

**EDUTL 7713: K-6: DATA ANALYSIS AND PROBABILITY**  
(2 CREDIT HOURS)

The Ohio State University  
College of Education and Human Ecology  
Department of Teaching and Learning

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***Conceptual Framework***

**VISION**

To serve as the epicenter of eminence for educator preparation (E<sup>3</sup>P)

**MISSION**

Our **mission** is to prepare highly effective educators who teach, lead, and serve. These highly effective educators will apply research-based practices that support academic and social development of all learners and engage in ongoing professional development.

**PHILOSOPHY**

The **philosophy** of The OSU Educator Preparation Unit is based upon a reciprocal relationship between theory and practice, using research to inform our programs. Drawing from multiple disciplines and methodologies, the Educator Preparation Unit focuses on educational processes across diverse P12 learners. We believe that educational research, practice, and policy constantly evolve and that highly effective educators lead and advocate in their respective fields.

**PURPOSE AND GOALS**



**THE OHIO STATE UNIVERSITY**

Our **purpose** is to support and enhance the development of educational leaders who engage in and implement research-based practices to support and advance P12 educational progress. Our programs prepare candidates for initial licensure and engage experienced educators who aspire to advance their practice. Candidates at all levels gain knowledge, skills and dispositions as critical thinkers, problem solvers, communicators, and collaborators.

The **goals** of The OSU Educator Preparation Unit provide direction for developing and aligning the curriculum, instruction, field experiences, clinical practices and assessments.

Candidates shall have a commitment to the following:

1. Acquiring the knowledge, skills and dispositions to interact effectively with all students in diverse learning environments;
2. Supporting practices with foundational and current research and theory;

3. Providing learning environments that support the development of all students;
4. Developing and executing objectives, based on continuous assessment, that support student learning;
5. Practicing integrity and ethical behavior; and
6. Engaging in professional development.

### **Course Description and Overview**

This 2-credit online graduate-level course is a K-12 course that may be taken by teachers in any Ohio State program or those interested in simply taking a graduate course. The course fulfills requirements in the P-6 Mathematics Specialist Endorsement, may serve as an elective in a graduate program, and also fulfills requirements for content in a mathematics education disciplinary focus. This fully online course is offered through Ohio State Columbus, but is open to students across the state. This course introduces statistics as a problem-solving process, and students will build their skills through investigations of different ways to collect and represent data, and describe and analyze variations in data. Data Analysis and Probability concepts are among those mathematics concepts fundamental to mathematical thinking for children in the P-6 classroom. Thus, the range of expertise required of the P-6 Mathematics Specialist must also include an understanding of these fundamental concepts. These specialists must also have a deep knowledge of the experiences that will help their students understand concepts such as issues related to chance and possible outcomes and predicting events as likely or unlikely, and testing predictions, and representational skills to depict and analyze data sets. This course will provide teachers the opportunity to examine the instructional strategies used to teach the mathematics content of data analysis and probability to plan instruction to implement these strategies in their classrooms.

### **Relationship to Other Courses/Curricula**

This course, along with 7711 Number and Algebra and 7712 Measurement and Geometry, are being planned to meet a specific need for teachers who are pursuing a specialization in the area of mathematics education in the P-6 environment. The course serves to meet competencies in the pedagogical content areas addressed in the Knowledge, Skills, and Dispositions section below, applied particularly toward the completion of a P-6 Mathematics Specialist Endorsement. The course also serves as an elective in the MA degree program with an area of concentration in mathematics education.

### **Knowledge, Skills, and Dispositions (Objectives/Student Learning Outcomes)**

This is a course designed to strengthen the content knowledge base of teachers teaching in a K-8 classroom. Students in this course will also investigate instructional strategies that support the development of data analysis and probability concepts. Conceptual development in these areas will be traced from early childhood experiences through 8<sup>th</sup> grade through an analysis of the NCTM Principles and Standards document. An emphasis will be a fundamental understanding of concepts that lead toward student success in the middle grades. After completing this course, the teacher will be able to implement instructional strategies to stimulate meaningful classroom learning. After notifying the instructor, if you are a secondary or special education teacher, we can adjust the syllabus and assignments to meet your needs.

### **Prerequisite**

Graduate standing in Mathematics Education or Mathematics, admission to PreK-6 Math endorsement program, or permission of instructor. Subdivisions intended to be taken in sequence.

### **Course Objectives**

The course prepares students to demonstrate content knowledge, pedagogical and professional knowledge, skills, and dispositions necessary to help children learn.

During this course students will develop the following **Competencies** in relation to Data Analysis and Probability.

1.5. Demonstrate procedural and conceptual understanding of data analysis and probability through statistical experiments.

- a. Pose questions, design investigations, and gather appropriate data to address the questions.
- b. Represent data using concrete objects, tables, and pictures and graphs.
- c. Describe a set of data, including its shape, spread, and center, using different forms of representations.
- d. Propose and justify conclusions and predictions that are based on data and design studies to further investigate the conclusions and predictions.
- e. Measure the likelihood of events occurring, and apply the idea of randomness to small and large samples.
- f. Coach inservice teachers in using methods for gathering, analyzing, and interpreting data in raw form, tables, and graphs.

In addition, students will:

- Become familiar with current theory about teaching children mathematics.
- Learn to apply theory to classroom teaching (i.e., to planning and implementing lessons).
- Develop instructional methods (including technological) for teaching children mathematics and broaden instructional repertoires of teaching ideas and activities.
- Organizing concepts of school mathematics, their development through the mathematics curriculum, and their role on the learning of mathematics.
- Examination of instructional strategies and connected mathematical processes of data analysis and probability.
- Develop skills in finding and using print and other resources as they apply to classroom teaching.
- Reflect critically on instructional issues and matters (e.g., choice of appropriate teaching methods and educational equity issues).
- Access online materials from remote sites on and off campus

### **NCATE Standards Addressed: Knowledge, Skills, and Dispositions**

4.2. Candidate recognizes and applies mathematics in contexts outside of mathematics.

- 8.1. Selects, uses, and determines suitability of the wide variety of available mathematics curricula and teaching materials for all students including those with special needs such as the gifted, challenged and speakers of other languages.
- 8.3. Uses multiple strategies, including listening to and understanding the ways students think about mathematics, to assess students' mathematical knowledge.
- 8.4. Plans lessons, units and courses that address appropriate learning goals, including those that address local, state, and national mathematics standards and legislative mandates.
- 8.7. Uses knowledge of different types of instructional strategies in planning mathematics lessons.

### **Diversity**

The curriculum and experiences will support the teaching of all students by investigating ways in which teachers may reach all learners through strategies such as the use of manipulative materials, grouping strategies and written and oral communication; and the practices of making accommodations for mathematics instruction for the range of student disabilities found in the K-6 classroom.

In addition, the methods used to teach participants in this course will model those described above so as to insure their understanding. Further, technology will be implemented to develop course materials and to provide multiple means for classroom teachers to come to understand methods of teaching these concepts as well as better understanding these concepts themselves.

### **Required Texts and Course Materials**

- Common Core Standards found at <http://www.corestandards.org/Math/Practice/>
- National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: Author. [see <http://standards.nctm.org/>]
- Ohio Mathematics Academic Content Standards [see <http://www.ode.state.oh.us/GD/Templates/Pages/ODE/ODEDetail.aspx?page=3&TopicRelationID=1704&ContentID=801&Content=67594>]

### **Assignments/Point Values**

Your EDUTL 7713 grade will be based on the following point system. (See attached assignment descriptions with scoring criteria beginning on the pages noted below.)

|                                                     |           |
|-----------------------------------------------------|-----------|
| Class Discussion Participation                      | 45 points |
| Quizzes                                             | 45 points |
| Assignment 1 (Pre Math Content Exams)               | 20 points |
| Assignment 2 (Equity in Math Ed Position Paper)     | 20 points |
| Assignment 3 (Data Analysis & Prob. Position Paper) | 20 points |
| Assignment 4 (Post Math Content Exams)              | 20 points |

|              |                   |
|--------------|-------------------|
| <b>Total</b> | <b>170 points</b> |
|--------------|-------------------|

### **Grading Standards**

In general, A's represent outstanding work, B's good work, C<sup>+</sup> satisfactory work, C minimally acceptable work, C- to D unsatisfactory work, and E completely unacceptable work.

### Grading Scale

|                |                |                |               |
|----------------|----------------|----------------|---------------|
| 93% - 100%: A  | 83% - <87%: B  | 73% - <77%: C  | 60% - <67%: D |
| 90% - <93%: A- | 80% - <83%: B- | 70% - <73%: C- | < 60%: E      |
| 87% - <90%: B+ | 77% - <80%: C+ | 67% - <70%: D+ |               |

### Course Schedule

| Week                          | Sections                                                                                                                                                                                                                                                                        | Video   | Quiz   | Class Discussion Forum   |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|--------|--------------------------|
| <b>1</b><br><b>8/27-9/2</b>   | Course Syllabus <ul style="list-style-type: none"> <li>NCTM Standards Documents (Process and Content)</li> <li>Common Core State Initiative Standards</li> <li>Comparison of the Common Core State Standards and the 2001 Academic Content Standards for Mathematics</li> </ul> |         |        | Class Discussion Forum 1 |
| <b>2</b><br><b>9/3-9/9</b>    | Equity in mathematics education – teaching all children.<br>A problem-solving Process                                                                                                                                                                                           |         | Quiz 1 | Class Discussion Forum 2 |
| <b>3</b><br><b>9/10-9/16</b>  | Statistics as Problem Solving<br>Examining Data Analysis and Probability across the grade levels                                                                                                                                                                                | Video 1 |        | Class Discussion Forum 3 |
| <b>4</b><br><b>9/17-9/23</b>  | Data Organization and Representation<br>Pose questions, design investigations, and gather appropriate data to address the questions.<br>Represent data using concrete objects, tables, and pictures and graphs.                                                                 | Video 2 |        | <b>Assignment 1</b>      |
| <b>5</b><br><b>9/24-9/30</b>  | Data Organization and Representation<br>The Median<br>Bar Graphs and Relative Frequencies                                                                                                                                                                                       | Video 2 | Quiz 2 | Class Discussion Forum 4 |
| <b>6</b><br><b>10/1-10/7</b>  | Describing Distributions<br>Organizing Data in a Stem and Leaf Plot<br>Histograms<br>Relative and Cumulative Frequencies                                                                                                                                                        | Video 3 | Quiz 3 | Class Discussion Forum 5 |
| <b>7</b><br><b>10/8-10/14</b> | The Five-Number Summary                                                                                                                                                                                                                                                         | Video 4 |        | <b>Assignment 2</b>      |

|                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                        |         |        |                           |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|--------|---------------------------|
|                                   | <p>Representational skills to depict and analyze data sets.</p> <p>Describe a set of data, including its shape, spread, and center, using different forms of representations.</p> <p>Propose and justify conclusions and predictions that are based on data and design studies to further investigate the conclusions and predictions.</p>                                                                                             |         |        |                           |
| <b>8</b><br><b>10/15-10/21</b>    | <p>The Five-Number Summary</p> <p>The Box Plot</p> <p>Finding the Five-Number Summary Numerically</p>                                                                                                                                                                                                                                                                                                                                  | Video 4 | Quiz 4 | Class Discussion Forum 6  |
| <b>9</b><br><b>10/22 – 10/28</b>  | <p>Variation About the Mean</p> <p>Fair Allocations</p> <p>Unfair Allocations</p> <p>Using Line Plots</p>                                                                                                                                                                                                                                                                                                                              | Video 5 | Quiz 5 | Class Discussion Forum 7  |
| <b>10</b><br><b>10/29 – 11/4</b>  | <p>Variation About the Mean</p> <p>Deviations for the Mean</p> <p>Measuring Variation</p>                                                                                                                                                                                                                                                                                                                                              | Video 5 | Quiz 6 | Class Discussion Forum 8  |
| <b>11</b><br><b>11/5 – 11/11</b>  | <p>Designing Experiments</p> <p>Comparative Studies, Comparative Observational Studies, Comparative Experimental Studies</p>                                                                                                                                                                                                                                                                                                           | Video 6 |        | <b>Assignment 3</b>       |
| <b>12</b><br><b>11/12 – 11/18</b> | <p>Bivariate Data and Analysis</p> <p>Scatter Plots, Contingency Tables, Modeling Linear Relationships</p>                                                                                                                                                                                                                                                                                                                             | Video 7 | Quiz 7 | Class Discussion Forum 9  |
| <b>13</b><br><b>11/19 – 11/25</b> | <p>Probability</p> <p>Probability in Statistics, Mathematical Probability</p> <p>Explore chance and possible outcomes, predicting events as likely or unlikely, and testing predictions.</p> <p>Propose and justify conclusions and predictions that are based on data and design studies to further investigate the conclusions and predictions.</p> <p>Modeling real-world situations; applications in algebra and data analysis</p> | Video 8 | Quiz 8 | Class Discussion Forum 10 |
| <b>14</b><br><b>11/26 – 12/2</b>  | <p>Random Sampling and Estimation</p> <p>Random samples, Selecting the Sample</p>                                                                                                                                                                                                                                                                                                                                                      | Video 9 | Quiz 9 |                           |
| <b>15</b><br><b>12/3 -12/9</b>    | <p>Random Sampling and Estimation</p> <p>Investigating Variation in Estimates</p> <p>The Effect of Sample Size</p>                                                                                                                                                                                                                                                                                                                     | Video 9 |        | <b>Assignment 4</b>       |

### Class Discussions Assignment (45 points)

Participate by reading and making comments from the first day of class until the last day of class.

Each week, you should

- 1) post at least one thoughtful and informative discussion message or pose a good question and
- 2) make at least two thoughtful productive comments. (You may make more, but be careful not to dominate.) Type your first name after every question and/or comment you make.

Someone should try to pose a question on or soon to “get the ball rolling.” You might pose questions based on course readings or video sessions (or from the course module). These might involve clarifications of things you didn’t understand, opinions (e.g., debate of issues or critiquing statements or activities), “how-to” (methods for teaching particular concepts or structuring instruction), and so forth. (You may also share good ideas and activities in general. However, the focus should be on follow-up and extension of course module, sections and course readings.)

Conversation should center about math education issues and should not include discussion related to other matters, such as practical class matters as in details about assignments.

At the end of the semester you should have posed at least 10 questions/discussion message and have made at least 20 thoughtful comments.

### **Scoring**

**Full Participation (15 points):** completion of at least 10 questions and at least 20 comments.

**Quality (30 points):** assessment of how substantial, thoughtful, and relevant your questions and comments were.

### **Quizzes (45 points of at most 5 points for each quiz)**

At the end of each session (week), you will have to answer questions that relate to readings, sessions, videos, activities etc. The sum of your total quiz grade is 45 points.

***Missed quizzes may not be made up (i.e., a grade of 0 will be earned)— this includes all reasons.***

### **Assignment Descriptions**

All assignments will be posted on Carmen. Read the assignment description carefully and respond accordingly. Go to the Dropbox on Carmen, read the assignment and post your response through the dropbox.

### **Notes**

- All assignments should be typed double-spaced in a readable 12-point font (e.g., Times or Times New Roman) with one-inch margins.
- “Presentation” (see scoring) refers to elements such as neatness, grammar, punctuation, spelling, general writing style, and requested format (e.g., typed and double-spaced with use of required headings/subheadings, where relevant). Clear reference must be made through citations and bibliography presented in the *American Psychological Association (APA) format*.
- In preparing assignments, attend carefully to all assignment information provided, *including scoring information*.

### **Assignment 1: Pre Mathematics Content Exams (20 points)**

A pre mathematics content test will be given at the beginning of the course to demonstrate growth in mathematical achievement in Data Analysis and Probability as well as to demonstrate competencies.

### **Assignment 2: Position Paper (20 points)**

The purpose of this assignment is to develop a valid position concerning “Equity in Mathematics Education.” Here’s what you have to do:

1. Go to the NCTM’ Position Statements [i.e., <http://www.nctm.org/about/content.aspx?id=13490>]
2. Read this statement.
3. Reflect on this statement based on your own experiences and beliefs with regard to equity in mathematics education, and real life situations.
4. Write your position paper. The paper should be approximately 2-3 pages typewritten, double-spaced, and should contain at least 6 references. At least half of the references must come from printed scholarly journals.

#### Scoring:

**Completeness (2 points):** inclusion of required references; evidence of reading position statement.

**Quality (6 points):** assessment of how substantial, thoughtful, and relevant your position paper is.

**Theoretical base (10 points):** position paper should be grounded in current theory/literature, as discussed in the sessions. readings, and videos.

**Presentation (2 points):** This includes neatness, grammar, punctuation, spelling, and general writing style. Paper should be 2-3 pages typewritten and double-spaced.

### **Assignment 3: Position Paper (20 points)**

The purpose of this assignment is to develop a valid position concerning the teaching and learning of Data Analysis and Probability in schools. Here’s what you have to do:

1. Go to the Journal Article “Using GAISE and NCTM Standards as Framework for Teaching Probability and Statistics to Pre-Service Elementary and Middle School Mathematics Teachers” [i.e., <http://www.amstat.org/publications/jse/v18n3/metz.pdf>]
2. Read this statement.
3. Reflect on this statement based on your own experiences and beliefs with regard to the teaching and learning of data analysis and probability, and real life situations.
4. Write your position paper. The paper should be approximately 2-3 pages typewritten, double-spaced, and should contain at least 6 references. At least half of the references must come from printed scholarly journals.

#### Scoring:

**Completeness (2 points):** inclusion of required references; evidence of reading position statement.

**Quality (6 points):** assessment of how substantial, thoughtful, and relevant your position paper

is.

**Theoretical base (10 points):** position paper should be grounded in current theory/literature, as discussed in the sessions, readings, and videos.

**Presentation (2 points):** This includes neatness, grammar, punctuation, spelling, and general writing style. Paper should be 2-3 pages typewritten and double-spaced.

#### **Assignment 4: Post Mathematics Content Exams (20 points)**

A post mathematics content test will be given at the end of the course to demonstrate growth in mathematical achievement in Data Analysis and Probability as well as to demonstrate competencies.

#### **Disability Accommodation Statement**

Each student who qualifies with a disability is to provide the course instructor with a letter from the Disability Resource Center (DRC) stating the appropriate accommodations for this course. If you have a documented disability and wish to discuss how these academic accommodations will be implemented for this course, please contact the course instructor as soon as possible.

#### **Policy on Late Assignments**

Assignments are due at their scheduled time. Assignments submitted after the week in which they are due will be reduced by 5% of the assignment's allocated points. Beyond that, a grade will decrease by 10% of the assignment's allocated points for each weekday.

#### **Plagiarism**

I consider *plagiarism* a willful act when a person knowingly uses the work of others and attempts to present it as his/her own. This obviously cannot be permitted. Academic dishonesty includes cheating on tests or lying about the work involved in class. If an individual engages in these activities I reserve the right to use all appropriate measures at my disposal to correct the situation. The OSU policy on academic dishonesty will be enforced.

#### **Disability Accommodation Statement**

Each student who qualifies with a disability is to provide the course instructor with a letter from the Disability Resource Center (DRC) stating the appropriate accommodations for this course. Any student with a documented disability who may require special accommodations needs to speak to the instructor within the first two weeks of classes to receive effective and timely accommodations.

#### **Borderline Grades**

Point ranges for grades will be observed as listed (i.e., no "rounding up" will occur). Outstanding performance in the area of professionalism as described above, including perfect attendance, will be considered for raising borderline grades (those within 2 points of a cut-off) to the next higher partial grade (e.g., 178 points may be raised to a grade of A- in such a case). This decision will be based solely on the instructor's professional judgment.

#### **Academic Misconduct**

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the University, or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the University's *Code of Student Conduct* is never considered an "excuse" for academic misconduct. If the course instructor suspects that a student has committed academic misconduct in this course, he is obligated by University Rules to report suspicions to the Committee on Academic Misconduct (COAM). If COAM determines that the student has violated the University's *Code of Student Conduct* (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in the course and suspension or dismissal from the University. For additional information, see the Code of Student Conduct ([http://studentaffairs.osu.edu/info\\_for\\_students/csc.asp](http://studentaffairs.osu.edu/info_for_students/csc.asp)).

### **Grievances and Solving Problems**

According to University Policies, available from the Division of Student Affairs, if you have a problem with this class, "You should seek to resolve a grievance concerning a grade or academic practice by ***speaking first with the instructor or professor***. Then, if necessary, with the department chairperson, college dean, and provost, in that order. Specific procedures are outlined in Faculty Rule 3335-7-23, which is available from the Office of Student Life, 208 Ohio Union." "Grievances against graduate, research, and teaching assistants should be submitted first ***to the supervising instructor***, then to the chairperson of the assistant's department."

### **Statement on Diversity**

Teachers are expected to be able to support the learning of *all* students and to have a conceptual understanding of how knowledge, skills, and dispositions related to diversity are integrated across the curriculum, instruction, assessments, and evaluations. In light of these expectations, each enduring understanding for the course will be developed in relationship to diversity – that is, ethnicity, race, socioeconomic status, gender, exceptionalities, language, religion, sexual orientation, and geographical area. The College of Education and Human Ecology affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

### **Instructor's Assistance**

The instructor's purpose is to help class members become the very best they can possibly become at this point in their professional learning. Please allow the instructor to assist in any way possible. Make an appointment, make contact by email, or make contact by phone at any time.

**Note:** This document represents the instructor's best attempt to delineate the contents of this course. It is subject to reasonable adjustments, including clarifications and additions based on the instructor's professional judgment.