updated syllabus: 1/20/2015

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Washington State University
MAJOR CURRICULAR CHANGE FORM - - NEW/RESTORE COURSE

- ☐ **Please attach rationale for your request, a complete syllabus**, and explain how this impacts other units in Pullman and other campuses (if applicable).
- ☐ **Obtain all required signatures with dates.**
- ☐ **Provide original stapled packet of signed form/rationale statement/syllabus** PLUS **10 stapled copies of complete packet to the Registrar's Office**, campus mail code 1035.
- ☐ **Submit one electronic copy of complete packet** to wsu.curriculum@wsu.edu.

Requested **Future** Effective Date: Spring 2016 (term/year) Course Typically Offered: Summer, Spring

DEADLINES: For fall term effective date: **October 1st**; for spring or summer term effective date: **March 1st**. See instructions.

NOTE: Items received after deadlines may be put to the back of the line or forwarded to the following year. Please submit on time.

☒ **New Course** ☐ Temporary Course ☐ **Restore Course**

T&L	~~428~~ 463/563 ~~545~~	Teaching concepts of probability and statistics
course subject/crosslist	course no.	title

3	(3	- 0)	Math 252
Credit hrs	lecture hrs per week	lab or studio hrs per week	prerequisite

Description for catalog: Development of mathematical concepts and related teaching strategies for probability and statistics, with an emphasis on middle school topics

Additional Attributes: Check all that apply.

☐ Crosslisting (between WSU departments)* ☑ Conjoint listing (400/500): ~~428/545~~ 463/563

☐ Variable credit:_____ ☐ Repeat credit (cum. max. hrs):_____

Special Grading: ☐ S, F; ☐ A, S, F (PEACT only); ☐ S, M, F (VET MED only); ☐ H, S, F (PHARMACY, PHARDSCI only)

☐ Cooperative with UI ☐ Other (please list request): _____

The following items require prior submission to other committees/depts. (SEE INSTRUCTIONS.)

☐ Request to meet Writing in the Major [M] requirement **(Must have All-University Writing Committee Approval.)**

☐ Request to meet UCORE in _____ **(Must have UCORE Committee Approval › › See instructions.)**

☐ Special Course Fee_____ **(Must submit request to University Receivables.)**

Contact: David Slavit Phone number: (360) 546-9653 Campus mail code: 9600

Email: dslavit@wsu.edu Instructor, if different: Slavit, other program faculty

Chair/date	Dean/date	All-University Writing Com Date
11-24-14	11-21-14	

Chair (if crosslisted/interdisciplinary)*	Dean (if crosslisted/interdisciplinary)*	UCORE Committee Approval Date

Catalog Subcommittee Approval Date	GSC or AAC Approval Date	Faculty Senate Approval Date

***If the proposed change impacts or involves collaboration with other units, use the additional signature lines provided for each impacted unit and college.**

Course Rationale

T&L 428/545: Teaching Concepts of Probability and Statistics

T&L 428/545 is a new requirement in the middle level mathematics endorsement program for public school teaching. As of 2014, a series of competencies related to probability and statistics were added to the middle level mathematics endorsement by the state of Washington. This course is being developed in response to these new competencies.

The middle level mathematics endorsement program serves primarily two WSU student populations: 1) preservice teaching students who are obtaining certification either at the elementary (K-8) level or at the secondary level in a non-mathematics discipline area (but wish to also be highly-qualified to teach mathematics), and 2) practicing classroom teachers who wish to improve their qualifications in and ability to teach mathematics. These two populations represent a blend of undergraduate and graduate students, prompting the need for the conjoint listing.

T&L 428/545 is one of five courses required to obtain the middle level mathematics endorsement at WSU. The endorsement program also includes Math 303, Math 351, T&L 426/533, and T&L 427/534. Math 106 is also required, but most students who enter the endorsement program have already taken this course.

The course is designed to develop conceptual understanding for topics in probability and statistics. The study of selecting and using appropriate statistical methods to analyze data, the developing and evaluating of inferences and predictions that are based on data, and the application of basic concepts of probability will be covered in this class. Further, the course will discuss specific teaching strategies related to these concepts and the ways in which children, particularly middle school students, think about and develop understandings of these ideas. The course has two specific student learning outcomes:

- Develop conceptual, usable knowledge related to topics in statistics and probability
- Develop knowledge, strategies, and skills for applying conceptual knowledge when teaching statistics and probability in classroom settings

Students who complete the middle level mathematics endorsement will have the option of taking either T&L 428/545 or Math 356 to satisfy the competencies related to probability and statistics. Both courses blend issues of content and pedagogy, but T&L 428/545 puts an emphasis on pedagogy, while Math 356 has a more mathematical-oriented focus. Both courses satisfy all relevant competencies related to the probability and statistics aspects of the middle level mathematics endorsement.

Because of the two different student populations who enroll in the course, a conjoint listing is necessary. The urban campuses have a roughly equal number of students from the two populations stated above, hence a roughly equal number of undergraduate and graduate students enrolled in the endorsement program at those campuses. Undergraduate and graduate students will be responsible for the same reading assignments, but will have differing levels of homework and assessment criteria. Please see the syllabus for specific details on the differing nature of the assignments and assessment criteria.

The course has no anticipated impacts on other units in Pullman or on the urban campuses.

WASHINGTON STATE UNIVERSITY
College of Education
Course Syllabus

T&L 428/545 Teaching Concepts in Probability and Statistics (3 cr)
Tuesday, 4:15 PM – 6:55 PM
Instructor: David Slavit
Office: VUCB 330
Email: dslavit@wsu.edu
Phone: 360-546-9653
Office hours by appointment

Required Textbook:
Stohl Lee, Hollylynne, Karen F. Hollenbrands, and P. Holt Wilson (2010). *Preparing to Teach Mathematics with Technology: An Integrated Approach to Data Analysis and Probability, Revised Printing.* Dubuque, IA: Kendall Hunt Publishing.

Other Course Materials (currently these are available for free download)**:**
Tinkerplots Software, available online at:
http://www.keycurriculum.com/products/tinkerplots
Fathom Software, available online at:
http://concord.org/fathom-dynamic-data-software

Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well (NCTM, 2000, p16).

Additional resources:
Brewer, W., McClain, K., & Mooney, E. S. (2003). *Navigating through data analysis in grades 6-8*. Reston, VA: National Council of Teachers of Mathematics.

Burrill, G., Frankin, C., Godbold, L., & Young, L. (2003). *Navigating through data analysis in grades 9-12*. Reston, VA: National Council of Teachers of Mathematics.

Developing Essential Understanding of Statistics for Teaching Mathematics in Grades 6-8. Tim Jacobbe, Gary Kader, Patricia Wilson, Rose Mary Zbiek.

Developing Essential Understanding of Statistics for Teaching Mathematics in Grades 9-12. Roxy Peck, Rob Gould, Stephen Miller, Rose Mary Zbiek.

Online Resources:
Online Statistics Education: An Interactive Multimedia Course of Study.
http://onlinestatbook.com/2/ Project Leader: David M. Lane, Rice University

Common Core State Standards Initiative (2010). *Common Core State Standards for Mathematics.* Available online at http://www.corestandards.org/Math

Course Description: This course is designed to develop conceptual understanding for topics in data analysis and probability critical for the mathematics and pedagogical content knowledge of middle school teachers. The study of selecting and using appropriate statistical methods to analyze data, the developing and evaluating of inferences and predictions that are based on data, and the application of basic concepts of probability will be covered in this class. Throughout the course, connections will be made to student thinking and curricula related to grade 6-12 standards articulated in Common Core State Standards for Mathematics. See below for specific middle level mathematics competencies addressed in this course.

Undergraduate and graduate students will be responsible for the same reading assignments, but will have differing levels of homework and assessment criteria (see the discussion below for these specific differences).

Course Goals and Objectives:

- Formulate questions that can be addressed with data.
- Design simple investigations and collect data (through random sampling or random assignment to treatments) to address specific questions.
- Select and use appropriate statistical methods to display and analyze data.
- Develop and evaluate inferences and predictions that are based on data.
- Explore and interpret data by observing patterns and departures from patterns in data displays, particularly patterns related to spread and variability.
- Anticipate patterns by studying, through theory and simulation, those produced by simple probability models.
- Understand and apply basic concepts of probability.
- Draw conclusions with measures of uncertainty by applying basic concepts of probability.
- Select and use appropriate technologies to explain concepts, demonstrate skills, and solve problems.
- Examine and analyze the learning trajectory of statistics and probability concepts across the K-12 curriculum, and develop teaching strategies in the context of each of the above goals.

Student Learning Outcomes:

A list of the Washington State Competencies related to the middle level mathematics endorsement with respect to probability and statistics are found near the end of the syllabus. This course is designed to allow students to meet each of these competencies. Specifically, students will:

Student Learning Outcomes	**Activities and Evaluation of Outcomes**
Develop conceptual, usable knowledge related to topics in statistics and probability	Class Discussion, Homework Tasks, Final Exam
Develop knowledge, strategies, and skills for applying conceptual knowledge when teaching statistics and probability in	Class Discussion, Homework Tasks, Problem Solving Interview, Final Exam

classroom settings	

Class Structure and Format:
This course will feature small-group collaborative activity, followed by whole-class discussions. For this reason, it is important that you come to each class prepared to think about mathematical ideas, and be ready to share those with others. Active participation is required of all students in both the small-group and whole-class settings.
The majority of what we discuss during classtime will relate directly to course readings. It is important that you *read* and *think about* the assigned readings PRIOR to coming to class.

Professionalism & Class Participation:
You are expected to attend all classes and to conduct yourself in a professional manner. Attendance will be taken at the beginning of class. If you are late, it is your responsibility to notify the instructor (after class) of your presence. If you must be absent from class, please let me know before the missed session if at all possible. Classes will only be worthwhile if we have all read the assigned readings and are ready to actively participate in discussions about them. Professional behavior in this course involves the following: (1) willingness to participate in and add to the quality of the discussion during classtime, (2) your attendance and tardiness record, and (3) your approach to course assignments.

Assignments:
This course has three activities that serve as required deliverables for assigning a grade in the course: A Final Exam, Homework Tasks, and a Problem Solving Interview.

Final Exam (15%)
A final examination of course content and applied teaching perspectives and techniques will be given at the end of the semester.

Homework (50%)
Various problem sets will be assigned throughout the semester. These will be due the following week after they are assigned, and will be discussed in class.

Problem Solving Interview (35%)
During the course of the semester you will gain experience working with a child in the 9-13 year-old age range. This activity is really several related assignments:

- **SELECT A CHILD WITH WHOM TO WORK**
- **WRITE A PROBABILITY OR STATISTICS PROBLEM**
- **CREATE A RUBRIC**
- **GIVE THE PROBLEM TO THE STUDENT**
- **ANALYZE THE SOLUTION**
- **WRITE A REPORT**

a) **SELECT A CHILD WITH WHOM TO WORK**. Introduce yourself to the child, identify an area of mathematics appropriate for that child, and arrange a time during which you could watch them work a mathematical problem.

b) **WRITE A MATH PROBLEM**. Create a mathematical problem to be worked by the child. You are free to consult sources, but it would probably serve you well to construct the problem mostly on your own. The problem must be turned in (for a grade) at any time before Week 5, and then given to the child ***after*** it is returned to you. Grading will be based on appropriateness to stated age level (be sure to state this when handing the problem in), cleverness, and opportunity for student thought and problem solving strategies. **The problem should be one for which you do not expect an immediate solution to be found, but for which the child will have success.** Be sure to provide any materials to the child that you feel are appropriate.

c) **CREATE A RUBRIC.** Analyze the PROBLEM (not the student work) in order to construct a grading rubric. This will be turned in any time before Week 7 along with the potentially revised problem. The rubric should address the following dimensions:

- The level of ***mathematical understanding*** displayed by the student. Possible things to consider are - Did the student focus completely on algorithms or manipulations? Did the student display understandings of mathematical concepts associated with the problem? Did the student make connections across various mathematical concepts or ideas? Did the student seem to understand the mathematical meaning of his or her solution?
- The appropriateness and effectiveness of the ***problem solving method***. Possible things to consider are - Did the student display a logical line of mathematical reasoning in the solution? Did the student's solution suggest a clear plan, or did it seem that a random application of algorithms and procedures were used? Was the method of solution appropriate to the problem?
- The appropriateness and clarity of the ***communication*** of the solution and solution strategy. Possible things to consider are - Did the student clearly articulate her line of reasoning? Did the student use multiple formats or representations (e.g., charts, tables, graphs, equations, pictures, etc.) for discussing her solution attempt, if appropriate.

NOTE: All problems contain their own unique aspects, and if there is another dimension that you find important, write up this dimension and include it in your rubric.

d) **GIVE THE PROBLEM TO THE STUDENT**. Observe the child as they work the problem. Pay special attention to the solution method or methods used, the kinds of mathematical understandings utilized while working the task, the way they represent and communicate their understandings and strategies, and the facets of the problem which the child found challenging, easy, or difficult to comprehend.

e) **ANALYZE THE SOLUTION**. Analyze the STUDENT WORK using the rubric.

f) **WRITE A REPORT**. Write a 4-6 page report on this experience. Be sure to include (1) a description of the problem, (2) a discussion of how the student reacted to the problem, including a detailed analysis of the problem solving aspects in part b), 3) a discussion of how, or if, you would change the problem based on the student's reaction, and 4) a series of reflections on what you learned from this experience. Attach the problem and rubric (and student work if possible) to the end as appendices. The report is due anytime before Week 12.

Your grade will not depend on how well the child performs on your problem; rather, it will depend on the quality at which you write about the three aspects of part f). Specifically, I will ask myself the following questions when grading your report:
Do I have a good sense of who this child is?
Do I have a good sense of the problem and the problem-solving environment?
Do I have a clear understanding of how the child initially understood and approached the problem? worked the problem? wrote up a solution? reflected on the solution?
Do I have a good idea of what the student felt was especially easy or difficult, and why?
Do I have a good idea of the affect involved – did the child like doing this, was he or she resistant or bored, etc.?
Do I understand what you learned from this experience, and how you might change things if you did this again? Is your discussion reflective, and not just descriptive of what happened?

Grading criteria differential for graduate and undergraduate students
The number of homework problems for graduate students will be slightly higher than that of undergraduate students throughout the course. This will be on the order of 10-15% more per assignment. These additional problems will be selected from the more challenging tasks in the homework collection.
The problem-solving interview and the pedagogically-related items on the homework and Final Exam will be graded to a higher standard for graduate students than undergraduate students. For these kinds of tasks, there are qualitative attributes that determine the grade. While it is difficult to specifically quantify the difference, points will be awarded on the attributes of level of reflection, depth in understanding, and description of teaching ideas to a more stringent manner for graduate students than for undergraduate students.

Grading Scale: For all students

A	93-100
A-	90-92
B+	87-89
B	83-86
B-	80-82
C+	77-79
C	73-76
C-	70-72
D+	67-69
D	60-66
F	0-59

Course Schedule

NOTE: The assigned readings should be done prior to coming to class that week. Specific homework problems related to the designated assigned reading sections will be provided the week prior to their due date.

Week 1
Course introduction; Establish classroom norms; Introduction to Tinkerplots and Fathom

Week 2, Describing Aggregate Data
Ch. 1, Sec. 1-2

Week 3, Center and Distribution
Ch. 1, Sec. 3-4

Week 4, Measures of Center and Central Tendency, Teaching Concepts Related to Center and Distribution
Ch. 1, Sec. 5-6

Week 5, Exploring and Analyzing Data
Ch. 2, Sec. 1-2

Week 6, Analyzing Student Thinking Related to Data Analysis
Ch. 2, Sec. 3-5

Week 7, Univariate Distributions
Ch. 3, Sec. 1-2

Week 8 Understanding Spread, Teaching the Concept of Distribution
Ch. 3, Sec. 3-4

Week 9, Correlation, Classroom Activities that Involve Correlation
Ch. 4, Sec. 1-2

Week 10, Residuals
Ch. 4, Sec. 3-4

Week 11, Regression, Connecting Regression to the Teaching of Functions
Ch. 4, Sec. 5-6

Week 12, Outliers
Ch. 4, Sec. 7-8

Week 13, Randomness, Simulations, How to Use Simulations to Teach Probability
Ch. 5, Sec. 1-4

Week 14, Likelihood, How to Informally and Formally Develop Likelihood
Ch. 6, Sec. 1-2

Week 15, Theoretical Probability
Ch. 6, Sec. 3-4

PESB Middle Level Mathematics – Grades 4-9 Competencies addressed

1.0 Standards for Mathematical Practices

1.A Make sense of problems and persevere in solving them.
1.B Reason abstractly and quantitatively.
1.C Construct viable arguments and critique the reasoning of others.
1.D Model with mathematics.
1.E Attend to precision.

5.0 Statistics and Probability

Candidates demonstrate conceptual understanding and procedural facility of statistics and probability.

5.A Use appropriate measures of central tendency and distributions to summarize, represent, and interpret categorical and quantitative data.
5.B Understand and evaluate random processes underlying statistical experiments and use random sampling to make inferences about whole populations.
5.C Understand and use the rules of probability to make predictions, evaluate decisions, and solve problems.
5.D Apply probability concepts to model real world situations.

7.0 Modeling and Technology

Candidates will be able to connect mathematics to real life problems through the use of mathematical modeling and technology.

7.A Construct mathematical models in the content strands - data analysis, statistics and probability.
7.B Use appropriate technology

8.0 Mathematics Instructional Methodology

Candidates possess a deep understanding of how students learn mathematics and of the pedagogical knowledge specific to mathematics teaching and learning.

8.B Demonstrate ability to present mathematical concepts using multiple representations (e.g., numerical, graphical, analytical, and contextual).

8.D Demonstrate knowledge of learning progressions, including conceptual and procedural milestones and common misconceptions, within the content domain of probability and statistics and connections to instruction.

Disability Accommodation: Reasonable accommodations are available for students with a documented disability. All accommodations must be approved through your WSU Disability Services office. If you have a disability and need accommodations, we recommend that you begin the process as soon as possible. All accommodations must be approved through Disability Services. For more information, contact a Disability Specialist on your home campus.

- **Spokane** /students/current/StudentAffairs/disability/index.html
- **Pullman** http://accesscenter.wsu.edu
- **Tri-Cities:** http://www.tricity.wsu.edu/disability/index.html
- **Vancouver:** http://studentaffairs.vancouver.wsu.edu/student-resource-center/disability-services

Academic Integrity: Academic integrity is the cornerstone of the university and will be strongly enforced in this course. Any student found in violation of the academic integrity policy will be given an "F" for the course and will be referred to the Office of Student Conduct. Read http://academicintegrity.wsu.edu/
For additional information about WSU's Academic Integrity policy, procedures, and definitions, please check online at http://www.conduct.wsu.edu/default.asp?PageID=338 and http://www.conduct.wsu.edu/.
Note: Plagiarism is a violation of academic integrity. Students sometimes do not realize what constitutes plagiarism. Please read the information at http://www.wsulibs.wsu.edu/plagiarism/what.html and associated links.

Emergency Notification System: WSU has made an **emergency notification system** available for faculty, students and staff. Please register at myWSU with emergency contact information (cell, email, text, etc). You may have been prompted to complete emergency contact information when registering for classes on RONet.
In the event of a **Building Evacuation**, a map at each classroom entrance shows the evacuation point for each building. Please refer to it.
Finally, in case of **class cancellation campus-wide**, please check local media, the appropriate WSU web page and/or http://www.flashalert.net/. Individual class cancellations may be made at the discretion of the instructor. Each individual is expected to make the best decision for their personal circumstances, taking safety into account.

Audio, video, digital, commercial note-taking and other recording during class: Copyright (insert year) (insert Faculty Name) as to this syllabus, all lectures, and course-related written materials. During this course students are prohibited from making audio, video, digital, or other recordings during class, or selling notes to or being paid for taking notes by any person or commercial firm without the express written permission of the faculty member teaching this course.

WSU Safety Statement: Washington State University is committed to maintaining a safe environment for its faculty, staff, and students. Safety is the responsibility of every member of the campus community and individuals should know the appropriate actions to take when an emergency arises. In support of our commitment to the safety of the campus community the University has developed a Campus Safety Plan,

http://safetyplan.wsu.edu. It is highly recommended that you visit this web site as well as the University emergency management web site at http://oem.wsu.edu/ to become familiar with the information provided.