

# Development of an Interdisciplinary Math & Science Course

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## Course Description

An interdisciplinary science course was clustered with a mathematical modeling course. Students in the course investigated current complex problems in society based on the themes of food and disease. The students for the course were randomly selected from the set of incoming freshman who had not decided on a major but indicated a preference for a major in a non-scientific field.

## Outcomes

- o Students will improve their scientific literacy.
- o Students will enhance their ability to communicate mathematics and science effectively orally and in writing.
- o Students will use elementary functions and appropriate technology to investigate and analyze applied problems and questions.
- o Student will be introduced to the interdisciplinary nature of science and mathematics.

## Course Content

- o Science
  - o *AIDS-HIV*
    - o basic cell biology
    - o chemistry of DNA
    - o societal implications
  - o *Genetically Modified Organisms*
    - o elementary genetics
    - o societal implications
- o Mathematics
  - o Function definition, construction
  - o Scatterplots of data, graphs of function
  - o Definition of mathematical model
  - o Linear, Exponential, Logarithmic, Polynomial, Logistic, & Piecewise Models

## Course Assignments & Assessments

Mathematical Modeling Audio Homework - Students recorded answers to pre-selected homework exercises. The recordings were turned into podcasts which the students listened to and critiqued.

### Audio Homework Listening Critique

In this exercise, you will be listening to a classmate's audio recording. You can help each other by providing constructive feedback on the recordings. Your feedback will be given to the author of the recording, but will remain anonymous.

1. Try to recreate the mathematics described in the recording. Draw or write your best interpretation in the space below.
2. What type of function (linear, exponential, quadratic, etc.) do you think is described AND why?
3. What did you find helpful about the recording, in terms of trying to recreate the mathematics?
4. What did you find confusing?
5. What suggestions do you have for the author?
6. Did this exercise help you to further understand any mathematical concepts or ideas? If so, which ones?
7. Did this exercise confuse you about any mathematical concepts or ideas? If so, which ones?

### Audio Homework Post Critique Self Evaluation

1. What did you find helpful about the critiques in terms of making your next recording?
2. What did you find confusing?
3. What advice do you have for your reviewers?
4. Did you learn anything about communicating mathematics by reading your critiques?

Group Presentations - Each group investigated a particular concern related to the AIDS virus. Students analyzed data related to their topic, developed a mathematical model of the data and interpreted the data in the societal context of their topic. The group presentation was assessed for both the scientific and mathematical content

### Group Rubric

Criteria	0	1	2	3
Clarity of Presentation of Model	Not Clear	Somewhat Clear	Clear	Exceptionally Clear
Completeness of Model	No model present	Incomplete	Mostly Complete	Totally Complete
Correctness of Model	No model present	Somewhat Correct	Mostly Correct	Totally Correct
Graphical Presentation	No presentation	Minimal Presentation	Adequate Presentation	Exceptional Presentation
Integration of Model into Presentation	Not Integrated	Somewhat Integrated	Integrated	Exceptionally Integrated
Explanation of Model	No explanation	Minimal Explanation	Adequate Explanation	Exceptional Explanation
Interpretation of Model in Context	No Interpretation	Minimal Interpretation	Adequate Interpretation	Exceptional Interpretation

### Individual Rubric

Criteria	0	1	2	3
Participation in Presentation	None	Low Than Others	More Than Others	Equal
Demonstrated Understanding	None	Little	Adequate	Exceptional
Work Coherence	None	Low Than Others	More Than Others	Equal

Criteria	3	2	1	0
<b>Research</b>	Information in presentation indicates the group has extensively researched topic	Presentation demonstrates good research	Research is incomplete	Research is inadequate
<b>Sources</b>	Sources are scholarly. The majority are primary sources	Most sources are scholarly but one or two are secondary sources (encyclopedias, newspaper articles)	The majority of sources are secondary or non-scholarly sources	No sources are provided
<b>Important Contributions</b>	Presentation includes a survey of the researchers important to the field	Presentation mentions several researchers in the area but is incomplete	Presentation mentions one or two of the prominent researchers in the area	No prominent researchers in the area are mentioned
<b>Preparation</b>	Group is prepared and obviously rehearsed	Group seems prepared but might have needed a couple more rehearsals	The group is somewhat prepared, but it is clear that rehearsal was lacking	Group is inadequately prepared to present
<b>Audio/Vis</b>	Student's audio-visual presentation is well organized. Student uses presentation to guide talking points but does not read directly from presentation.	Student's audio-visual presentation is organized. Student occasionally reads from sources	Student's audio-visual presentation is not well organized OR student often reads directly from presentation.	Student is unfamiliar with audio-visual presentation OR student always reads directly from presentation.
<b>Content</b>	Group demonstrates an excellent understanding of the topic.	Group demonstrates a good understanding of the topic.	Group demonstrates an inadequate understanding of parts of the topic.	Group demonstrates an inadequate understanding of the topic.
<b>Length</b>	Presentation is 10-15 minutes long	Presentation is less than 8 minutes long	Presentation is less than 7 minutes long	Presentation is less than 6 minutes OR more than 20 minutes
<b>Speaking</b>	Speaks clearly and distinctly all (100-95%) of the time, and responsiveness to words.	Speaks clearly and distinctly all (100-95%) of the time, but responsiveness to words does not speak loudly enough to be understood all of the time.	Speaks clearly and distinctly most (94-85%) of the time	Other members or class not be understood OR responsiveness more than one word

Reading & Discussions - Students prepare for daily science class group discussions by reading primary & secondary sources. Student discussions were evaluated using a discussion rubric developed by the Northwest Regional Educational Laboratory.

## Course Assignments & Assessments

Annotated Bibliography - Students researched a particular concern related to the AIDS virus and developed an annotated bibliography of scientific sources which they used as the research basis for the group presentations.

Criteria	4 - exemplary	3 - accomplished	2 - developing	1 - beginning or incomplete
<b>Research</b>	Annotated bibliography indicates the group has extensively researched topic	Annotated bibliography demonstrates good research	Research is incomplete and articles presented do not cover the topic adequately	Research is lacking as evidenced by articles unrelated to each other or shallow
<b>Summary</b>	A clear concise summary of the main idea of each source is provided and a connection to the topic is made. Summary includes all required information requested in assignment.	Summarizes the main idea of each source and a connection to the topic is made. A few mistakes in grammar and spelling are made OR the summary is not clear and concise. One of the guidelines (see assignment) is not addressed.	Summarizes the main idea of each source and a connection to the topic is made. Many mistakes are made in the writing. Two of the guidelines (see assignment) are not addressed.	Summarizes the main idea of each source and a connection to the topic is made. Many mistakes are made in the writing. Two of the guidelines (see assignment) are not addressed.
<b>Sources</b>	Sources are scholarly. The majority are primary sources	Most sources are scholarly but one or two are secondary sources (encyclopedias, newspaper articles)	The majority of sources are non-scholarly sources	The sources are not sufficiently related to topic
<b>Format</b>	Format style is consistent and appropriate for subject matter	Format style is appropriate but not consistent	Format style is inappropriate but consistently applied	Contains contain all important information but no format style is evident
<b>Bibli</b>	Bibliography is complete. Annotations provide context for topic	Bibliography is complete but annotations are missing important contextual information	Bibliography is incomplete and/or annotations are inadequate	Bibliography contains a few references with no clear theme

## Technology

- o iPods & Podcasting -
  - o Students find, listen to and critique science podcasts.
  - o Students listen to each other's podcast descriptions of mathematical models and provide critiques
  - o Students' group presentations are audio/visually recorded and podcast.
  - o Students' watch, listen and provide each other with feedback

## Data Collection

Students' skill level on each outcome was evaluated with a pretest. The course assignments were designed to reinforce and increase the students' proficiency in all outcome areas. During the semester students received written and oral feedback and completed self-evaluations. At the end of the semester students completed post-tests to measure the changes in skill level for each desired outcome. We will continue to collect data to assess the effectiveness of these teaching methods.