

LSC Use Only Proposal No:

LSC Action-Date: App-2/9/12UWUCC Use Only Proposal No: 11-800UWUCC Action-Date: App-3/6/12Senate Action Date: App-3/20/12

Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

Contact Person(s) Edel Reilly	Email Address ereilly@iup.edu
Proposing Department/Unit mathematics	Phone (724) 357-7907

Check all appropriate lines and complete all information. Use a separate cover sheet for each course proposal and/or program proposal.

1. Course Proposals (check all that apply)

- New Course Course Prefix Change Course Deletion
 Course Revision Course Number and/or Title Change Catalog Description Change

Current course prefix, number and full title: MATH 151: Elements of Mathematics I

Proposed course prefix, number and full title, if changing: _____

2. Liberal Studies Course Designations, as appropriate

This course is also proposed as a Liberal Studies Course (please mark the appropriate categories below)

- Learning Skills Knowledge Area Global and Multicultural Awareness Writing Across the Curriculum (W Course)
 Liberal Studies Elective (please mark the designation(s) that applies – must meet at least one)
 Global Citizenship Information Literacy Oral Communication
 Quantitative Reasoning Scientific Literacy Technological Literacy

3. Other Designations, as appropriate

- Honors College Course Other: (e.g. Women's Studies, Pan African)

4. Program Proposals

- Catalog Description Change Program Revision Program Title Change New Track
 New Degree Program New Minor Program Liberal Studies Requirement Changes Other

Current program name: _____

Proposed program name, if changing: _____

5. Approvals	Signature	Date
Department Curriculum Committee Chair(s)	<i>Edel Reilly</i>	<u>12/6/11</u>
Department Chairperson(s)	<i>[Signature]</i>	<u>12/6/11</u>
College Curriculum Committee Chair	<i>[Signature]</i>	<u>12/15/11</u>
College Dean	<i>[Signature]</i>	<u>12/16/11</u>
Director of Liberal Studies (as needed)	<i>[Signature]</i>	<u>3/5/12</u>
Director of Honors College (as needed)		
Provost (as needed)		
Additional signature (with title) as appropriate	<i>Edel Reilly (ECC)</i>	<u>3/2/12</u>
UWUCC Co-Chairs	<i>Gail Sedquist</i>	<u>3/6/12</u>

Received

MAR 2 2012

Liberal Studies

Received

FEB 10 2012

Liberal Studies

Received

DEC 19 2011

Liberal Studies

Elements of Math I

Overview of changes from original syllabus of record

1. Prerequisite: Two appropriate majors have been eliminated. Due to the changes in teacher education at the PA Department of Education level, obtaining a BSED in Elementary Education (ELED) and BSED in Early Childhood Education / PreK-Grade 6 (ECED) are no longer degree options. They have been replaced with BSED in Middle School Education and BSED in Early Childhood/Special Ed, PreK-Grade 4. The syllabus had already been updated to indicate these new degrees but ELED and ECED had remained through the current catalog.
2. Objectives: The course objectives were aligned with the Expected Undergraduate Student Learning Outcomes.
3. The textbook has been updated.

I. CATALOG DESCRIPTION

MATH 151 Elements of Mathematics I

3c-01-3cr

Prerequisite: Appropriate Major:

EDEX: BSED in Education of Exceptional Persons

SPLP: BSED in Speech-Language Pathology and Audiology

EDHL: BSED in Education of Deaf and Hard-of-Hearing Persons

FCSE: BSED in Family and Consumer Sciences Education

ARED: BSED in Art Education

CDFR: BS in Child and Family Studies

MIDL: BSED in Middle School Education

ECSP: BSED in Early Childhood/Special Ed, PreK-Grade 4

Topics included are sets, concepts of logic, mathematical systems, systems of numeration, developing the set of integers, rational numbers, and real numbers.

II. COURSE OUTCOMES

RELATIONSHIP OF COURSE TO COLLEGE CONCEPTUAL FRAMEWORK: The College of Education has developed a teacher education program based upon a preservice teacher who is competent in content and pedagogy. MATH 151 is a content course which broadens and deepens the student's knowledge of the mathematics content of the elementary grades as a vehicle to develop a pedagogical framework for learning to teach mathematics. In the course, students use a variety of materials for learning, work with conceptual models, use conceptual models to do mathematics, perform activities that develop new perspectives, and demonstrate competence in elementary school mathematics. These activities help preservice teachers become reflective practitioners who are capable of inquiry into a variety of methods of communicating mathematics while learning to collaborate and interact with their peers and with experienced teachers.

Objective 1:

Examine and develop sets and logic related to elementary school content, concepts, and skills.

Expected Student Learning Outcomes 1 and 2:

Informed and Empowered Learners

Rationale:

Assignments will require students to have a level of knowledge of sets and logic that will enable them to understand the formation of the concept of number. Assignments will also require students to critically analyze operations on sets which form the foundation of addition, subtraction, multiplication, and division. Assignments will also require students to develop and apply deductive reasoning skills.

Objective 2:

Examine and develop mathematical and numeration systems related to elementary school content, concepts, and skills.

Expected Student Learning Outcomes 1 and 2:

Informed and Empowered Learners

Rationale:

Assignments will require students to have a level of knowledge of mathematical and numeration systems that will enable them to understand numbers, ways of representing numbers, relationships among numbers, and number systems. Assignments will also require students to critically analyze the fundamental ideas of the mathematical operations and how they relate to one another. Students will be asked to apply appropriate techniques, tools, and technology.

Objective 3:

Examine and develop integers, rational numbers, and real numbers related to elementary school content, concepts, and skills.

Expected Student Learning Outcomes 1 and 2:

Informed and Empowered Learners

Rationale:

Assignments will require students to have a level of knowledge of integers, rational numbers, and real numbers that will enable them to recognize equivalent representations for the same number and generate them by composing and decomposing. Assignments will also require students to use physical models and manipulatives to aid in their understanding.

Objective 4:

Explore mathematical representations, reasoning, problem solving, and communication in order to gain insight and perspective into the nature of mathematics as taught in the elementary school.

Expected Student Learning Outcomes 1 and 2:

Informed and Empowered Learners

Rationale:

Assignments will require students to build new mathematical knowledge through problem solving, and to solve problems that arise in math and in other contexts. Assignments will also require students to recognize reasoning as a fundamental aspect of mathematics and to develop and evaluate mathematical arguments. Assignments will allow students to communicate their mathematical thinking through both written and oral forms of communication, and the use the language of mathematics to express mathematical ideas precisely.

Objective 5:

Demonstrate that one is a learner and doer of mathematics by actively engaging in problem solving and critical thinking, applying multiple strategies to solve problems, and making sense of solutions found. This includes interpreting, understanding, and applying algorithms for operations on numbers.

Expected Student Learning Outcomes 1 and 2:

Informed and Empowered Learners

Rationale:

Assignments will require students to apply and adapt a variety of appropriate problem solving strategies and to monitor and reflect on the process of mathematical problem

solving. Assignments will also require students to recognize and apply mathematics in contexts outside of mathematics.

Course Objective	College Conceptual Framework / Danielson	INTASC Standard /Principle	NCATE / ACEI Elementary Education Program Standard	Course Assessment Measuring Objective
1	1a – Content & Pedagogy	1, 4	2.3 Mathematics	Tests, Projects, and Quizzes
2	1a – Content & Pedagogy	1, 4	2.3 Mathematics	Tests, Projects, and Quizzes
3	1a – Content & Pedagogy	1, 4	2.3 Mathematics	Key Assessment: Fractions Exam
4	1a – Content & Pedagogy	1, 4	2.3 Mathematics	Tests, Projects, and Quizzes
5	1b – Knowledge of Students	9	2.3 Mathematics	Projects and Quizzes

III. COURSE OUTLINE

- A. Introduction to Problem Solving (*Objectives #4, #5*) 4.5 academic hours
 - 1. The Problem Solving Process and Strategies
 - 2. Three Additional Strategies
- B. Sets, Whole Numbers, and Numeration (*Objectives #1, #2, #4, #5*) 4.5 academic hours
 - 1. Sets As a Basis for Whole Numbers
 - 2. Whole Numbers and Numeration
 - 3. The Hindu-Arabic System
 - 4. Relations and Functions
- C. Whole Numbers: Operations and Properties (*Objectives #2, #4, #5*) 4 academic hours
 - 1. Addition and Subtraction
 - 2. Multiplication and Division
 - 3. Ordering and Exponents
- D. Whole-Number Computation – Mental, Electronic and Written (*Objectives #2, #4, #5*) 2.5 academic hours
 - 1. Mental Math, Estimation, and Calculators
 - 2. Written Algorithms for Whole-Number Operations
 - 3. Algorithms in Other Bases
- E. Number Theory (*Objectives #2, #4*) 4 academic hours
 - 1. Primes, Composites, and Tests for Divisibility
 - 2. Counting Factors, Greatest Common Factor, and Least Common Multiple
- F. Fractions (*Objectives #3, #4, #5*) 6 academic hours
 - 1. The Set of Fractions

2. Fractions: Addition and Subtraction
3. Fractions: Multiplication and Division

G. Decimals, Ratio, Proportion, and Percent (*Objectives #3, #4, #5*) 5 academic hours

1. Decimals
2. Operations with Decimals
3. Ration and Proportion
4. Percent

H. Integers (*Objectives #3, #4, #5*) 1.5 academic hours

1. Addition and Subtraction
2. Multiplication, Division, and Order

I. Rational Numbers, Real Numbers, and Algebra (*Objectives #3, #4*) 4 academic hours

1. The Rational Numbers
2. The Real Numbers
3. Functions and Their Graphs
4. Solving Equations with One Variable

This syllabus covers 36 academic hours, leaving 6 academic hours for testing and/or review. The final is an additional 2 academic hours.

IV. EVALUATION METHODS

Criteria used in assessing the competency of the student will vary depending upon the instructor, but generally include examinations, projects, presentations, lab activities, writing assignments, and class participation.

More specifically, the following guidelines are recommended:

- 60% Tests (Tests and final). Tests provide a summative assessment of topics covered and fulfillment of course outcomes (*e.g., Fractions Exam to cover fractions*). Performance assessments consist of group and individual tasks and may be used as formative as well as summative evaluations.
- 20% Participation and Quizzes. Participation includes attendance, homework, and in-class activities. Quizzes provide a formative assessment of class members' understandings and fulfillment of course outcomes.
- 20% Projects. Projects include but are not limited to: in-class activities, in-class presentations, small-group project problems, course topic reflections, reviews of elementary school journals and textbooks, and a portfolio of student's work. Group and individual projects are assigned. Projects show students' understandings and application of course topics in order to fulfill course outcomes.

V. EXAMPLE GRADING SCALE

90 – 100%	A
80 - 89%	B

70 - 79%	C
60 - 69%	D
0 - 59%	F

VI. UNDERGRADUATE-COURSE ATTENDANCE POLICY

The course attendance policy is consistent with the University policy.

VII. REQUIRED TEXT

Beckmann, S. (2011). *Mathematics for Elementary Teachers*. Boston: Pearson

VIII. SPECIAL RESOURCES REQUIREMENTS

None.

IX. BIBLIOGRAPHY

- Bassarear, T. (2005). *Mathematics for Elementary School Teachers*. Boston, MA: Houghton Mifflin.
- Bennett, A. B & Nelson, L. T. (2004). *Mathematics for elementary teachers: A conceptual approach*. Boston, MA: McGraw-Hill.
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- Smith, N., Lambdin, D., Lindquist, M., & Reys, R. (2001). Teaching elementary mathematics: A resource for field experiences. NY: John Wiley & Sons.
- Sonnabend T. (2004). Mathematics for teachers: An introductory approach for grades K-8. California: Thomson Brooks/Cole.
- Van De Walle, J. (2004). Elementary and middle school mathematics: Teaching developmentally. New York: Pearson.

Old Syllabus of Record

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3c-0l-3cr

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The student will:

1. develop and demonstrate knowledge of mathematical sets and logic related to elementary school content, concepts, and skills.
2. develop and demonstrate knowledge of mathematical and numeration systems related to elementary school content, concepts, and skills.
3. develop and demonstrate knowledge of integers, rational numbers, and real numbers related to elementary school content, concepts, and skills.
4. use and explain mathematical representations, reasoning, problem solving, and communication in order to gain insight and perspective into the nature of mathematics as taught in the elementary school.
5. demonstrate that one is a learner and doer of mathematics by actively engaging in problem solving, applying multiple strategies to solve problems, and making sense of solutions found.

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VI. UNDERGRADUATE-COURSE ATTENDANCE POLICY

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VII. REQUIRED TEXT

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VIII. SPECIAL RESOURCE REQUIREMENTS

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- Van De Walle, J. (2004). Elementary and middle school mathematics: Teaching developmentally. New York: Pearson.

Sample Major Course Assignment and Rubric

Name _____
Section _____

Project 1: Calculating Debt & Interest

Note: Always show your work. Partial credit is given for work shown.

I. Car Loan

Suppose that you buy a car for \$21,000. You put \$3000 as a down payment, so you owe \$18,000. You borrow the rest over 4 years (48 months) at 8.5% APR (annual percentage rate). APR helps consumers by telling us the yearly rate of interest no matter what method of charging is used by a bank.

1. Before you calculate anything, estimate what you think is the overall cost of the car. _____ (1)

The money you will pay as a finance charge can be found in a table (handed out in class). For example, the total finance charge per \$100 over 48 months at 8.50% interest is \$18.31. If you borrow \$200, you pay back an extra \$36.62 for a total of \$236.62.

2. Calculate the total finance charge for the car. _____ (3)

3. What is the total amount you will pay for the car at 8.5% APR? _____ (3)

4. Suppose you pay the car loan off over 5 years instead of 4 years. Your finance charge at 8.5% APR per \$100 is larger since you borrow over a longer period of time. What is the total amount you pay for the car over 5 years? _____ (3)

5. Now, consider a loan at 7% APR over 4 years. Calculate the total for the car now. _____ (3)

II. Credit Cards

If you have a credit card, you can use the Disclosure Statement sent to you by the credit card company. You can also get information to answer these questions from a bank or credit union through a phone call, brochure, or web site. (5)

6a. Card type _____. Finance charge is what you pay to borrow money. What method of finance charges does your credit card use? Circle one.

Unpaid Balance Average Daily Balance Other (specify): _____

6b. What is the APR (annual percentage rate)? _____

6c. What is the late fee? _____

6d. What is the minimum finance charge? _____

6e. What is the "over limit" fee? _____

Suppose that you charge \$200 to a credit card for groceries. For this exercise, the unpaid balance on your first bill is the full amount. The credit card charges 18% APR. Your bill is based on last month's unpaid balance and you pay the greater of \$10 or $1/48$ of the balance (*after finance charges are added*). The first bill comes to \$203.00 = \$200 + $(\$200 \times .18 / 12)$, rounded to the nearest penny. Use rounding rules. (6)

Did you know that you can ask your credit card company for a lower rate? If you have been making payments on time and you would like a lower interest rate, give them a call to say that you are shopping for a lower rate card. You don't have anything to lose.

- 7a. What is the total paid back?
- b. How many monthly payments do you make to pay off the groceries?

8. Find a "Calculator" on the Internet to find Interest, Investment, Mortgage, or other financial calculations. A search should result in many options. Research a financial question you have. *Suggestions: What monthly investment will make you a millionaire by age 65? What will a mortgage payment be on a \$100,000 house? How much will a car payment be?* Name and print a page from the site. Explain what information you entered and what you found. Turn in a typed paragraph. (5)

III. Investing Your Money

To celebrate a first job, suppose you invest \$100 at 6% APR for 40 years. You have \$106 dollars after one year, and after the second year, $\$112.36 = 1.06 \times \106 . (4)

9. What is your first \$100 worth after 10 years? _____
After 20 years? _____
After 30 years? _____
After 40 years? _____

Note: a calculator that remembers the last operation is helpful.

- 10a. Suppose that you continue to put \$100 a month into the investment. What is your total contribution (how much you invested) over 40 years?

_____ (3)

- 10b. Fortunately, there is a formula to calculate how much you will have after 40 years. I will tell you the actual amount in class. For this question, ONLY estimate the total you think will result after 40 years of investing \$100 per month. Look how much the first \$100 grew!

_____ (1)

Annual Percentage Rate Table for Monthly Payments Plans
(Finance charge per \$100 of Amount Financed)

Number of Payments	Annual Percentage Rate									
	7.00%	7.50%	8.00%	8.50%	9.00%	9.50%	10.00%	10.50%	11.00%	11.50%
6	2.05	2.20	2.35	2.49	2.64	2.79	2.93	3.08	3.23	3.38
12	3.83	4.11	4.39	4.66	4.94	5.22	5.50	5.78	6.06	6.34
18	5.63	6.04	6.45	6.86	7.28	7.69	8.10	8.52	8.93	9.35
24	7.45	8.00	8.54	9.09	9.64	10.19	10.75	11.30	11.86	12.42
30	9.30	9.98	10.66	11.35	12.04	12.74	13.43	14.13	14.83	15.54
36	11.16	11.98	12.81	13.64	14.48	15.32	16.16	17.01	17.86	18.71
48	14.94	16.06	17.18	18.31	19.45	20.59	21.74	22.90	24.06	25.23
60	18.81	20.23	21.66	23.10	24.55	26.01	27.48	28.96	30.45	31.96

Overall Scoring Rubric:

- 34 – 37 Mastery of concepts and calculations involving debt and interest; perhaps, minor mistakes in calculations
- 30 – 33 Minor misconceptions *or* Some question not completely answered
- 26 – 30 Misconceptions interfered with ability to answer questions correctly, work not shown, or some questions left unanswered
- ≤ 25 Major misconceptions with little or no progress answering some questions

For 3-Point Questions: Scoring Rubric:

- 3 Full answered; justification for the answer such as calculation shown
- 2 Minor mistake in calculation *or* Most elements of a correct answer
- 1 Major misconception *or* Some elements of a correct answer
- 0 Little or no progress toward an answer

Question #8 Scoring Rubric:

- 5 Question researched is given. Excellent details and insights in written paragraph. Copy of page included.
- 4 Question researched is given. Some thought given to the information found. Copy of page included.
- 3 Some required component missing or Little thought given to the answer found
- ≤ 2 Little to no evidence of research on a question being done.

Answers to Liberal Studies Questions

- A. Within the department, there is a curriculum committee, the Elementary Mathematics Education Committee (EMEC), which oversees this course's scheduling, staffing, and the textbook selection. Most sections of this course are taught by members of EMEC who regularly meet and discuss issues related to the course. A Reflective Practice group was formed by the members of EMEC and continues to meet to discuss various instruction practices used in MATH 151
- B. There are many contributions to the mathematics in this course. Algorithms, games, and visual representations come from many cultures. As mathematics educators who teach this course, we are aware of the need to recognize cultural and individual contributions. This course is presented in ways that provide perspectives to future teachers for teaching to all children with problem solving, cooperative learning, visual, and hands on approaches. The approaches we use to teach content are those that are recognized in the field for teaching children with learning disabilities, English-Language Learners, minorities, and women. In so doing, this enables us to use this course as a foundation for experiencing the mathematics and pedagogy that is presented in subsequent courses delivered to education majors. In the textbooks we use for this course, authors explicitly give contributions to the mathematics by other cultures, women, and minorities. These textbook features are made mandatory reading assignments and used in classroom lessons by instructors of the course..
- C. This course is designed to develop higher level quantitative skills, and as such, the content does not include substantial literary works.
- D. This course is intended for selected majors who have chosen education as their major. The focus of this course is to develop perspectives appropriate for understanding mathematics in ways that make sense to children. As such, mathematics is presented in non-standard ways, such as using blocks, counters, or visual representations to show a mathematical concept or idea. Students practice the mathematics they have already learned, but also, students are involved in activities that show the math in ways they may not have seen or approaches they may have forgotten.

Answers to Course Analysis Questionnaire

- A. 1 The course is a three credit mathematics course intended for selected majors who have chosen education as their major. The focus of this course is to develop perspectives appropriate for understanding mathematics in ways that make sense to children. As such, mathematics is presented in non-standard ways, such as using blocks, counters, or visual representations to show a mathematical concept or idea. Students practice the mathematics they have already learned, but also, students are involved in activities that show the math in ways they may not have seen or approaches they may have forgotten.
- A. 2 No this course does not require a change to an existing program.
- A. 3 Yes, this course has been taught at IUP for many years.
- A. 4 This course is not a dual-level course.
- A. 5 This course is not offered for variable credit.
- A. 6 Yes, any institution preparing education majors who plan to work with elementary or middle level students will have a similar course. For example, West Chester University of Pennsylvania, MAT 101.
- B. 1 This course will only be taught by instructors from the Elementary Mathematics Education Committee.
- B. 2 The content of this course does not overlap that of any courses offered in other departments.
- B. 3 This course is not cross-listed.
- B. 4 There will be seats in this course for students in the School of Continuing Education.
- C. 1 Faculty resources are currently adequate.
- C. 2 Resources for this course are adequate.
- C. 3 None of the resources for this course are covered by a grant.
- C. 4 This course will be offered every semester.
- C. 5 There are currently 5 sections of this course offered in the fall semester and two sections offered in the spring semester.
- C. 6 The maximum enrollment will be 40 students per section. This is based on room capacity.
- C. 7 No professional society recommends enrollment limits or parameters for this course.