

STATISTICAL LITERACY APPROVED FOR GENERAL EDUCATION AT THE UNIVERSITY OF NEW MEXICO

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Abstract: Statistical Literacy (Math 1300) has been approved as satisfying a mathematics requirement in the University of New Mexico core curriculum and in the New Mexico Higher Education General Education curriculum.

Statistical Literacy is a new course offered by the Department of Mathematics and Statistics at the University of New Mexico (UNM Albuquerque) in fall 2021. Statistical literacy is critical thinking about statistics as evidence in arguments. This offering is arguably the first time a confounder-based statistical literacy course has been offered at a public university. Math 1300 is designed for consumers of statistics: students in non-quantitative majors (majors that do not require a mathematics course). Statistical literacy studies how statistics are constructed and manipulated.

This paper reviews the steps involved in getting academic approval for Statistical Literacy to satisfy a mathematics requirement in the New Mexico general education curriculum. These steps include the Registrar's New Course request form, the syllabus, the Student Learning Outcomes, assessing Student Learning Outcomes and the relationship between the course goals and the Student Learning Outcomes. This course is approved for the branch campuses in New Mexico.

Key Words: UNM Core Curriculum, New Mexico Higher Education General Education, Numeracy, Quantitative Literacy

1. Offering an Alternative to Introductory Statistics

Many – if not most – UNM majors are required to take one course in mathematics and statistics. The UNM Department of Mathematics and Statistics has historically supported 11 courses that satisfy a mathematics requirement in the New Mexico General Education Curriculum. See Appendix A.

Other departments have offered newer courses that are more interdisciplinary and that offer a more modern approach to age-old topics. See Appendix B.

1.1 Updating the Teaching of Statistics at UNM

There was some concern that the Introductory Statistics course (Math 1350) was not meeting the needs of the diverse students at UNM. This classic course focused more on the needs of those who might become producers of statistics. It wasn't designed to focus on the needs of those who would probably not become the producers of statistics, but would certainly be consumers of statistics.

Dr. Erik Erhardt investigated recent developments in introductory statistics. He attended the US Conferences on Teaching Statistics in 2015, 2017 and 2019. He was familiar with

the 2016 GAISE update that encouraged changes in the introductory statistics course. Those changes included a greater focus on multivariate data and on confounding.

Erhardt (2017) summarized the goals and key points of a statistical literacy course.

Dr. Erhardt met with the Dean of the College of Arts and Sciences, (Dr. Peceny) and secured a promise of funding a new position for three years. With that in place, a statistics hiring committee was formed with Dr. Erik Erhardt as the chair. Members included Dr. Fletcher Christensen, Dr. Li Li, Dr. Lan Lu, and Dr. Guoyi Zhang.

The initial goal of the hiring committee was to hire a full time lecturer who would lead the department in developing and coordinating two new statistics courses: "Statistical Literacy" (for students in non-quantitative majors) and "Statistics for Research" (for students in the quantitative majors).

Dr. Erhardt discussed the hiring of this person with many leaders in statistics education, including Jessica Utts, past president of the American Statistical Association and a world leader in Statistical Literacy.

A hiring document was created. See Appendix C. Some 25 applications were received. The committee interviewed three.

In his interview on June 19, 2019, Dr. Milo Schield presented "Teaching Confounder-Based Statistical Literacy". Here is Schield's closing slide:

"By featuring confounding in introductory statistics we can change our destiny. Statistical literacy can help untangle the confusion in many political debates. Distinguishing between a crude association and a standardized association would be a big step forward. We are at a fork in the road. Which one will statistical educators take? Their choice will influence what most college graduates will study in decades to come."

Schild's slides are available at www.statlit.org/pdf/2019-Schild-UNM-Slides.pdf

In fall 2019, Dr. Schield was hired to create and coordinate the teaching of statistical literacy. He was hired as a consultant since he was full time at another university.

2. Academic Approval for Statistical Literacy at UNM

In the 2019-2020 academic year, Schield led the effort to get Math 1300 approved by the Department, by the University and by the New Mexico Higher Education Department.

This involved a lot of paperwork, dealing with committees and meeting deadlines. It was more complex than usual because the system for approving new courses was undergoing a major change. Some of the new steps were not clearly identified.

The paperwork submitted on behalf of this new course is in the following appendices:

Appendix 1A: Add New Course Request: Form B

Appendix 1B: Catalog Description

Appendix 1C: Generic Syllabus

Appendix 2A: Add Course to NM Common Course Numbering System

Appendix 2B: Student Learning Outcomes

- Appendix 3A: Adding Courses to the NM General Education Curriculum
- Appendix 3B: Assessment of Student Learning Outcomes
- Appendix 3C: Course Goals and NM HED Student Learning Outcomes
- Appendix 3D: Sample Assessment Items
- Appendix 4A: Form C Degree or Program Change
- Appendix 4B: Budgetary and Faculty Load Implications and Long range Planning

Arguably the most important of these are the Student Learning Outcomes (2B) and the Course Goals and the New Mexico Higher Education Student Learning Outcomes (3C). These outcomes drove the assessment (3B and 3D) which in turn informed the Catalog Description (1B) and the Generic Syllabus (1C).

2.1 Student Learning Outcomes

Here are the student learning outcomes for Statistical Literacy. Appendix 2B.

1. Can distinguish association from causation in reality and in using ordinary English. Can use ordinary English to form arithmetic descriptions and comparisons of statistics.
2. Can identify and evaluate known influences (confounding, assembly, randomness and error) on a statistic. Can think hypothetically about influences that are unknown or unmeasured.
3. Can identify, evaluate and use various techniques to take control of – or control for – these influences. These techniques include the physical control of randomness to determine statistical significance and the mental control for the influence of measured confounders on a statistic, a statistical association and statistical significance.
4. Can use ordinary English to describe and compare ratios as presented in statements, tables and graphs using percent, percentage, rate and chance grammars.
5. Can evaluate the strength of evidence provided by statistics in the everyday media, in press releases and in journal articles.

2.2 The Catalog Description

Key differences between this statistical literacy course and the traditional introductory statistics course are the focus on social statistics and observational studies, the emphasis on confounding and assembly, and the use of ordinary English. See the Student Learning Outcomes and the catalog description in Figure 1. See also Appendix 1B.



Statistical Literacy



MATH 1300 (3)

Participants will study the social statistics encountered by consumers. Investigate the story behind the statistics. Study the influences on social statistics. Study the techniques used to control these influences. Strong focus on confounding.

Meets New Mexico General Education Curriculum Area 2: Mathematics and Statistics.

Figure 1: UNM Catalog Entry for Math 1300

2.3 Time Involved in Getting Math 1300 approved

Getting a new course approved for the catalog takes time. The bigger the institution, the more steps involved and thus the more time it takes. Finally, getting a new course approved to satisfy a general education requirement may take much more time.

Getting Math 1300 (Statistical Literacy) approved at UNM took almost 18 months. It took another four months before the course appeared in the current catalog. During the 10 month 2019-2020 academic year, time spent directly on task totalled 156 hours (not including the 68 hours of flying time).

2.4 Items not Reviewed

The UNM statistical hiring committee did not review Schield's textbook or the associated materials such as the exercises, tests and the Odyssey forum. The evaluation by the teaching faculty, the students taking Math 1300 and their grades will provide the basis for an assessment once the first semester was finished.

For background on the structure of the course, see Schield (2010).

3. Summary

Inaugurating a confounder-based statistical literacy course is a major undertaking. It takes strong leadership and solid support from the department and administration. It takes a concerted effort spanning eight to 16 months to implement this new course into the general education curriculum at a large university.

The first question is whether the content of this new course is appropriate to meet student needs in the 21st century. With less than a 30% overlap with the traditional course, the appropriateness is a big issue. Even if the content is appropriate, questions remain about how readily faculty can be trained to teach this new material. And even if faculty can be readily trained, the final question is whether students see value in studying a confounder-based statistical literacy course taught by these newly trained teachers.

All of these will be analyzed and evaluated as this course is taught at the University of New Mexico: a world-wide pioneer in teaching confounder-based statistical literacy.

The big question is whether the statistical education as a discipline will take on confounder-based statistical literacy as a central part of their mission. Statistical education has been reluctant to make any major change in the content of the introductory statistics course since the first statistics textbooks were formulated in the 1950s. See Schield (2013).

4. Conclusion

Getting a confounder-based statistical literacy course approved as satisfying a mathematics requirement in the New Mexico general education curriculum is a major step forward. This course involves almost no algebra. Supporting this course as a college math course is a major change. It is only possible if the faculty recognize that this course involve "sophisticated reasoning with elementary mathematics rather than elementary reasoning with sophisticated mathematics."

Acknowledgements

Dr. Erik Erhardt – UNM Teaching fellow (2016), Academic Affairs core curriculum faculty fellow (2018), and academic affairs general education faculty fellow for undergraduate research (2019) – led the effort to offer statistical literacy and the statistics hiring team: Dr. Fletcher Christensen, Dr. Li Li, Dr. Lan Lu, and Dr. Guoyi Zhang.

Dr. Mark Peceny, Dean of the UNM College of Arts and Sciences, provided academic guidance and a promise of three years of critical financial support totalling \$150,000.

Dr. Diane Marshall, Associate Dean of Arts and Sciences, provided valuable advice on navigating the process for new course approval. Dr. Pamela Cheek, Associate Provost for Student Success and EVP for Academic Affairs, provided assistance in getting approvals from the NMCAC committee. Dr. Christina Pereyra, Chair of the Mathematics and Statistics Department, provided staffing and scheduling support. Dr. Shaun Berman, Interim Dean of the Anderson School of Business, gave approval for all undergraduate business majors to take either Math 1300 or 1350 to satisfy their statistics requirement.

Michael Raine, Associate Registrar, provided insight into the complex and recently updated process of getting approvals. Stephanie Hands, Director of Advising for Arts and Sciences, led the effort to enroll 132 students in this new course in fall 2021. Dr. Robert Giebitz commented on an earlier version of this paper.

References

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Appendices

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- Appendix B: Social Science Courses that satisfy General Education
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Appendix A. Course Descriptions for Selected Math-Stat Courses

The UNM Department of Mathematics and Statistics has historically supported 11 courses that satisfy a mathematics requirement in the New Mexico General Education curriculum. All 11 courses are certified as adequately covering three of the General Education Essential Skills: Communication, Quantitative Reasoning and Critical Thinking. See <https://gened.unm.edu/areas-of-study/math-and-stats.html>

These 11 courses include eight traditional courses:

- MATH 1220 College Algebra
- MATH 1240 Pre-Calculus
- MATH 1250 Trigonometry & Pre-Calculus
- MATH 1350 Introduction to Statistics
- MATH 1430 and 1440 Applications of Calculus I and II
- MATH 1512 and 1522 Calculus 1 and 2

These 11 include three other courses:

- HNRS 2221 Mathematics in the World
- MATH 1130 Survey of Mathematics
- MATH 2118 Mathematics for Elementary and Middle School Teachers III

Here are the course descriptions for four of these 11 courses:

- Math 1130 Survey of Mathematics: An introduction to some of the great ideas of mathematics, including logic, systems of numbers, sequences and series, geometry and probability. Emphasizes general problem-solving skills.
- HNRS 2221 Mathematics in the World: This course is an opportunity for Honors students at UNM to gain an interdisciplinary and rigorous introduction to mathematical reasoning by learning from and how mathematicians do and have done mathematics and how that relates to the rest of human activity and thought. Students will do mathematics in this course, and also are expected to produce work that reflects an understanding of the context in which that mathematical work takes place. Themed sections connect foundational ideas of mathematics, such as logic, systems of numbers, sequences and series, geometry, and probability to other aspects of human thought. Each will focus on particular content areas by specifying both the nature of problem solving and additional context-relevant work that students will produce.
- MATH 2118 Mathematics for Elementary and Middle School Teachers III: Algebra from the viewpoint of the elementary curriculum with emphasis on proportional and linear relationships. Also included: data analysis and other topics with connections to the elementary curriculum. Problem solving is emphasized throughout.
- MATH 1350 Introduction to Statistics. Techniques for the visual presentation of numerical data, descriptive statistics, introduction to probability and basic probability models used in statistics, introduction to sampling and statistical inference, illustrated by examples from a variety of fields.

Appendix B: Courses in the Social and Behavioural Sciences that satisfy the General Education Essential Skills

Twenty-eight courses satisfy these three essential skills: Communication, Personal & Social Responsibility, and Critical Thinking.

<https://gened.unm.edu/areas-of-study/social-and-behavioral-sciences.html>

These 28 courses are divided into two groups: modern and classic with 14 in each.

MODERN (14 courses):

- AFST 1120 Race in the Digital Age
- AMST 1110 Introduction to Environmental & Social Justice
- AMST 1140 Introduction to Race, Class, & Ethnicity
- ANTH 1140 Introduction to Cultural Anthropology
- ANTH 1155 Introduction to Linguistic Anthropology
- ARCH 1210 Introduction to Environmental Planning
- CCST 1110 Intro to Comparative & Global Ethnic Studies
- FDMA 1520 Introduction to Film & Digital Media
- GEOG 1165 People and Place
- HNRS 2364 The Individual & the Collective
- ME 217 Energy, Environment, & Society
- PH 101 Introduction to Population Health
- PH 102 Global Health Challenges and Responses
- SOCI 2315 The Dynamics of Prejudice

Classic (14 courses):

- ANTH 1115 Introduction to Anthropology
- ANTH 2175 World Archaeology
- ECON 2110 Macroeconomic Principles
- ECON 2120 Microeconomic Principles
- ENG 200 Technology in Society
- FCST 2130 Marriage and Family Relationships
- GEOG 217 Energy, Environment, & Society
- LING 2110 Introduction to the Study of Language and Linguistics
- POLS 1120 American National Government
- POLS 1140 The Political World
- POLS 2110 Comparative Politics
- POLS 2120 International Relations
- PSYC 1110 Introduction to Psychology
- SOCI 1110 Introduction to Sociology

Appendix C: UNM Department of Mathematics and Statistics: Hiring Form

Full-time lecturer position in statistics!

The Department of Mathematics and Statistics at the University of New Mexico is hiring a full-time lecturer beginning August 2019.

Duties include developing and coordinating two new statistics courses, "Statistical Literacy" and "Statistics for Research", and developing a formal training for statistics teaching assistants. Preference given to candidates with experience implementing and evaluating evidence-based and innovative pedagogy.

Read the job description; apply online at unmjobs.unm.edu under Search, Faculty, "8225"

Open Rank Lecturer

Posting Number:	req8225
Employment Type	Faculty
Faculty Type	Open Rank
Hiring Department	Mathematics Statistics (869A)
Academic Location	College of Arts & Sciences
Campus	Main - Albuquerque, NM

The Department of Mathematics and Statistics at the University of New Mexico has a full-time lecturer position available beginning August 19, 2019. Applicants must have an MS or PhD in Statistics, Biostatistics, or a closely related field by the start date of appointment and provide evidence of teaching excellence. Duties include developing and coordinating two new statistics courses, "Statistical Literacy" and "Statistics for Research", developing a formal training for statistics teaching assistants, and teaching associated general lower division statistics courses in the fall and Spring semesters.

This is a new full-time lecturer position designed for individuals who wish to focus their careers on the development and implementation of innovative teaching strategies, professional activities, and service to the University and public. Preference will be given to candidates who demonstrate outstanding teaching in a variety of statistics courses at the post-secondary, lower-division level; who have experience implementing and evaluating evidence-based and innovative pedagogy to undergraduates at all levels; who have ongoing participation in national and international statistical education conferences such as ICOTS, USCOTS, and eCOTS; who have a demonstrated or potential publication record in recognized premier journals in the area of statistical education; who have potential for service to the Statistics Program and Department; and demonstrated commitment to diversity, equity, inclusion, and student success, as well as, working with broadly diverse communities. Professional development support in learner-centered teaching, such as hybrid/flipped classrooms and using clickers, is available through the University's Center for Teaching and Learning.

In developing a second course, "Statistical Literacy", the role will involve developing and implementing a statistics course for the majority of UNM students, specifically, those fulfilling their one math requirement who need basic everyday skills to evaluate information; The May 2017 issue of The Statistics Education Research Journal was dedicated to Statistical Literacy.

Source: <https://math.unm.edu/news-events/news/full-time-lecturer-position-statistics>

Appendix D: Math 1300 (Statistical Literacy) Pre-Requisites

There are two courses that advising considers as being relevant to Math 1300. They are Math 1350 (Introduction to Statistics) and Math 1130 (Survey of Mathematics). Catalog descriptions and pre-requisites are at <https://math.unm.edu/courses/current-term/math>

Per the 2021 catalog, Math 1350 (Introduction to Statistics) had these prerequisites: (118 and 119) or 1215 or (1215X and 1215Y) or 1220 or 1230 or 1240 or 1430 or 1440 or 1512 or 1522 or 2530 or ACT Math \Rightarrow 22 or SAT Math Section \Rightarrow 540 or ACCUPLACER Next-Generation Quantitative Reasoning, Algebra, and Statistics \Rightarrow 253 or ACCUPLACER Next-Generation Advanced Algebra & Functions \Rightarrow 218.

Per the 2021 catalog, Math 1130 (Survey of Mathematics) has the same pre-requisites as Math 1350 with two additional options: Math 1350 (Introduction to Statistics) or Math 2531 (Calculus III). The lowest level mathematics of these many doorways for both Math 1350 and Math 1130 is arguably "1215X and 1215Y".

Math 1215X (Intermediate Algebra IA) has this catalog description¹:

A study of linear and quadratic functions, and an introduction to polynomial, absolute value, rational, radical, exponential, and logarithmic functions. A development of strategies for solving single-variable equations and contextual problems.

Prerequisite: (MATH 021 and MATH 022) or MATH 100 or FYEX 1010 or ISM 100 or ACT Math \Rightarrow 17 or SAT Math Section \Rightarrow 460 or ACCUPLACER Next-Generation Advanced Algebra and Functions =218-238. Corequisite: 1215Y.

Math 1215Y (the second semester of Algebra 1) has the same catalog description as Math 1215X but with Math 1215X as the prerequisite.

Suppose a mathematics department offers a course which does not use any mathematics beyond the first semester of Algebra 1 – such as Math 1130. Should those students be required to complete the second semester as a pre-requisite? Going even further, suppose that a mathematics department offers a course that does not use any mathematics beyond arithmetic and the square root – such as Math 1300. Should those students be required to complete the first semester of Algebra 1 as a pre-requisite?

Many – if not most – of the UNM courses that satisfy a general education requirement in the social and behavioral sciences (such as Micro and Macro Econ) have no prerequisite. Physics and Chemistry often offer versions of their introductory course that don't require any mathematics. This is not generally the case for courses offered by Mathematics departments. Deciding how much mathematics to require – even if not needed in a particular mathematics course – is an ongoing issue for Departments of Mathematics at four-year colleges and universities. One issue is whether lowering the pre-requisites will increase the failure rate (C minus or lower). An underlying issue may be accreditation.

As Dr. Lynn Steen (2004), past-president of the MAA, noted, "The essence of QL is the ability to use mathematical and logical thinking in context." Quantitative Literacy (QL) skills involve "sophisticated reasoning with elementary mathematics rather than elementary reasoning with sophisticated mathematics."

¹ <https://catalog.unm.edu/catalogs/2021-2022/courses/MATH/1215X.html>

APPENDIX 1a: Add New Course Request (Page 2 of 4)

C. C1. Co-requisites to this course: a. _____ b. _____ c. _____

*If this course is a new co-requisite to those listed, you must submit a Form A for each course that is affected.
 Note: Please see the instructions for information on one-way vs. two-way co-requisites.*

C1a. If the co-requisite course exists in another department, the co-requisite offering department must approve it as well.

Department	a.	b.	c.
Course			
Chair Name			
Chair Signature			

C2. Crosslisted courses: Complete the table, including signatures from all departments offering the crosslisted courses.

Department	a.	b.	c.	d.	e.	f.
Subject Code & Number						
Chair Name						
Chair Signature						

C3. Course Fees: Yes No If yes, attach a completed, signed *Special Course Fees Approval Form* from the office of the Associate Provost for Academic Affairs.

C4. Is this course *elective* or *required* for a degree program? If *required*, **submit a Form C** as well.

C5. Branches Only: Is this course: Occupational Technical Academic (*Please check one*)

D. D1. Restrictions. List any restrictions placed on students for registration in any section of this course. If none, write "None" in the box.

None

D2. Pre-requisites for Course: If the course has pre-requisites, list all of them, including course subject code and course number or test name and test score for each one. Be sure to include the appropriate conjunction (and / or) between each item and between any sets of pre-requisites. If any of the pre-requisites come from another department, have the department chair sign to acknowledge awareness of those relationships. If none, write "None" in the box.

(MATH 101 and MATH 102) or (MATH 118 and MATH 119) or MATH 120 or MATH 121 or MATH 123 or MATH 150 or MATH 162 or MATH 163 or MATH 180 or MATH 181 or MATH 264 or ACT Math =>22 or SAT Math Section =>540 or ACCUPLACER Elementary Algebra =66-103 or ACCUPLACER College-Level Math =37-68. (Summer, Fall, Spring)

For courses outside the offering department to be used as pre-requisites:

 Department Chair Signature Department Chair Signature Department Chair Signature

E. E1. Does this course duplicate any content in the current UNM Catalog? Yes No

If yes, complete the following table:

Department Name	Duplicate Course	Department Chair	Chair Signature	Check One:
				AGREE TO DUPLICATE
				DISAGREE TO DUPLICATE
				AGREE TO DUPLICATE
				DISAGREE TO DUPLICATE
				AGREE TO DUPLICATE
				DISAGREE TO DUPLICATE

E2. Has this course been offered as a topic course? Yes No

If yes, in which term(s), and to what average enrollment? _____

APPENDIX 1a: Add New Course Request (Page 3 of 4)

E3. Will this course replace a deleted course? Yes No If yes, which one? _____

If yes, and the deleted course is 100 or 200 level, has this change been discussed with all the branch campuses that offer this course? Yes No

Provide a statement below or attach a memo explaining how this replacement will impact Branch campuses and programs.

N/A

F. F1. Justification for Graduate Credit: If the course is numbered outside of 500-699, indicate the nature of additional work to be required of graduate students.

N/A

F2. Justification for CR/NC or Alternative Grading Scale (include scale in justification):

N/A

G. G1. Budgetary and Faculty Load Implications. All new courses have such implications, even when replacing a deleted course.

a. Justification for offering the course:

Students in non-STEM majors need a statistics course that studies everyday statistics as evidence in arguments. This course complements the existing Introductory Statistics course: MATH 1350.

b. Impact on long-range planning for unit, school / college, and university:

If other departments decide to require Statistical Literacy, this could lead to an increase in the number of sections that need to be offered after the first two years.

c. Budget and faculty load data:

Since it involves converting sections of MATH 1350 to Statistical Literacy (along with their instructors), there is no expectation of a change in total sections, faculty load or Math-Stat budget for the first two years.

G2. Relevant Library Impact Statement: Complete below or attach a signed memo.

No direct library impact. Students may access more journal articles online.

Name of Library

Name and Signature of Librarian

APPENDIX 1a: Add New Course Request (Page 4 of 4)

H. Required Signatures:

Office	Signature	Date
1. Department Chair		
2. College or School Curricula Committee		
3. College or School Faculty (if necessary)		
4. College or School Dean / Dean of Instruction		
5. Office of Registrar—Catalog		
6. Director of Relevant Library		
7. FS Graduate Committee (graduate courses)		
8. FS Undergraduate Committee (undergraduate courses)		
9. FS Curricula Committee		
10. Associate Provost for Academic Affairs		

After securing departmental approval, send this form and all attachments, **collated into 4 sets of documents**, to the Registrar's Catalog Office, which retains the original and returns copies to the department and college office.



For Registrar's Office Use ONLY (After approval by Faculty Senate Curricula Committee):

Entered in Banner _____ Entered in Catalog _____ Copies Mailed _____

Attributes: 1. _____ 2. _____ 3. _____ 4. _____

Grade Modes _____

Appendix 1B: Catalog Description

Add New Course: Catalog Copy
STATISTICAL LITERACY

Department: Mathematics – Statistics

Prefix: STAT

Number: To be assigned (134 proposed)

Name: Statistical Literacy

Description: (35 word maximum)

Participants will study social statistics encountered by consumers. Investigate the story behind the story. Study influences on statistics and techniques to mitigate these influences. Strong focus on confounding.

Pre-requisites:

Prerequisite: (MATH 101 and MATH 102) or (MATH 118 and MATH 119) or MATH 120 or MATH 121 or MATH 123 or MATH 150 or MATH 162 or MATH 163 or MATH 180 or MATH 181 or MATH 264 or ACT Math ≥ 22 or SAT Math Section ≥ 540 or ACCUPLACER Elementary Algebra =66-103 or ACCUPLACER College-Level Math =37-68. {Summer, Fall, Spring}

Appendix 1C: Generic Syllabus (Page 1 of 2)

Fall 2020

**STAT 134: Statistical Literacy
Generic Syllabus**

UNM

Title	STAT 134 Statistical Literacy (3 credits)		
Description	Participants will study the social statistics encountered by consumers. Investigate the story behind the story. Study the influences on social statistics. Study the techniques used to control these influences. Strong focus on confounding.		
Goals	To help students think critically about statistics as evidence in arguments: to see the story behind the story. To help students see value in becoming statistically literate.		
Objectives (Student Learning Outcomes)	Can use ordinary English to distinguish association from causation and to form arithmetic associations of numbers and ratios. Can identify and evaluate influences (confounding, assembly, randomness and error/bias) on a statistic. Can identify, evaluate and use various techniques to take control of – or control for – these influences. Can use ordinary English to describe and compare statistics as presented in statements, tables and graphs. Can evaluate the strength of evidence provided by statistics in the everyday media, press releases and journal articles.		
Required	Text: <i>Statistical Literacy</i> by Schield Registration in the online forum.		
Grading Scale	[98≤A+≤100], [93≤A<98], [90≤A<-93], [87≤B+<90], [83≤B<87], [80≤B<-83], [75≤C+<80], [70≤C<75], [50≤D<70], [F<50], and F if you do not show up to take the final exam.		
Grading Components Requirements	Chapter Exercises (7@3%)	21%	Exams (two) 18%
	Forum writing (10-16 cases)	20%	Final Exam 30%
	Project and Attendance	9%	Course Evaluations 2%
Online Components	Course instruction is web-enhanced: This course has two online sources. Chapter exercises and quizzes are in the UNM course management system. Writing is done in an online forum.		

Schedule of Activities*Subject to change: Minor changes announced in class, major ones provided in writing.*

Week of	Material Covered	Notes / UNM Deadlines
Aug 17	Introduction, Forum/Discussion Board Ch 1 Statistics in Arguments. Take CARE	Aug 17 – Instruction Begins
Aug 24	Ch 2 Forming comparisons. Devices for controlling influences.	Aug 28: Last day to add courses or change sections or grade mode
Aug 31	Evaluate statistics as evidence in media. Review homework	Sep 3 – Labor Day Holiday Sep 7 – Last day to drop without a grade
Sep 7	Ch 3: Understanding Measurements. Confounder influence on averages.	
Sep 14	Ch 4A: Percent/percentage grammar	
Sep 21	Ch 4B: Half tables; rate/chance grammar	
Sep 28	Study statistics in media. Review homework	
Oct 5	Review Ch 1-4A. Exam 1: Ch. 1-4A	
Oct 12	Ch 5. Compare ratios. Use Likely grammar	Oct 11-12 – Fall Break
Oct 19	Ch 6 Interpreting Ratios. Medical Tests, Simpson's Paradox; Cornfield Conditions	
Oct 26	Review homework, news studies & Exam 1	
Nov 2	Review Ch 4-6. Exam 2: Ch 4-6.	
Nov 9	Ch 7 Samples, significance & confounding	
Nov 16	Assign projects. Review homework/Exam 2. Evaluate statistics as evidence in media.	11/9 – Last day to withdraw without dean's approval
Nov 23	Study statistics in media. Projects/Present	Nov 19-20 – Thanksgiving Break
Nov 30	Project Presentations and Course Review	Dec 4: Last day withdraw w dean approval
Dec 7	Final Exam Ch 1-7	Dec 7 – Final Exam, Time, room TBD

Forum Challenges: One or two challenges per week.

Chapter Exercises (On Line). Class Project: Determined by Instructor

Appendix 1C: Generic Syllabus (Page 2 of 2)

Instructor	Name, E-mail, phone
Office	Location, Hours
Meeting	Semester: Room, Days/Time
Web Site	Click on STAT 134 under Course Materials in the Courses tab at www.math.unm.edu .
Calculator	A scientific calculator may be used on all homework and exams. A calculator with statistical functions (mean, standard deviation, statistical tests, etc.) is recommended but not required. Use of cell phone calculators or calculators on other WIFI-capable devices is not allowed on exams.
Extra Credit	There will be no provision for extra credit. ALL EXAMS – FINAL INCLUDED - MUST BE TAKEN. Exams will not be curved or re-worked for extra points.
Homework	The chapter exercises and the Forum are homework.
Missed Exams	If you know you are going to miss an exam, you must make prior arrangements with your instructor to take a make-up exam. If you miss an exam due to an emergency, to take a make-up exam you must provide documentation of the emergency (doctor's note, police report, etc.), and email instructor notification of the missed exam within 24 hours of the missed exam.
Attendance	Attendance is mandatory. Tardiness or an early departure may be regarded as an absence. To be excused, the instructor must be notified of an absence before the class starts. If a student has more than six hours of unexcused absences the instructor may drop the student unless it is after the last day to withdraw without dean approval. It is the student's responsibility to drop the course if he/she chooses not to complete the course.
Student Behavior	Per the Code of Conduct as stated in the Policies and Regulations for UNM, student activities that interfere with the rights of others to pursue their education or to conduct their University duties and responsibilities will lead to disciplinary action. This includes any activities that are disruptive to the class and any acts of academic dishonesty. You are expected to behave in a courteous and respectful manner toward the instructor and your fellow students. You may be dropped for inappropriate behavior. The use of cell phones, headphones, smart watches, etc. is not permitted during class or exams.
Title IX	Our university should always be spaces of mutual respect, kindness, and support, without fear of discrimination, harassment or violence. Any disclosure of gender discrimination (including sexual harassment, sexual misconduct, and sexual violence) made to your instructor must be reported to the university's Title IX coordinator (oeo.unm.edu). For more information on the policy regarding sexual misconduct, see policy.unm.edu/university-policies/2000/2740.html .
Cheating	Cheating of any kind will not be tolerated. Examples are: looking at a neighbor's exam; plagiarizing; modifying an exam after it is graded, etc. The instructor may warn an offending student, the score of the exam may be reduced, the score may be set to zero, the student may get dropped from the class, the student may get a grade of F for the class, and in most cases the incident will be reported to the Dean of Students.
Deadlines	The Department of Mathematics and Statistics will adhere to all of the registration deadlines and final exam schedule published by the Office of the Registrar in the schedule of classes. We will not give permission to override any deadline except in documented emergencies; failing a class is not considered an emergency. No early final exams will be permitted except in documented emergencies: <u>flight reservations, weddings, non-NCAA events are not considered emergencies.</u>
Accessibility	The Accessibility Resources Center (Mesa Vista Hall 2021, 277-3506) provides academic support to students who have disabilities. If you think you need alternative accessible formats for undertaking and completing coursework, you should contact this service right away to assure your needs are met in a timely manner.
Grade mode and Withdrawals	You must select your grade mode (letter grade, CR/NC, or Audit) by the "Last day to Change Grading Options" indicated on the course schedule; we will not give permission to change the grade mode after this deadline. Students who withdraw after this date but before the "Last day to drop a course without approval of college dean" will receive a grade of W. Otherwise, If you are in the regular grade mode, and you do not withdraw, you will receive the letter grade you earn (not a W). If you are in the CR/NC grade mode and you do not withdraw, you will receive the CR/NC grade you earn (not a W).
Grading	To get full credit on graded writing, students must give answers that include all relevant information. Proper grammar is essential. Notation and legibility will be taken into account when assigning points.

Appendix 2A: Add Course to NM Common Course Numbering System (Page 1 of 2)

This document was submitted to the New Mexico Curriculum and Articulation Committee (NMCAC) within in the New Mexico Higher Education Department (NMHED).

Add a Course to the New Mexico Common Course Numbering System

Instructions

To add a course to the New Mexico Common Course Numbering System (NMCCNS):

1. Review the New Mexico Common Course Outlines for the discipline of interest.
2. If a comparable course with the same student learning outcomes is found and you plan to adopt the student learning outcomes of the common course, list the New Mexico Common Course Name.
3. If a comparable course is not found, mark that the course is unique. Unique courses will be assigned a unique number consistent with the NMCCNS.
4. Documentation is coordinated by the School Dean or designee and submitted to the Office of Academic Affairs.

Contact Information

Name and Title of Contact Person	Milo Schield, Research Professor
Email of Contact Person	SchildMilo@UNM.edu
Submitting Institution	UNM Albuquerque
Chief Academic Officer	James Holloway

Which type of course will be added?

- Common Course **Unique Course**

Current

Course Number: NOT APPLICABLE	Course Number
Course Name: NOT APPLICABLE	Course Name

Proposed

New Mexico Common Course Number	CCNS Number: STAT 134 [MATH 1340]
New Mexico Common Name	CCNS Name: STATISTICAL LITERACY

- Syllabus attached **OR** Agree to Adopt Common Description and Student Learning Outcomes

This course has been reviewed and approved by the institution's Academic Affairs to be added to the Common Course Numbering System.

Signature of Chief Academic Officer

Date

Appendix 2A: Add Course to NM Common Course Numbering System (Page 2 of 2)

Dr. Pamela Cheek was instrumental in presenting this new course to the NMCAC committee. Dr. Pamela Cheek is the UNM Albuquerque representative to this committee. She is Associate Provost for Student Success in the Office of the Provost. See https://hed.state.nm.us/resources-for-schools/public_schools/general-education/new-mexico-curriculum-and-articulation-committee

Add a Course to the New Mexico Common Course Numbering System

HED Internal Use Only
Presented to NMCAC _____
Approved or Denied _____
Reason for denial _____

Appendix 2B: Student Learning Outcomes

11/19/2018

Student Learning Outcomes
Statistical Literacy

V2

Here are five student learning outcomes.

They encompass most of what is covered in a confounder-based statistical literacy course.

They can be readily assessed.

1. Can distinguish association from causation in reality and in using ordinary English. Can use ordinary English to form arithmetic descriptions and comparisons of statistics.
2. Can identify and evaluate known influences (confounding, assembly, randomness and error) on a statistic. Can think hypothetically about influences that are unknown or unmeasured.
3. Can identify, evaluate and use various techniques to take control of – or control for – these influences. These techniques include the physical control of randomness to determine statistical significance and the mental control for the influence of measured confounders on a statistic, a statistical association and statistical significance.
4. Can use ordinary English to describe and compare ratios as presented in statements, tables and graphs using percent, percentage, rate and chance grammars.
5. Can evaluate the strength of evidence provided by statistics in the everyday media, in press releases and in journal articles.

Appendix 3A: Adding Courses to the NM General Education Curriculum (Page 1 of 5)

**Adding Courses to the New Mexico General Education Curriculum
Statistical Literacy (Draft)**

Contact Information

Name: Milo Schield
Phone:
Title: Adjunct Research Professor
E-mail: SchieldMilo@UNM.edu

Submitting Institution

Name HEI: University of New Mexico: Albuquerque
Submitting Department: Mathematics and Statistics

Chief Academic Officer

Name: James Halloway
E-mail: Provost@UNM.edu

Registrar

Name: Sheila Jurnak
E-mail: sjurnak@unm.edu

Is this course for the entire system (WNMU, NMSU & UNM)?

Answer: Yes

Institutional Course Information

Prefix: STAT
Number: 134 (Suggested)
Title: Statistical Literacy
Credits: 3 credits

Was this course previously part of the general education curriculum?

Answer: No

Will this course only count toward General Education for the AAS degree (at your institution)?

Answer: No

Co-requisite Course

Prefix: N/A
Number: N/A
Title: N/A

New Mexico Common Course Information

Prefix: MATH [Suggested]
Number: 1340 [Suggested]
Title: Statistical Literacy

A. Content Area and Essential Skills

To which content area should this course be added?
Mathematics

B. Learning Outcomes

List all common course student learning outcomes for the course.
Quantitative Reasoning, Communication and Critical Thinking

Appendix 3A: Adding Courses to the NM General Education Curriculum (Page 2 of 5)

**Adding Courses to the New Mexico General Education Curriculum
Statistical Literacy (Draft)**

C. Learning Outcomes¹

List all common course learning outcomes² for the course

1. Can use ordinary English to distinguish association from causation. Can use ordinary English to form arithmetic descriptions and comparisons of statistics.
2. Can identify and evaluate known influences (confounding, assembly, randomness and error) on a statistic. Can think hypothetically about influences that are unknown or unmeasured.
3. Can identify, evaluate and use various techniques to take control of – or control for – these influences. These techniques include the physical control of randomness to determine statistical significance and the mental control for the influence of measured confounders on a statistic, a statistical association and statistical significance.
4. Can use ordinary English to describe and compare ratios as presented in statements, tables and graphs using percent, percentage, rate and chance grammars.
5. Can evaluate the strength of evidence provided by statistics in the everyday media, in press releases and journal articles.

D. Narrative:

Explain what students are going to do to develop the critical skills (selected above) and how you will assess their learning?

¹ <https://math.unm.edu/undergraduate/program-learning-goals-and-outcomes>

² <https://calbaptist.edu/programs/bachelor-of-arts-applied-statistics/outcomes>

Appendix 3A: Adding Courses to the NM General Education Curriculum (Page 3 of 5)

Adding Courses to the New Mexico General Education Curriculum Statistical Literacy (Draft)

#1: Communication. Genre and Medium Awareness, Application and Versatility; Strategies for Understanding and Evaluating Messages; and Evaluation and Production of Arguments. In this box, provide a narrative that explains how the proposed course addresses the outcomes of the first essential skill. 250 – 400 words. (399 words)

Students learn how to read, interpret and evaluate the statistics used as evidence in arguments in the everyday media. They will see how quantitative messages are encoded in various media: in text, tables and graphs.

Social statistics are typically used as evidence in arguments to support a non-statistical point or an action. Since social statistics are socially constructed, they are usually shaped or selected for a particular audience and purpose.

The key strategy for understanding and evaluating these messages involves the ability to read and interpret descriptions and comparisons of counts, measures and ratios using ordinary English.

This literacy course studies the use of ordinary English to distinguish association from causation. They learn that most of these statements are ambiguous: they state an association but seem to imply causation.

Ordinary English is used to describe quantitative relationships qualitatively ("The more X, the more Y" or "As X increases, Y increases") or quantitatively ("As X increases by n_1 , Y increases by n_2 ").

Ordinary English is used to make qualitative comparisons (X is more than Y) and quantitative comparisons: a difference (X is # more than Y), a ratio (X is # times [as much as] Y), and a relative difference ("X is #% more than Y" or "X is # times more than Y"). Students learn when "X is # times less than Y" is meaningful. They learn that a 6% interest rate is not 2% more than 4%. It is 2 percentage points more (or 50% more).

Ordinary English is used to describe ratios using ordinary prepositions (3 *out of* 4 pizza slices were sausage) and using "per" (In 2017, New Mexico's unintentional death rate was 70 *per* 100,000 population.) It shows how percent, percentage, rate and chance are used as named-ratio grammars each of which has its unique syntax. E.g., "The percentage of women who are runners" is different than "the percentage of women among runners."

Ordinary English is used to compare ratios using "likely". "Men are more likely to die accidentally than are women." Is the car stolen most often a Toyota Camry (most frequently) or a Cadillac Escalade (most likely to be stolen)?

ASSESSMENT: The literacy aspect of this course is assessed by multiple choice exercises, by writing one-line descriptions and comparisons of averages, rates and percentages, and by short essays analyzing and evaluating the statistics used in the everyday media, press releases, and journal articles.

Appendix 3A: Adding Courses to the NM General Education Curriculum (Page 4 of 5)

**Adding Courses to the New Mexico General Education Curriculum
Statistical Literacy (Draft)**

#2: Critical Thinking. *Problem Setting; Evidence Acquisition; Evidence Evaluation; and Reasoning/Conclusion*

In this box, provide a narrative that explains how the proposed course addresses the outcomes of the second essential skill. 250 – 400 words. (365 words)

Statistical literacy is critical thinking about statistics as evidence in arguments.

Typically these arguments involve inferences of an unobservable from observable. These include generalization (inferring population statistics from sample statistics), predictions (inferring future values from past or present data), specification (inferring relations between sub-groups based on relations between groups) and explanation (inferring causation from association). Statistical literacy studies the use of ordinary English to make these distinctions clearly or ambiguously.

Specifically, statistical literacy identifies and evaluates the sensitivity of statistics to various influences. These influences include 1) Confounding: the influence of related factors that were not analyzed, collected or known. 2) Assembly or Assumptions: how things are defined, counted, measured, collected, summarized and communicated in words, tables or graphs. 3) Randomness: how sample statistics are influenced randomly by sample size. How random assignment controls for all pre-existing confounders. 4) Error or bias: how sampled statistics can be influenced systematically by subject bias, researcher or measurement bias and sampling bias.

The greater the sensitivity of a statistic or a statistical association to any of these influences, the less support that statistic or statistical association provides to support the point of an argument.

Statistical literacy studies the Cornfield conditions: the necessary conditions for a related factor to nullify or reverse and observed association. This negates the claim that you can say anything you want with statistics.

Statistical literacy studies statistics as being socially constructed by people with motives and goals. In primary research, these motives and goals influence the questions being asked prior to collecting the data, the type of study involved, the choice of variables being counted or measured, the types of data in which the data is counted or measured, the ways in which count data is described and compared. See Communications skill.

In secondary research or arguments, these motives and goals influence the primary research that is selected and the ways in which this summary data can be combined, manipulated and presented to support a particular claim.

ASSESSMENT: The critical thinking aspect of this course is assessed in forums by student's writing short essays. In these essays they analyze and evaluate arguments that use statistics in the everyday media, press releases, and journal articles.

Appendix 3A: Adding Courses to the NM General Education Curriculum (Page 5 of 5)

**Adding Courses to the New Mexico General Education Curriculum
Statistical Literacy (Draft)**

#3: Quantitative Reasoning. *Communication/Representation of Quantitative Information; Analysis of Quantitative Arguments; and Application of Quantitative Models*

In this box, provide a narrative that explains how the proposed course addresses the outcomes of the third essential skill. 250 – 400 words. (321 words)

Statistical Literacy studies the quantitative aspects of comparisons and associations. Students learn how to calculate the arithmetic sensitivity of statistics to various influences. They learn how to calculate the uncertainty in generalizing from random sample to the associated population and from present to future.

Students learn how to describe and compare averages, rates and percentages as presented in text, tables and graphs. They learn how to calculate the number of deaths attributable to factors that are not observably related. E.g., the number of deaths attributable to obesity.

These influences are grouped into four categories: 1) Confounding: the influence of related factors that were not analyzed, collected or known. 2) Assembly: how things are defined, counted, measured, collected, summarized and communicated in words, tables or graphs. 3) Randomness: how sample statistics are influenced randomly by random selection or by random assignment. 4) Error or bias: how sampled statistics can be influenced systematically by subject bias, researcher or measurement bias and sampling bias.

The greater the sensitivity of a statistic or a statistical association to any of these influences, the less support that statistic or statistical association provides to support the point of an argument.

This course introduces a graphical technique to show how a binary confounder can influence a statistical association involving a binary predictor. This allows students to work multiple-regression problems without needing a computer. It helps students understand Simpson's paradox: the reversal of an association after taking into account a related factor.

This course uses non-overlapping confidence intervals as a sufficient condition for statistical significance. This course uses a graphical technique to show how a statistically-significant relationship can become statistically insignificant – and vice versa – after taking into account a confounder. Showing how controlling for a confounder can reverse statistical significance remedies what is arguably the biggest weakness in the traditional research-based introductory statistics course.

ASSESSMENT: The Quantitative Reasoning aspect of this course is assessed in each exercise, quiz and test

E. Supporting Documents

- Sample Assessment Attached (required)
- Rubric Attached (Optional)

F. Assessment (Must be on file with HED by August 1, 2019)

Link to Institution's General Education Assessment Plan [Click here to enter text.](#)

This course meets institutional standards for general education.

Signature of Chief Academic Officer

Date

Appendix 3B: Assessment of Student Learning Outcomes

Statistical Literacy
Assessment of Student Learning Outcomes

#	STUDENT LEARNING OUTCOMES	METHOD OF ASSESSMENT *
1	Can distinguish association and causation. Can use ordinary English to form arithmetic associations of numbers and ratios.	Multiple choice questions and one-line written statements
2	Can identify and evaluate various kinds of influence (confounding, assembly, randomness and error/bias) on a statistic.	Multiple choice questions and written statements some of which involve arithmetic calculations
3	Can identify, evaluate and use various techniques to take control of – or control for – these influences.	Multiple choice questions some of which involve arithmetic calculations
4	Can use ordinary English to describe and compare statistics as presented in statements, tables and graphs.	Multiple choice questions and one-line written statements
5	Can evaluate the strength of evidence provided by statistics in the everyday media, in press releases and journal articles.	Based on the quality of writing in the online forum in analyzing news stories

* May include in-class or video presentations depending on the instructor.

Appendix 3C: Course Goals and NM HED Student Learning Outcomes

UNM **Statistical Literacy** 12/4/2019
UNM Course Goals and NMHED Student Learning Outcomes (SLOs)

Course Goal #1: Communication

Addresses UNM Core Area 2/HED Area II: Statistics (Literacy Competency)

SLO 1: Use correct English to distinguish association from causation and to form arithmetic descriptions and comparisons.

SLO 4: Uses ordinary English to describe and compare ratios presented in statements, tables and graphs using percent, percentage, rate and chance grammars.

Course Goal #2: Social statistics

Addresses UNM Core Area 2/HED Area II: Statistics (Critical Thinking)

SLO 2: Can identify and evaluate known influences on a statistic.

Can think hypothetically about influences that are unknown or unmeasured.

SLO 3: Can identify, evaluate and use techniques to take control of – or control for – these influences.

Course Goal #3: Describe and compare statistics involving counts and measures

Addresses UNM Core Area 2/HED Area II: Statistics (Quantitative Reasoning)

SLO 1: Can form arithmetic descriptions and comparisons.

SLO 3: Can control for various influences using selection, ratios and standardization.

SLO 4: Can describe and compare ratios as presented in statements, tables and graphs.

SLO 4: Can adjust (standardize) ratios for a difference in mixtures by mix-matching.

Course goal #4: Quantitative Reasoning.

Addresses UNM Core Area 2/HED Area II: Statistics (Quantitative Reasoning)

SLO 3: Can infer statistical significance from non-overlapping 95% confidence intervals
Can compare statistical significance before and after standardization.

SLO 4: Can describe and compare ratios presented in statements, tables and graphs.

Course goal #5: Critical Thinking: Use techniques and distinctions from the preceding goals to assess the sensitivity of a given statistic to various influences.

Addresses UNM Core Area 2/HED Area II: Statistics (Critical Thinking)

SLO 5: Can evaluate the strength of evidence provided by statistics in the everyday media, in press releases and in journal articles.

Appendix 3D: Sample Assessment Items

UNM STATISTICAL LITERACY COURSE:

Sample Assessment Items

The course assessment is based on forum essays, chapter exercises, an instructor project and exams.

1. **Forum essays** (12%: 12 challenges): As a literacy course, this course involve writing. Instructors issue challenges; students write short responses. This course uses an online forum ([Odyssey](#))¹ that doesn't allow a student to see anyone else's answer until after they have submitted their own (no free riders), that never shows a student's name or ID (anonymous) and that requires students to grade each other (immediate feedback from multiple sources). Here is an example:

Challenge #1: How much Math do we really need?
 In a Washington Post essay, G. B. Ramanathan (a math teacher) argued that we don't need much math. Challenge: Pick just one side as your conclusion. (1) State "AGREE" or "DISAGREE" as the first word in your post. AGREE says "Math is NOT needed"; DISAGREE says "Math is needed."
 (2) Define exactly what YOU mean by "Math". What courses or levels of school math?
 (3) Give several reasons supporting your conclusion. Number the parts of your answer.
 A copy of this article is available at www.StatLit.org/CP/20101023-Math.pdf

Students review each other's responses on four criteria (Responsiveness, Explanation, Extension and Writing) and give the reasons for their choices. The Odyssey program computes a score for each review and then computes a cumulative power for each student based on all the review scores they received. Students are graded based on the ratio of their power to the median power in their class.

2. **Chapter Exercises** (28%). These exercises are all online: mainly multiple choice. The multiple choice questions usually allow two tries; the writing is limited to a one-line description or comparison.

A) Multiple choice:

Q1. Cases attributable: Suppose that the malaria death rate is 2% among whites (1% among blacks) with 20,000 deaths among whites. How many of the malaria deaths among whites are attributable to being white? **ANSWER: 10,000.**

Q2. Given the number of deaths attributable to being white, this means that those deaths were caused by being white. T or F? **ANSWER: False.**

Q2. Reading statistics presented in tables of percentages or rates:

Insert 100% Column-based toy table.

Students	-----SEX -----		
MAJOR	MALE	FEMALE	ALL
Business	60%	20%	40%
Economics	10%	50%	30%
MIS	30%	30%	30%
ALL	100%	100%	100%

Which of the following accurately describes the 60% in the upper left hand corner?
 a. Sixty percent of these Social Science majors are Freshmen.
 b. Sixty percent of these freshmen are Social science majors
 c. 34% of these students are freshmen social science majors
ANSWER: A.

B) One-liner: Compare the 60% and the 20% in the top row as a ratio using likely grammar:
 >> ***Among these students, guys are three times as likely to be Business Majors as [are] gals.***

3. **Project** (10%): This is up to the instructor. These points may be allocated among the other items.
4. **Exams** (50%). The two tests and the final are very similar to the chapter exercises shown above.

¹ Schield (2014). Odyssey: A Journey to Life-Long Statistical Literacy. www.statlit.org/pdf/2014-Schild-ICOTS.pdf

Appendix 4B: Budgetary and Faculty Load Implications and Long range Planning

New Course Proposal
Statistical Literacy

Budgetary and Faculty Load Implications and Long-range planning?

During the first two years, the department does not foresee any increase in budget or faculty load – aside from that being funded by the Dean's office.

The Dean of the College of Arts and Sciences, Mark Peceny, has reviewed this proposal and has pledged three-years of funding to support a consultant/coordinator to oversee the implementation of this new program and to teach some of the sections.

Starting in 2020, the Statistics Department plans to offer one to three sections of this new course by converting sections from the current statistics course: Introduction to Statistics (MATH 1350). Teaching assistants that would have taught sections of MATH 1350 will be teaching Statistical Literacy.

At the end of the first two years, the future demand of this course can be better predicted. Ideally, it would simply involve converting sections of MATH 1350 to Statistical Literacy. However, there is a possibility that additional sections, budget and faculty load will be required if student interest and demand exceeds current expectations.

Prepared by Dr. Milo Schield, Research Professor.
Department of Mathematics and Statistics. UNM Albuquerque

Appendix 5: Advising Handout Math 1300 vs. Math 1350 (Page 1 of 2)

Feb: Approved for NM General Education

Apr: Schedule. See Math 1996

Fall 2020

Advising

UNM ABQ

MATH 1330 vs. MATH 1350

Starting fall 2020: the Mathematics department will offer two introductory statistics course.

Both are good courses. They have different audiences.

- **Math 1350: INTRODUCTION TO STATISTICS.** A traditional introductory statistics course. *This course is designed for producers of statistics or those who will deal with research results based on clinical trials. It focuses on randomness: random sampling and random assignment. Data from these sources will be used to infer and test claims about the properties of the population. This course provides a more rigorous foundation for those for those taking additional statistics courses or going to graduate school. See <https://math.unm.edu/courses/materials/math-1350-introduction-statistics>*
- **Math 1330: STATISTICAL LITERACY.** A new non-traditional introductory statistics course. *This course is designed for the consumers of statistics. This literacy course focuses on reading, interpreting the statistics in the everyday media. It critically evaluates these statistics and all of the influences on a statistic: confounders, assembly, randomness and error/bias. The focus is on observational studies and quasi-experiments both of which involve confounding and assembly more often than randomness and bias. This literacy course uses ordinary English to distinguish association from causation, and to describe and compare percentages and rates in statements, tables and graphs. This course uses basic arithmetic to take into account the influence of a confounder and see if a statistically significant result will become statistically insignificant or vice versa.*

These courses are different (only a 30% overlap). So which majors should take which course?

- **Strongly recommended to take MATH 1350: Traditional Statistics.**
All students majoring in STEM, Economics and Psychology who are required to take a statistics course. These students will need this more-focused and rigorous foundation for subsequent courses and/or for grad school.
- **Strongly recommended to take MATH 1330: Statistical Literacy**
All students in non-quantitative majors: majors that don't require a math class: English, History, Journalism, Political Science, Art, Music, Philosophy, Classics, Languages, etc.
- **Free to choose either MATH 1350 or MATH 1330.**
Everyone else who is required to take statistics or needs to take a mathematics course.

MAT 1330 has been approved by the UNM Faculty Senate Curriculum Committee as a core course. It will be reviewed by the NM HED for General Education at their next meeting.

The Mathematics department plans to offer four sections of Statistical Literacy in Fall 2020. They need 200 students. Hopefully, advising and department chairs can make this happen!

For additional information, contact Milo Schield at SchieldMilo@UNM.edu

Appendix 5: Advising Handout Math 1300 vs. Math 1350 (Page 2 of 2)

Fall 2020

Advising MATH 1330

UNM ABQ

Math 1330, Statistical Literacy, is a new course and it is a very different course when compared with traditional introductory statistics. This argument-based course has less than a 30% overlap in topics with those in traditional statistics. Thus, 70% of this course is new material. Much of this new material is taken from Epidemiology and Statistics II, and from statements, tables and graphs presented in the everyday media.

Catalog description:

Description: Participants will study social statistics encountered by consumers. Study statistics as numbers in context and as evidence in arguments. Study influences on statistics and techniques to mitigate these influences. Strong focus on confounding.

Goals: To help students think critically about statistics as evidence in arguments: to see the story behind the story. To help students see value in becoming statistically literate.

Objectives: Can use ordinary English to distinguish association from causation and to form arithmetic associations of numbers and ratios. Can identify and evaluate influences (confounding, assembly, randomness and error/bias) on a statistic. Can identify, evaluate and use various techniques to take control of – or control for – these influences. Can use ordinary English to describe and compare statistics as presented in statements, tables and graphs. Can evaluate the strength of evidence provided by statistics in the everyday media, press releases and journal articles.

Text: Required: *Statistical Literacy for Decision Makers* (1st ed) by Schield

Grading Scale [98≤A+≤100], [93≤A<98], [90≤A-<93], [87≤B+<90], [83≤B<87], [80≤B-<83], [75≤C+<80], [70≤C<75], [50≤D<70], [F<50], and F if you do not show up to take the final exam.

Grading: Chapter Exercises (7@3%) 21%; Forum Challenges (20) 20%; Project and Attendance 9%; Exams (2@9%) 18%; Final Exam 30%; Course Evaluations 2%.