Core Course Assessment Plan, 2019-20
Element 2: Mathematics

Please complete all sections; do not delete section information. Submit to Pilot when complete.

SECTION 1: GENERAL INFORMATION

Course Dept. Prefix: MTH   Course #: 1450 or 1440

Semester when assessment will occur: ☐ Spring   ☐ Summer   XX Fall   Year: 2019 or 2020

Course Title: Math in the Modern World

Section Types and number of sections offered in 2019-20. Complete all that apply.
 4   Dayton face-to-face   2   Lake face-to-face
 1   Dayton online   _____ Lake online
 _____ Dayton Honors   _____ Lake Honors

Attributes: ____   Integrative Writing in Core
                   ____   Multicultural Competency in Core
                   ____   Service Learning in Core

Dept. Core Assessment Lead: Peggy Kelly   peggy.kelly@wright.edu

List at least two assessors; this may include course instructor only if there are multiple sections <u>and</u> multiple instructors of the course. Note - The instructor may not assess his/her students' papers.
- Peggy Kelly
- Mindy Diesslin
- Erik Potts
- Cathryn Curry
- Nate Tymes
- James Adabor

SECTION 2: ASSESSMENT PLAN

It is preferable to have the assessment plan for all sections of a course. If not feasible, please complete an assessment plan for separate sections.

<u>Course Outcomes.</u> _____ Check here if Outcomes have been modified.

The course must address all 5 outcomes but must assess a minimum of 1 outcome. Highlight in yellow the outcome(s) you will assess. If you have modified the outcomes, please insert here in place of standard outcomes.

1. Identify the various elements of a mathematical or statistical model;
2. Determine the values of specific components of a mathematical/statistical model or relationships among various components;
3. Apply a mathematical/statistical model to a real-world problem;
4. Interpret and draw conclusions from graphical, tabular, and other numerical or statistical representations of data; and
5. Summarize and justify analyses of mathematical/statistical models for problems, expressing solutions using an appropriate combination of words, symbols, tables or graphs.

<u>Assignments. Select **one** of the options below for assessment of one or more outcomes</u>

☐ Written assignment(s) that addresses/address outcome(s). Include outcome #, title and description for each assignment.

Outcome #: _____ Title:

Description of assignment:

XX **Essay question**(s). Provide the question(s) and outcome(s) below.

Outcome #: <u>3, 4, and 5</u> Essay Question:

Suppose that one winter (winter A) the low temperature of the day followed a normal distribution with a mean temperature of 10 degrees F with a standard deviation of 5 degrees. The following winter (winter B) the daily low temperatures also were normally distributed with a mean of 15 degrees F and a standard deviation of 9 degrees. Which winter would have had a higher percentage of days with temperatures below zero? Show graphs and calculations that support your decision. Explain why you're sure your answer is correct.

☐ Pilot asynchronous written discussion that addresses outcome(s). Provide the outcome # and question(s).

1. Outcome #: _____ Discussion Question: _____
2. Outcome #: _____ Discussion Question: _____
3. Outcome #: _____ Discussion Question: _____

☐ Multiple Choice or T/F Marker questions – 3 to 4 questions per outcome. List the outcome and question numbers. A rubric is not used for Marker questions. "All the above" should not be used as the correct answer more than once. **Courses that are IW or SRV/SRVI must use written assignments for those attributes**. Complete the benchmark: We expect _____% of students to answer _____% of the question(s) correctly.

1. Outcome #: _____
   a) Question: _____
   b) Question: _____
   c) Question: _____
2. Outcome #: _____
   a) Question: _____
   b) Question: _____
   c) Question: _____
   d) Question: _____
3. Outcome #: _____
   a) Question: _____
   b) Question: _____
   c) Question: _____

<u>Collecting and submitting the student assignment(s)</u>

Other: Will use this essay question on all finals for the course. All instructors will be given the question to place on their final. Student workers will copy this page of the final before any grading begins and we will use that question to assess the outcomes. Lake campus will share with Dayton campus and vice versa for assessment purposes with scanned pages.

They will be split so that each assessor is assessing about the same amount of pages (that are not their own students). The Math & Stats Dept office will need to figure out if there is an ideal way to have all pages available to all assessors.

Rubric Selection (A, B). Select the items you feel best match your assignment(s) in the rubric(s) on the next pages. Please highlight in yellow. **If this course has an IW attribute, please also see section B.**

A. Element 2 Rubric. **Select the item(s) you will use in your rubric by highlighting in yellow the item(s). You may select one or more of them.** As there is overlap, **choose the items that best fit the assignment you select for assessment.** The items below are taken from the Association of American Colleges and Universities (AACU) Value Rubrics for Math Literacy.

IF YOU ARE USING MARKER QUESTIONS FOR THE OUTCOME, DO NOT USE THIS RUBRIC.

	Capstone 4	Milestones 3	Milestones 2	Benchmark 1
Interpretation *Ability to explain information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words)*	Provides accurate explanations of information presented in mathematical forms. Makes appropriate inferences based on that information. *For example, accurately explains the trend data shown in a graph and makes reasonable predictions regarding what the data suggest about future events.*	Provides accurate explanations of information presented in mathematical forms. *For instance, accurately explains the trend data shown in a graph.*	Provides somewhat accurate explanations of information presented in mathematical forms, but occasionally makes minor errors related to computations or units. *For instance, accurately explains trend data shown in a graph, but may miscalculate the slope of the trend line.*	Attempts to explain information presented in mathematical forms, but draws incorrect conclusions about what the information means. *For example, attempts to explain the trend data shown in a graph, but will frequently misinterpret the nature of that trend, perhaps by confusing positive and negative trends.*
Representation *Ability to convert relevant information into various mathematical forms (e.g., equations, graphs, diagrams, tables, words)*	Skillfully converts relevant information into an insightful mathematical portrayal in a way that contributes to a further or deeper understanding.	Competently converts relevant information into an appropriate and desired mathematical portrayal.	Completes conversion of information but resulting mathematical portrayal is only partially appropriate or accurate.	Completes conversion of information but resulting mathematical portrayal is inappropriate or inaccurate.
Calculation	Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem. Calculations are also presented elegantly (clearly, concisely, etc.)	Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem.	Calculations attempted are either unsuccessful or represent only a portion of the calculations required to comprehensively solve the problem.	Calculations are attempted but are both unsuccessful and are not comprehensive.

	Capstone 4	Milestones 3	2	Benchmark 1
Application / Analysis *Ability to make judgments and draw appropriate conclusions based on the quantitative analysis of data, while recognizing the limits of this analysis*	Uses the quantitative analysis of data as the basis for deep and thoughtful judgments, drawing insightful, carefully qualified conclusions from this work.	Uses the quantitative analysis of data as the basis for competent judgments, drawing reasonable and appropriately qualified conclusions from this work.	Uses the quantitative analysis of data as the basis for workmanlike (without inspiration or nuance, ordinary) judgments, drawing plausible conclusions from this work.	Uses the quantitative analysis of data as the basis for tentative, basic judgments, although is hesitant or uncertain about drawing conclusions from this work.
Assumptions *Ability to make and evaluate important assumptions in estimation, modeling, and data analysis*	Explicitly describes assumptions and provides compelling rationale for why each assumption is appropriate. Shows awareness that confidence in final conclusions is limited by the accuracy of the assumptions.	Explicitly describes assumptions and provides compelling rationale for why assumptions are appropriate.	Explicitly describes assumptions.	Attempts to describe assumptions.
Communication *Expressing quantitative evidence in support of the argument or purpose of the work (in terms of what evidence is used and how it is formatted, presented, and contextualized)*	Uses quantitative information in connection with the argument or purpose of the work, presents it in an effective format, and explicates it with consistently high quality.	Uses quantitative information in connection with the argument or purpose of the work, though data may be presented in a less than completely effective format or some parts of the explication may be uneven.	Uses quantitative information, but does not effectively connect it to the argument or purpose of the work.	Presents an argument for which quantitative evidence is pertinent, but does not provide adequate explicit numerical support. (May use quasi-quantitative words such as "many," "few," "increasing," "small," and the like in place of actual quantities.)

B. If this is an IW course, you will use the items on this page. You may select one or more of them. Please highlight in yellow.

Item	Mastery 4	Partial Mastery 3	Progressing 2	Emerging 1
Includes considerations of audience, purpose, and the circumstances surrounding the writing task(s).	Demonstrates a thorough understanding of context, audience, and purpose that is responsive to the assigned task(s) and focuses all elements of the work.	Demonstrates adequate consideration of context, audience, and purpose and a clear focus on the assigned task(s) (e.g., the task aligns with audience, purpose, and context).	Demonstrates awareness of context, audience, purpose, and to the assigned tasks(s) (e.g., begins to show awareness of audience's perceptions and assumptions).	Demonstrates minimal attention to context, audience, purpose, and to the assigned tasks(s) (e.g., expectation of instructor or self as audience).
Content Development	Uses appropriate, relevant, and compelling content to illustrate mastery of the subject, conveying the writer's understanding, and shaping the whole work.	Uses appropriate, relevant, and compelling content to explore ideas within the context of the discipline and shape the whole work.	Uses appropriate and relevant content to develop and explore ideas through most of the work.	Uses appropriate and relevant content to develop simple ideas in some parts of the work.
Formal and informal rules inherent in the expectations for writing in particular forms and/or academic fields (please see glossary).	Demonstrates detailed attention to and successful execution of a wide range of conventions particular to a specific discipline and/or writing task (s) including organization, content, presentation, formatting, and stylistic choices	Demonstrates consistent use of important conventions particular to a specific discipline and/or writing task(s), including organization, content, presentation, and stylistic choices	Follows expectations appropriate to a specific discipline and/or writing task(s) for basic organization, content, and presentation	Attempts to use a consistent system for basic organization and presentation.
Sources and Evidence	Demonstrates skillful use of high-quality, credible, relevant sources to develop ideas that are appropriate for the discipline and genre of the writing	Demonstrates consistent use of credible, relevant sources to support ideas that are situated within the discipline and genre of the writing.	Demonstrates an attempt to use credible and/or relevant sources to support ideas that are appropriate for the discipline and genre of the writing.	Demonstrates an attempt to use sources to support ideas in the writing.
Control of Syntax and Mechanics	Uses graceful language that skillfully communicates meaning to readers with clarity and fluency, and is virtually error-free.	Uses straightforward language that generally conveys meaning to readers. The language in the portfolio has few errors.	Uses language that generally conveys meaning to readers with clarity, although writing may include some errors.	Uses language that sometimes impedes meaning because of errors in usage.

Faculty Senate CORE Oversight Committee

Assessment Plan Review

Element: 2

Course: MTH 1450 / 1440

Review 1

Item	Complete / NA / Revision Requested	Comments
Learning Outcomes for Element 2 Mathematics	**Complete**	
Assignments matched to Element 2 LOs	**Revision Requested**	**At the bottom of p. 2, Change "All instructors will be given the question to place on their 'final'" to All instructors will be given the question to place on "a test". Add the following, "The student worker will then create a zip file of the separate, ungraded exams to be sent to Carl Brun for entry into Aqua Watermark".**
Rubric for LOs	**Complete**	
Rubric for IW Attribute	**N/A**	
Assigned Approved Reviewers	**Revision Requested**	**Coordinate with Lake Campus the assessment of this course, including the possibility of at least 1 assessor from Lake Campus.**
Other	**Revision Requested**	**On Page 1, Courses must be assessed in 2019-2020 academic year; Fall 2020 is not within that range.**

Review Status: <mark>**Revision Requested**</mark>

Committee Chair Signature _____MH:bfn_____ Date _____5/1/2019_____

The next section is for the University Core Oversight Committee (UCOC) Review only.

UCOC Review

Item	Complete/NA	Revision Requested	Comments
Learning Outcomes for Global Traditions	**XX**		
Rubric for LOs	**XX**		
Rubric for MC Attribute	**N/A**		
Rubric for IW Attribute	**N/A**		
Rubric for SRV/SRVI Attribute	**N/A**		
Assigned Departmental Reviewers	**XX**		

Committee Review Completed XX

Committee Chair Signature ____*Ann M. Bowling*_____ Date __12/2019_____

Core Assessment Element 2 Report for MTH 1450/1440

Date Report Submitted: May 28, 2021 (submitted late due to Covid-19)

Element: Core Element 2 – Mathematics

Academic Year: 2019-2020

Course and Sections Assessed: MTH 1450-01, 02, 03, 06, 11 (Dayton campus), MTH 1440-W01 (Lake campus)
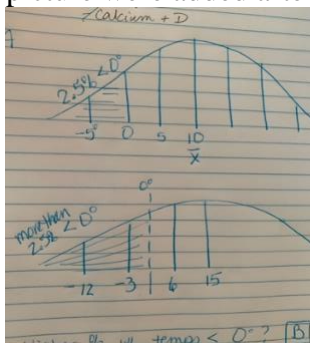
Assessment Plan:

We assessed the following course outcomes:

1. Apply a mathematical/statistical model to a real-world problem;
2. Interpret and draw conclusions from graphical, tabular, and other numerical or statistical representations of data; and
3. Summarize and justify analyses of mathematical/statistical models for problems, expressing solutions using an appropriate combination of words, symbols, tables or graphs.

by inserting the following essay question into each final exam for the course:
Suppose that one winter (winter A) the low temperature of the day followed a normal distribution with a mean temperature of 10 degrees F with a standard deviation of 5 degrees. The following winter (winter B) the daily low temperatures also were normally distributed with a mean of 15 degrees F and a standard deviation of 9 degrees. Which winter would have had a higher percentage of days with temperatures below zero? Show graphs and calculations that support your decision. Explain why you're sure your answer is correct.

Each instructor submitted a scanned version of student submissions (before they were graded) to the Math & Stats office. The assessors (3 instructors/lecturers who teach the course – two from Dayton, one from Lake) were assigned a similar number of pages to grade that were not their own students. Instructors used the following rubric and picture (the portions in bold type and the picture were added after the original assessment plan was submitted) to assist with assessment:

	Capstone 4	Milestones 3	2	Benchmark 1
Interpretation *Ability to explain information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words)*	Provides accurate explanations of information presented in mathematical forms. Makes appropriate inferences based on that information. *For example, accurately explains the trend data shown in a graph and makes reasonable predictions regarding what the data suggest about future events.* **Student refers to each normal curve correctly to explain why Winter B has a higher percentage of days below 0 than Winter A**	Provides accurate explanations of information presented in mathematical forms. *For instance, accurately explains the trend data shown in a graph.*	Provides somewhat accurate explanations of information presented in mathematical forms, but occasionally makes minor errors related to computations or units. *For instance, accurately explains trend data shown in a graph, but may miscalculate the slope of the trend line.* **Student refers to at least one of the normal curves to explain which winter has a higher percentage of days below 0**	Attempts to explain information presented in mathematical forms, but draws incorrect conclusions about what the information means. *For example, attempts to explain the trend data shown in a graph, but will frequently misinterpret the nature of that trend, perhaps by confusing positive and negative trends.* **Student offers an incorrect explanation.**
Representation *Ability to convert relevant information into various mathematical forms (e.g., equations, graphs, diagrams, tables, words)*	Skillfully converts relevant information into an insightful mathematical portrayal in a way that contributes to a further or deeper understanding. **Student draws two normal curves with the mean and standard deviations below the mean correctly placed**	Competently converts relevant information into an appropriate and desired mathematical portrayal.	Completes conversion of information but resulting mathematical portrayal is only partially appropriate or accurate. **Attempts normal curves for each winter, but may not place needed values on curves.**	Completes conversion of information but resulting mathematical portrayal is inappropriate or inaccurate. **Attempts something besides using a normal curve to organize the information.**
Calculation	Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem. Calculations are also presented elegantly (clearly, concisely, etc.) **Student is able to use 68-95-99.7 rule to calculate that 2.5% is below 0 in A and more than 2.5% is below 0**	Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem. **Student shows some work/thinking for arriving at 2.5% below 0 in B and more than 2.5% below 0 in A**	Calculations attempted are either unsuccessful or represent only a portion of the calculations required to comprehensively solve the problem. **Student may have 2.5% for A and more than 2.5% for B, but shows no work to support this.**	Calculations are attempted but are both unsuccessful and are not comprehensive.

	Capstone 4	Milestones 3		2	Benchmark 1
	in B.				
Application / Analysis *Ability to make judgments and draw appropriate conclusions based on the quantitative analysis of data, while recognizing the limits of this analysis*	Uses the quantitative analysis of data as the basis for deep and thoughtful judgments, drawing insightful, carefully qualified conclusions from this work. **Student correctly states that Winter B has higher percentage of days with temps less than 0. The student understands that more than 2.5% of B is less than 0, but cannot calculate exactly how much (should indicate that 0 falls between -3 and 6 degrees). Student is able to conclude that exactly 2.5% of days are below 0 in A**	Uses the quantitative analysis of data as the basis for competent judgments, drawing reasonable and appropriately qualified conclusions from this work. **Student correctly states that Winter B has higher percentage of days with temps less than 0. They correctly (but not completely) refer to the normal curve to support this statement.**		Uses the quantitative analysis of data as the basis for workmanlike (without inspiration or nuance, ordinary) judgments, drawing plausible conclusions from this work. **Student correctly states that Winter B has higher percentage of days with temps less than 0.**	Uses the quantitative analysis of data as the basis for tentative, basic judgments, although is hesitant or uncertain about drawing conclusions from this work.

Assessment Data Collection:

We individually assessed 165 student responses. Scores were broken down by rubric category and total.

Category:	Average Score
Interpretation	2.2
Representation	3.1
Calculation	1.1
Application/Analysis	2.1
Total	8.6 out of 16

Assessment Results:

This assessment used a typical problem involving a normal distribution and forced students to have enough of an understanding of the normal curve to be able to successfully compare two distributions. The 3.1 average score for Representation indicates that students generally knew they needed a normal curve to solve it and most were able to complete two mostly correct curves. The calculation score was very low, indicating that either students had memorized percentage values for the curve or did not know how to find them. The assessors discussed possibly changing the way this category is assessed. In the future we might rely more on the graphs with some correct numbers to support reasoning.

Interpretation and Application scores were very close to each other. With an average of around 2 it appears that many students started thinking about solving the problem correctly but many did not do everything correctly.

Assessment Feedback:

The assessors discussed possibly changing the way the Calculation category is assessed. In the future we might rely more on the graphs with some correct numbers to support reasoning rather than showing how they got 2.5%. Some instructors emphasize the calculations, some don't, but we felt the problem could still be completed correctly and with complete understanding even if they did not show how they got to the 2.5% with numerical calculations.

The assessors felt that the Interpretation and Application categories were very similar and it might be best to only assess one category like this in the future.

The results will be shared with instructors through a OneDrive file and with the department's curriculum committee through our department Pilot page.

Assessment Administration Feedback

The whole process of core assessment was well structured and carefully planned. The only thing we would like to suggest is the following: since our department (math and stat) has a relatively large number of core courses, it would be very helpful if we can avoid doing the core assessment for all of them in one academic year, in other words, we can split these core classes into several groups and let each group have a different 5-year cycle for assessment purposes.

UCOC Report Review

Item	Complete/NA	Revision Requested	Comments
Identified Outcome Assessed	**XX**		
Identified Procedure for Assessment	**XX**		
Summary of Results	**XX**		
Results Shared with Instructor, Dept Curriculum Committee, etc.	**XX**		
Plan for Improvements	**XX**		

Committee Review Completed XXX

Committee Chair Signature ___ *Dr. Ann M. Bowling* _____ Date __4/18/2022_____