

William Paterson University
College of Education
Department of Education Leadership and Professional Studies

*Theme - Preparing Inquiring Educators for Diverse Settings:
Developing Knowledge, Applications, Dispositions*

COURSE OUTLINE

1. **Course Title and Number of Credits:** ELCL 6080 Mathematics Content for Elementary Teachers (3 graduate credits)

2. **Course Description:** This course will serve as an elective option for students who need to develop more in-depth knowledge of elementary mathematics content. It focuses on the content knowledge elementary teachers need to know in order to be more effective teachers of mathematics at the K-5 level. It incorporates the most current principles and standards for school mathematics as outlined by the National Council of Teachers of Mathematics (NCTM), as well as Common Core State Standards. The course is designed to engage teachers in understanding the deeper principles underlying elementary mathematics and increase competence in doing and teaching elementary mathematics. Among the topics covered are the numeration system, the development of real numbers, integers, decimals and percentages, fractions, proportion and ratios, logic, probability and statistics, and applied problem solving.

3. **Prerequisites:** NONE

4. **Course Objectives:**

To enable candidates to:

1. Become familiar with the NCTM, and Common Core State Standards for teaching and assessing elementary students' mathematics knowledge.
2. Become familiar with the use of technology to enhance teaching and learning.
3. Increase the explicit knowledge of the number system and elementary mathematical ideas in the area of number theory.
4. Deepen instructional methods for understanding for rational numbers, proportions, decimals, and percents.
5. Analyze the conceptual and procedural underpinning of probability and statistics.
6. Learn the nature of a "problem" and the problem solving process at the elementary level.
7. Use the knowledge gained in the course to effectively teach and assess K-5 mathematics topics in depth.

5. Student Learning Outcomes:

Candidate will be able to:

1. Describe the vision of mathematic education put forth in the NCTM and Common Core State Standards and the characteristic of effective elementary school Mathematics program. Identify, describe and analyze coherent and focused mathematics content and pedagogy underlying elementary mathematics .
2. Identify and describe ways the Internet and various websites can be used to locate information of instructional value for planning elementary mathematics instruction and providing students with appropriate interactive experiences in content knowledge.
3. Describe the fundamental theorem of arithmetic, classify counting numbers, identify the relationships between the system of real numbers and its subsystems, and relate the structure of number theory and number systems in a through practical application.
4. Use ratios and proportions to describe problem situations and to solve percentage problems; perform operations and inverse operations on numbers expressed in decimal form.
5. Describe and determine possible outcomes in a simple probability experiment and determine the theoretical and experimental probability that certain events will occur.
6. State and use a variety of strategies for solving problems, and creating higher order problems for students at all mathematical levels in the class.
7. Translate the mathematics content learned in this course to teach a K-5 mathematics strategies in-depth.

Student Learning Outcome	Concentration-Specific standards	COE Advanced Programs Outcomes	NJ Professional Standards for Teachers and Administrators
Identify ,describe and analyze elementary mathematic content.. (SLO #1)	1 knowledge of essential mathematics	knowledge 1. a disposition 5.j field experience 3b	subject matter knowledge 1i instructional planning 4

Effective use of educational technology resources, Websites (SLO #2)	8. employ technology in teaching mathematics	knowledge 1.d Diversity 2d	4. instructional planning and strategies 4i
Knowledge of essential number theory concepts (SLO #3,#4,#5)	1. Essential mathematic knowledge	knowledge 3. b, 3.d	1. subject matter knowledge 1i, 1 iii
Proficiency in problem solving and problem posing (SLO #6)	2. Variety of pedagogical techniques.	Critical thinking, High level success 2.c, 5.i	4. instructional planning 4 ii iii 3. diversify learning
Rational number Mastery (SLO #4)	1 . Essential mathematic knowledge	knowledge 3.b,3.d	1. subject matter knowledge 1i, 1iii
Mastery of experimental and theoretical probability (SLO #5)	1. Essential mathematic knowledge	knowledge 3.b,3.d	1. Subject matter knowledge 1i, 1iii
project plan and demonstration (SLO #7)	1,2,3,9. apply knowledge as an elementary teacher	Knowledge 3. b, 3.d Dispositions 5.a Leadership 6e	10. professional development communication 10 iii 9 collaboration and partnerships

Standards: <http://www.wpunj.edu/coe/resources/standards.dot>

6. Course Content:

1. Current content standards for elementary mathematics and their implications for teaching in grades K-5 (including the Common Core State Standards for Mathematics (CCSS), Mathematical Standards or Practice, and the National Council of Teachers of Mathematics *Principles and Standards for School Mathematics* (NCTM)).
2. Technology tools and websites for enhancing teaching and learning.
 - a. Use websites to develop mathematical concepts.
 - b. Use videos and interactive activities.
3. Number sense and numeration understanding numbers, representations, relationships, and number systems

- a. What is a number System
 - b. Number sets Infinity and Zero
 - c. Place Value (base 10, base 2 and base 5)
 - d. Divisibility test and factors
 - e. Number Theory
4. Concepts of proportional reasoning, operations with rational numbers expressed as fractions, decimals, and percents
 - a. Fraction and decimal concepts and computation
 - b. Meaning and Model of operations
 - c. Connections of fractions, percents and ratios
5. Data analysis, Statistics, and Probability
 - a. Statistics as problem solving
 - b. Data representation
 - c. Describing distribution
 - d. Five number summary
 - e. Probability
 - f. Sampling and Estimation
 - g. Bivariate Data Analysis
 6. Developing strategies to teach in a problem-based elementary classroom using expanded instructional formats (manipulative materials, technology, problem solving)
 - a. Understand problem posing and problem solving
 - b. Provide engaging explorations of mathematics
 7. Development of an in-depth K-5 mathematics content project and presentation that reflect the objectives of Mathematical Standards for Practice

7. Teaching/Learning Methods:

Students will be involved in a variety of teaching and learning strategies and activities, including:

1. Lectures and discussions
2. Assigned readings
3. In-class small group problem solving and planning activities
4. Presentation by students
5. Assigned practice examples
6. Collaborative lesson and presentation

8. Student Assessment/Evaluation Methods:

1. Completion of ten homework assignments dealing with elementary mathematics content and problems solving (SLO #1,#2,#3,#4,#5, and #6)
2. Midterm/Final exam on mathematical content (SLO #1,#3,#4, and #5)
3. Develop lesson plan (SLO #3 or #4 or #5 or #6)

4. In class demonstration of in depth- mathematics content project (SLO #7)
5. Peer evaluation of demonstration of in-depth mathematics content lesson (SLO #7)
6. Report on how to explain mathematical topics to elementary students using internet resources (SLO #2).

9. Recommended Texts/Readings:

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: Author.

National Council of Teachers of Mathematics. (2002). *Learning and teaching with technology: Focus issue of Teaching Children Mathematics*. Reston, VA: Author.

New Jersey, State Department of Education. (2010). *Common Core Standards*. Retrieved from http://www.corestandards.org/assets/CCSSI_Math%20Standards.pdf

10. Bibliography:

Bassarear, T. (2008). *Mathematics for elementary school teachers*. Belmont, CA: Cengage/Cole Learning.

Beckmann, S. (2005). *Mathematics for elementary teachers*. Boston: Addison-Wesley.

Bennett, A. B., & Nelson, L. T. (2007). *Mathematics for elementary teachers: A Conceptual approach* (7th Ed.). Boston: McGraw-Hill Higher Education.

Billstein, C., Libeskind, S., & Lott, J. W. (2010). *A problem solving approach to mathematics for elementary school teachers*. Addison Wesley Longman: Reading, Mass.

Cathcart, W. G. (2006). *Learning mathematics in elementary and middle schools: A learner centered approach*. Upper Saddle River, N.J.: Pearson Merrill Prentice Hall.

Chancellor, D., & Schielack, J., F. (2010). *Mathematics in focus, K-6 how to help students understand big ideas and make critical connections*. Portsmouth, NH: Heinmann.

Burns, M., & Silbey, R. (2000). *So you have to teach math? Sound advice for K-6 Teachers*. Sausalito, Ca: Math Solutions Publications.

Fernandez, C. (2002). Learning from Japanese approaches to professional development: The case of lesson study. *Journal of Teacher Education*, 53(5), 393-405.

Fuson, K. C., Carroll, W. M., & Drueck., J. V. (2000). Achievement results for second and third graders using the standards-based curriculum everyday mathematics.

- Journal for Research in Mathematics Education*, 31(3), 277-295. Reston, VA: NCTM.
- Gardner, M. (2001). *The colossal book of mathematics*. New York: W.W. Norton & Company.
- Gonzales, P., Williams, T., Jocelyn, L., Roey, S., Kastberg, D., & Brenwald, S. (2009). *Highlights from TIMSS 2007: Mathematics and science achievement of U.S. fourth - and eighth-grade students in an international context*. Washington, D.C.: National Center for Educational Statistics.
- Harwell, M. R., Post, T. R., Maeda, Y., Davis, J. D., Cutler, A. L., Andersen, E., & Kahan, J. A. (2007). Standards-based mathematics curricula and secondary students' performance on standardized achievement tests. *Journal for Research in Mathematics Education*, 38(1), 71-101. Reston, VA: NCTM.
- Loucks-Horsley, S., Stiles, K. E., Mundry, S., Hewson, P. W., & Love, N. (2010). *Designing professional development for teachers of science and mathematics* (3rd Ed.). Thousand Oaks, CA: Corwin.
- Musser, G. L., Burger, W. F., & Peterson, B. E. (2006). *Mathematics for elementary teachers: A contemporary approach*. Hoboken, NJ: J. Wiley.
- National Center for Education Statistics. (2006). *Comparing mathematics content in the National Assessment of Educational Progress (NEAP), Trends in International Mathematics and Science Study (TIMSS), and Program for International Student Assessment (PISA) 2003 assessments [electronic resource]: technical report*. Washington, D.C.: United States Dept. of Education, National Center for Education Statistics, Institute of Education Sciences.
- Parker, T. H., & Baldrige, S. J. (2004). *Elementary mathematics for teachers (Volume 1)*. Okemos, MI: Sefton-Ash Publishing.
- Reves, C. A., & Reeves, R. (2003). Encouraging students to think about how they think! *Mathematics Teaching in the Middle School*, 8(7), 374-377.
- Sheffield, L. J. & Cruikshank, D. G. (2001). *Teaching and learning elementary and middle school mathematics*. New York, NY: John Wiley & Sons.
- Smith, N. L., Lambdin, D. V., Lindquist, M., & Reys, R. (2009). *Teaching Elementary Mathematics: A Resource for Field Experiences*. New York, NY: John Wiley & Sons.
- Sonnabend, T., & Sonnabend, T. (2004). *Mathematics for teachers: An interactive approach for grades K-8*. Belmont, CA: Thomson Brooks/Cole.
- Van de Walle, J. A. (2010). *Elementary and middle school mathematics: Teaching developmentally* (7th Ed.). Boston, MA: Pearson, Allyn and Bacon.

Wheeler, R. E., Wheeler, E. R., & Wheeler, R. E. (2005). *Modern mathematics for elementary educators*. Dubuque, Iowa: Kendall/Hunt Pub. Co.

11. Online resources:

- National Council of Teachers of Mathematics
www.nctm.org
Includes specific information for teachers, parents, leaders, and researchers. It provides its beliefs statements, and positions on important topics. It contains an overview of Principles and Standards and free access to interactive applets.
- Key issues in Math
www.mathforum.org/social/index.html
Part of the Math Forum at Drexel University, this page lists numerous questions concerning issues in mathematics education with answers supplied by experts in short articles or excerpts.
- Mathematics Education: Constructivism in the Classroom
<http://mathforum.org/mathed/costructivism.html>
Provided by the Math Forum, this page contains links to numerous sites concerning constructivism as well as article written by researchers.
- www.lerner.org/index.html
A unit of the Annenberg Foundation offers professional development information and useful information for teachers who want to learn about teaching mathematics.
- NCTM Illuminations
<http://illuminations.nctm.org/>
Provides lessons for each of the five content standards and each of the five process standards. Interactive applets, and links to websites for learning and teaching elementary mathematics.
- Math Archives: K-12 Internet Sites
<http://archives.math.utk.edu/k12html>
Contains a large collection of links to lessons, software, information (public and commercial), and curricula material.
- Probability Resources (Math Forum)
<http://mathforum.org/library/topics/probability>
Links to hundreds of articles, lesson and applets related to probability.
- National Council of Teachers of Mathematics e-Examples
<http://standards.nctm.org/document/eexamples/idex.htm>
Many applets are referenced in and directly support the text of *Principles and Standards for School Mathematics*.

- The National Library for Virtual Manipulatives (NLVM)
<http://matti.usu.edu/nlvm/nav/vilibrary.html>
Contains a huge collection of applets organized by the five content strands of the *standards* and by four grade bands.
- Shodor Interactive (Shodor Education Foundation)
<http://www.shodor.org/interactive>
This site contains a huge list of applets that continue to grow. There are lessons and activities, many that include the use of applets. They are arranged by content rather than grade level.

12. **Preparers' Names and Dates:** Dr. Sandra Alon, Fall 2010

13. **Reviser's Name and Date:** Dr. Sandra Alon, Fall 2010

14. **Departmental Revision Approval Date:** Fall 2010, Fall 2011