, it is important to identify the appropriate team composition, including the number of participants, the appropriate roles, and both the role-specific and shared responsibilities. For the multimedia systems course, four roles were indicated for the collaborative assignment: project manager, author, designer, and subject matter expert.

4. Establish Communication Pathways. The nature of the communication pathways is directly related to the assignment structure. The collaborative project entailed five deliverables: requirements document, project schedule, navigation map, storyboards, and the final, media-enhanced product. Six discussion threads – one per deliverable, plus a general communication thread – for each team were indicated. Although students were not prohibited from using synchronous communications tools (chat sessions, conference calls, etc.) or other asynchronous instruments (email), they were strongly encouraged, through the evaluation criteria discussed below, to focus their communication in the threaded discussion forums established for each team.

5. Evaluation. One of the biggest concerns regarding collaborative activities for both students and teachers is evaluation. Even in face-to-face settings it is difficult to identify and appropriately address problems such as “free loaders” and “dictators” in a group. In an unconstrained setting such as an asynchronous learning network, in which students are separated by both time and place and the instructor has only indirect contact, fair and accurate evaluation is indeed troublesome. To address this concern, the evaluation of the collaborative assignment included both group and individual factors. Details of the criteria used for student evaluation in the multimedia systems course are given in the list below.

1) Each student was evaluated on the basis of the work of the team as a whole (55% of assignment grade) based on the quality of the final product produced:
   a) Quality of media elements
   b) Effective integration of media elements
   c) Effective interactivity
   d) Synthesis of media elements to improve communication

2) Each student was also evaluated on her or his individual work as a member of the team, including:
   a) Performance in assigned role as shown by the item of documentation for which she or he was responsible (15% of assignment grade)
      i) Project Manager: project schedule
      ii) Author: navigation map
      iii) Designer: storyboards

   b) The Collaboration Reflection (15% of assignment grade)
      i) Analyze the contributions each member of the team (including yourself) made to the team effort
      ii) Assess the overall value of the group experience
   c) The instructor's assessment of the students participation on the team, as measured by her or his contributions to the team discussion forum threads (15% of assignment grade)

RESULTS

The model described above was used in three sections of a graduate-level course in multimedia systems that was offered over three consecutive 12-week terms. As described above in the Goals section, three elements of “effectiveness” were identified:

1. Facilitating the attainment of the learning outcome for which the assignment was designed.
2. Providing the instructor with a means to monitor and evaluate team-based assignments.
3. Alleviating student anxiety regarding team-based assignments.

The first two elements were assessed via an analysis of the grades earned and instructor interviews. The final element was assessed through an analysis of the student feedback in the Collaboration Reflection.

The course grades were analyzed by first determining the average grade received on the team assignment, and then comparing that grade with the grades received on the other elements in the course with the dual goals of determining the extent to which the learning outcomes for the assignment were met and how effectively the instructor was able to evaluate the assignment. The average grade on the team-based project was quite high – 96% – strongly indicating attainment of learning outcomes for the course, an observation reinforced in the interview with the course instructor.

An investigation of the grades on each element comprising the team-based project revealed that the three elements on which the students were evaluated as individuals – the item of documentation for which the student was responsible, the Collaboration Reflection, and the instructors’ assessment of the student’s participation in the team activities did not provide the desired separation of student performance. When coupled with the report from the instructor, these data indicate the granularity of the tools for evaluating student collaboration was less than optimal.

A Collaboration Reflection was collected from each student. The Collaboration Reflection was analyzed qualitatively (Table I) to gauge the student reaction to the assignment. As seen in Table I, four major themes were identified through the review of the comments on the Collaboration Reflection. The desire for greater structure was indicated by the qualitative analysis. Interestingly, although the students predominately indicated satisfaction with the threaded discussion forum as a tool to promote collaboration, their comments strongly indicated the need for synchronous communication. The comments
of the students did, however, support the indications that the teams did in fact function as teams in promoting attainment of the course learning outcomes.

**CONCLUSIONS**

The goal of this study was to develop and test a model for planning project-based, team assignments for delivery via an asynchronous learning network. Three indicators of effectiveness were identified:

1. Facilitating the attainment of the learning outcome for which the assignment was designed.
2. Providing the instructor with a means to monitor and evaluate team-based assignments.
3. Alleviating student anxiety regarding team-based assignments.

The study presents mixed results regarding the attainment of this goal. On the positive side, the data collected supports the conclusion that the assignment as structured was effective in facilitating attainment of the identified learning outcomes and was viewed as a positive experience by the majority of the students, lending support to the first and third indicators. On the negative side, the data suggest that the assignment was difficult for the instructor to monitor and evaluate and that for those students for whom the assignment “didn’t work”, the experience was markedly negative. In summary, indicator one appears to have been satisfied effectively by the project-based, asynchronous collaboration learning model tested. Indicator three was at least partially satisfied, and indicator two does not appear to have been met.

Student anxiety in this team-based activity appeared to be related to two factors: the perception of inadequate structure for the assignment, and discomfort with a totally asynchronous environment (See comments in Table I). This discomfort – especially that related to the structure – might well have been more directly associated with anxiety at having to function at a higher cognitive level. The learning outcomes that were to be facilitated by this assignment were cognitively demanding.

The difficulty in meeting the goal in terms of the second indicator – providing the instructor with a means to monitor and evaluate team-based assignments – appears to be a function of two factors. The instructor reported difficulty in effectively evaluating a part of the project documentation such as the project schedule in isolation. The instructor also indicated it was hard to accurately evaluate each individual’s collaborative contributions without going into a detailed discourse analysis of the discussion forum.

This type of assignment presents a mixed set of benefits based on the effort required and difficulty with assessment in using collaboration. The benefits appear to be significant: students are able to work as members of a project team using primarily asynchronous tools for collaboration. True team interactions and processes do appear to grow during this activity and online students are afforded the opportunity of experiencing a learning environment that more closely parallels the reality of the workplace. The level of effort required by both the instructor and the student should not be ignored, however. Assessment of the assignment is difficult and time consuming. Managing group-breakdowns such as withdrawals from the class and interpersonal conflicts can be quite challenging. Perhaps most significantly, the assignment presumes a level of sophistication and competence on the part of the students. The following observation by one of the less satisfied participants best illustrates this point: “At a graduate level the amount of structure should have been fine. In the case of my team it was insufficient.” The impact of marginally qualified, socially inept, or distracted students is quite difficult to predict and manage.

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### Table I

#### Inadequate Structure: 11 comments

<table>
<thead>
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<tr>
<td>A required detailed weekly status report to the project manager from each team member to communicate their participation. 2. A required milestone report from the project manager to keep the team focused and on track.</td>
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<td>I would have preferred more detailed instructions relative to the exact nature of work for the specific duties of the developer, author, designer, etc. Additionally, more examples or samples would have been helpful in being able to predict the best outcome possible for the type of project being worked on.</td>
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<tr>
<td>At a graduate level the amount of structure should have been fine. In the case of my team it was insufficient.</td>
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### Need for synchronous capability: 15 comments

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<td>We did however use various means of communications, such as forums, E-mails, phone conversation, and Instant messaging chats. I think that as a group we found the instant messaging meetings to be the best long distance collaboration tool we could use.</td>
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<td>I think that given the constraints and limitations of a distance learning online assignment, we functioned exceptionally well. It’s just that I am very sure the experience would have been MUCH better if we were all in the same classroom and in the same city for personal collaboration.</td>
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### Presence of group interactivity: 16 comments

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<td>The collaboration of the group was a wonderful experience and felt it was appropriate in nature. We worked well together and help each other through our various weaknesses. The use of email was quite helpful as well as the forum to discuss ideas, problems and solutions.</td>
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<td>Collaborating with my team members brought forth an awareness of the various responsibilities within this process to include those required of the project manager, subject matter expert, project designer and project author.</td>
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<td>My bonding process with my team allowed me the opportunity to expand my knowledge of multimedia, as well as develop a working environment where I was able to share a project with several talented individuals.</td>
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### Group Didn’t Work: 4 comments

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<td>My overall experience with this group has been nothing short of frustrating. Although I requested to be paired off with the members of my group, it was later learned that it would be a mistake that I would not soon recover from. As a result of request, I will forever hate the idea of being placed in a team project.</td>
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<tr>
<td>If my experience is at all common, I would make group participation optional. Those who wish to work independently should be given that option. I knew within days of the team assignments that my teammates were unreliable and, had I been able to begin independent work then I would have had time to complete a project that I would have been proud of and from which I would have learned about multimedia production.</td>
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<td>My suggestion is to not have team or group projects. It too difficult to trust someone that you don’t know. And there is no way to accommodate for personalities clashes.</td>
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Implications for Future Studies

The benefits associated with the task-based, team assignments certainly warrant further investigation into how to effectively integrate them into courses delivered via asynchronous learning networks. A number of topics for further research are suggested by the results of this study.

1. How can the tools available in an asynchronous environment be utilized to alleviate the often frustrated desire for synchronous communication?
2. How can instructors more effectively evaluate the participation of students in their role as a team member?
3. What is the proper balance between structure and freedom for teams to exercise initiative?

References


