
Independent Study Course Syllabus

Course Number: MAT 921

Course Title: Teaching First Year Algebra

Online Distance Learning

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Units: 3

Grade Level: 7-12

Course Description

This course offers hope, encouragement, and concrete help by providing useful tools and resources for teachers faced with the task of teaching first year algebra. The ideas, approaches, and strategies in this course should make teaching first year algebra less abstract and more satisfying to both teacher and student.

Participants in this course will be asked to read several articles and to experiment with selected "tools" to make algebra concepts more concrete. They will design, teach, and evaluate activities that will supplement their classroom texts to help students gain a clear understanding of algebraic concepts.

Each teacher enrolled will be allowed to choose those activities which are most appropriate for his or her classroom. The "tools" in this course are designed to reinforce basic concepts rather than a particular text or approach since many different algebra curricula are used throughout the nation.

The NCTM (National Council of Teachers of Mathematics) Math Standards document is the primary source of standards used in the development of this course. While this course is designed to assist teachers of students in beginning algebra, normally taught in grades 7 through 10, it may be useful at other grade levels as well.

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To register for courses go to <http://ce.fresno.edu/cpd> and log in

Course Dates:

Self-paced; students may enroll at any time and take up to one year to complete assignments.

You have up to one year from the date of registration, and no less than three weeks (one week per credit), to complete the course.

Course Materials

Resource books for this course:

Rappaport, Josh. *Algebra Survival Guide*, Santa Fe, New Mexico: Singing Turtle Press, 2015.

Rappaport, Josh. *Algebra Survival Guide Workbook*, Santa Fe, New Mexico: Singing Turtle Press, 2003.

Reimer, Wilbert, *What's Next? A Pattern Discovery Approach to Problem Solving*, Vol. 1. Fresno, CA. Aims Education Foundation. **(On enclosed CD)**

Supplementary materials and resources are provided in the course materials. Information about Fresno Pacific University, the Center for Professional Development, and the instructor, plus details on course policies and procedures, is included in the course packet.

National Library of Virtual Manipulatives for Interactive Mathematics

(<http://matti.usu.edu/nlvm/nav/vlibrary.html>) is a highly recommended website offering many interactive activities related to algebra. A CD containing all of their interactive activities is also available. This is an exceptionally useful site that should not be overlooked.

Course Requirements

To complete this course satisfactorily, participants must submit

1. A list of four recommended articles/websites.
2. Response to five ideas in the *Algebra Survival Guide*.
3. A total of five evaluations, one for each of the activity options selected for classroom use.
4. Report on peer discussion.

See the "Schedule of Topics and Assignments" for more details on these assignments and for summer or "off-track" alternatives.

All work should be typed and sent to the instructor at one time when the course is completed. Please make a copy; work will not be returned. Students have one full year to finish the course but should not send completed work in less than three weeks from registration.

Send completed work by email attachments to: wreimer@fresno.edu

OR

Mail all the above items to the above address.

National Standards

The following standards identified by the Common Core State Standards for Mathematics are addressed throughout this course:

A. Seeing Structure in Expressions

- Interpret the structure of expressions
- Write expressions in equivalent forms to solve problems

B. Arithmetic with Polynomials and Rational Expressions

- Perform arithmetic operations on polynomials
- Understand the relationship between zeros and factors of polynomials
- Use polynomial identities to solve problems
- Rewrite rational expressions

C. Creating Equations

- Create equations that describe numbers or relationships

D. Reasoning with Equations and Inequalities

- Understand solving equations as a process of reasoning and explain the reasoning
- Solve equations and inequalities in one variable
- Solve systems of equations
- Represent and solve equations and inequalities graphically

National Board for Professional Teaching Standards:

Five Core Propositions

In addition to the content standards referenced above, this course supports the following core propositions that characterize National Board Certified Teachers (NBCTs).

Proposition I: Teachers are Committed to Students and Their Learning

- NBCTs are dedicated to making knowledge accessible to all students. They believe all students can learn.
- They treat students equitably. They recognize the individual differences that distinguish their students from one another and they take account for these differences in their practice.
- NBCTs understand how students develop and learn.
- They respect the cultural and family differences students bring to their classroom.
- They are concerned with their students' self-concept, their motivation and the effects of learning on peer relationships.

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Proposition 2: Teachers Know the Subjects They Teach and How to Teach Those Subjects to Students.

- NBCTs have mastery over the subject(s) they teach. They have a deep understanding of the history structure and real-world applications of the subject.
- They have skill and experience in teaching it, and they are very familiar with the skills gaps and preconceptions students may bring to the subject.
- They are able to use diverse instructional strategies to teach for understanding.

Proposition 3: Teachers are Responsible for Managing and Monitoring Student Learning.

- NBCTs deliver effective instruction. They move fluently through a range of instructional techniques, keeping students motivated, engaged and focused.
- They know how to engage students to ensure a disciplined learning environment, and how to organize instruction to meet instructional goals.
- NBCTs know how to assess the progress of individual students as well as the class as a whole.
- They use multiple methods for measuring student growth and understanding, and they can clearly explain student performance to parents.

Proposition 4: Teachers Think Systematically about Their Practice and Learn from Experience.

- NBCTs model what it means to be an educated person—they read, they question, they create and they are willing to try new things.
- They are familiar with learning theories and instructional strategies and stay abreast of current issues in American education.
- They critically examine their practice on a regular basis to deepen knowledge, expand their repertoire of skills, and incorporate new findings into their practice.

Proposition 5: Teachers are Members of Learning Communities.

- NBCTs collaborate with others to improve student learning.
- They are leaders and actively know how to seek and build partnerships with community groups and businesses.
- They work with other professionals on instructional policy, curriculum development and staff development.
- They can evaluate school progress and the allocation of resources in order to meet state and local education objectives.

Learning Objectives/Outcomes

Participants in this course will

- identify the difficulties faced by many first year algebra learners (CCSS A-D; NBPTS #1, 2, & 3)
- analyze the importance of teaching algebra from a real-world, concrete perspective (NBPTS #1 & 2)
- utilize a variety of approaches for addressing challenges to teaching first year algebra (CCSS

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A-D; NBPTS #1, 2, 3, & 4)

- formulate confidence-building activities for classroom use (CCSS A-D; NBPTS #1, 2, 3, 4, & 5)
- identify how the concepts and activities are connected to a standards based curriculum (NBPTS #4 & 5)

Schedule of Topics and Assignments

A. Reading Component:

1. Research mathematics journals or websites for articles about the challenges of teaching 1st year algebra. Identify four articles that you would recommend to your colleagues. Include the title and author of each, its location (or site), and the reason you found it worthwhile. Be sure to test the sites you select according to guidelines established for identifying reputable sources on the Internet. The following two sites may be useful resources:
<http://www.lib.berkeley.edu/TeachingLib/Guides/Internet/Evaluate.html>
<http://scholar.google.com/intl/en/scholar/help.html>
2. The *Algebra Survival Guide* offers some great teaching ideas. Study this book and briefly identify (with one paragraph each) five things you will do differently because of what you have learned from this text. The accompanying workbook offers optional practice activities.

NOTE: At this point, contact the instructor (wreimer@fresno.edu), writing several sentences to convey your initial reactions or questions related to the focus of this course.

B. Activity Component: Select and complete **five** of the following activities.

1. *What's Next?* Pattern Recognition:

The understanding of variables in algebra becomes clearer and more concrete when students learn to recognize a pattern, to describe this pattern, and to shape a generalization based on this pattern. Students should be familiar with number families such as the triangular numbers, the squares, and the powers of two to be able to effectively utilize patterns to solve problems.

What's Next? Using Patterns to Solve Problems (on included CD), is designed to help students gain experience with patterns and use them to solve problems. When a student sets up a T table and looks for the solution for n , that student is challenged to respond using the language of algebra.

Select four separate activities from *What's Next?* and implement them in your teaching.

2. Algebra magic:

Helping students discover how magic number tricks work by using algebra is a highly motivating strategy for first year algebra teachers. When algebra explains the mystery behind the trick and proves that the trick works all the time, students recognize that algebra can be useful in an extremely practical context.

The Algebra Magic materials in the appendix offer a rich resource of magic tricks that connect to algebra. Review this collection. Select and teach a total of four activities.

3. Algebra tiles:

Algebra tiles can help make some algebra concepts more concrete and understandable. In the course appendix, "Making Algebra More Concrete with Algebra Tiles," offers a beginning experience with algebra tiles. Photocopy (on lightweight cardstock) the included master and cut out the tiles to create a supply of each tile shape. Students may work with the tiles individually or in small groups.

Work through the entire packet with your class.

4. Guess and Check Tables:

It is often overwhelming for students to take in all the information in a word problem and translate it into an algebraic equation. Guess and check tables allow students to use trial and error to arrive at solutions. In the process, students identify patterns that help them create algebraic equations to represent the problems.

Model the use of guess and check tables, then work through the exercises in the appendix with your class. Require your students to make at least three guesses so that they have an easier time identifying patterns for writing equations.

Identify three lessons in the text used in your algebra class that could incorporate the guess and check strategy.

5. Integer Tiles:

Proficiency with integer rules is a key to success in many algebraic tasks. Integer tiles give students a concrete understanding of why the rules work.

Integer tiles can be made from 3/8 inch plastic tile spacers, available at any hardware store. The spacers are in the shape of a +, and negatives can be created by cutting off opposite "arms."

Create a class set of integer tiles. Practice using the tiles with basic integer operations by working through the materials in the course appendix. In the process, you will demonstrate integer rules to your class using tile spacers (overhead projectors work nicely for this). Your students will generalize the rules and create an integer rule "list." They should also

demonstrate proficiency using the integer tiles to perform operations, and be encouraged to think concretely as they work with larger integers.

6. Cups and Tiles:

This is a hands-on activity for solving basic algebraic equations. It uses small (bathroom-size) paper cups to represent variables, and integer tiles to represent constants.

Model the examples in the appendix materials. Then have your students work in pairs or groups to complete the exercises.

*If you have completed activity #8 (word problems), you may also ask your students to write a word problem from a picture of cups and tiles.

7. “X-Factors” and “Groupies”

These are techniques for factoring trinomials. “X-Factors” helps students factor a trinomial with no leading (quadratic) coefficient, and “Groupies” is used when a leading coefficient is present. Students enjoy these “brain games” and end up having fun with factoring.

Study the examples provided in the course appendix. Guide students as they complete the exercises.

Using your classroom textbook, create a lesson that requires students to use these techniques to check their solutions when multiplying binomials (working backwards from FOIL).

8. Mix 'Em or Match 'Em

In this activity, students will match statements expressed in symbols with those in written words. They also will be encouraged to create word problems from the mathematical symbols given. This reverse method has been shown to help students develop more insight into writing equations for the solution of word problems.

Prepare symbol strips and word strips as described in the materials in the course appendix. Guide your students as they work through the exercises.

C. Evaluations:

For each of the five activity options you select to teach (from B: Activity Component, 1 - 8) submit the following information in a brief evaluation.

1. Topic or activity selected. If the activity involved a selection (such as *What's Next?* Or Algebra Magic), list all of the specific experiences.
2. Student responses or reactions.
3. How did you measure the learning of your students?
4. What would you do differently if you were to teach this lesson again?
5. How could you integrate this strategy into your current algebra curriculum or text? Which standards or objectives does this strategy address?

Note: If you are not currently teaching or are unable to use these strategies in the classroom, draft a few colleagues, family members, or young persons and try the five activities with them, reporting their response to complete the above evaluation.

D. Peer Discussion:

Because collaboration and idea sharing are important aspects of learning, engage another algebra teacher in a discussion of one of the activities or some of the reading from this course. Write several paragraphs reporting on your conversation.

Evidence of Learning

- 1) Student demonstrated evidence of understanding of course objectives through reflective writing assignments. (Assignment section A)
- 2) Student demonstrated evidence of understanding of course objectives through presentation of lesson plans and projects. (Assignment sections B, C, & D)
- 3) Student demonstrated openness towards and creative use of a variety of learning methodologies and strategies. (Assignment section B)
- 4) Student demonstrated an understanding of appropriate hands-on methods of teaching through classroom activities. (Assignment section B & C)
- 5) Student reflected the use of critical thinking skills and made connections to his or her state content and/or professional teaching standards. (Assignment sections A, B, C, and D)

Grading Policies and Rubrics

Grades will be determined using the following percentages:

1. List of four additional recommended articles/websites. 20%
2. Response to five ideas in the *Algebra Survival Guide*. 20%
3. A total of five evaluations, one for each of the activity options selected for classroom use. 50%
4. Report on peer discussion. 10%

Total scores determine the final grade:

- 90 - 100% = A
- 80 - 89% = B
- 79% or below = no credit

All coursework must reflect a minimum "B" quality to receive credit. The discernment between an A and a B is at the discretion of the instructor, based on the quality of work submitted (see assignment rubric). Participants may request either a letter grade (A or B) or credit (CR). Coursework falling short of a "B" or CR grade will be returned with further instructions. Every person with a score of 80% or above will receive three semester units of credit.

Scoring Rubric

Type of Assignment	90-100 Points	80-89 Points	70-79 Points Not Acceptable
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Written responses	Student's written responses show an exceptional investment of time, energy and thoughtful reflection. The work submitted by the student is original and thorough. The student effectively organizes key insights and demonstrates evidence of interaction with the texts and exercises.	Student's written responses show an adequate investment of time, energy and thoughtful reflection. The work submitted by the student is complete, but lacks thoroughness and originality. The student sufficiently organizes insights and demonstrates evidence of interaction with the course activities.	Student's written responses show little investment of time, energy and thoughtful reflection. The work submitted by the student does not show adequate thought or effort.
Lesson Design	Lesson plans show an exceptional investment of time, energy and thoughtful reflection. Student consistently makes connections to local instructional goals/standards and implements research-based strategies and approaches.	Lesson plans show an adequate investment of time, energy and thoughtful reflection. Student makes some connections to local instructional goals/standards and research-based strategies and approaches.	Lesson plans submitted by the student do not show adequate thought or effort, and may not address specific goals.
Lesson evaluations	Student includes the use of critical thinking and reflection in the evaluation of lessons implemented.	Student includes the use of reflection in the evaluation of lessons implemented, but may lack sufficient detailed analysis.	Student does not demonstrate critical thinking or reflection in the evaluation of lessons implemented.
Presentation	Student effectively organizes key insights into a thoughtful and well-structured presentation.	Student includes several key insights in a presentation.	Student presentation lacks key insights.
Research	Research accesses multiple sources available via the internet. Web descriptions demonstrate thorough engagement with site information.	Research accesses sources available via the internet. Web descriptions demonstrate adequate engagement with site information.	Research fails to access sources available via the internet. Web descriptions demonstrate little engagement with site.

Instructor/Student Contact

Students are warmly invited to contact the instructor at any time with concerns, questions, or comments related to course work. They are specifically asked to do after finishing section A: Reading Component. At the completion of the course, the instructor will comment on the student's work and make suggestions, if needed.

Final Course Grade and Transcripts

When all work for the course has been completed, students will need to logon to the Center for Professional Development website (<http://ce.fresno.edu/cpd>) to "Submit Grade Form". Once the instructor fills out the grade form online, students may log back in to request their Grade Report as well as order transcripts online. Please allow at least two weeks for the final grade to be posted. For more information see the Independent Studies Policies and Procedures that were sent to you when you received your course materials, or in your online course. They are available, also at <http://ce.fresno.edu/cpd> - under General Information > CPD Policies.

Plagiarism and Academic Honesty

All people participating in the educational process at Fresno Pacific University are expected to pursue honesty and integrity in all aspects of their academic work. Academic dishonesty, including plagiarism, will be handled according to the procedures set forth in the Fresno Pacific University Catalogue. URL <http://www.fresno.edu>.

CONTINUING EDUCATION PROGRAM STUDENT LEARNING OUTCOMES:

CE 1. Demonstrate proficient written communication by articulating a clear focus, synthesizing arguments, and utilizing standard formats in order to inform and persuade others, and present information applicable to targeted use.
CE 2. Demonstrate comprehension of content-specific knowledge and the ability to apply it in theoretical, personal, professional, or societal contexts.
CE 3. Reflect on their personal and professional growth and provide evidence of how such reflection is utilized to manage personal and professional improvement.
CE 4. Apply critical thinking competencies by generating probing questions, recognizing underlying assumptions, interpreting and evaluating relevant information, and applying their understandings to the professional setting.
CE 5. Reflect on values that inspire high standards of professional and ethical behavior as they pursue excellence in applying new learning to their chosen field.
CE 6. Identify information needed in order to fully understand a topic or task, organize that information, identify the best sources of information for a given enquiry, locate and critically evaluate sources, and accurately and effectively share that information.

FRESNO PACIFIC UNIVERSITY STUDENT LEARNING OUTCOMES

Student Learning Outcomes Oral Communication: Students will <i>exhibit</i> clear, engaging, and confident oral communication – in both individual and group settings – and will critically <i>evaluate</i> content and delivery components.
Written Communication: Students will <i>demonstrate</i> proficient written communication by <i>articulating</i> a clear focus, <i>synthesizing</i> arguments, and utilizing standard formats in order to <i>inform</i> and <i>persuade</i> others.
Content Knowledge: Students will <i>demonstrate</i> comprehension of content-specific knowledge and the ability to apply it in theoretical, personal, professional, or societal contexts.
Reflection: Students will <i>reflect</i> on their personal and professional growth and <i>provide evidence</i> of how such reflection is utilized to manage personal and vocational improvement.
Critical Thinking: Students will <i>apply</i> critical thinking competencies by <i>generating</i> probing questions, <i>recognizing</i> underlying assumptions, <i>interpreting</i> and <i>evaluating</i> relevant information, and <i>applying</i> their understandings to new situations.
Moral Reasoning: Students will <i>identify</i> and <i>apply</i> moral reasoning and ethical decision-making skills, and <i>articulate</i> the norms and principles underlying a Christian world-view.
Service: Students will <i>demonstrate</i> service and reconciliation as a way of leadership.
Cultural and Global Perspective: Students will <i>identify</i> personal, cultural, and global perspectives and will employ these perspectives to <i>evaluate</i> complex systems.
Quantitative Reasoning: Students will accurately <i>compute</i> calculations and symbolic operations and <i>explain</i> their use in a field of study.
Information Literacy: Students will <i>identify</i> information needed in order to fully understand a topic or task, <i>explain</i> how that information is organized, <i>identify</i> the best sources of information for a given enquiry, <i>locate</i> and critically <i>evaluate</i> sources, and accurately and effectively <i>share</i> that information.