CREATING ONLINE COURSE FOR DISTANCE LEARNING

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Background

Alcorn State University[2] is located in an isolated place in Southwest Mississippi. Department of Mathematics had been experiencing dwindling and weakening enrollment for quite some time in its mathematics education graduate program leading up to the possibility of closing the program. Over the years it was noticed that graduate students were not able to attend the class in the evening because of the location and financial implications of scheduling small classes. At the same time it was not possible for students to attend day classes as many of the students signing up for these classes came from working population. The common practice of combining undergrad and grad classes, where possible, was found to be compromising the quality of education by the instructors. Faculty members volunteered using virtual classroom software Elluminate Live, which is integrated with the school's Blackboard portal, to hold these graduate classes during evening hours beyond and above their normal workload. This arrangement was far from satisfactory, but it did show a possible solution, namely distance learning. The author had already talked about the 'distance learning option' to the president of the university, who liked the idea very much, and asked for a concept paper. All graduate faculty in the department concurred with this suggestion. Developing graduate online course is a very serious, laborious, and time consuming process. Unlike many undergraduate courses, not many online resources are available at the graduate level. Most academic portals cater to undergraduate courses. The timeframe suggested in the concept paper aimed at developing three courses, one each by the three graduate faculty members, during the summer months every year. It would cost the university two months summer salary for three graduate faculty members for three years for the complete development of the graduate curriculum. The concept paper listed following reasons for developing an online curriculum:

- Because of the location of Alcorn State University, most students in the grad program come from neighboring four counties only.
- Most of the students are teachers or prospective teachers.
- Because of the poor enrollment and perhaps to save money the graduate classes are combined with undergraduate classes. This makes it difficult for the graduate students to attend because most of them are working.

- Asking a grad student to attend a corresponding undergrad class, where possible, is like asking the student to repeat the course at a lower level. This robs the program of quality and competitiveness.

The concept paper also listed the following possible positives resulting from offering mathematics education graduate program online.

- An online course will cut across the limits imposed by the location of Alcorn State University by reaching out to students all over. This will result in increasing enrollment and, therefore, sustainability of the program.
- The online courses will be offered strictly at the graduate level. This will restore quality and competitiveness.

Whereas the president liked the proposal and gave a signal to go ahead, he did not promise the summer salary. Clearly, in the absence of any such arrangement, all the faculty members decided not to pursue the idea. Seeing the dire need for a distance learning alternative, which has a potential for not only saving but expanding the program, the chair of the department of mathematics & computer science and the dean of the graduate program secured an outside grant[3] to pay $3000.00 per course and the faculty members were free to develop the courses during the year so that they could keep summer teaching job intact. Even though the compensation did not match the amount of work involved, the graduate faculty members in the department, at the persuasion of the department chair, agreed to develop the courses to be delivered online. Decision to this effect was taken in the academic year 2009-2010.

Infrastructure

A committee, consisting of the chairperson of math & computer science department and the five mathematics and computer science graduate instructors, met several times to discuss the design for the graduate online courses. Four schools (divisions) at Alcorn were already offering online/hybrid courses in some form at the time, but in the absence of any clear directions by the university, the committee set out to explore and discuss the framework. Many members of the committee were well-versed with online portals Cengage and Hawkes' Learning System. After extensive research[4,5,6], it was decided that the content of the course will consist of

1. course syllabus including reading references
2. pre-requisites material
3. chapter-wise discussion
4. resource materials on the Internet

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[3] HBCU Masters Degree Program: Strengthening Masters Degree Programs at Alcorn State University funded by US Department of Education
[4] http://mathdl.maa.org/mathDL/4/?pa=content&sa=viewDocument&nodeId=1057&bodyId=1238
[5] http://online.rit.edu/about/newsletter/one_article.cfm?which=70
[6] http://mathforum.org/

5. ideas for projects/term papers
6. worked out examples
7. exercise sets (at least 40 exercises for the entire course)
8. Sample exams/tests (twice as many as to be administered), including pre and post tests

It was decided that the content material should be dynamic, as far as possible, and the documents must be in pdf, PowerPoint, and video formats where possible. Videos, if created for the course, should not exceed ten minutes each in length. It was also decided to not show the instructor's picture (PIP) in the videos because the course may be taught in future by someone else too. The rubrics and the legend for evaluating the student work were left entirely to the instructor teaching the course at a given time.

Everyone was asked to prepare some sample documents and present them for the benefit of others in the group. Documents were prepared in the form of PowerPoint presentation with sound clips incorporated in them, slides using adobe acrobat, EXCEL documents, and Camtasia and Adobe Captivate movies. These documents were showcased among the committee members. A result of this activity was that the project purchased Sony 820P digital video recorder for each member to record good quality clips for incorporating in the PowerPoint documents.

Delivery of Courses

Alcorn State University's Blackboard portal has interfaced Elluminate Live with it and uses SafeAssign to identify plagiarism. It was decided to use Blackboard to deliver the materials and Elluminate Live to hold virtual classes. It was also decided to identify institutions/agencies for students to take proctored exams if a student is not in the proximity of Alcorn State University. However, it was agreed that low stake assessment, such as assignments and quizzes, will be conducted online only. Low stake assessment should not account for more than 40% of the total assessment. Pretest and post-test will be used to evaluate the student performance along with the regular assessment. Pretest will also be used to tweak supplemental efforts by the instructor to enhance student learning.

The university does have a web-based system for evaluation of courses, but it is used only at the end of a semester. It was decided to use surveymonkey.com to evaluate the course from time to time at the department/course level. The department had already made tablet PCs and webcams available to all faculty members. As pointed out earlier, digital voice recorder was made available for each participating faculty to record sound clips. Adobe Acrobat, Camtasia Studio, and Adobe Captivate licenses were purchased for the interested faculty.

Creation of Courses

The three mathematics courses selected to be delivered by August 31, 2010 were Real Analysis, Modern Algebra, and Special Topics (Discrete Modeling). The author prepared the discrete modeling course. This course is based on Neuwirth & Arganbright's Mathematical Modeling book[7] and therefore incorporates learning and use of advanced EXCEL skills.

EXCEL Documents

These documents were created in two formats; showing all EXCEL formulas used (instructor files) and hiding formulas etc (student files). These documents were password protected. A finished EXCEL document includes tables, charts, form controls etc besides formatting. Personally, we would have liked to use ActiveX controls, but ran into the difficulty of posting them on the web[8]. These documents also demonstrated to students how the finished product may look like. Each of the EXCEL documents is accompanied by a document consisting of instructions and some questions to explore.

PowerPoint Documents

In order to incorporate dynamics in the PowerPoint documents, for a student to understand better, we use animation on the slides, not restricting it to transition bullet point or a diagram. For example, where desirable, we also animate different elements, such as text boxes; variables; diagrams; and symbols for making the learning process of the student as comfortable and active (cutting on the boredom brought on by normal documents). This is quite a laborious work. Sound clips are added where necessary, mostly at the start however.

Videos

Camtasia Studio 6.0 is used to convert some PowerPoint and EXCEL documents into videos to give the instructor an alternative way of presenting the documents. These videos are made interactive by incorporating some quizzing. EXCEL techniques are explained by short videos made with Adobe Captivate 4.0, simply because it lets you make a training video rather easily. Callouts are inserted for ease in understanding. All in all making videos proved fun and interesting but very time consuming.

Adobe Acrobat Slides

Documents containing examples, theorems, and their proofs were created as PDF files. In order to make these documents more readable by the student and focusable for the instructor to explain in a virtual class session, they were converted into clickable slides

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[7]Neuwirth, E, & Arganbright, D. (2004). Mathematical Modeling with Microsoft EXCEL. Belmont, CA, USA: Brooks/Cole

[8] Despite talking to many advance EXCEL users at meetings, conferences, and privately, we could not solve the problem of posting an EXCEL 2007 document using ActiveX controls on the web. We do have a workaround of creating a self executable zipped file without exe extension packaged with a batch file that restores the exe extension, but this is not a neat solution.

by age-old technique of illusion that is made possible by creating several pages out of a single page with a progression of the content. Every click replaces a page with the next that not only retains the previous content in exact same position but includes some additional content too. Adobe Acrobat 8.0 was used for this purpose. Clicking was made possible by setting full screen option in Adobe Acrobat[9].

Other Documents

Documents containing exercises, term paper ideas, quizzes and exams etc. were made in two formats: docx and pdf. The WORD documents were made for the convenience of the instructor who may like to edit and modify the documents.

Software and Internet Resources Used

In order to make PowerPoint presentations and movies, it is helpful to tap Internet for freebies, for example, PowerPoint templates, background music, animations etc. There are many such resources on the Web. It is important to keep in mind the copyrights and acknowledge the sources. Here are some useful websites

1. www.brainybetty.com
2. www.fppt.com
3. www.animationlibrary.com

As mentioned above, the software used included

1. Microsoft Office 2007 for Word, EXCEL, and PowerPoint documents
2. Camtasia Studio 6.0 (including SnagIT) from TechSmith to create Camtasia videos
3. Adobe Captivate 4.0 from Adobe for creating EXCEL training videos
4. Adobe Acrobat 8 for creating clickable adobe slides

However, the Internet is replete with free software of every kind. For example, FastStone Screen Capture or Gadwin PrintScreen can be used for capturing portions of screen; and uTipu, ScreenToaster, CamStudio, or Jing for creating videos by for capturing the screen.

Before giving some details we the course design map show in the following diagram.

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[9] http://www.creativetechs.com/iq/build_an_acrobat_pdf_slideshow.html

Course Design
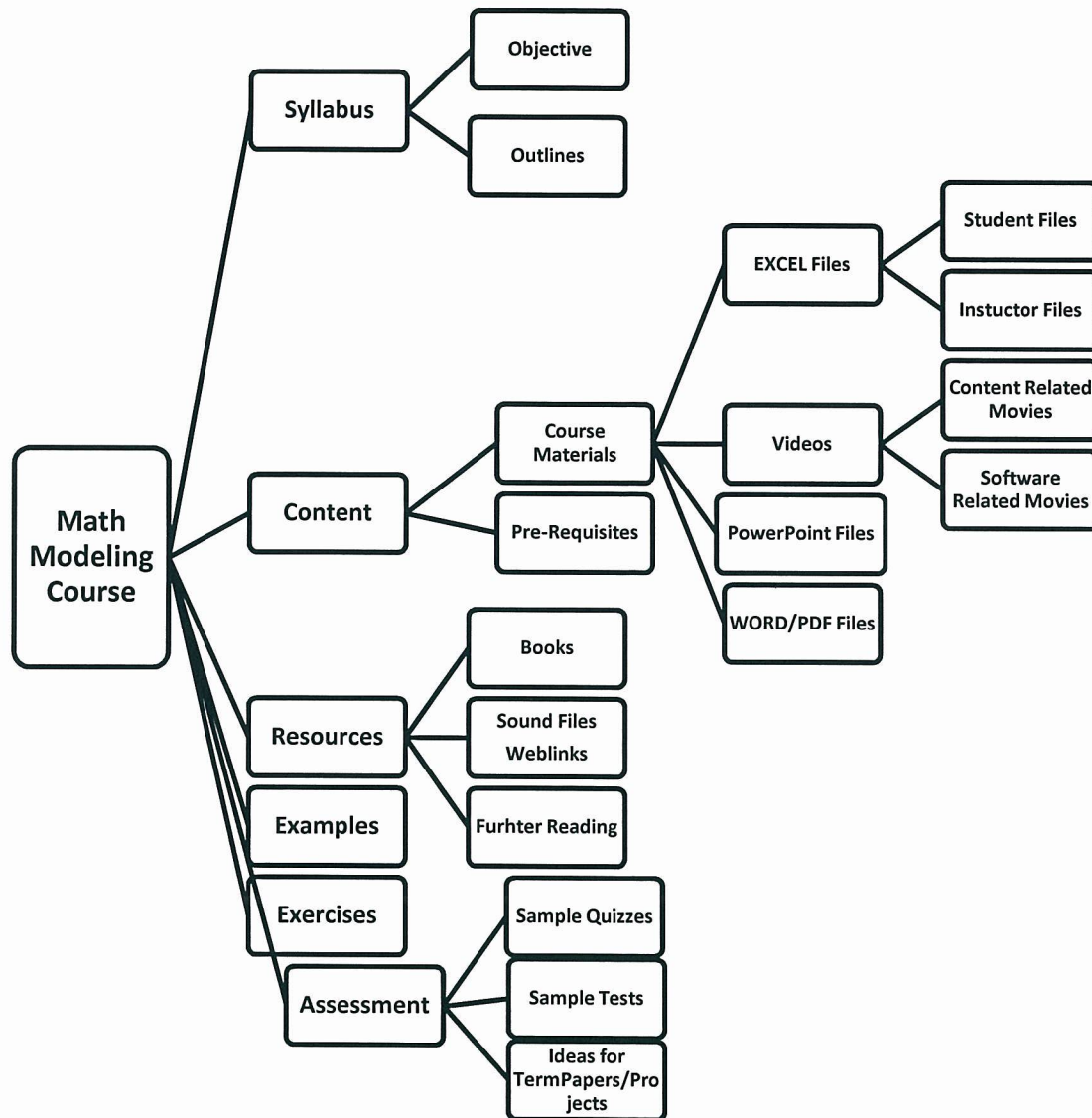
Content

<u>Models:</u> The following models were included in the course. These models reflect use of a variety of difference equations/systems of difference equations. Also, these models are based on different mathematical concepts, including arithmetic, number theory, probability, linear algebra, and calculus. Materials for these models consisted of PowerPoint presentations, pdf documents, Camtasia Studio videos, and EXCEL files

1. Investment/Mortgage Model
2. Lake Pollution Model

3. Prey - Predator Model
4. Progeny Model
5. Fibonacci/Golden Ratio Model
6. Population Dynamics/Markov Chain Model
7. Converting Numbers to a Base Model
8. Newton Model (Newton's method for solving equations)
9. A Probability Model
10. Gradebook Model

Additional Suggested Models
1. Hybrid and Non-hybrid Car Model[10]
2. Social Security Income Model[11,12,13]
3. Horse Race Simulation Model (Probability-Based)
4. Graph Tracer Model
5. A Linear Programming Model (Two parameters)
6. Leontief Input-Output Model

Other Materials
1. Explanation, background, and mathematical theory needed for many of the models.
2. Training videos for EXCEL techniques
3. Exercise sets and examples
4. Sample exams (Assessment)

Pre-Requisite Materials
Basic information on these topics is given. It is expected that the students are familiar with these topics. They are advised to read more about these topics from other sources.

1. Representation of a number in different bases
2. Investment/Mortgage
3. Probability
4. Matrices and eigen values
5. Newton's Method

Ideas for Term Papers (Assessment)
Students are advised to make an extensive search on Internet and published media to write term papers on the following models:

1. Lake Pollution Models
2. Prey-Predator Models

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[10] http://www.kbb.com/
[11] http://www.ehow.com/about_7262952_social-security-monthly-benefits-computed_.html
[12] http://www.ssa.gov/retire2/AnypiaApplet.html
[13] http://moneywatch.bnet.com/investing/blog/wise-investing/social-security-strategies-how-are-my-benefits-calculated/1062/

3. Lotka-Volterra Model
4. Manuela-Stella Model
5. Golden Ratio and Fibonacci Sequences
6. Leontief Input-Output Model

Some Useful References and Resource Materials
A.   Weblinks for Mathematical Modeling Course

1. Issues related to pollution in Great Lakes
http://www.great-lakes.net/teach/pollution/water/water3.html

2. YouTube Movie about pollution in Great Lakes
http://www.youtube.com/watch?v=MK8RYbHzxQM

3. What is mortgage?
http://www.move.com/home-finance/mortgages/what-is-mortgage.aspx?source=ig

4. Fibonacci Sequence
http://milan.milanovic.org/math/english/lucas/lucas.html
http://www.mathacademy.com/pr/prime/articles/fibonac/index.asp
http://mathworld.wolfram.com/FibonacciNumber.html
http://en.wikipedia.org/wiki/Fibonacci_number

5. Golden Ratio
http://mathforum.org/dr.math/faq/faq.golden.ratio.html
http://mathworld.wolfram.com/GoldenRatio.html
http://www.geom.uiuc.edu/~demo5337/s97b/art.htm
http://jwilson.coe.uga.edu/EMT668/EMAT6680.2000/Obara/Emat6690/Golden%20Ratio/golden.html
http://www.world-mysteries.com/sci_17.htm

6. Prey - Predator
http://necsi.org/projects/evolution/co-evolution/pred-prey/co-evolution_predator.html
http://www.scholarpedia.org/article/Predator-prey_model
http://mathworld.wolfram.com/Lotka-VolterraEquations.html
http://www.tiem.utk.edu/bioed/bealsmodules/predator-prey.html

7. Numbers to Different Bases
http://mathforum.org/dr.math/faq/faq.bases.html
http://betterexplained.com/articles/numbers-and-bases/

8. Probability

http://www.regentsprep.org/regents/math/algebra/APR5/theoProp.htm
http://www.onlinemathlearning.com/theoretical-probability.html
http://www.authorstream.com/Presentation/manavazhagan-235721-probability-education-ppt-powerpoint/
http://www.dartmouth.edu/~chance/teaching_aids/books_articles/probability_book/amsbook.mac.pdf

9. Markov Chains

http://en.wikipedia.org/wiki/Examples_of_Markov_chains
http://www.dartmouth.edu/~chance/teaching_aids/books_articles/probability_book/amsbook.mac.pdf

10. Linear Algebra

http://tutorial.math.lamar.edu/Classes/LinAlg/LinAlg.aspx
http://ceee.rice.edu/Books/LA/

B.   Books

1. Neuwirth & Arganbright. The Active Mathematical Modeler: Mathematical Modeling. Brooks/Cole. ISBN: 0-534-42085-0
2. http://cowles.econ.yale.edu/P/cm/m13/
3. Thomson, Johnson & McCool. Mathematical Modeling With Applications. Brooks/Cole. ISBN: 0-495-11332-8
4. Giordano, Fox, Horton, Weir. A First Course in Mathematical Modeling. Brooks/Cole. Edition 4th. ISBN: 0-495-01159-2
5. Edelstein-Keshet. Mathematical Models in Biology. McGraw Hill. ISBN: 0-07-554950-6

Conclusion

Creating an online course almost from a scratch is a daunting yet rewarding experience. It affords an opportunity of going through each step and each detail of creating the curriculum for the course. This course will be implemented in Fall 2011. After one semester's experience, the author and the instructor, if different, will come back together, re-evaluate and refine the course so that its utility for instructors and students is enhanced.