I. Course Description

This course is designed to introduce students to methods for teaching all children in developmentally appropriate topics in PreK through elementary mathematics, as outlined by NCTM’s Principles to Actions. Emphasis is placed on current movements in mathematics education, the big ideas of elementary mathematics, teaching for understanding, and understanding children’s mathematical thinking. Students engage in examining and analyzing children’s mathematical thinking and work, design and lead discussions of mathematical tasks, and work with manipulatives and technologies to explore mathematics, solve problems, and learn ways to teach mathematics content to children.

II. Student Outcomes

This course is designed to enable students to:

<table>
<thead>
<tr>
<th>Student Learning Outcomes</th>
<th>PDE PreK-4 Program Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Describe, discuss and reflect upon the essential topics of the grades PreK-4 mathematics program.</td>
<td>V.A-C, P-T</td>
</tr>
<tr>
<td>2. Explore, solve, and discuss problems in the mathematical content areas of logic, numbers and operations, geometry, algebra, measurement, and data analysis and probability appropriate for adaption to grades. PreK-4</td>
<td>II.C</td>
</tr>
<tr>
<td>3. Listen to, analyze, and interpret children’s mathematical thinking and use this information to plan instruction.</td>
<td>I.A.1-2, 6-7</td>
</tr>
<tr>
<td>4. Plan and lead a classroom discussion of mathematical tasks and concepts.</td>
<td>I.F.3</td>
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<tr>
<td></td>
<td>I.A.7</td>
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<td>3.A.7</td>
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<tr>
<td>5. Identify and use selected manipulatives and technology such as</td>
<td>I.G.1-3,6</td>
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</tbody>
</table>
| counters, base ten models, fraction circles, Tangrams, color tiles, calculators, and Internet resources to teach appropriate mathematics content topics in grades PreK-4. | II.C.1.j  
II.C.2.d  
II.C.2.g |
| 6. Identify and use various instructional strategies and techniques (cooperative and peer group learning, activity centers, laboratories and workshops, teacher-directed presentations, technology supported learning) to teach mathematical content topics appropriate for the elementary and middle grades to all children including those from non-mainstreamed populations. | I.A.7  
V.P  
V.S  
V.T |
| 7. Identify and use alternative methods for assessing students’ work in mathematics including the assessment of children’s thinking as a guide for planning for future instruction. | III.A.1-5  
III.B  
III.C  
III.F.1-4 |
| 8. Choose community based activities as a means of teaching mathematical concepts. | I.G.1-6  
V.A-C,P-T |
| 9. Gain confidence and knowledge, both in one’s own mathematical ability and in one’s ability to teach mathematics with understanding. | V.A-C,P-T |

### III. Nature of Course Delivery

This course 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 opportunities to analyze authentic artifacts of teaching and engage in a variety of experiences with manipulatives, models, and tools appropriate for elementary school mathematics. We will explore the teaching of mathematics, investigating both what to teach and how to teach it. We will explore what it means to do mathematics and what it means to understand mathematics through individual, small group, and large group mathematical problem solving. We will investigate ways to represent understandings of mathematical concepts, communicate reasoning about mathematical ideas, and construct mathematical arguments. We will investigate and read about ways children might represent mathematical concepts, looking at ways to help children build connections and see relationships among mathematical ideas. We will explore 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.

Throughout the course, you will engage in elementary mathematics teaching and learning in several ways:

1. Participating in a common practice: Our class activities, discussions, and interactions offer us opportunities to study the practice of teaching. You will experience the
content of elementary mathematics as a learner. You will take steps to understand and deepen your own mathematical understanding as well as that of your colleagues.

2. Engage in interpreting and assessing elementary students’ mathematical thinking through the study of real classroom practice. You will observe, read about, and discuss classroom instructional episodes for the purposes of identifying and understanding elementary students’ mathematical thinking.

3. **Actively** practice ideas discussed in the readings and in class by engaging in mathematical tasks, observing and analyzing examples of teaching, making connections among mathematics topics at various levels, and leading mathematical discussions.

4. Further explore and practice these ideas with elementary students in your field placement.

IV. **Texts and Readings**

**Required**

*Text:*


*Web-based Resources:*

NCTM Principles to Action Executive Summary:

[https://www.nctm.org/uploadedFiles/Standards_and_Positions/PtAExecutiveSummary.pdf](https://www.nctm.org/uploadedFiles/Standards_and_Positions/PtAExecutiveSummary.pdf)

Jo Boaler’s You Cubed:

[https://www.youcubed.org](https://www.youcubed.org)

Pennsylvania Department of Education Mathematics Core Standards

[http://static.pdesas.org/content/documents/PA%20Core%20Standards%20Mathematics%20PreK-12%20March%202014.pdf](http://static.pdesas.org/content/documents/PA%20Core%20Standards%20Mathematics%20PreK-12%20March%202014.pdf)

Common Core Standards for Mathematics (2010)


Instructor posted readings or videos found on D2L course site ECE 321

**Suggested:**

*Text:*

McNamara, J. & Shaughnessy, M. (2010). *Beyond pizzas and pies: 10 essential strategies for supporting fraction sense, grades 3-5.*


Journal:
1. Teaching Children Mathematics - This NCTM publication is available in hard copy in the library or online through our library’s digital journal subscription. If you have trouble accessing either of these please contact a librarian and they can help.

V. Course Requirements, Assignments, & Evaluation Criteria

The assignments across the semester are intended to further your understandings of what it means to teach, learn, and assess mathematics in light of NCTM’s Principles to Action. The assignments are designed to focus your attention on students’ understanding and thinking about mathematics and how to use that knowledge to plan effective mathematics instruction. All assignments are to be turned in to your instructor on time.

Grading Policies
- Assignments are due on the date listed in the syllabus.
- **LATE ASSIGNMENTS**: Late work will not be accepted for full credit, 10% will be deducted for each day the assignment is late.
- All written and typed assignments are to be clear and coherent.
- Typed assignments are to be double spaced with 12 point times new roman font.
- Unless specified otherwise, all out of class assignments should be submitted through D2L.

Assignments

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Points</th>
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<tbody>
<tr>
<td>Reading questions and reflections (Discussion)</td>
<td>5</td>
</tr>
<tr>
<td>PreK Learning Story and Annotated Bibliography</td>
<td>5</td>
</tr>
<tr>
<td>PreK-1st Grade Lesson Plan</td>
<td>5</td>
</tr>
<tr>
<td>MidTerm</td>
<td>15</td>
</tr>
<tr>
<td>Book Study Assignment</td>
<td>10</td>
</tr>
<tr>
<td>Basic Skills, Math Night, Math Club Participation and Reflection</td>
<td>15</td>
</tr>
<tr>
<td>Assessment of student thinking interview</td>
<td>10</td>
</tr>
<tr>
<td>Leading a mathematical number sense discussion</td>
<td>5</td>
</tr>
<tr>
<td>Design and teach a whole-class community based lesson</td>
<td>10</td>
</tr>
<tr>
<td>Philosophy of Math Education Portfolio</td>
<td>15</td>
</tr>
<tr>
<td>Final: Interview Exit</td>
<td>5</td>
</tr>
</tbody>
</table>

100 points

A. Reading questions and reflections (5 points)

Reading questions: After completing the weekly assigned readings, you will submit a short reading assignment through D2L assignments. As directed by the instructor, you will answer a specific guided question or submit at least one related question or idea. This could be a question that you still have after completing the reading; a new question that arose from the ideas discussed in the reading; a reflection on the reading, etc. Questions will be due by **11:55 pm each assigned Sunday**.

*Read chapters with an eye toward identifying main math concepts, cognitive milestones and stumbling blocks (i.e. common confusions). There are many lesson activity examples that can be skimmed.*

*(CC V.A-C, P-T)*
B. PreK Learning Story and Annotated Bibliography (5 points)*

The purpose of this assignment is to introduce you to PreK mathematics research and classroom practices that address the mathematical concepts covered in this course. In this assignment you will read 5 articles about PreK mathematics instruction and write an annotated bibliography describing the content of each article. The annotated bibliography will consist of five entries based on three instructor provided articles from a NAEYC publication and two individually found journal article from NCTM’s Teaching Children Mathematics. Your annotated bibliography should be written in APA style, and make sure that each paragraph entry is fact based and does not include your opinion.

Following your preschool visit you will create a one page poster that includes a picture of your student engaged in play, what the student was doing/interested in, what math was evident in the play, and what the teachers next steps could be.

(CC V.A-C, P-T)

C. PreK-1st Grade Lesson Plan (5 points)

After learning about content typically taught in PreK-1st grade classes, you will plan a mathematics lesson that utilizes the knowledge you have gained about students’ mathematical thinking from our class activities and readings. The lesson should include a clear plan for eliciting and responding to students’ thinking about the mathematics in the lesson and should engage students in discussing and making sense of their own and their classmates’ ideas. This lesson should also include the use of manipulatives. As part of the assignment, you will include an assessment description of how you would collect student data to determine what learning occurred during the lesson. The objectives of this lesson must address the PA Core Standards.

(CC I.G.6, V.P, V.R)

D. MidTerm (15 points)

This will be a short exam of various teaching methods discussed during the first half of the semester. The format will be multiple choice and open-ended response questions.

(V.A-C, P-T)

E. Book Study (10 points)

This will be a collaborative project that you will complete in a professor assigned group. You will meet throughout the semester, at the same time each week (during weeks 6-10) to discuss chapter readings. Towards the end of the semester you will present a reflective presentation on a professor assigned topic from the book. Each week a different group member must be the leader and submit your groups audio responses to the weekly prompts via email.

(CC I.A.7, I.F.3, 3.A.4)
F. Basic Skills, Math Night, and Math Club Participation and Reflection (15 points)

The purpose of this assignment is for you to gain experience in engaging in mathematics instruction with students during school and in an after-school setting. You will create mathematics and STEM activities to use with students and, during Math Night with their families. These activities will be completed prior to the Basic Skills, Math Club, or Math Night sessions and all needed materials will be prepared and submitted to the professor. You will collaboratively work with classmates to prepare these activities.

You will be graded by your attendance at these events, your preparedness (if you created all activities in a timely and responsive manner), and your synthesized reflection of these events. Your reflection can be a 2 page paper, a splice film, or another professor approved mode. Your reflection needs to address the following prompts:

• Before completing the activities, where were your expectations/concerns about the assignment? Looking back, how did you address this expectation and what would you change in the future?
• Overall, what do you think went well? What could have gone better?
• Write about your interactions with students, families, and teachers at the school.
• Write about how this assignment relates to your goals as a prospective teacher.
• (CC V.A-C, P-T)

G. Assessment of student thinking interview and observation (10 points)

In order 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 through a concept interview. You will use two of your practicum observations to complete this assignment. Following your observations and interview you will submit a report describing your observations, interview, and interview outcomes. This report can be a 2-4 page paper or a splice film. During your observation:

• Make note of what strategies the teacher is using to instruct and assess students.
• What are the students doing and how are they responding to the instruction?

You will be focusing on individual student learning with response to the instruction. After the lesson, interview at least one student independently. Ask the student to complete a similar task to the one presented in the lesson and to explain his or her thinking. You may use math journals but please also ask the student to explain verbally. If possible, audio record the interview. Answer or respond to the following questions and statements in your report:

• What happened during the lesson (brief synopsis)?
• What did students seem to understand and how did you know?
• How did the teacher’s instruction support this student understanding?
• What would be the next logical steps in the development of the students’ understanding and instruction to support that development?
• Explain how your observations related to the discussions and readings from our class.
  (CC III.A.1-5, III.B, III.C, III.F.1-4)
H. Leading a mathematical discussion (5 points)

In your placements, you will lead a discussion on students’ thinking about and understanding of a mathematical concept or task. The tasks could occur at the beginning or end of the mathematics period or at another time. It could be a discussion of a problem of the day, a main task from the daily lesson, a “number talk”, or a warm-up activity or bell ringer (i.e., the Math Message or Mental Math and Reflexes activities in *Everyday Mathematics*). You will work with your host teacher to choose a task appropriate for your placement. The main focus of the assignment is for you to **plan and lead a discussion** of the mathematics in the task following the ideas discussed in class throughout the semester. Your goal is to elicit and take note of students’ mathematical thinking. You will encourage students to justify and explain their thinking and encourage students to make sense of their peer’s responses. You will (1) write a short lesson plan for this activity, and (2) a one page analysis of your discussion including what you learned about the students’ understanding and the “talk moves” used and decisions made in leading the discussion. *(CC I.A.7, I.F.3, 3.A.4)*

I. Philosophy of Mathematics Education Portfolio* (15 points)

The purpose of this assignment is to provide you an opportunity to consider mathematics teaching and learning from a holistic view, that is grounded in NCTM’s Principles to Action. You will be drawing upon your experiences in this course, in the schools as a pre-service teacher, and as a student of mathematics to reflect upon three major areas: 1) your knowledge of mathematics; 2) your beliefs about mathematics teaching and learning; and 3) your goals as a teacher of mathematics. You will create a portfolio that includes artifacts that clarify your views on mathematics education and can be used during your first years of teaching. This assignment should be completed throughout the semester, and submitted during the last week of classes. This assignment must include one artifact that addresses each of the eight Mathematics Teaching Practices outlined in Principles to Action. Below are the following eight principles:

- Establish mathematics goals to focus learning
- Implement tasks that promote reasoning and problem solving
- Use and connect mathematical representations
- Facilitate meaning mathematical discourse
- Pose purposeful questions
- Build procedural fluency from conceptual understanding
- Support productive struggle in learning mathematics
- Elicit and use evidence of student thinking

While there is no one single artifact that must be submitted for each practice, I am looking to see that you have really thought about how you want to teach and that you are preparing to do so. *(CC V.A-C, P-T)*

J. Design and teach a whole-class community based mathematics lesson* (10 points)

Near the end of the course, you will plan, teach, and complete a reflection on one whole-class community based mathematics lesson in your practicum. The purpose of this assignment is to get to know the community/neighborhood and family activities of your students as a resource for mathematics learning and teaching. The goal is to learn about the **mathematics context and practices in the local community/neighborhood and family households that can be used to develop a mathematics lesson for your students.** You will: (1) explore at least two places in the
local community/neighborhood, and if desired you may interview family/community members, (2) develop a mathematics lesson utilizing data you gather on your community visit, and (3) reflect on this process as a tool to develop your mathematics instruction and support mathematics learning. The lesson should utilize the knowledge you have gained about students’ mathematical thinking from our class activities and readings. The lesson should include a clear plan for eliciting and responding to students’ thinking about the mathematics in the lesson and should engage students in discussing and making sense of their own and their classmates’ ideas. As part of the assignment, you will be collecting and analyzing student data to determine what learning occurred during the lesson. You must include a 2-3 page reflection that describes how your community visit informed your math lesson, summary of student learning during your lesson, reflection about this experience of connecting mathematics to community, and its connection to your future mathematics teaching. (CC IV.A, IV.C.1-8)

K. Final Project: Exit Interviews (5 points)*
This assignment will be completed individually as a final for this course and includes rubric scored questions grounded in NCTM’s Principles to Actions. (CC I.G.6, V.A-C,P-T, V.R)

* You will be provided an assignment description sheet outlining further details of this assignment.

Evaluation Schema
Determination of the Final Grade:
A 93%-100%
A- 90%-92.99%
B+ 87%-89.99%
B 83%-86.99%
B- 80%-82.00%
C+ 77%-79.99%
C 73%-76.99%
C- 70%-72.99%
D 60 – 69%
F Below 59%

VI. Attendance Policy
There is a strong correlation between regular class attendance and academic success. Students who attend classes regularly tend to earn higher grades and have higher passing rates in courses. Excessive absences may jeopardize students’ grades. You are expected to attend every Block Class Session. A variety of experiences and participation activities will be integrated into our class sessions this semester. You will share view, analyze, and discuss examples of teaching and student thinking. You will deepen your understanding of mathematics topics relevant to the elementary curriculum and explore connections to upper-level mathematics. You will participate in class activities that model approaches to teaching these topics in the elementary school. These assignments require your active engagement in class sessions; therefore, there is no opportunity to “make-up” these assignments. You will be expected to participate in each class session by completing and participating in all assigned work.

Students who are absent from class for any reason are responsible for all missed work and for contacting their instructor promptly. Students absent from a regularly scheduled quiz because of authorized College activities will have the opportunity to take the quiz at an alternate time.
Students who are regularly absent from class will be subject to overall point deduction from the professor, or be asked to withdraw from the course.

**VII. Academic Integrity Statement**
The standards of academic integrity as stated in the Student Handbook will be strictly enforced.

**VIII. Social Justice**
Westminster College is committed to social justice. I concur with that commitment and expect to maintain a positive learning environment based upon open communication, mutual respect, and non-discrimination. Our College does not discriminate on the basis of race, sex, age, disability, veterans status, religion, sexual orientation, color or national origin. Any suggestions as to how to further such a positive and open environment in this class will be appreciated and given serious consideration. If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise me and make appropriate arrangements with the Office of Disability Resources. It is the responsibility of the student to notify the faculty member at the beginning of the school term.

**IX. Course Schedule**

*Note: The course schedule is subject to revision at the discretion of the instructor. Revisions will be announced via email and/or in class.*

<table>
<thead>
<tr>
<th>Week</th>
<th>Class Date</th>
<th>Topic</th>
<th>Reading Due</th>
<th>Assignments Due</th>
</tr>
</thead>
</table>
| 1    | January 22nd     | Establish mathematics goals to focus learning  
  1. Course introduction  
  2. Teaching mathematics in the era of the NCTM and CCSS Standards  
  3. Teaching all Students Equitably  
  4. Exploring what it means to know and do mathematics | Chapters 1, 6 | • Mathematics Autobiography submitted electronically by 8PM Friday |
| 2    | January 29th     | Implement tasks that promote reasoning and problem solving  
  1. Discourse in the mathematics class  
  2. Problem Solving  
  3. Planning in the problem-based classroom | Chapter 2, 3, & 4 | • Reading reflection on chapters by Sunday 11:55pm |

**Class Meets at 8AM in the Preschool Lab**

**Visit WAES Basic Skills Class to do short game**
| 3 | February 5<sup>th</sup> | **WAES groups**
**Math Club** Starts 3-4:30PM NWES | **Use and connect mathematical representations**
1. PreK Mathematics
2. Using Technology to Teach Mathematics
3. Assessment in the Mathematics Class
4. Diagnostic Interviews | Chapters 5 & 7
PreK Articles | • Reading reflection on chapters by Sunday at 11:55PM
• PreK Learning Story 11:55pm Friday |
| 4 | February 12<sup>th</sup> | **WAES groups**
**Math Club** | **Facilitate meaningful mathematical discourse**
1. Developing early number concepts and number sense
2. Developing meanings for the operations
3. Literature and Writing in Mathematics Class | Chapters 8 & 9
CGI Articles | • Reading reflection on chapters by Sunday at 11:55PM
• PreK-1<sup>st</sup> grade mathematics lesson plan due by Friday at 11:55pm |
| 5 | February 19<sup>th</sup> | **WAES debrief with teachers**
**Math Club** | **Pose purposeful questions**
1. Helping children master the basic facts
2. Developing whole-number place value concepts
3. Base-Ten Blocks
4. Using Computational Estimation with Whole Numbers | Chapters 10 & 11
| 
| 6 | February 26<sup>th</sup> | **WAES groups**
**Last Math Club**
**Build procedural fluency from conceptual understanding**
1. Developing strategies for whole-number computation | Chapters 12 & 13
Book Study | • Reading reflection on chapters by Sunday at 11:55PM |
| 7 | March 5<sup>th</sup> | **Spring Break** |
| 8 | March 12<sup>th</sup> | 1. Algebraic thinking: Generalizations, patterns, and functions | Chapter 14
Algebra in Early | Mid-term |
<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
<th>Reading Reflections</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 March 19th</td>
<td><strong>WAES groups</strong> Support productive struggle in learning mathematics</td>
<td>Reading reflection on chapters by Sunday at 11:55PM</td>
</tr>
<tr>
<td></td>
<td>1. Developing concepts of decimals and percent’s</td>
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<td></td>
<td>2. Fraction and Decimal Computation</td>
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<td>10 March 26th</td>
<td><strong>WAES groups</strong> 1. Geometry</td>
<td>Reading reflection on chapters by Sunday at 11:55PM</td>
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<td>3. Data Analysis and Probability</td>
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<td>Book Study</td>
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<td></td>
<td>Chapters 19, 21-22</td>
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<tr>
<td>Date</td>
<td>Event</td>
<td>Tasks</td>
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<tr>
<td>April 3rd</td>
<td><strong>Elicit and use evidence of student thinking</strong>&lt;br&gt;1. Book Study Presentations&lt;br&gt;2. Basic Skills Noticing’s&lt;br&gt;3. Review of Practicum assignments</td>
<td>- Reading reflection on chapters by Sunday at 11:55PM&lt;br&gt;- Book Study Presentations April 3rd during class&lt;br&gt;- Book Study Paper Due Friday April 7th 11:55PM</td>
</tr>
<tr>
<td>April 9th</td>
<td><strong>Practicum Starts April 9th</strong></td>
<td>- Leading a mathematical discussion reflection&lt;br&gt;- Assessment Assignment&lt;br&gt;- Teach-Whole Class Lesson</td>
</tr>
<tr>
<td>April 16th</td>
<td>Practicum</td>
<td>- Leading a mathematical discussion reflection&lt;br&gt;- Assessment Assignment&lt;br&gt;- Teach-Whole Class Lesson</td>
</tr>
<tr>
<td>April 23rd</td>
<td>Practicum</td>
<td>If not completed over the last two weeks:&lt;br&gt;- Leading a mathematical discussion reflection&lt;br&gt;- Assessment Assignment</td>
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<tr>
<td>15</td>
<td>April 30th</td>
<td>Work in groups to debrief, create portfolio, and prepare for Exit Interviews during regular class time</td>
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<tr>
<td>16</td>
<td>May 7th</td>
<td>Finals Exit Interview</td>
</tr>
</tbody>
</table>

**PDE Framework for Grades PreK-4 Candidate Competencies Covered in ECE 321 & 322**

I. Development, Cognition, and Learning

Candidates will be able to:

A. **Curriculum** - Develop, implement, assess and modify curriculum and lessons as evidenced by their ability to:
   1. Delineate how individuals acquire and process information;
   2. Design learning environments to facilitate encoding, storage and retrieval of knowledge and information for memory, attention, perception, action, problem solving;
   3. Identify early interactions with adults and peers, the Pre K – 4 teaching methods and curricula, and comprehensive interventions that support learning and development, specifically in domains that prepare children from diverse backgrounds for kindergarten and the early grades;
   4. Demonstrate an understanding of and ability to plan for: type, identification, prevalence, effective, evidenced-based instructional practices and adaptations;

F. **PA Early Learning Standards** - Demonstrate proficiency with Pennsylvania’s early childhood learning standards, which is the framework that guides young children’s
II. Subject Matter Pedagogy Content:
Candidates will be able to:

1. Develop effective and appropriate curriculum that creates a secure base from which young children can explore and tackle challenging problems;
2. Develop and implement meaningful, challenging curriculum that support’s young children’s ability and motivation to solve problems and think well;
3. Develop curriculum that includes both planned and spontaneous experiences that are meaningful and challenging for all children that lead to positive learning outcomes and develop positive dispositions towards learning within each content area.

G. Classroom environment - Demonstrate understanding of the way in which classroom environments influence children’s learning including:
1. Design of classrooms, Pre K - 4, that demonstrate appropriate use of indoor and outdoor physical space and materials;
2. Design of classrooms, Pre K - 4, that are inclusive for diverse learners, including differences in age, development, culture and linguistics;
3. The connection between classroom arrangement and positive learning outcomes for students;
4. The way in which a positive climate for learning involves the establishment and maintenance of partnerships with families;
5. The use of classroom assessment tools to inform teaching strategies;
6. The connection between classroom materials, learning standards, and instruction.

II. Subject Matter Pedagogy Content:
Candidates will be able to:

C. Early math foundations
1. Number and Operations—develop, implement, assess and modify curriculum and lessons as evidenced by their ability to teach students how to:
   a. Count with understanding and recognize “how many” in sets of objects;
   b. Develop understanding of the relative position and magnitude of whole numbers and of ordinal and cardinal numbers and their connections;
   c. Connect number words and numerals to the quantities they represent, using various physical models and representations;
   d. Develop a sense of whole numbers and represent and use them in flexible ways, including relating, composing, and decomposing numbers;
   e. Understand various meanings of addition and subtraction of whole numbers and the relationship between the two operations;
   f. Understand the effects of adding and subtracting whole numbers;
   g. Use multiple models to develop initial understandings of place value and the base-ten number system;
   h. Understand situations that entail multiplication and division, such as equal groupings of objects and sharing equally;
i. Develop and use strategies for whole-number computations, with a focus on addition and subtraction;

j. Use a variety of methods and tools to compute, including objects, mental computation, estimation, paper and pencil, and calculators;

k. Understand the place-value structure of the base-ten number system and be able to represent and compare whole numbers and decimals;

l. Recognize equivalent representations for the same number and generate them by decomposing and composing numbers;

m. Develop understanding of fractions as parts of unit wholes, as parts of a collection, as locations on number lines, and as divisions of whole numbers;

n. Use models, benchmarks, and equivalent forms to judge the size of fractions;

o. Understand various meanings of multiplication and division;

p. Understand the effects of multiplying and dividing whole numbers;

q. Identify and use relationships between operations, such as division as the inverse of multiplication, to solve problems;

r. Develop fluency in adding, subtracting, multiplying, and dividing whole numbers;

s. Develop and use strategies to estimate the results of whole-number computations and to judge the reasonableness of such results;

t. Select appropriate methods and tools for computing with whole numbers from among mental computation, estimation, calculators, and paper and pencil according to the context and nature of the computation and use the selected method or tool;

u. Recognize and generate equivalent forms of commonly used fractions, decimals;

v. Understand the effects of multiplying and dividing whole numbers;

w. Identify and use relationships between operations, such as division as the inverse of multiplication, to solve problems;

x. Understand and use properties of operations, such as the distributive property of multiplication over addition;

y. Develop fluency with basic number combinations for multiplication and division and use these combinations to mentally compute related problems, such as 30 x 50.

2. Algebra—candidates will be able to develop, implement, assess and modify curriculum and lessons as evidenced by their ability to teach students how to:

a. Sort, classify, and order objects by size, number, and other properties;

b. Recognize, describe, and extend patterns such as sequences of sounds and shapes or simple numeric patterns and translate from one representation to another;

c. Analyze how both repeating and growing patterns are generated;

d. Use concrete, pictorial, and verbal representations to develop an understanding of inverted and conventional symbolic notations;

e. Describe qualitative change, such as a student’s growing taller;

f. Illustrate general principles and properties of operations, such as commutative, using specific numbers;

g. Model situations that involve the addition and subtraction of whole numbers, using objects, pictures, and symbols;

h. Describe quantitative change, such as a student’s growing two inches in one year;

i. Describe, extend, and make generalizations about geometric and numeric patterns;
j. Represent and analyze patterns and functions, using words, tables, and graphs;
k. Identify such properties as commutative, associative, and distributive and use them to compute with whole numbers;
l. Model problem situations with objects and use representations such as graphs, tables, and equations to draw conclusions;
m. Express mathematical relationships using equations.

3. Geometry—develop, implement, assess and modify curriculum and lessons as evidenced by their ability to teach students how to:
a. Recognize, name, build, draw, compare, and sort two-dimensional shapes;
b. Describe attributes and parts of two- and three-dimensional shapes;
c. Describe, name, and interpret relative positions in space and apply ideas about relative position;
d. Describe, name, and interpret direction and distance in navigating space and apply ideas about direction and distance;
e. Find and name locations with simple relationships such as “near to” and in coordinate systems such as maps (this use of coordinate systems is not identified as a focal point or connection);
f. Create mental images of geometric shapes using spatial memory and spatial visualization;
g. Recognize geometric shapes and structures in the environment and specify their location;
h. Investigate and predict the results of putting together and taking apart two- and three-dimensional shapes;
i. Recognize and create shapes that have symmetry;
j. Recognize and represent shapes from different perspectives;
k. Relate ideas in geometry to ideas in number and measurement;
l. Identify, compare, and analyze attributes of two- and three-dimensional shapes and develop vocabulary to describe the attributes;
m. Classify two- and three-dimensional shapes according to their properties and develop definitions of classes of shapes such as triangles and pyramids;
n. Investigate, describe, and reason about the results of subdividing, combining, and transforming shapes;
o. Explore congruence and similarity;
p. Make and test conjectures about geometric properties and relationships and develop logical arguments to justify conclusions;
q. Make and use coordinate systems to specify locations and to describe paths;
r. Build and draw geometric objects;
s. Create and describe mental images of objects, patterns, and paths;
t. Use geometric models to solve problems in other areas of mathematics, such as number and measurement;
u. Recognize geometric ideas and relationships and apply them to other disciplines and to problems that arise in the classroom or in everyday life;
v. Identify, compare, and analyze attributes of two- and three-dimensional shapes and develop vocabulary to describe the attributes;
w. Investigate, describe, and reason about the results of subdividing, combining, and transforming shapes;
x. Describe location and movement using common language and geometric vocabulary;
y. Predict and describe the results of sliding, flipping, and turning two-dimensional shapes;
z. Describe a motion or a series of motions that will show that two shapes are congruent:
   aa. Identify and describe line and rotational symmetry in two- and three-dimensional shapes and designs.
4. Measurement—develop, implement, assess and modify curriculum and lessons as evidenced by their ability to teach students how to:
   a. Recognize the attributes of length, volume, weight, area, and time (time is not identified as a focal point or connection);
   b. Compare and order objects according to these attributes;
   c. Understand how to measure using nonstandard and standard units;
   d. Select an appropriate unit and tool for the attribute being measured;
   e. Measure with multiple copies of units of the same size, such as paper clips laid end to end;
   f. Use repetition of a single unit to measure something larger than the unit, for instance, measuring the length of a room with a single meter stick;
   g. Use tools to measure;
   h. Develop common referents for measures to make comparisons and estimates;
   i. Understand such attributes as length, area, weight (identified in Grades 1 and 2 Curriculum Focal Points), volume, and size of angle and select the appropriate type of unit for measuring each attribute;
   j. Carry out simple unit conversions, such as from centimeters to meters, within a system of measurement;
   k. Explore what happens to measurements of a two-dimensional shape such as its perimeter and area when the shape is changed in some way;
   l. Develop strategies for estimating the perimeters, areas, and volumes of irregular shapes;
   m. Select and apply appropriate standard units and tools to measure length, area, volume, weight, time, temperature, and the size of angles (measuring time and temperature is not identified as a focal point or connection);
   n. Select and use benchmarks to estimate measurements;
   o. Understand the need for measuring with standard units and become familiar with standard units in the customary and metric systems;
   p. Develop, understand, and use formulas to find the area of rectangles and related triangles and parallelograms.
5. Data Analysis and Probability—develop, implement, assess and modify curriculum and lessons as evidenced by their ability to teach students how to:
   a. Pose questions and gather data about themselves and their surroundings;
   b. Describe parts of the data and the set of data as a whole to determine what the data show;
   c. Sort and classify objects according to their attributes and organize data about the objects;
   d. Design investigations to address a question and consider how data-collection methods affect the nature of the data set;
   e. Collect data using observations, surveys, and experiments;
   f. Represent data using tables and graphs such as line plots, bar graphs, and line graphs;
   g. Compare different representations of the same data and evaluate how well each representation shows important aspects of the overall data set;
   h. Propose and justify conclusions and predictions that are based on data and design studies to further investigate the conclusions or predictions;
   i. Describe the shape and important features of a set of data and compare related data sets, with an emphasis on how the data are distributed.
III. Assessment
Candidates will be able to:
*Same competencies required in the Accommodations & Adaptations for Diverse Learner Guidelines, for students with disabilities.

A. Identify, administer, interpret and plan instruction based on each of the assessment components in a standards aligned system:
   1. Authentic
   2. Screening
   3. Diagnostic
   4. Formative
   5. Summative
B. Demonstrate an understanding of the types of assessments used (e.g., screening, diagnostic, formative, summative) and the purpose of each assessment in a data-based decision making process;
C. Effectively use systematic observations, documentation and other effective assessment strategies;
D. Implement approaches to child assessment including:
   1. Ways to use informal and formal assessment tools, including work and play samples, portfolios including electronic portfolios (digital cameras, digital videos), documentation panels, teacher-made tests/tasks, checklists, observational schemes, and nontraditional means (e.g. composing a poem about each child, drawing a picture of each child) activities to gauge child well-being and learning and the relationship between teacher and each child;
   2. Ways to use assessment data to implement instructional and/or programmatic revisions for quality improvement;
   3. Articulating the impact of instruction on child well-being and learning;
   4. Describing the impact of state-wide student performance testing and the influence on the program and the child;

2.

IV. Family and Community Collaboration Partnerships
Candidates must apply their understanding of children and families diversity to:

A. Early childhood education candidates must know family systems and the role of families in children’s development

B. Candidates must know and understand strategies to partner with families including:
   1. Maintaining respectful, ongoing, meaningful communication with family members that develops and sustains partnerships with families
   2. Identifying and addressing family information, communication and collaboration needs
   3. Conferencing with families
   4. Involving families in the policy decisions of a program
   5. Providing families with meaningful opportunities to be involved throughout their child’s education
   6. Gathering evaluation information from families of children with and without disabilities
   7. Strategies for keeping families informed of children’s progress
   8. Culturally responsive factors that promote effective communication and collaboration with individuals with exceptional learning needs, families, school and agency personnel, and community members

V. Professionalism
Candidates must understand the value of and strategies for creating a community of learners. They will be able to:

A. Establish and maintain a positive social context for learning;
B. Set developmentally, culturally, linguistically and individually appropriate expectations for children;
C. Relate to, communicate with, develop and sustain partnerships with families;