

**CALIFORNIA STATE UNIVERSITY SAN MARCOS**  
**College of Education**  
**EDMS 543**  
**Teaching Mathematics in the Elementary School**  
(3 units)  
Fall 2001

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The mission of the College of Education Community is to collaboratively transform public education by preparing thoughtful educators and advancing professional practice. We are committed to diversity, educational equity, and social justice, exemplified through reflective teaching, life-long learning, innovative research and ongoing service. Our practices demonstrate a commitment to student centered education, diversity, collaboration, professionalism, and shared governance. (*adopted by COE Governance Community October, 1997*)

**REQUIRED MATERIALS:**

Customized Course Packet of Readings: *Mathematics Education in Elementary School* by Tom Bennett

National Council of Teachers of Mathematics (2000): *Principles and Standards for School Mathematics*. Reston, VA: author. This document can be found on the WWW at: <http://standards.nctm.org/>. From website, click on "Electronic Principles and Standards".

California Department of Education (1999). *Mathematics Framework for California Public Schools*. PDF version can be found at <http://www.cde.ca.gov/> Found **within** the Framework is *Mathematics Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, Sacramento, CA author. From left side of CDE homepage, click on CDE PRESS. Then on top of that page click on Free Downloads. Scroll to and download the 1999 Mathematics Framework for CA Public Schools.

**COURSE DESCRIPTION:**

Learning to teach mathematics well is difficult and this course will not complete your education in learning how to teach mathematics. This course is but one stage in what is hoped will be a continuing evolution of you as a mathematics teacher. The focus of this course will be on (1) developing an understanding of the current reform efforts in mathematics, (2) learning to teach content specific concepts in reform-minded ways, and (3) practicing how to teach for mathematical understanding. Enfolded into this course will be curriculum development, developing an understanding of children's content specific thinking, creating a classroom environment that promotes the investigation and growth of mathematical ideas, and developing strategies to ensure the success of all students in multi-cultural settings. And last but not least, you will learn to teach mathematics in a fun manner!

**CLAD EMPHASIS:**

In 1992, the College of Education voted to infuse Cross-cultural, Language and Academic Development (CLAD) competencies across the curriculum. The CLAD competencies are attached to the syllabus and the competencies covered in this course are highlighted.

**METHOD OF EVALUATION:** Grades will be calculated using the following weights:

Weekly Assignments:	20%	Student Interviews:	20%	Collaborative Participation:	5%
Classroom Presentation:	25%	Curriculum Assignment:	25%	Standards Presentation:	5%

Weekly Assignments (20%) - Each week students will write a “meaningful” one page reflection on the article(s) assigned to be read for that week. Each assignment will have ½-inch top, bottom and right margins and a 1-inch left margin. Use single spacing with **only** your name and class session as a heading. These reflections should not repeat what is in the assigned readings. Instead, reflect on, analyze, and connect what is contained in the readings to your own educational experiences, beliefs and thoughts. **You are to turn in only one reflection per week (your choice).**

Student Interviews (20%) - You and one of your classmates will conduct a series of four different student interviews based on questions provided in class. For each interview, you will ask questions to any one student at a predetermined grade level. The purpose of this activity is to get you to begin thinking about students’ mathematical understanding, to learn how to effectively pose questions and interpret the meaning of students’ answers, and to provide you with valuable opportunities to interact with students.

Classroom Presentation (25%) - Working in small groups you will develop a lesson on a predetermined mathematical topic that you will present to the class. The purpose of this activity is to help you learn how to design effective mathematical activities that reflect the current reform efforts, to provide you with an opportunity to begin compiling mathematical activities that will prove beneficial when you teach, and to provide you with an opportunity to practice teaching mathematics. You will receive feedback on your lesson from your peers as well as the instructor.

Curriculum Assignment (25%) - Students will review mathematics curriculum (e.g., a textbook) at one grade level and write a short paper outlining the strengths and weaknesses of the curriculum. Students will also be asked to provide suggestions for how the curriculum might be used by teachers to be effective.

Standards Assignment (5%) – You will give a brief, oral presentation (no more than 10 minutes) in class of a predetermined mathematics curriculum standard(s). This will be assigned to each student during Session 1.

Collaborative Participation (5%) – Defined as **actively** engaging in discussions/activities in **all** class sessions. A **positive attitude** is also part of the criteria for this definition.

**GRADING SCALE:** Grades will be based on the following grading scale:

A.....	95 - 100 %	A.....	90 - 94 %
B.....	85 - 89 %	B.....	80 - 84 %
C.....	75 - 79 %	C.....	70 - 74 %
D.....	65 - 69 %	D.....	60 - 64 %
F.....	below 60 %		

**Punctual attendance and active participation** are essential in this class, not only for you to learn, but so that others may benefit from your input. Due to the dynamic and interactive nature of this course, all students are expected to attend all classes and participate actively. Consistent with the COE’s Attendance Policy, for each two class sessions missed, your grade may be lowered one letter grade. For grading purposes, two late arrivals or early departures of more than 15 minutes will be considered the same as one missed class session. Students missing more than 20% of class time may fail this course. Please discuss with me any extenuating circumstances that will cause you to miss class prior to your absence. Attendance will be taken at each class session. Furthermore, grades on assignments turned in late will be lowered unless **prior arrangements** have been made with the instructor.

**PLAGIARISM AND CHEATING:**

Please be sure to read and understand the university policy on plagiarism and cheating as it will be strictly enforced. Academic dishonesty will not be tolerated and will result in a failing grade for this

course and will be reported to the University.

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## **TOPIC AND ASSIGNMENT DUE *ON THAT DAY***

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### **Session #1 (8/27/2001)**

#### **COURSE INTRODUCTIONS**

NO ASSIGNMENT DUE TODAY

ASSIGNMENT OF NCTM STANDARDS FOR SESSION #4

### **Session #2 (8/29)**

#### **MODELING**

Carpenter, T.P., Fennema, E., Franke, M.L., Empson, S., & Levi, L. (in preparation). Problem solving as modeling. In Cognitively Guided Instruction in Mathematics: Professional development in primary mathematics (pp.47-49). Madison, WI: Wisconsin Center for Educational Research.

Carpenter, T.P., Ansell, E., Frank, M.L., Fennema, E., Weisbeck, L. (1993). Models of problem solving: A study of kindergarten children's problem solving processes. Journal for Research in Mathematics Education, 24 (5), 427-440.

### **Session #3 (9/05)**

#### **CHILDREN'S UNDERSTANDING**

Carpenter, T.P., & Lehrer, R. (in preparation). Teaching and learning mathematics with understanding.

Ginsburg, H.P. & Baron, J. (1993). Cognition: Young children's construction of mathematics. In R.J. Jensen (Ed.), Research ideas for the classroom: Early childhood mathematics, (pp. 3-21). New York, NY: Macmillan Publishing Company.

### **Session #4 (9/10)**

#### **FRAMEWORK AND STANDARDS**

National Council of Teachers of Mathematics (2000). Principles and Standards for School Mathematics. Reston, VA: author. This document can be found on the WWW at <http://standards.nctm.org/>.

California Department of Education (1999). Mathematics Content Standards for California Public Schools, Kindergarten Through Grade Twelve. Sacramento, CA: author. This document can be found on the web at <http://www.cde.ca.gov/cdepress>

### **Session #5 (9/12)**

#### **ADDITION AND SUBTRACTION (Part 1)**

Carpenter, T.P., Fennema, E., Franke, M.L., Empson, S., & Levi, L. (in preparation). What is cognitively guided instruction (CGI)?. In Cognitively Guided Instruction in Mathematics: Professional development in primary mathematics (pp. 1-3). Madison, WI: Wisconsin Center for Educational Research.

Carpenter, T.P., Fennema, E., Franke, M.L., Empson, S., & Levi, L. (in preparation). Children's mathematical thinking. In Cognitively Guided Instruction in Mathematics: Professional development in primary mathematics (pp. 4-7). Madison, WI: Wisconsin Center for Educational Research.

Carpenter, T.P., Fennema, E., Franke, M.L., Empson, S., & Levi, L. (in preparation). Classification of addition/subtraction. In Cognitively Guided Instruction in Mathematics: Professional development in primary mathematics (pp. 8-13). Madison, WI: Wisconsin Center for Educational Research.

Carpenter, T.P., Fennema, E., Franke, M.L., Empson, S., & Levi, L. (in preparation). Children's solution strategies of addition/subtraction problems. In Cognitively Guided Instruction in Mathematics: Professional development in primary mathematics (pp. 14-29). Madison, WI: Wisconsin Center for Educational Research.

### **Session #6 (9/17)**

#### **INTERVIEWS**

Huinker, D.M. (1993). Interviews: A window to students' conceptual knowledge of the operations. In N.L. Webb (Ed.) Assessment in the mathematics classroom: 1993 Yearbook (pp. 80-86). Reston, VA: National Council of Teachers of Mathematics.

### **Session #7 (9/19)**

#### **TECHNOLOGY**

Dick, T. (April 1988). The continuing calculator controversy. Arithmetic Teacher, 37-41

#### **INSTRUCTIONAL PRACTICES (Part 1)**

Heaton, R.M. (1996). Learning while doing: Understanding early efforts to create new practices of teaching and learning mathematics for understanding. In D. Schifter (Ed.), What's happening in math class?: Reconstructing professional identities Vol. 2 (pp. 74-80). New York: Teachers College

Lester, J.B. (1996). Establishing a community of mathematics learners. In D. Schifter (Ed.), What's happening in math class?: Envisioning new practices through teacher narratives Vol. 1 (pp. 88-102). New York: Teachers College.

#### **INSTRUCTIONAL PRACTICES (Part 2)**

Ball, D.L. (Summer 1992). Magical hopes: Manipulatives and the reform of math education. American Educator, 14, 16-18, 46-47

### **Session #8 (9/24)**

#### **\*Interview #1 Due Today (Everyone--NOT Optional)**

#### **FRACTIONS**

#### **\*Fractions Interview Due Today (Option For Interview #2)**

Bezuk, N. & Bieck, M. (1993). Current research on rational numbers and common fractions: Summary and implications for teachers (pp. 118-136). In D.T. Owens (Ed.), Research Ideas for the classrooms: Middle grades mathematics. New York: Macmillan.

Empson, S.B. (October 1995). Using sharing situations to help children learn fractions. Teaching Children Mathematics, 110-114.

Owens, D.T. & Super, D.B. (1993). Teaching and learning decimal fractions (pp. 137-158). In D.T. Owens (Ed.), Research ideas for the classrooms: Middle grades mathematics. NY: Macmillan

**Session #9 (9/26)****MEASUREMENT AND SCALE****\*Measurement and Scale Interview Due Today (Option For Interview #2)**

Sanford, S. (1993). Assessing measurement in the primary grades. In N.L. Webb (Ed.), Assessment in the mathematics classroom: 1993 Yearbook (pp. 74-79). Reston, VA: National Council of Teachers of Mathematics.

Hendry, A.M. (1996). Facilitating children's construction of their own mathematical understandings. In D. Schifter (Ed.), What's happening in math class?: Envisioning new practices through teacher narratives Vol. 1 (pp. 9-13). New York: Teachers College.

**Session #10 (10/01)****GEOMETRY****\*Geometry Interview Due Today (Option For Interview #3)**

Nitabach, E. & Lehrer, R. (April 1996). Developing spatial sense through area measurement. Teaching Children Mathematics, 2 (8), 473-476.

Sovchik, R.J. (1996). Geometry (pp. 493-525). In Teaching mathematics to children, (2nd ed.). New York: Harper Collins.

**Session #11 (10/03)****FUNCTIONS AND ALGEBRA****\*Functions and Algebra Interview Due Today (Option For Interview #3)**

Usiskin, Z. (February 1997). Doing algebra in grades K-4. Teaching Children Mathematics, 3 (6), 346-356.

**Session #12 (10/08)****STATISTICS AND PROBABILITY****\*Statistics and Probability Interview Due Today (Option For Interview #3)**

Russell, S. J. & Mokros, J. (February 1996). What do children understand about average? Teaching Children Mathematics, 2 (6), 360-364.

Fennell, F. (1993). Probability. In T.E. Rowan & L.J. Morrow (Eds.), Implementing the K-8 curriculum and evaluation standards: Readings from the arithmetic teacher (pp. 78-82). Reston, VA: National Council of Teachers of Mathematics.

Friel, S. N. & Corwin, R.B. (1993). The statistics standards in K-8 mathematics. In T.E. Rowan & L.J. Morrow (Eds.), Implementing the K-8 curriculum and evaluation standards: Readings from the arithmetic teacher (pp 73-77). Reston, VA: National Council of Teachers of Mathematics.

**Session #13 (10/10)****NUMBER CONCEPTS AND PLACE VALUE****\*Number Concepts and Place Value Interview Due Today (Option For Interview #4)**

Carpenter, T.P., Fennema, E., Franke, M.L., Empson, S., & Levi, L. (in preparation). Base-ten number concepts. In Cognitively Guided Instruction in mathematics: Professional development in primary mathematics (pp. 67-90). Madison WI: Wisconsin Center for Ed. Research

**Session #14 (10/15)****ADDITION AND SUBTRACTION (Part 2)****\*Addition and Subtraction Interview Due Today (Option For Interview #4)**

Hiebert, J., Carpenter, T.P., Fennema, E., Fuson, K., Human, P., Murray, H., Olivier, A., & Wearne, D. (in preparation). Designing classrooms for learning mathematics with understanding.

**Session #15 (10/17)****MULTIPLICATION AND DIVISION****\*Multiplication and Division Interview Due Today (Option For Interview #4)**

Carpenter, T.P., Fennema, E., Franke, M.L., Empson, S., & Levi, L. (in preparation).  
Multiplication and division. In Cognitively Guided Instruction in mathematics: Professional development in primary mathematics (pp. 30-46). Madison, WI: Wisconsin Center for Ed. Research

Carey, D.A., Fennema, L., Carpenter, T.P., & Franke, M.L. (1995). Equity and mathematics education. In W.G. Secada, E. Fennema, & L.B. Adajian (Eds.), New directions for equity in mathematics education (pp. 93-125). New York: Cambridge.

**STUDENT TEACHING BEGINS 10/18/2001**

## STUDENT INTERVIEWING GUIDLINES

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These assignments are designed to give you an opportunity to focus on a single child's thinking about mathematics. It will also help you to improve your use of inquiry for assessment purposes and to better understand elementary level students with different understandings.

I recommend that you have a partner for interviewing. A partner would be especially helpful for note-taking and additional insights into the child's thinking. As a pair, you would interview one child. Each person would then be responsible for writing up his/her own follow-up reflection. Papers should be submitted together, along with the student work (no names on the work, please).

Interviews will be directed toward primary (K-2) or upper elementary (3-5) students. Therefore, if possible, students who are observing/student teaching in a K-2 classroom might want to pair with a student observing/ student teaching in a 3-5 classroom.

### Prior to the interview

- You should arrange with a teacher (or parent of a child you know) to interview one child for 20-30 minutes in a quiet place outside of the classroom, if possible.
- Ask the teacher what manipulatives the child has experience using and see if it is possible to have these materials available during the interview. Minimally, you will want paper and pencil and some type of concrete material for counting.
- Develop a list of questions you may want to use if the child is not forthcoming with a response. For example, if the child says, "I just knew it", you might respond with, "What did you think about first?" or, "If you were helping a friend, how would you explain what you did?"

### During the interview

Work with the child individually. Begin the interview by informing the child that you will be giving him/her a series of math problems to solve and that you are interested in his/her thinking process and in the strategies s/he uses to solve these problems. Tell the child that s/he can solve the problems in any way s/he wants. Introduce the child to the manipulatives available.

Orally provide the child with the problems you received from class and provide him/her with sufficient time to complete each problem. You may also want to provide the child with a written copy of the problem--only give the child one written problem at a time (not the entire interview).

After the child answers each problem, you should ask a variety of questions that will help you to better understand the child's thinking and to assess his/her mathematical understanding. **You will want to note the questions you ask and the child's responses**, and it may be necessary to ask the child to wait while you are writing--it is OK to ask the child to wait. **You should not tape-record/video-tape the interview without parental permission.**

### **During the interview, be sure to consider the following:**

- The best thing you can be is genuinely curious. Remember, the point of the interview is to discover how the child thinks--**NOT** to guide the child to the correct answer.
- Be careful to respond similarly to correct and incorrect answers. Be curious about all solution strategies-not just the ones leading to incorrect solutions.
- Your primary role is to listen. Make sure you allow enough “wait time”--children need time to think before answering.
- Make sure the child feels comfortable during the entire interview. If the child clearly cannot answer a problem, move on to the next problem. If you feel that the child is really struggling and frustrated, you may want to end the interview or give the child a problem you are fairly certain s/he can solve and then end the interview. If you end an interview early, be sure to discuss your reasoning in your write-up.

### **After the interview**

You (and your partner) should each write a reflection (no more than two pages) that includes a clear discussion on each of the following two bulleted points: **NOTE: PLEASE ANSWER THESE QUESTIONS THOROUGHLY!! FULL CREDIT WILL NOT BE GIVEN UNLESS BOTH QUESTIONS ARE ADDRESSED!!**

- What specifically did you learn about this child’s mathematical understanding? Here you will want to make claims about the mathematics your student understands or doesn’t understand. I am looking for more of an explanation than just your student could or couldn’t solve a particular problem.
- What specifically might you do for this child if you were his/her teacher? Here you might want to include discussions about such issues as curriculum, instructional strategies, etc.

### **Grading:**

Each interview will be graded according to a 5-point scoring rubric. **The course packet will detail the grading criteria.** Specifically, I will be looking for nicely written papers that clearly and specifically express what you learned about:

- 1) the child’s current mathematical understanding in regards to the interview content area problems and
- 2) what you would do next for this child if you were his/her teacher (again be specific here). For example, you might recognize that this student lacks a conceptual understanding of multiplication--so as this child’s teacher, you might want to pose meaningful problems related to multiplication, etc. It would be helpful to include a few examples of these meaningful problems.

**\*NOTE:** When you turn in your write-up, you should also **include the child’s written work** (if it exists) with the child’s name removed. If it does not exist, please explain why.



## CLASSROOM PRESENTATIONS

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Students will participate in the design, construction, and presentation of a reform-minded mathematical activity. Students will work in small groups of approximately three individuals on a particular mathematical topic. This activity should be designed for use in a classroom with students from grades K-8 (your choice). The purpose of this activity is to help you learn how to design reform-minded mathematical lessons, learn where to find mathematical resources, provide you with an opportunity to practice teaching mathematics, and to help you build a mathematical resource file you can use when you teach. Your group might consider creating an integrated lesson that incorporates different content areas such as literature, social studies, etc.

When planning your activity, you should try to be **CREATIVE** while effectively incorporating the key components of the reform ideas into the activity. **Warning:** Be careful not to lose sight of the mathematical issues in your fun activity!

### Plan of Action:

Your group should:

- Decide on a specific mathematical objective (options for topics will be given in class-Session #2) you want your students to learn
- Find an equitable way to divide up the work load so that everyone participates fully in the design and implementation of your activity. At the conclusion of your activity, you will each be asked to evaluate each group member's participation and contribution. In addition, your cohorts will assess your activity and make recommendations and comments on a scoring template.
- Investigate what information is available that relates to your topic. For example, you might begin by investigating what the National Council of Teachers of Mathematics (NCTM) *Teaching Children Mathematics* or *Arithmetic Teacher* journals can offer in the way of providing you with suggestions. The CSUSM library carries *Teaching Children Mathematics* (look under the "mathematics" section of the journals rather than education). You can also get ideas from your master teacher, the San Diego County Office of Education, the WWW, teacher supply stores, and of course from me. The NCTM also has numerous publications that would be helpful to you as you design your activity.
- Be certain that your activity does not lose sight of your mathematical objective. You should ask yourself, "What will students learn from this activity?" Furthermore, your lessons **must** be in line with the *NCTM's Principles and Standards for School Mathematics* and the *California Content Standards* documents. (You certainly want to make good use of these documents when you design your lessons. As future educators, all your mathematics lessons must align with these standards.)
- You will be required to meet with me at least two weeks prior to the date of your presentation (this is not to say that you can only meet once!). One of the primary purposes of this activity is to provide me with an opportunity to work with each of you on a more individual basis so that I can help you learn to design effective mathematical activities. Please feel free to discuss ideas with me at any time (I will be happy to provide you with ideas/suggestions after you have thought about the ideas on your own). I will expect you to have prepared ideas for your presentation and to show me the resources you have identified for your packet.
- Each group will present their activity to the class which should last no more than 40 minutes including closure. You will want to rehearse your activity in advance so that you might modify your presentation based on what you learn and to then try out your ideas on students at that grade level to be certain that it is grade appropriate. Furthermore, you will want to practice your activity with others so

that you know how long the lesson will take. Each group member should have some role in the presentation.

- On the day of your presentation your group will need to turn in one nicely prepared document which will include your lesson plan for your activity. Your packet **should** have a list of teacher support materials that relate to your topic like relevant journal articles, children's literature, children's mathematical software, teacher support/reference books, manipulatives, annotated WWW locations, research related articles, videos or movies. Include any useful information that you found when researching your topic so that your colleagues can learn from your work ( Do not include duplicated pages from teacher workbooks; rather, provide citations). If each group prepares a packet of materials that is filled with important information, and we share that information in class, then you will each have a wealth of information on some of the important mathematical topics for use when you teach!

### **Grades:**

In this activity, which will be worth 25% of the total grade for the course, I am as interested in the process your group goes through as much as the final product. I really want this to be an opportunity for you to learn and grapple with such things as where to go for mathematics resources, how to prepare lesson plans and what to consider when writing a lesson plan, the challenges of teaching your mathematics lesson, etc.

### **The**

### **5-point grading rubric for this assignment will be based on:**

- The extent to which the lesson design adheres to The California Content Standards and NCTM Standards). Both California and NCTM Standards addressed by your lesson plan should be listed by number and annotation.
- A complete, detailed, informative lesson plan packet which should specify content area, give specific goals, learning objectives, time frame, materials used, activity procedures, provide for closure or debriefing, and assessment methods. In addition all packet components must be included as discussed above. **The lesson plan should follow SDAIE methods of instruction, including accommodation for cultural and linguistic diversity as well as special needs learners.**
- A plan for assessment/evaluation must be included. Be specific as to how you will determine that each student has "arrived" to his/her intended destination—your goals and objectives for them in the lesson.
- A clear presentation of the lesson which focuses on children's thinking and is sensitive to cultural and linguistic diversity as well as special needs.
- Your degree of involvement in the lesson design and presentation. Each group member should contribute equally to both preparation and presentation of the lesson. If the overall group identifies one member that did not fairly contribute to the final product, then I will likely lower the grade of that individual (please work together and share the workload).

Your lesson should make good use of what we know about how students think (within the context of your chosen topic), is grade appropriate, is well thought out and prepared, is sensitive to the needs of **all** students, and shows clear thought and preparation (preferably is not just a lesson from a book--although it can be adapted). This is a time for you to try things out and to make mistakes. Your classmates will be providing you with feedback for your information only.

**\*\* If anything is unclear or if you ever have questions, please ASK me.**

**\*\* YOUR PRESENTATION IS DUE THE DATE THAT THE INTERVIEW FOR THAT TOPIC IS DUE (REFER TO SYLLABUS)**

