Math 604.01: Ethnomathematics

Course Meeting Location:	Downtown Lancaster Campus Room 3-03 *(except Jan. 22nd and April 30th, which will be in Room 2-03)*
Class Meetings:	6:30PM-9:00PM T (CRN: 16419)
Course Instructor:	Dr. Cynthia Taylor
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Office:	Wickersham 102
Office Hours:	E-mail is the best way to get in touch with me

I. Course Description. This course aims to introduce Ethnomathematics as a field by examining mathematics across and within cultures. In addition, the course is designed to strengthen and expand students' understanding of mathematical topics (e.g., number systems, geometry, combinatorics, group theory) through study of the mathematics of world cultures. Furthermore, students will discuss ways in what is done in the course may be used to refresh or augment 7-12 school mathematics courses and develop school materials in Ethnomathematics.

   Prerequisite: Enrollment in Master of Education in Mathematics or permission of the instructor.

II. Major Objectives. The purpose of this course is to promote more effective teaching of mathematics. When you successfully complete this course, you should be able to:

1. Develop connections between different cultures, including your own, through the lens of mathematical thinking.
2. Identify, develop mathematical connections, and apply mathematical concepts from a variety of civilizations and cultures from different parts of the world.
3. Explain how some mathematical topics have been used in everyday life throughout time.
4. Develop ethnomathematics lessons to be taught in the classroom.
5. Identify the mathematics used in the social organization among some groups of people.

III. Required Materials.

   At this point, there is no required text. Readings will come from handouts, journal articles, and individual research. We will make regular use of articles from the library and web.
There is a handout of *References* that you may find helpful for assignments.

IV. Specific Learning Activities

   You are expected to complete all of the following activities prior to successfully completing the course. Each activity should be developed for an instructional level that is appropriate for you. Please type all material given to me to read.

1. CLASS ASSIGNMENTS—specific readings (and other assignments) will be assigned periodically throughout the first half of the semester. Class discussion will center upon the weekly assignments.

      WEEKLY READING ASSIGNMENTS—For the assigned readings, submit on D2L your written reaction to the week's reading assignment at least four hours before class

(i.e., by 2:30pm on the day the assignment is due). These reading reactions will be partly based on prompts that I provide and partly based on aspects of the readings that were particularly intriguing to you as a learner. These reading reactions serve two purposes: 1) much of our class discussion will revolve around the readings and your reactions; and 2) they allow you to reflect, and articulate in writing, on how the readings influence your thinking. In turn, they allow me to "see" how, on an individual basis, you are thinking about the reading material.

*I expect your reading reactions to contain **thoughtful** reactions regarding the readings. Please **DO NOT** summarize the readings in your writing, but instead provide reaction to the questions that I pose in addition to commenting on aspects of the readings other than those I specifically suggest.*

ETHNOMATHEMATICIAN PRESENTATION—You will choose an ethnomathematician to research. For your chosen individual, provide background (both educational, professional, and personal) and his/her contributions to the mathematics education community (i.e., in ethnomathematics and other significant contributions). Draw on works (e.g., books and journal articles) that were foundational for him/her to help you gather applicable information to present (e.g., powerpoint presentation) to your classmates.

JOURNAL ANALYSIS AND PRESENTATION—You will choose a journal from a given list. For your chosen journal, become an expert on the type of articles the journal publishes, the target audience, the submission guidelines, etc. Briefly relay how you would advise a potential author to submit to this journal (i.e., skim several articles to garner a sense as to the format/type of articles the journal publishes). Present your findings to the class in a format that will be shared with the class (e.g., word document, powerpoint presentation).

2. LEADING A SEMINAR—Each seminar day, one individual will be responsible for developing materials for, organizing, and leading a seminar on a topic from the list of topics provided (or another topic, with the permission of the professor). The seminar leader will facilitate discussion but all students are expected to participate. The facilitator should have a plan, in written outline form. Preparation expectations (readings, materials, etc.) should be given to all students and me one week in advance. Introduction should be given, relevant mathematics or mathematics background should be offered, classroom activities and questions or topics for discussion should be prepared, and you should engage your peers in activities where you can collect sample student work. Use audio-visual aids, technology, and give handouts, as appropriate.

3. PARTICIPATION IN AND CRITIQUES OF OTHER SEMINARS—Prepare for seminar as directed in advance by seminar leaders. Participate in meaningful ways in the discussion (offer insights, ask questions, etc.) and help seminar leader outline a journal article after the inclass presentation. Hand in one class later (or e-mail prior to the class) a typed critique of the seminar most recently attended.

4. WRITING A JOURNAL ARTICLE—For this component of the course you will write an **original** manuscript suitable to be submitted for publication (e.g., MTMS, Convergence, PCTM Magazine, etc.). The manuscript should be about 2500 words in length (or follow the

guidelines for the journal you intend to submit to). Utilize a portion (e.g., one activity) from the seminar you led or write an article sharing an activity authentic to your own culture that other teachers could implement in the classroom for the manuscript topic. A draft of the manuscript is due Tuesday, April 16th. During this class, we will edit and provide feedback to your manuscript. Your draft should include appropriate headings, citations and a reference list in the format your target journal requires. For example, PCTM Magazine requests APA format (see https://owl.english.purdue.edu/owl/resource/560/01/ for APA 6th edition guidelines) whereas MTMS and MT requires *Chicago Manual of Style,* 15th ed. (see https://www.chicagomanualofstyle.org/home.html for guidelines). NOTE: *In order to receive any credit for this assignment, your work must be free of plagiarism. Please do not express the ideas of others as your own. If you are quoting someone else, use quotation marks and cite the source. If you are paraphrasing them, you still have to cite the source before the end of the first sentence where that source material was used. Please do not plagiarize. For more information on common forms of plagiarize, see "Avoiding Plagiarism" located at:* https://www.millersville.edu/english/for-faculty/academic-integrity/plagiarism.php

5. FINAL PROJECT—This project will be based on introducing activities authentic to your own culture in some way (or another approved topic by the professor). You will be required to research and investigate a personally meaningful theoretical or pedagogical aspect of your choice, which relates to mathematics as a cultural product. You will then write a paper on your topic, and organize a classroom discussion or an activity relating to this topic. Your project will be negotiated based on personal interests. The project can be completed individually, in pairs, or in small groups. The project scope will be dependent upon the number of people involved.

V. Evaluation

Final grades for Math 604 will be calculated from students' performance on all assignments as well as tasks completed in class. All assignments will be assessed with a letter grade (A+, A, A-, B+, B, B-, C+, C, C-). Any assignment that would receive below a C- will be returned to the student to be revised and resubmitted. Resubmitted work will be averaged with original work to obtain a grade for that particular assignment.

To receive a grade in the A range means you have:	To receive a grade in the B range means you have:	To receive a grade in the C range means you have:
• Addressed all required parts of the assignment. • Supported your statements with evidence from the readings, class discussion, video, and/or other class artifacts as appropriate. • Presented prose that is grammatically correct and clear. • Made connections across course content as appropriate. • Turned in work that	• Addressed majority of required parts of the assignment. • Provided some support for your statements, but have left some statements without appropriate support. • Presented prose with some grammatical problems and/or a lack of clarity in writing. • Missed important connections across course content.	• Not addressed all required parts of the assignment. • Provided limited support for your statements. • Presented prose with major grammatical problems and/or lack of clarity in writing. • Not connected to other course content. • Turned in work that is not thoughtful, appears rushed, and is deemed unsatisfactory for a 600-

demonstrates thoughtful treatment of the topic.	• Turned in work that appears rushed and not particularly thoughtful.	level course.

Grades will be determined using following the distribution:
- Class participation/In Class Contributions (20%)
- Leading a seminar (20%)
- Participation in and critique of other seminars (20%)
- Writing a journal article (20%)
- Final project (20%)

*Class Participation:
I expect every student to attend all classes and actively participate in class discussions. Excessive absences will affect your grade for the course.

Academic Honesty Statement:
Academic integrity is expected at all times. If you cheat on a quiz or exam, you will receive a zero for that quiz or exam. Furthermore, the university's policies on academic honesty and dishonesty will be strictly enforced in this course (e.g., policies related to cheating, academic misconduct, etc.). Review these policies in your student handbook and in the Academic Honesty and Dishonesty brochure.

Accessibility Statement:
If you need accommodations because of a documented disability, if you have emergency medical information to share with me, or if you need special arrangements in case the building must be evacuated, please inform me immediately. Please see me privately after class, or at my office.

Reporting of Sexual Violence Statement:
Millersville University and its faculty are committed to assuring a safe and productive educational environment for all students. In order to meet this commitment, comply with Title IX of the Education Amendments of 1972, 20 U.S.C. §1681, et seq., and act in accordance with guidance from the Office for Civil Rights, the University requires faculty members to report to the University's Title IX Coordinator incidents of sexual violence shared by students. The only exceptions to the faculty member's reporting obligation are when incidents of sexual violence are communicated by a student during a classroom discussion, in a writing assignment for a class, or as part of a University-approved research project. Faculty members are obligated to report to the person designated in the University Protection of Minors policy incidents of sexual violence or any other abuse of a student who was, or is, a child (a person under 18 years of age) when the abuse allegedly occurred.

Information regarding the reporting of sexual violence, and the resources that are available to victims of sexual violence, is available at http://www.millersville.edu/sexualviolence/index.php.

Academic Performance Statement:
Students sometimes face mental health or drug/alcohol challenges in their academic careers that interfere with their academic performance and goals. Millersville University is a caring community and resources are available to assist students who are dealing with problems. The Counseling Center (717-871-7821) is an important resource for both mental health and substance abuse issues. Additional resources include: Health Services (871-5250), Center for Health Education & Promotion (871-4141), Campus Ministries, and Learning Services (717-871-5554).

Potential Seminar Topics:

1. Africa
- A. Spoken and gesture counting from different ethnic groups in Africa
- B. Egypt
  Numeration system and computations, Diophantine equations
- C. Angola
  Graph theory
- D. Kenya
  Numeration system and computations, geometry
- E. Mozambique
  Art and geometry in Inhambane, one dimensional and planar symmetry groups
- F. Islam
  Algebra, geometry and combinatorics
- G. How religion has influenced mathematics in Africa
- H. Enumeration tools from Africa
- I. Contributions from other countries in Africa

2. The Americas
- A. Native American
  Inuit, Ojibway, Chumash, and Nootka calendrical and numeration systems
- B. Belize, El Salvador, Guatemala, Mexico
  Aztecs, Mayan and Otomies numeration systems and operations, calendrics, and sacred geometry
- C. Argentina, Bolivia, Chile, Colombia, Ecuador, Peru
  Quechua numeration system, the Inca quipus, one dimensional and planar symmetry groups from the Incas and Mapuches
- D. How religion has influenced mathematics in America
- E. Enumeration tools from America
- F. Contributions from other countries in America

3. Asia
- A. India
  Vedic mathematics
- B. South India and Pakistan
  Graph theory
- C. Israel
  Jewish calendric functions, modular arithmetic
- D. Japan
  Mathematics in origami, conformal symmetries, multidimensional transformations
- E. China
  Chinese numerals, counting methods, Chinese version of Pascal's triangle, binary numbers and coding, magic squares, dihedral group
- F. Maldives
  Measuring, counting
- G. How religion has influenced mathematics in Asia
- H. Enumeration tools from Asia
- I. Contributions from other countries in Asia

4. Europe
- A. France
     Modular arithmetic in the social organization among the Basque of Sainte-Engrace
- B. Italy
     Leonardo of Pisa, Fibonacci, applications of Fibonacci sequences, geometry
     Leonardo Da Vinci, mathematics and art
- C. The Netherlands
     Mauritus Escher, tessellations, polyhedra, hyperbolic spaces and topology
- D. Greece
     Pythagoras, different proofs of Pythagoras' Theorem
- E. How religion has influenced mathematics in Europe
- F. Enumeration tools from Europe
- G. Contributions from other countries in Europe

5. Oceania
- A. Australia
     Northern Territory's Warlpiri tribe, logic, dihedral groups
- B. New Zealand
     Maori, one-dimensional and planar symmetry groups
- C. South Pacific Islands
     Republic of Tonga, partial and total orderings
- D. How religion has influenced mathematics in Oceania
- E. Enumeration tools from Oceania
- F. Contributions from other countries in Oceania

6. Additional Seminar Topics OR Final Project Topics
- A. Quilting: Hawaiian, European, African, African American
- B. Fourfold Symmetry in Native American Art
- C. Iterative Design Techniques in Weaving, Beadwork, and Art
- D. Architecture: African, Native American, Pacific Islander
- E. Kinship: Hawaiian, Warlpiri, African, Malekula
- F. Fivefold symmetry and Basket Weaving in Various Cultures
- G. Mathematical Recreations: African Games, Mu Torere of the Maori, I Ching, Native American Games
- H. Mathematics in Western and Non-Western Music
- I. Space and Time: Navigation, Calendars, Spatial Models
- J. Strip Patterns: Maori, Inca, Other
- K. Geometric Patterns in Islamic art/Tiling and Mosaics in Several Cultures
- L. Number Systems (Hawaiian, African, Native American) and Counting Devices (Quipu, Philippine Sungka, Abacus)
- M. Songs from various countries: music has shape which can be represented mathematically, as can also its pattern and rhythm (KwaZulu, USA, Germany, Etc.)
- N. Mathematical elements in Japanese origami
- O. Scandinavian Yule baskets
- P. Mandalas of the East

Class Structure:

January 22nd: Introduction

January 29th: Prominent Individuals in Ethnomathematics and Journal Presentations

February 5th: Prominent Individuals in Ethnomathematics and Journal Presentations

February 12th: Prominent Individuals in Ethnomathematics and Journal Presentations

February 19th:

February 26th:

March 5th: Guest Lecturer

March 12th: NO CLASS—Spring Break

March 19th: Seminar Day

March 26th: Seminar Day

April 2nd: Seminar Day

April 9th: Seminar Day

April 16th: Edit Journal Manuscripts

April 23rd: Edit Revised Journal Manuscripts

April 30th: LAST DAY OF CLASS
 • Presentations sharing the mathematics of your culture

May 7th: FINAL EXAM—no class
 • Final version of manuscript due (in Assignments on D2L by 11:59 PM)
 • Final Project Paper due (in Assignments on D2L by 11:59 PM)