Asynchronous Philosophy of Math E-Learning: Call for the Need to Improve Feedback and Communication

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Introduction:

Should the conception of the asynchronous model of distant learning be altered for better performance? The asynchronous learning environment's structure was designed for student flexibility. That method of teaching is only effective if the student plays an active role in the learning process. For the student to succeed in this modality of education, the student must spend more individual time with instructors than is possible in a regular classroom normally through the communication of email or threaded discussion. Communication through this mode is difficult in math courses which require notation not easily communicated between the users. Feedback and communication is the key to learning successfully. When this cannot be achieved a question about whether in some cases the asynchronous model should implement synchronous communication arises to improve certain aspects of communication.

Literature Search:

Should the conception of the asynchronous model of distant learning be altered for better performance? Moore & Kearsley (1996 p. 2) in fact define distance education as: “planned learning that normally occurs in a different place from teaching and as a result requires special techniques of course design, special instructional techniques, special methods of communication by electronic and other technology, as well as organizational and administrative arrangements.” This mode of education normally occurs asynchronously where the learners are not accessing the information at the same time it is offered nor at the same time that other learners may be accessing it. “Besides convenience, asynchronous courses allow students to proceed at their own pace, and often catalyze typically quiet members to participate more. Besides the immediacy of contact between instructors and students, synchronous learning expands the horizons of students by broadening the student population and ameliorating the barriers of geography” (Haefner). The asynchronous learning environment's structure was designed to have the instructor guide students to have an enduring understanding of the course material. That method of teaching is only effective if the student plays an active role in the learning process. This is just one of the many shortcomings in asynchronous learning. “Crossing the end of the 19th and beginning of the 20th century.

In correspondence learning the major means of communication are printed materials, usually customized textbooks that contain lesson outlines and exercises. Students complete assignments based on the textbook instructions and ‘mail’ the assignments to the instructor, who provides feedback via first class mail” (Moore & Kearsley 1996). Currently some distance learning professors in the field of math teach their distance education students using a interactive cd-companion textbook as their primary tool and third party internet resources. When a student has a problem with the material the umbrella company that houses communication between the student and teacher is poorly equipped to illustrate math notation. For the student to succeed in this modality of education, the student must spend more individual time with instructors than is possible in a regular classroom normally through the communication of email or threaded discussion. Communication through this mode is difficult in math courses which require notation not easily communicated between the users. Feedback and communication is the key to learning successfully, when this cannot be achieved a question about whether in some cases the asynchronous model should implement synchronous communication to improve certain aspects of communication. Implementing synchronous communication may help to provide an obligation to think in real time that normally presents itself in a traditional learning model. With asynchronous learning students tend to not have the motivation or feel they have an obligation to complete work until towards the deadline.

The asynchronous philosophy is a concept coined by many professors who only know this method to properly conduct a course through computer mediated communication. Even though most distance education courses are
taught this way, there is no demand for asynchronous communication by either the Learning Anytime Anywhere Partnerships section of the reauthorized Higher Education Act (enacted 7 October 1998) or the Alfred P. Sloan Foundation's Asynchronous Learning Network. Therefore nothing prevents instructors from implementing synchronous learning methods in an online course.

**Research Question:**

There are many shortcomings in asynchronous learning, and some shortcomings in synchronous learning. In a traditional learning environment there is equilibrium of asynchronous and synchronous learning that has been proven to be a successful learning style. Who is to say that this cannot be accomplished in distance education? Is there a method to incorporate synchronous communication to the asynchronous learning model successfully?

**Method:**

Web-based distance learning environments have improved to support formulas and diagrams, in their postings. Ideally, however, they have still not perfected feedback and communication of math notation. Numerous articles have been written about distance education, but few have talked about the issue of math communication. MathThread was an NSF sponsored research project, working to improve web-based and hybrid college mathematics courses by providing the ability for instructors and students to communicate easily with diagrams, formulas, graphs and math notation. Currently, the research group is using an online environment "NetTutor", to provide instructors with tools for 2-way asynchronous communication of formulas, diagrams and graph. The research also looks at how web-based course structure affects interaction (instructor-student and student-student) and how this interaction affects meeting student and instructor educational goals. A case study will be conducted on two college mathematics courses, where both instructors have previously taught mathematics through alternative modes of asynchronous learning and are currently using NetTutor as an alternative asynchronous/synchronous learning method. To investigate the research question this paper uses the research that has been conducted by my participation in MathThread. This partial subset of data would include instructor interviews who taught there courses via a cd-companion textbook and who teach this using other alternatives for better communication. This data will help to determine if this new mode of communication has helped students learn better in their opinion. The student interviews would help to determine if they have learned better or what suggestions they might have to improve the current modes of communication. This study would show that better communication would mean better education success rates.

Interviews and course structure analysis will be conducted on the two classes. The theme of the interview will revolve around problem solving which is the main learning strategy in learning mathematics, and NetTutor which is the alternative approach to asynchronous learning through a combination of asynchronous and synchronous modalities.

The instructor interview questions are listed below:

1) How did you use NetTutor in your course?
2) What did you think of NetTutor?
3) Would you use NetTutor again?
4) Would you recommend NetTutor to other SLN faculty?
5) What did you like about NetTutor?
6) What did you NOT like about NetTutor?
7) What are your comments about the usability of NetTutor for you and your students?

The student interview questions are listed below:

1) What is your understanding of what is meant by "Problem solving" as it relates to College level Mathematics?
2) How do you best learn Problem Solving and what strategies could the teacher use to help you learn better?
3) How do you learn to solve problems in your class?
4) Is your approach to learning Problem Solving different for Face to Face classes versus distance learning classes?
5) A) What are some of your successful and unsuccessful approaches to learn Problem Solving in Face to Face classes?
5) B) What are some of your successful and unsuccessful approaches to learn Problem Solving through distance learning classes?
6) What is the role of diagrams and graphs in your learning of Problem Solving?
7) How does group or cooperative problem solving work in Face to Face versus Distance Learning classes?

Limitations:

Due to the short amount of time to conduct this research the amount of data collected will be limited to the amount of data that can be collected through interviews recently conducted, and or those previously conducted by MathThread.

Results:

Course Structure Analysis

Evelyn Pascarelli teaches a college level mathematics course as part of the State University of New York Student Learning Network. She implements asynchronous learning through a cd companion textbook, text version of lectures, and threaded discussions. She implements synchronous learning through group work and office hours. The synchronous portion of her class is not mandatory.

Maryanne Morea teaches a college level mathematics course as part of the State University of New York Student Learning Network. She implements asynchronous learning through threaded discussions, and collaborative study. She implements synchronous learning through office hours and collaborative work. The synchronous portion of her class is mandatory.

Below is a summary of the instructor interviews questions that have been pulled out of the original interviews that can be found in Appendix A.

1) How did you use NetTutor in your course?

Evelyn: “To demonstrate points covered in the lessons; for a live chat; to post lectures.”

Marianne: “I am using NetTutor with my MA27 Algebra II course. I have taught the course since the Spring of 2002. I taught it one semester without NetTutor and am now teaching it for the 6th time with NetTutor. This course runs 2 sections every fall and spring. I use NetTutor in several different ways for situations where I want to see students using algebraic notation. Every module includes a cooperative exercise bulletin board where students contribute one step at a time to problems. This simulates working on problems in class at the blackboard where I would ask students to lead how a problem would be solved and write out the solution on the board. Each student contributes a step and leaves it for the next student to continue. They may each return to contribute again or correct errors and the participation on this task counts as 10 % of their course grade. I use worksheets for assignments that would be difficult to produce in the written assignments area of the SLN template so that algebraic work and graphs can be shown. I also use them for parts of the midterm and final exams where I need to see their work. Finally I have tried to use the live chat capability to hold help sessions with individuals and groups of students. I have found that scheduling group meetings doesn't work out as the schedules and time demands on online students make it impossible. What has worked out better is to let students know that if they need help we can arrange an appointment to meet on NetTutor to work.”

2) What did you think of NetTutor?

Evelyn: “Liked it very much; liked its ease of use for the students and myself.”
Marianne: “NetTutor has given me capability to teach algebra where it seemed difficult to have students see algebra being done and also for me to see how proficient they really are. I like have the whiteboard for them to able to produce graphs and algebraic notation. The bulletin boards give me a more appropriate type of discussion activity for a math course that is really skill driven and not opinion driven.”

3) Would you use NetTutor again?

Evelyn: “Yes, and would expand my use of it for more class participation.”

Marianne: “I have used NetTUtor now for 6 semesters and can't imagine not having it available and would recommend it to other instructors looking for these types of capabilities.”

4) Would you recommend NetTutor to other SLN faculty?

Evelyn: “Yes I would”

Marianne: “Yes I would recommend NetTutor to other faculty. It would be great if you could link SLN and NetTutor, let me know how it goes.”

5) What did you like about NetTutor?

Evelyn: “The Whiteboard – like being in front of a classroom, ease of use.”

Marianne: “This is the best solution that I feel I have available to bridge the gap between being in the classroom and online. It is not a perfect solution but much better than what I had before.”

6) What did you NOT like about NetTutor?

Evelyn: “It is a great tool for teaching math.”

Marianne: “The biggest complaint from students is having to deal with different websites for the course and certainly a better setup would be to have a whiteboard and equation editing capabilities available on the SLN template. Students do sometimes have technical problems with NetTutor and having everything consolidated would give them one help desk to deal with. Also better instructions on the use of the whiteboard would be helpful. I also have some problems with NetTutor, most notably the inability to edit my worksheets and delete things myself. There are times when the site is slow, I assume during heavy traffic time.”

7) What are your comments about the usability of NetTutor for you and your students?

Evelyn: “It was easy to use right after the first time; easy to navigate.”

Marianne: “All in all NetTutor has been a great aid in providing an online algebra class. Hopefully in the future we will have other tools or a consolidation of the tools but for now I am thankful for the opportunity to use it.”

Discussion:

A small factor that affected the amount of student participation in synchronous modalities was if that portion of the course was mandatory. In the case that it was not mandatory, there was only one student so far that used the synchronous portion of office hours to collaborate with the instructor to review homework problems via a real-time interaction whiteboard interface. In the case that it was mandatory students met on there own time to collaborate in groups to work on projects together. Alternatively the students worked on this asynchronously through threaded online discussion when not all members of the team could collaborate together.

Since the class taught by Evelyn Pascarelli does not make the synchronous portion of the class mandatory the students in the class have chosen to not respond to the student interview because it was located in the same section as the synchronous utility.
Based on the student interviews that was returned by some of the students in Maryanne Morea’s class, in the appendix, students wanted to learn math in distance education via the same learning methods that they would encounter in the traditional learning style of face to face learning with the ability to ask questions immediately as in a lecture of directed learning. Most students responded that time was a major issue in studying, which is expected since that was one of the purposes to create a distance education course. Problem solving as a learning tactic for math can best be learned by breaking down problems. This can be achieved synchronously with a professor during office hours in real time online. Maryanne Morea used NetTutor to conduct online office hours using the synchronous capability of NetTutor such that the student can communicate via an instant messaging delivery system that housed an interactive whiteboard with easy to use mathematical notation. According to the interview conducted this capability allowed for many students to understand complicated material calculation better through step by step work.

Above all else communication between the student and instructor was an important factor. Poor communication of mathematical concepts via conventional methods of instruction has proven to be frustrating for the student and instructor. The problem solving strategy to understand math cannot be achieved successfully through delayed thinking. Since students do not think to solve parts of a problem through steps that take days for a response the asynchronous method to asking or receiving help is not acceptable. Only through step by step problem solving techniques learned in real time can a student understand the material better.

One of the major problems with introducing synchronous components to an asynchronous learning environment is the amount of tools that students already have, only through proper support between teaching semesters can an instructor begin to replace components of learning with synchronous components. This is one of the major drawbacks to implementing synchronous components. It took Maryanne Morea almost 4 semesters till she finally was able to successfully implement synchronous learning into her course.

Conclusion:

This case study has shown that the combination of asynchronous and synchronous learning modalities is feasible and successful. Though the State University of New York Student Learning Network prefers instructors to teach primarily asynchronously, they understand how synchronous modalities may be helpful. This past year MathThread and the State University of New York Student Learning conducted several pilot study courses to determine for themselves if this should be implemented that has yet been determined. Studies conducted in this project and MathThread show that this modality of implementing synchronous utilities has proven to only improve the amount of learning that goes on in distance education math courses. This research paper calls for the need to assess possibly all courses that are taught online to determine whether synchronous utilities can improve the method to teach other subjects in all other levels of education.

Appendix A: (Maryann Morea Student Interviews)

Student 1:

1. To me problem solving is learning through steps to find the correct way to solve a problem.
2. The best ways to learn problem solving is through steps, and to break the problem into individual problems.
3. By reading the math textbook, answering the mathXl problems and with the NetTutor problems.
4. It is about the same but I found that I use the math textbook a lot more.
5 (a) The successful is that you have a teacher to point out the problem that you are having without have to find out where you made a mistake in the whole problem. The unsuccessful is that when the classes are full it is hard to concentrate and hard to ask questions.
5 (b) The successful approaches to learn problem solving through distance learning classes is you can go at your own pace and you focus more when you are learning going through problems. The unsuccessful is that if you fall behind it is harder to get back on track because you feel overwhelmed with the amount of work.

6. The role of diagrams and graphs in the learning of Problem Solving is to give information that should be used in order to understand the problem. They also help to “see” the problem in another way to help better understand the problem.

7. Group or cooperative problem solving in Face to Face I feel works much better than Distance because it is easier to communicate and to help each other understand stand a problem or what someone is doing wrong. Maybe with newer technology Distance learning will get better.

**Student 2:**

1. Problem solving at this level, is more about how you get the answer and improving problem solving abilities, rather than just getting the right answer.

2. I best learn problem solving from trial and error with guidance along the way.

3. I learned problem solving by first reading lectures and the correct way to do so. I was then given an example of how this was done. This was followed by some problems for me to try. I was then critiqued on the mistakes and shown what I did wrong. After this was done one to several times I was then assessed on my ability to problem solve.

4. I would think so, but the interaction in this class was so good and the responses to my questions were so quick that it was practically like I was in class, almost being tutored.

5 (a). One of the biggest obstacles for learning problem solving in a classroom setting is listening to the questions of others which often confused me more.

5 (b). The best approach was trial and error with excellent guidance from the professor.

6. Diagrams and graphs are essential, they give a “dry” equation or question a more helpful visual perspective.

7. Group work lends itself much better to classroom settings. There is too much time in between contacts amongst group members in distant learning, and the work suffers.

**Student 3:**

1. To translate the problem into an equation and then solve the problem.

2. Starting off with easy to understand problems and then moving up to harder ones, plus the textbook explains it.

3. I learned from reading the book.

4. I think I learn better face to face personally, but it's not hard to understand online either.

5 (a). I understand it more when I hear it explained.

5 (b). It's a little harder to learn on my own, because if I need it more explained I can't hear it.

6. Diagrams and graphs help, all visuals help.
7. In group work I think it's pretty much the same.

**Student 4:**

1. To me, problem solving is working with a given set of data or parameters to find a suitable solution to an equation or word problem.

2. I am the type of person who “learns by doing”, so I think I could have benefited from more teacher interaction.

3. In this case I used MathXL to walk me through a few problems until I felt comfortable trying them out on my own.

4. Slightly. I think with more time to think about what I’m looking at; I tend to take a few extra minutes to absorb the problem solving techniques, and therefore I tend to grasp them a little better.

5 (a) My most successful approach was simply paying attention in lectures, and taking good notes....My most Unsuccessful, was relying too much on the text.

5 (b) I’ve used the same approach throughout the duration of the class, I would have liked a better result, but my shortcomings in this class only reflect my failure to devote the proper amount of time to the material.

6. No matter what I do, I always seem to have trouble with graphing. So therefore I’d have to say the role of graphs and diagrams in problem solving are simply to pollute my grade.

7. Cooperative problem solving in distance learning classes is more difficult because communication is more difficult.

**Student 5:**

1. Problem solving as it relates to college level math is a process of taking a problem and breaking it down into logical smaller steps in order to solve.

2. I always learn best by doing so once the teacher shows me how to solve a problem I like to do some problems on my own to see if I am following what has been taught. I also learn by being taught why things are the way they are and how a certain math problem can be applied to everyday life.

3. This is an online math class and we have access to a web site that will allow me to do all the problems I need to in order to feel comfortable. This site also has what they call “guided solutions” that break problems down step by step.

4. I would say my approaches would be the same.

5. Not sure how to answer A & B other than what I've already stated.

6. No diagrams in this class. Graphs were used and are helpful to see if the points your are resolving to in the solution work.

7. Face to face group problem solving will give you much quicker results than distance learning classes. We were going to try to use a Chat room in my current online class but we couldn't get everyone to agree to a time to meet. The closest we've come to this in this class is a bulletin board approach were I could leave a problem and it's solution and someone else could later comment on it.

**Student 6:**

1. To me it means working out a math problem that was put to us in a problematic context.
2. The best way to learn for me is by example. Providing many different examples is the best way for a teacher to help me learn better.

3. The teacher gives us a problem and explains how to solve it, then provides other examples to help us further understand.

4. I think in either environment lots of examples are the way to go.

5 (a). I have to say my experiences have mostly been successful except for once. I took a class that the teacher just lectured us and she did all the work and we basically fell asleep.

5 (b). I have always had successful experiences through distance learning classes. I think that is because it is pretty hard to lecture through the computer. There is a higher student involvement through distance learning than in the class.

6. It’s just another visual tool to help with learning. I personally learn better through visualizations.

7. I would think that it is easier in a Face to Face involvement. It is harder in a distance learning environment to cooperatively learn. The only way that I have seen this achieved is if certain groups are assigned specific problems and must work and check each others work.

**Student 7:**

1. Problem solving means calculating an answer and being able to explain the steps in words so that someone else who does not understand the material can follow the steps and gain understanding.

2. I liked the guided solutions in Math XL. You could test out of what you know, but where you needed help, the prompts helped you step by step, with interim questions to assure what was learned with broken down steps. I wish they would offer the same in explaining answers to the exam questions that we get wrong.

3. I am a sixth grade math teacher, taking additional credits needed for math 7-12 teacher certification. Most of the material is easy for me. I rarely used the book. I would often just quickly read the minilectures, try a few examples in Math XL practice and take the test. I don’t think my background is representative of most students in your study.

4. I tend to enjoy getting involved in class discussion. The opportunity to do that is limited, although many of us commented on each other’s responses in a discussion. I don’t think my approach is different, but it takes a different level of effort.

5 (a) I like to participate and ask questions in face to face classes, to address problems I have to get clarification and understanding. I generally do not have unsuccessful approaches.

5 (b) I took the distance learning class because of limited time. One of the approaches I used was taking an exam, seeing what errors I made, reviewing that material, and retaking the test. This approach is typically not available as a standard approach. It is comparable to an open book test, which is essentially what distance learning is about.

6. I think diagrams and graphs add to understanding. There has been excellent use of technology with this class with graphing programs. I particularly liked the slider to see the changes in the slope of a line and x and y intercepts.

7. Many of us got involved with sharing ideas and perspectives in the discussion. Both face to face and distance learning has advantages and disadvantages. I personally and very happy that the distance learning option was available.

I also think the professor makes a big difference in the success of a distance learning class. Clarity of information/directions and responsiveness to concerns are key elements to the success of a distance learning course.
Student 8:

1. Solving different kinds of mathematical problems while continuing to show your work.

2. I best learn how to solve problems through examples in the textbook. Our teacher does a good job of providing different web pages with even more examples to look at.

3. Trial and Error, if the answer is wrong then you know to go back and figure out what you did wrong.

4. You have to wait a little longer to get a reply for a question that you might have. But sometimes it works out a lot better, if you have a question on an assignment the teacher is around more to assist.

5 (a). I sometimes don't ask questions in class because I don't like others to think that I don't know what I'm doing. While online I don't really care and so I will ask a question if I have one.

5 (b) Same as above, asking questions when I have them. I actually read the textbook a lot more then in a classroom setting.

6. Depends on the kind of math we are studying, in some cases I think that they help out a great deal while in other cases I find them kind of useless.

7. I like it better online because groups aren't as "clicky." I find it easier to stay on track also online rather then in a classroom setting.

Student 9:

1. My understanding of what problem solving means is learning to solve math problems that will relate to the real world. Example: I am going into the nursing field and will need to calculate dosage. I think problem solving will help me in that area.

2. I learn from hands on, I have to work the problem out several times to understand it. I am not a big fan of reading how to do it, sometimes I just have to see how the steps are taken and figure it out that way.

3. I would read the mini lecture then look at it in the book quickly, then I use Math XL. I found the guided steps to be easy to follow.

4. It is different only in the fact that I spend more time working at my math than I do in the classroom. It seems to be a little more challenging than a face to face class room. I have taken several different types of online classes and find this to be true for all of them.

5 (a) I like when I can ask a question and have the answer right then while I am working on the problem.

5 (b) I find that online I can work at my pace putting in hours when I want. I just keep working the same problems over and over till I understand it.

6. We used graphs to plot points. We also worked out word problems and plotted the points, so you could see how it would be used in everyday life.

7. I think that more students participated in the distance classes than in face to face classes. First you are graded in how much to participate and it is easier for someone to type what they want to say than it is for someone to talk in front of a group.

References


Smith, G. G., Taveras, M. (in press). E-learning, we have a problem: The future of online education. Technological Horizons in Education.

