George Mason University
College of Education and Human Development
Elementary Education Program

ELED 552 C01 – Mathematics Methods for the Elementary Classroom
3 Credits, Summer 2024
Thompson Hall, Room 1020, Fairfax Campus
June 24, 2024 to July 29, 2024
Monday 9:00 AM – 12:45 PM
Wednesday 9:00 AM – 12:45 PM

Faculty

Name: Jennifer Lempp, EdD
Office Hours: By appointment
Office Location: Thompson 1800, Fairfax Campus
Office Phone: Please email
Email address: jlempp@gmu.edu

Prerequisites/Corequisites

Admission to the elementary education licensure program.

University Catalog Course Description

Introduces methods for teaching all children topics in arithmetic, geometry, algebra, probability, and statistics in elementary grades. Focuses on using manipulatives and technologies to explore mathematics and solve problems.

Course Overview

In this course, we will begin an inquiry into mathematics teaching and learning that will guide you in your first teaching job and give you the tools that will enable you to continue to inquire and learn as part of your work as a teacher. Class sessions will be interactive and will include a variety of hands-on experiences with concrete and virtual manipulatives appropriate for elementary school mathematics. We will explore:

- The teaching of mathematics, investigating both *what* to teach and *how* to teach it.
- What it means to do mathematics and what it means to understand mathematics through individual, small group, and large group mathematical problem-solving.
- Ways to represent understandings of mathematical concepts, communicate reasoning about mathematical ideas and construct mathematical arguments.
- The ways children might represent mathematical concepts and look at ways to help children build connections and see relationships among mathematical ideas.
- Characteristics of a classroom environment conducive to mathematical learning by reading and

discussing the importance of mathematical tasks, mathematical tools, the roles of teachers and students, and the assessment of mathematical understanding.

In this course, we will take a stance of learning ***for, from,*** and ***in*** practice as follows:

Learning *FOR* Practice (Doing Mathematics): We will build our own *knowledge* of mathematics by closely investigating ideas in number sense and fraction concepts. Additionally, we will engage in several math tasks, extending our knowledge of mathematics and students' thinking, which will provide the foundation for your professional decision-making.

Learning *FROM* Practice (Examining Records of Practice): Records of practice—such as videotapes of lessons taught by yourself or others, students' work, and teachers' professional writing—will allow us to investigate the work of teaching mathematics and improve our own practice.

Learning *IN* Practice (Trying Things Out): Because teaching involves more than just having knowledge, you will be engaged in *enacting* the practices we are investigating as much as possible, so that you are developing the skills and professional decision-making that will make you a successful teacher.

Course Delivery Method

This class will be delivered in person on the Fairfax Campus. Individual session formats vary and may include lecture, small group/large group discussion, hands-on, interactive work, student presentations, and cooperative learning. Practical applications of theory will be explored in group activities.

Technical Requirements

To participate in this course, students will need to satisfy the following technical requirements:

- High-speed Internet access with standard up-to-date browsers. To get a list of Blackboard's supported browsers see: https://help.blackboard.com/Learn/Student/Getting_Started/Browser_Support#supported-browsers
  To get a list of supported operating systems on different devices see: https://help.blackboard.com/Learn/Student/Getting_Started/Browser_Support#tested-devices-and-operating-systems
- Students must maintain consistent and reliable access to their GMU email and Blackboard, as these are the official methods of communication for this course.
- Students may be asked to create logins and passwords on supplemental websites and/or to download trial software to their computer or tablet as part of course requirements.
- The following software plug-ins for PCs and Macs, respectively, are available for free download:
  - Adobe Acrobat Reader: https://get.adobe.com/reader/

- Windows Media Player: https://support.microsoft.com/en-us/help/14209/get-windows-media-player
- Apple QuickTime Player: www.apple.com/quicktime/download/

Expectations

- Course Week:
  Our course week will begin on the Monday of each week that we meet as indicated on the Class Schedule.
- Log-in Frequency:
  Students must actively check the course Blackboard site and their GMU email for communications from the instructor, class discussions, and/or access to course materials at least 4 times per week.
- Participation:
  Students are expected to actively engage in all course activities throughout the semester, which includes viewing all course materials, completing course activities and assignments, and participating in course discussions and group interactions.
- Technical Competence:
  Students are expected to demonstrate competence in the use of all course technology. Students who are struggling with technical components of the course are expected to seek assistance from the instructor and/or College or University technical services.
- Workload:
  Please be aware that this course is not self-paced. Students are expected to meet *specific deadlines* and *due dates* listed in the Class Schedule section of this syllabus. It is the student's responsibility to keep track of the weekly course schedule of topics, readings, activities, and assignments due.
- Instructor Support:
  Students may schedule a one-on-one meeting to discuss course requirements, content or other course-related issues. Students should email the instructor to schedule a one-on-one session, including their preferred meeting method and suggested dates/times.

Learner Outcomes or Objectives

This course is designed to enable students to do the following:

A. Know what constitutes the essential topics in mathematics of the modern early and intermediate grades school program.
B. Identify and use selected manipulatives and technology such as linking cubes, attribute blocks, geoboards, base-10 blocks, fraction circles, tangrams, calculators, and computers to teach appropriate mathematics content topics in the early and middle grades.
C. Identify and use various instructional strategies and techniques (cooperative and peer group learning, activity centers, laboratories and workshops, teacher-directed presentations, etc.) to

teach mathematical content topics appropriate for the early and intermediate grades to all children, including those from non-mainstreamed populations.

D. Identify and use alternative methods for assessing students' work in mathematics in the early and intermediate grades.
E. Solve problems in the mathematical content areas of logic, number theory, geometry, algebra, probability, and statistics appropriate for adaptation to the early and intermediate grades.
F. Know and explain the learning progression in relation to the standards-based mathematics curriculum, the key elements of the National Council of Teachers of Mathematics Principles and Standards for School Mathematics, and the key elements of the Virginia Standards of Learning for Mathematics.
G. Understand the multiple representations of mathematical concepts and procedures.
H. Understand and use the five processes—reasoning mathematically, solving problems, communicating mathematics effectively, making mathematical connections, and using mathematical representations—at different levels of complexity.
I. Explore the contributions of different cultures toward the development of mathematics, and the role of mathematics in culture and society.
J. Understand the relationship of math to science, the design process, and technology.
K. Understand, possess, and integrate the knowledge, skills, dispositions, and processes needed to support learners' achievement in an interdisciplinary manner in Virginia's Foundation Blocks for Early Learning: Comprehensive Standards for Four-Year-Olds and the Virginia Standards of Learning in English, mathematics, history and social science, science, and computer technology.

Additionally, this course supports the CEHD Core Values of collaboration, ethical leadership, research-based practice, social justice, and innovation. Statements of these goals are at http://cehd.gmu.edu/values/.

Professional Standards

(Interstate Teacher Assessment and Support Consortium (InTASC)

Upon completion of this course, students will have met the following professional standards:

Course Student Outcomes (above)	**INTASC Standard (2013)**
A. Essential math	#4 Content Knowledge
B. Planning and Teaching using manipulatives	#7 Planning for Instruction
C. Instructional Strategies	#8 Instructional Strategies

D. Assessing	#6 Assessment
E. Problem Solving	#5 Application of Content
F. Learner Development and Understanding of Learning Progression	#1 Learner Development, #2 Learner Differences
G. Multiple Representations	#4 Content Knowledge, #5 Application of Content
H. Five Processes	#4 Content Knowledge, #5 Application of Content

Required Text

Van De Walle, J., Karp, K. S., & Bay-Williams, J. M. (2018). *Elementary and Middle School Mathematics: Teaching Developmentally.* (10th edition) New York: Pearson (2019:9780134802084)

Course Performance Evaluation

All assignment details, templates, and rubrics will be available on Blackboard. Students are expected to submit all assignments on time in the manner outlined by the instructor (e.g., Blackboard).

Assignment Overview

Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Math Autobiography and Vision Statement	Reasoning Routines Video Vignette #1: NCTM Teaching Practice	Learning Station Game Activity Video Vignette #2: NCTM Teaching Practice	 Video Vignette #3: NCTM Teaching Practice	Problem-Solving Lesson	Learning Trajectory Assessment Project Share-Out
Interactive Notebook (daily)	Interactive Notebook (daily)	Interactive Notebook (daily)	Interactive Notebook (daily)	Interactive Notebook (daily)	Interactive Notebook (daily)
			Learning Trajectory Assessment Project **Parts 1-2**	Learning Trajectory Assessment Project **Part 3**	Learning Trajectory Assessment Project **FINAL**

Assignment Details

- **Daily Participation, digital Interactive Notebook (dINB), and Professional Dispositions (22 points)**
  Addresses Learner Outcomes: A, B, C, D, E, F, G
  Reading and activity reflections will be done via daily Interactive Notebook entries. During class meetings, students are expected to analyze and reflect on solution strategies, provide differentiated approaches to center activities, and actively participate in class discussions by applying class readings. This work will be collected and kept in a digital interactive notebook shared with the instructor in Google Slides. Professional dispositions are to be displayed at all times while interacting with the instructor and other students.

  Students are expected to contribute to both group and class discussions and activities online as well as genuinely listen to peers as they do the same. The instructor may also call on students to maximize classroom opportunities to hear from ALL of the students enrolled in the course. Remember, participation is more than just talking. Participation should raise the level of academic discourse, which may include asking questions and encouraging exploration, consideration, and learning. To be active participants in class, you must complete all pre-assigned readings and tasks before the class session for which they are assigned.

  It is expected that you will attend all scheduled classes outlined within the syllabus. Absence from class to observe a religious holiday, to serve jury duty, or to participate in required military service, and medical emergencies are exceptions to the above policy. If you need to be absent for any planned reason, please make arrangements at least 48 hours in advance. In addition, you are expected to be on time to class each session unless 48 hours advance notice has been provided to the instructor.

  This course operates with the assumption that knowledge is socially constructed, and the most meaningful learning opportunities are those where you have the opportunity to offer and explore diverse perspectives with peers; therefore, you are expected to contribute to all class and online discussions and activities as well as genuinely listen to peers as they do the same. You are expected to be prepared for each class, which means having completed all assigned readings and tasks for that class prior to the start of class. Your participation includes the completion of all synchronous and asynchronous application activities. This includes but is not limited to

    - Contributions to whole group and small group discussions
    - All digital Interactive NoteBook (dINB) work

  Cell phones are for emergency use only and it is expected that you will not use cell phones or computers in class for purposes beyond enhancing your learning of course content.

Evaluation for dINB - You will complete in-class and between-class activities in your online class notebook. Your notebook is located at the journal tab on Blackboard. **PLEASE NOTE: If you

are absent from class, you can earn half the daily points by completing all the between-session classwork.

Daily Participation and Interactive Math Memo RUBRIC

	Unsatisfactory (0 pts per day)	Proficient (2 pts per day)
Classwork: includes work due prior to the class session, participation during the session, and reflective and interactive work done after the class session.	The student is absent from class and/or is not prepared for class (between class work is incomplete). Some or all work is missing.	The student is punctual and prepared for class (between class work is complete). The student actively participates and supports the members of the learning group and the members of the class. Work is completed professionally.

- **Math Autobiography and Vision Statement (4 points)**

  Write a 1–2-page math autobiography and vision statement addressing the following questions:
  - What was learning math like for you in your early grades? Middle and onwards?
  - What worked and didn't work for you as a math learner?
  - How does your experience shape you as a teacher?
  - What visions of math teaching and learning do you have for your own classroom?

- **Reasoning Routine (10 points)**

  Addresses Learner Outcomes: A, B, C, D, E, F, G

  With a small group, you will plan, teach, and complete a reflection for a Reasoning Routine taught to your classmates during the summer course. Each Reasoning Routine will include the essential elements of and address a mathematical concept. A planning template will be provided for this, to which you will add your anticipated student responses and your expected series of questions.

  Each group is expected to: 1) prepare any materials needed for the Reasoning Routine; 2) anticipate possible student responses to the problems presented; 3) plan an expected sequence of follow-up questions and 4) reflect individually.

  See the rubric on Blackboard for more detail.

- **Learning Station Analysis (10 points)**

  Addresses Learning Outcomes A, B, C, D, E, F, G

  With a small group, you will plan for and teach a math learning station (game) to your classmates during the summer course. Your group should determine the mathematical concept(s) connected to this learning station, as well as the related Virginia SOL. A planning template will be provided to guide your selection and reflection of this learning station.

Each group is expected to: 1) prepare any materials for the learning station; 2) determine the mathematical concept(s) and the Virginia SOL(s) connected to this station; 3) identify prior knowledge students must have to successfully complete this station; 4) identify misconceptions students may have with regard to this station.

See the rubric on Blackboard for more detail.

- **Problem-Based Lesson with Student Work Analysis (12 points)**
  Addresses Learner Outcomes: A, C, D, E, F, G, H, I
  This lesson will be taught by a small group and presented to your classmates as a simulated lesson. You are expected to: 1) select a VDOE rich task that includes student anchor papers and create your own group's lesson plan using the provided template; 2) solve the problem yourself using all three representations (concrete, pictorial, abstract); 3) Prepare and use a *Planning for Mathematical Discourse Chart* that includes anticipated student responses/strategies and questions to assess and advance student work; 4) Implement the rich task with your peers in our classroom; 5) Select and sequence student responses for sharing out and make connections between student solutions (include analysis of student anchor papers); 6) complete a Google Slide Deck to summarize and reflect on your lesson.

  See the rubric on Blackboard for more detail.
- **Teaching Vignette Analysis Using NCTM 8 Teaching Practices: (12 points)**
  Addresses Learner Outcomes: A, C, D, E, F, G, H
  Being able to decompose a planned and enacted lesson for high-quality mathematics instruction is essential. This assignment will allow you to identify and analyze evidence of the mathematical teaching practices in a high-quality mathematics lesson. Students will be provided with video vignettes to evaluate using the NCTM 8 Teaching Practices Observation Tool (3 activities with 4 points each).

- **Learning Trajectory Assessment Project : (30 points)**
  Addresses Learner Outcomes: A, B, C, D, F

  To plan effective instruction, you will need to know how to assess children's knowledge of mathematical concepts. One way to assess children's thinking is a diagnostic assessment. This assignment has four parts:

  Part 1. Description of the Learning Trajectory/Progression with visual of LT concept map (3-5 pages)

  Part 2. Administer a Quick Formative Assessment with a small group or individual with screenshots of student work on the formative assessment (3-5 pages)

Part 3. Describe the data from part 2, set learning goals and propose a set of activities that will advance the learner along the developmental learning trajectory. (3-5 pages)

Part 4. Reflection (1-2 pages) and share out with a brief set of slides

More details can be found in the assignment rubric found on the syllabus and on Blackboard.

Note: Faculty reserve the right to add, alter, or omit any assignment as necessary during the course of the semester. You will always receive advance notice of any modifications. Bookmark this link to access the most current schedule of readings and due dates.

Attendance Policy

Attendance in the course is mandatory. You are held accountable for all information from each class session whether you are present or not. Reasons for any absence must be reported to the instructor in writing. Attendance is tied to your participation grade. If you are not in class, you are not participating.

Tardiness

It is your responsibility to be on time for each class session. Reasons for any absence must be reported to the instructor in writing.

Late Work

Work is due on the announced due date. All late work will incur a penalty of 10 percent for each day late. The only exception to this is for those students with excused absences (see Attendance Policy above). Given these policies, I also acknowledge this is a fast-paced and condensed course. I care that you have opportunities to succeed. If something arises that threatens your ability to succeed in this course, communicate with me as soon as is reasonably possible.

Grading

Course Assignment Weighting

Assignment	**Points**
Daily participation and digital Interactive NoteBook (dINB)	22
Math Autobiography and Vision Statement	4
Reasoning Routine	10
Learning Station Analysis	10

Problem-Based Lesson with Student Work Analysis	12
Teaching Vignettes Analysis (3)	12
Learning Trajectory Assessment Project	30
Total	**100**

Policies for Grading

The mathematics education courses in GMU's Elementary Education Program integrate pedagogy and mathematics content appropriate for the elementary school grades. For students to earn a grade of A in the course, they must demonstrate excellence in *both* the pedagogical knowledge and the content knowledge of the mathematics appropriate at their level of teaching. Thus, the grading in the course is structured to help evaluate student excellence in both areas. Problem sets and assessment work focuses primarily on ascertaining student excellence in handling mathematics content appropriate for the elementary grades and represents 50% of students' grades. Pedagogical knowledge is ascertained primarily from readings, assignments, and participation in the course, and represents 50% of students' grades. Therefore, students who demonstrate excellence in both pedagogical knowledge and content knowledge receive grades of A.

At George Mason University coursework is measured in terms of quantity and quality. A credit normally represents one hour per week of lecture or recitation or not fewer than two hours per week of laboratory work throughout a semester. The number of credits is a measure of quantity. The grade is a measure of quality. The university-wide system for grading graduate courses is as follows:

Grade	GRADING	Grade Points	Interpretation
A	**94-100**	**4.00**	**Represents mastery of the subject through effort beyond basic requirements**
A-	**90-93**	**3.67**	
B+	**85-89**	**3.33**	**Reflects an understanding of and the ability to apply theories and principles at a basic level**
B	**80-84**	**3.00**	
C*	**70-79**	**2.00**	**Denotes an unacceptable level of understanding and application of the basic elements of the course**
F*	**<69**	**0.00**	

***** Note: "C" is not satisfactory for a licensure course

"F" does not meet the requirements of the School of Education.

Professional Dispositions

Students are expected to exhibit professional behaviors and dispositions at all times. (See https://cehd.gmu.edu/students/polices-procedures/).

Class Schedule

These topics and activities are subject to change to be responsive to the pace of the course. This is a projected sequence of due dates and planned readings. **An "Always Current" schedule will be maintained on Google Drive and can be accessed through the Blackboard course site.**

Week 1			
Session # Time	**Active Learning and Discussion Emphasis**	**Readings Due** (read in advance of class)	**Assignments Due** (due by 9 AM on class day)
Session 1 Monday June 24	Welcome! Intro to Math Methods Knowing and Doing Mathematics How Do Children Learn Mathematics?	Ch 2: pp. 13–28 Watch Video: Surprising Facts About Learning	Review the blackboard site and syllabus. Come prepared to introduce yourself to the class.
Session 2 Wednesday June 26	Teaching Through Problem Solving NCTM Mathematical Teaching Practices What is Number Sense?	Ch 3: pp 30-53 Read: Transforming Math Learning	**Math Autobiography and Vision Statement** Daily Interactive Notebook (DiNB)
Week 2			
Session 3 Monday July 1	Tasks That Promote Problem Solving Video Vignette Activity #1 NCTM teaching practices Mathematical Discourse - 5 Practices	Video: How Thinking Works Never Say Anything a Kid Can Say Read Orchestrating Discussions (2009)	Daily Interactive Notebook (DiNB) **Video Vignette Analysis #1**
Session 4 Wednesday July 3	Early Number Sense Developing Meanings for the Operations	Chapter 7: pp. 127-134, 150-151 Chapter 8: pp. 154-173; pp. 180-181	Daily Interactive Notebook (DiNB) **Reasoning Routine Activity**

Week 3			
Session 5 Monday July 8	Developing Basic Fact Fluency Developing Whole-Number Place-Value Concepts Video Vignette Activity #2 NCTM teaching practices	Chapter 9: pp. 184-189; pp. 205-210 Chapter 10 pp. 211-222; p. 236	Daily Interactive Notebook (DiNB) **Video Vignette Analysis #2**
Session 6 Wednesday July 10	Developing Strategies for Addition and Subtraction Computation Developing Strategies for Multiplication and Division Computation	Chapter 11: Select pages Chapter 12: Select Pages	Daily Interactive Notebook (DiNB) **Learning Station Activity**
Week 4			
Session 7 Monday July 15	Developing Fraction Concepts Developing Fraction Operations	Chapter 14 Select pages Chapter 15: Select Pages	Daily Interactive Notebook (DiNB) ***LT Assessment Project Part 1***
Session 8 Wednesday July 17	Differentiating Instruction Teaching Mathematics Equitably to ALL Children	Ch 4: 69-74 Chapter 6 pp. 103-124	Daily Interactive Notebook (DiNB) **Video Vignette Analysis #3** ***LT Assessment Project Part 2***
Week 5			
Session 9 Monday July 22	Developing Measurement Concepts	Chapter 18: Select pages	Daily Interactive Notebook (DiNB) ***LT Assessment Project Part 3***

Session 10 Wednesday July 24	Developing Algebraic Thinking Mathematical Modeling	Chapter 13: Select pages	Daily Interactive Notebook (DiNB) **Problem-Based Lesson**
Week 6			
Session 11 Monday July 29	Planning in the Problem-Based Classroom Summing It Up Course Reflection	Ch 4: pp 55-69	Daily Interactive Notebook (DiNB) **Final LT Project DUE** **LT Project Share Symposium**

Core Values Commitment

The College of Education and Human Development is committed to collaboration, ethical leadership, innovation, research-based practice, and social justice. Students are expected to adhere to these principles: http://cehd.gmu.edu/values/.

GMU Policies And Resources For Students

Policies

- Students must adhere to the guidelines of the Mason Honor Code (see https://catalog.gmu.edu/policies/honor-code-system/).
- Students must follow the university policy for Responsible Use of Computing (see https://universitypolicy.gmu.edu/policies/responsible-use-of-computing/).
- Students are responsible for the content of university communications sent to their Mason email account and are required to activate their account and check it regularly. All communication from the university, college, school, and program will be sent to students solely through their Mason email account.
- Students with disabilities who seek accommodations in a course must be registered with George Mason University Disability Services. Approved accommodations will begin at the time the written letter from Disability Services is received by the instructor (see https://ds.gmu.edu).
- Students must silence all sound emitting devices during class unless otherwise authorized by the instructor.

Campus Resources

University Libraries https://library.gmu.edu

Questions or concerns regarding use of Blackboard should be directed to https://its.gmu.edu/knowledge-base/blackboard-instructional-technology-support-for-students/

Notice of mandatory reporting of sexual assault, interpersonal violence, and stalking:

As a faculty member, I am designated as a "Responsible Employee," and must report all disclosures of sexual assault, interpersonal violence, and stalking to Mason's Title IX Coordinator per University Policy 1202. If you wish to speak with someone confidentially, please contact one of Mason's confidential resources, such as Student Support and Advocacy Center (SSAC) at 703-380-1434 or Counseling and Psychological Services (CAPS) at 703-993-2380. You may also seek assistance from Mason's Title IX Coordinator by calling 703-993-8730 or emailing titleix@gmu.edu.

For information on student support resources on campus, see https://ctfe.gmu.edu/teaching/student-support-resources-on-campus

For additional information on the College of Education and Human Development, please visit our website http://cehd.gmu.edu/.

Support for submission of assignments to VIA should be directed to viahelp@gmu.edu or https://cehd.gmu.edu/aero/assessments.

Questions or concerns regarding use of Blackboard should be directed to https://its.gmu.edu/knowledge-base/blackboard-instructional-technology-support-for-students

Emergency Procedures

You are encouraged to sign up for emergency alerts by visiting the website https://alert.gmu.edu. There are emergency posters in each classroom explaining what to do in the event of crises. Crisis in Education App at: https://itunes.apple.com/us/app/in-case-of-crisis-education/id476578079?mt=8

Course Materials and Student Privacy

- All course materials posted to Blackboard or other course sites are private; by federal law, any materials that identify specific students (via their name, voice, or image) must not be shared with anyone not enrolled in this class.
- Video recordings of class meetings that include audio or visual information from other students are private and must not be shared.

- Live video conference meetings (e.g. Collaborate or Zoom) that include audio or visual information from other students must be viewed privately and not shared with others in your household.
- Some/all of your CEHD synchronous class meetings may be recorded by your instructor to provide necessary information for students in this class. Recordings will be stored on Blackboard (or another secure site) and will only be accessible to students taking this course during this semester.

Assessment Rubrics

Reasoning Routine (10 points)

Part A Plan: Design a slide of the Reasoning Routine with brief launch and summary of the routine; identify the goal of the routine and the Virginia SOL addressed in the routine; pinpoint anticipated student responses along the learning progression; include questions for making math visible, encouraging justification and reflection, and orienting students to other ideas or extending on other's ideas.	3 points
Part B Teach: Implement the routine, facilitate discourse, make connections between students' contributions	3 points
Part C Reflect: After enacting the routine, reflect on how the lesson supports math learning and equitable teaching practices for student learning.	4 points
Total Points	10

Learning Station (10 points)

Part A Plan: Plan a mathematics learning station (game); identify the goal of the activity and the Virginia SOL addressed; pinpoint anticipated student misconceptions and include any prerequisite knowledge students must have to successfully complete this activity	3 points
Part B Teach: Implement the learning station, and identify mathematical concepts and standards addressed.	3 points
Part C Reflect: After enacting the learning station, reflect on how the activity supports math learning and equitable teaching practices for student learning.	4 points
Total Points	10

Problem-Based Lesson with Student Work Analysis (14 points)
VDOE task site and Google Slide template

Part A: Plan: Unpack the VDOE rich task by creating your own lesson plan for the problem-solving task and completing the Google Slide template	5 points
Part B: Teach: Create and use a *Planning for Mathematical Discourse Chart* for your task**.** Anticipate how you will select, sequence, and connect student work.	5 points
Part C: After facilitating the task, reflect on how the lesson supports equitable teaching practices for student learning.	2 points
Total Points	12

Learning Trajectory Assessment Project (30 points)

George Mason University College of Education and Human Development

Elementary Education Program

In the Elementary Education program, the Learning Trajectory Assessment Project is completed during EDCI 552 and is assessed by the instructor. The candidate must earn a score of 3, based on the project rubric, to be successful on this assignment. If a student does not earn a 3 on the assignment, they must meet with the course instructor or assessor prior to resubmitting. The data from this assessment is used to identify best practices and identify gaps in developing and assessing a specific lesson plan to impact individual learning. The rubric for the Learning Trajectory Assessment project can be found on the course Blackboard site.

STANDARDS

- **InTASC Standards**: 1, 2, 5, 6, 7, 8
- **CAEP Standards:** 1.1, 1.3, 1.4, 1.5
- **VDOE Standards:** 1, 2, 3, 4, 5

INTASC Standard #1: Learner Development. The teacher understands how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.

INTASC Standard #2: Learning Differences. The teacher uses understanding of individual differences and diverse cultures and communities to ensure inclusive learning environments that enable each learner to meet high standards.

INTASC Standard #4: Content Knowledge. The teacher understands the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches and creates learning experiences that make the discipline accessible and meaningful for learners to ensure mastery of the content.

INTASC Standard #5: Application of Content. The teacher understands how to connect concepts and use differing perspectives to engage learners in critical thinking, creativity, and collaborative problem solving related to authentic local and global issues.

InTASC Standard #6 Assessment. The teacher understands and uses multiple methods of assessment to engage learners in their own growth, to monitor learner progress, and to guide the teacher's and learner's decision-making.

INTASC Standard #7: Planning for Instruction. The teacher plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.

INTASC Standard #9: Professional Learning and Ethical Practice. The teacher engages in ongoing professional learning and uses evidence to continually evaluate his/her practice, particularly the effects of his/her choices and actions on others (learners, families, other professionals, and the community), and adapts practice to meet the needs of each learner.

ASSESSMENT OBJECTIVES

- The candidate will use knowledge of individual learning differences and assessment to develop an instructional plan for a learner with developmental, learning, physical or linguistic differences.
- The candidate will develop an assessment of learner progress.

RATIONALE

Lesson planning is an essential skill for an educator. A lesson plan is a road map for instruction. When planning teachers and teacher candidates need to answer four main questions:

- Who are my learners? What are my learners' strengths? (Context/Learner Needs)
- What do the learners need to know and be able to do? (Objectives/Goals)
- How will I support all learners to know and do the new tasks? (Teaching and learning strategies)
- How will I know the learning objectives were achieved? (Goals/Outcomes/Assessments)

The first step in planning is aligning the learning objectives with the goals/outcomes/assessments for the lesson. This should include considerations based on learner abilities, challenges, and prior knowledge. Before developing specific learning activities, determine how you will assess if learners have met the lesson objectives. Once you know how you will assess learning, you can develop activities that align instruction with the assessment. Additionally, a teacher must consider learners' prior knowledge and strengths, how to differentiate to meet learner needs, and how to do so within the time allotted. Lesson plans include pacing, transitions, checking for understanding, and ideas for re-teaching or extending learning based on learner needs.

The planning process is the same whether you are planning a lesson for a class or for an individual. For this assessment, you will develop an instructional plan for a learner with developmental, learning, physical, or linguistic differences, including a plan for assessing the learner's progress. The Learning Trajectory Assessment Project directions with further details and a template are found on the course Blackboard site.

NCTM Process Standards Virginia Standards for Learning (for students)

Mathematical Process Goals for Students

The content of the mathematics standards is intended to support the following five process goals for students: becoming mathematical problem solvers, communicating mathematically, reasoning mathematically, making mathematical connections, and using mathematical representations to model and interpret practical situations. Practical situations include real-world problems and problems that model real-world situations.

Mathematical Problem Solving

Students will apply mathematical concepts and skills and the relationships among them to solve problem situations of varying complexities. Students also will recognize and create problems from real-world data and situations within and outside mathematics and then apply appropriate strategies to determine acceptable solutions. To accomplish this goal, students will need to develop a repertoire of skills and strategies for solving a variety of problem types. A major goal of the mathematics program is to help students apply mathematics concepts and skills to become mathematical problem solvers.

Mathematical Communication

Students will communicate thinking and reasoning using the language of mathematics, including specialized vocabulary and symbolic notation, to express mathematical ideas with precision. Representing, discussing, justifying, conjecturing, reading, writing, presenting, and listening to mathematics will help students to clarify their thinking and deepen their understanding of the mathematics being studied. Mathematical communication becomes visible where learning involves participation in mathematical discussions.

Mathematical Reasoning

Students will recognize reasoning and proof as fundamental aspects of mathematics. Students will learn and apply inductive and deductive reasoning skills to make, test, and evaluate mathematical statements and to justify steps in mathematical procedures. Students will use logical reasoning to analyze an argument and to determine whether conclusions are valid. In addition, students will use number sense to apply proportional and spatial reasoning and to reason from a variety of representations.

Mathematical Connections

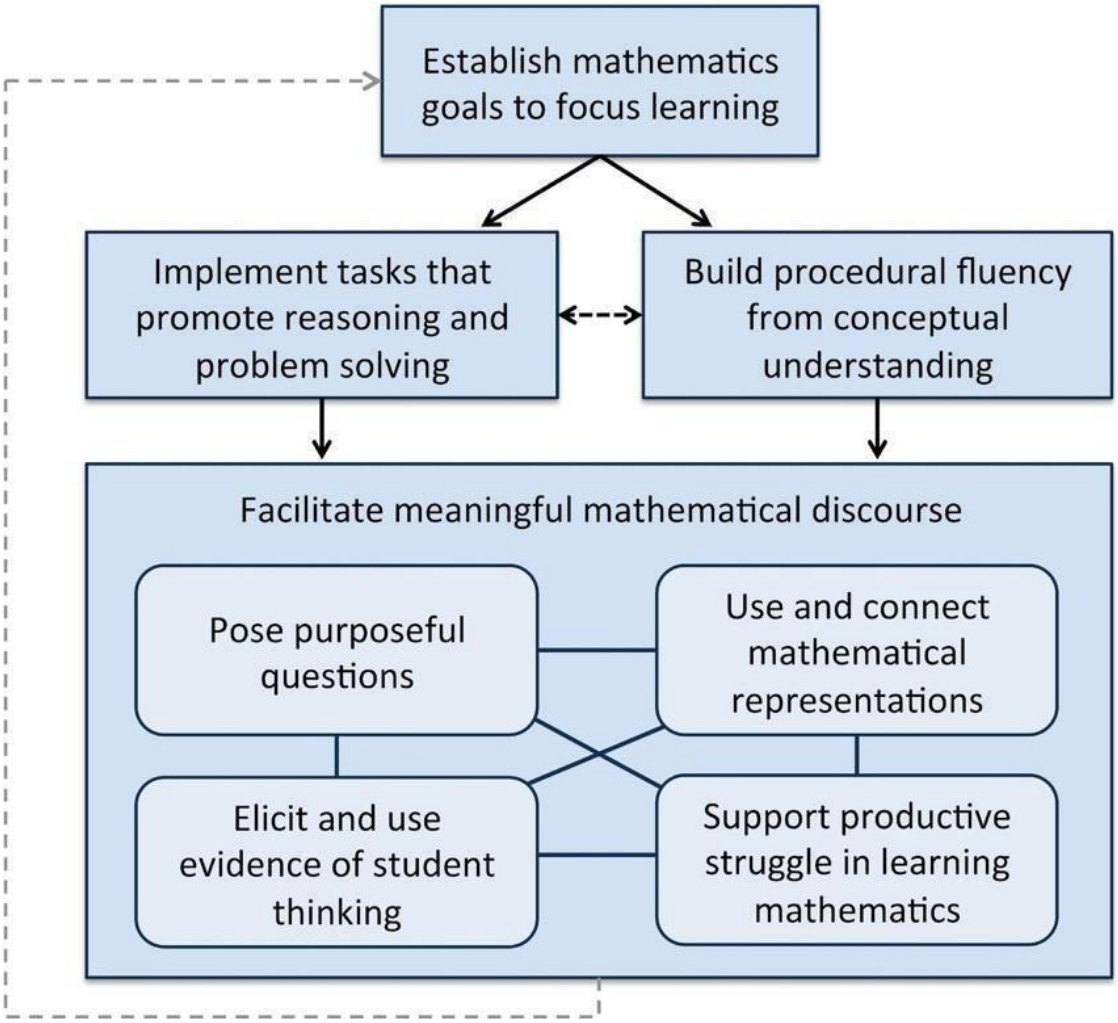
Students will build upon prior knowledge to relate concepts and procedures from different topics within mathematics and see mathematics as an integrated field of study. Through the practical application of content and process skills, students will make connections among different areas of mathematics and between mathematics and other disciplines, and to real-world contexts. Science and mathematics teachers and curriculum writers are encouraged to develop mathematics and science curricula that support, apply, and reinforce each other.

Mathematical Representations

Students will represent and describe mathematical ideas, generalizations, and relationships using a variety of methods. Students will understand that representations of mathematical ideas are an essential part of learning, doing, and communicating mathematics. Students should make connections among different representations – physical, visual, symbolic, verbal, and contextual – and recognize that representation is both a process and a product.

National Council of Teachers of Mathematics - 8 Teaching Practices (for teachers)

See Appendix B, page 635 of textbook



Mathematics Teaching Practices: Supporting Equitable Mathematics Teaching

EQUITABLE TEACHING PRACTICES VDOE SOL Institutes, 2018	
Mathematics Teaching Practices (NCTM)	Equitable Teaching
1. **Establish mathematics goals to focus learning.** Effective teaching of mathematics establishes clear goals for the mathematics that students are learning, situates goals within learning progressions, and uses the goals to guide instructional decisions.	• Establish learning progressions that build students' mathematical understanding, increase their confidence, and support their mathematical identities as doers of mathematics. • Establish high expectations to ensure that each and every student has the opportunity to meet the mathematical goals. • Establish classroom norms for participation that position each and every student as a competent mathematics thinker. • Establish classroom environments that promote learning mathematics as just, equitable, and inclusive.
2. **Implement tasks that promote reasoning and problem solving.** Effective teaching of mathematics engages students in solving and discussing tasks that promote mathematical reasoning and problem solving and allow multiple entry points and varied solution strategies.	• Engage students in tasks that provide multiple pathways for success and that require reasoning, problem solving, and modeling, thus enhancing each student's mathematical identity and sense of agency. • Engage students in tasks that are culturally relevant. • Engage students in tasks that allow them to draw on their funds of knowledge (i.e., the resources that students bring to the classroom, including their home, cultural, and language experiences).
3. **Build procedural fluency from conceptual understanding.** Effective teaching of mathematics builds fluency with procedures on a foundation of conceptual understanding so that students, over time, become skillful in using procedures flexibly as they solve contextual and mathematical problems.	• Connect conceptual understanding with procedural fluency to help students make sense of mathematics and develop a positive disposition toward mathematics. • Connect conceptual understanding with procedural fluency to reduce mathematical anxiety and position students as mathematical knowers and doers. • Connect conceptual understanding with procedural fluency to provide students with a wider range of options for entering a task and building mathematical meaning.

EQUITABLE TEACHING PRACTICES

VDOE SOL Institutes, 2018

Mathematics Teaching Practices (NCTM)	Equitable Teaching
4. **Facilitate meaningful mathematical discourse.** Effective teaching of mathematics facilitates discourse among students to build shared understanding of mathematical ideas by analyzing and comparing student approaches and arguments.	● Use discourse to elicit students' ideas and strategies and create space for students to interact with peers to value multiple contributions and diminish hierarchical status among students (i.e., perceptions of differences in smartness and ability to participate). ● Use discourse to attend to ways in which students position one another as capable or not capable of doing mathematics. ● Make discourse an expected and natural part of mathematical thinking and reasoning, providing students with the space and confidence to ask questions that enhance their own mathematical learning. ● Use discourse as a means to disrupt structures and language that marginalize students.
5. **Pose purposeful questions.** Effective teaching of mathematics uses purposeful questions to assess and advance students' reasoning and sense making about important mathematical ideas and relationships.	● Pose purposeful questions, then listen to, and understand students' thinking to signal to students that their thinking is valued and makes sense. ● Pose purposeful questions to assign competence to students. Verbally mark students' ideas as interesting or identify an important aspect of students' strategies to position them as competent. ● Be mindful of the fact that the questions that a teacher asks a student and how the teacher follows up on the student's response can support the student's development of a positive mathematical identity and sense of agency as a thinker and doer of mathematics.
6. **Use and connect mathematical representations.** Effective teaching of mathematics engages students in making connections among mathematical representations to deepen understanding of mathematical concepts and procedures and to use as tools for problem solving.	● Use multiple representations so that students draw on multiple resources of knowledge to position them as competent. ● Use multiple representations to draw on knowledge and experiences related to the resources that students bring to mathematics (culture, contexts, and experiences). ● Use multiple representations to promote the creation and discussion of unique mathematical representations to position students as mathematically competent.

EQUITABLE TEACHING PRACTICES

VDOE SOL Institutes, 2018

Mathematics Teaching Practices (NCTM)	Equitable Teaching
7. **Elicit and use evidence of student thinking.** Effective teaching of mathematics uses evidence of student thinking to assess progress toward mathematical understanding and to adjust instruction continually in ways that support and extend learning.	● Elicit student thinking and make use of it during a lesson to send positive messages about students' mathematical identities. ● Make student thinking public, and then choose to elevate a student to a more prominent position in the discussion by identifying his or her idea as worth exploring, to cultivate a positive mathematical identity. ● Promote a classroom culture in which mistakes and errors are viewed as important reasoning opportunities, to encourage a wider range of students to engage in mathematical discussions with their peers and the teacher.
8. **Support productive struggle in learning mathematics.** Effective teaching of mathematics consistently provides students, individually and collectively, with opportunities and supports to engage in productive struggle as they grapple with mathematical ideas and relationships.	● Allow time for students to engage with mathematical ideas to support perseverance and identity development. ● Hold high expectations, while offering just enough support and scaffolding to facilitate student progress on challenging work, to communicate caring and confidence in students.

Equity-Based Practices for Teaching Mathematics

Going deep with mathematics.
Developing a deep understanding of mathematics is a major goal of equity-based mathematics teaching practices (Aguirre 2009; Gutstein 2006). Lessons include high cognitive demand tasks that support and strengthen student development of the strands of mathematical proficiency, including conceptual understanding, procedural fluency, and problem solving and reasoning (National Governors Association Center for Best Practices and Council of Chief State School Officers 2010; National Research Council 2001a; Stein et al. 2000).

Leveraging multiple mathematical competencies.
Recognizing and positioning students' various mathematical backgrounds and competencies is a key equity-based practice (Featherstone et al. 2011; Horn 2012; Turner et al. 2012) All students have different mathematical strengths that can serve as resources for learning and teaching mathematics.

Affirming mathematics learners' identities.
A positive, productive mathematics learner identity contributes to the mathematical learning of a child (Berry 2008; Boaler 2002; Martin 2000, 2009; Stinson 2008). Instruction that values multiple mathematical contributions, provides mul6ple entry points and promotes student participation in various ways (teams, groups, and so on) can aid the development of a student's mathematical learning identity.

Challenging spaces of marginality.
Traditionally, mathematics learning has been an independent and isolating experience with a focus on lecture and seatwork. Further, students who do not perform well in this traditional classroom setting are often marginalized, ignored, or positioned as "dumb" (Boaler 2002; Jackson 2009). Practices that embrace student competencies, diminish status, and value multiple mathematical contributions as essential to cultivate (Aguirre et al. 2012; Featherstone et al. 2011; Horn 2012).

Drawing on multiple resources of knowledge.
Equity-based teaching depends on the capacity to recognize and intentionally tap students' knowledge and experiences-mathematical, cultural, linguistic, peer, family, and community-as resources for mathematics teaching and learning. Drawing on this knowledge and experience includes helping students bridge everyday experiences to learn mathematics, capitalizing on linguistic resources to support mathematics learning, recognizing family or community mathematical practices to support mathematics learning, and finding ways to help students learn and use mathematics to solve authentic problems that affect their lives (Aguirre 2009; Aguirre et al. 2012; Civil 2007; Brenner and Moschkovich 2002; Gutiérrez 2002; Gutstein 2006; Moschkovich 1999; Simic-Mueller, Turner, and Varley 2009; Staats 2009; Turner et al. 2012; Turner and Strawhun 2007).