Term Information

Effective Term	Spring 2026
Previous Value	*Summer 2025*

Course Change Information

What change is being proposed? (If more than one, what changes are being proposed?)

We are proposing to add this course to the Number, Nature, Mind GE Theme.

What is the rationale for the proposed change(s)?

The course fits the Goals and ELOs of the Number, Nature, Mind GE Theme.

What are the programmatic implications of the proposed change(s)?

(e.g. program requirements to be added or removed, changes to be made in available resources, effect on other programs that use the course)?

none

Is approval of the requrest contingent upon the approval of other course or curricular program request? No

Is this a request to withdraw the course? No

General Information

Course Bulletin Listing/Subject Area	Linguistics
Fiscal Unit/Academic Org	Linguistics - D0566
College/Academic Group	Arts and Sciences
Level/Career	Undergraduate
Course Number/Catalog	3804
Course Title	AI Models of Language
Transcript Abbreviation	AI Language Models
Course Description	This non-programming course introduces students to AI language models like ChatGPT, explains how they work and what kinds of things they can do, and contrasts them with models of human language and mind.
Semester Credit Hours/Units	Fixed: 3

Offering Information

Length Of Course	14 Week, 12 Week, 8 Week, 7 Week, 6 Week, 4 Week
Flexibly Scheduled Course	Never
Does any section of this course have a distance education component?	No
Grading Basis	Letter Grade
Repeatable	No
Course Components	Lecture
Grade Roster Component	Lecture
Credit Available by Exam	No
Admission Condition Course	No
Off Campus	Never
Campus of Offering	Columbus, Lima, Mansfield, Marion, Newark, Wooster
Previous Value	*Columbus*

Prerequisites and Exclusions

Prerequisites/Corequisites	
Exclusions	
Electronically Enforced	No

Cross-Listings

Cross-Listings

Subject/CIP Code

Subject/CIP Code	16.0102
Subsidy Level	Baccalaureate Course
Intended Rank	Freshman, Sophomore, Junior, Senior

Requirement/Elective Designation

Number, Nature, Mind

The course is an elective (for this or other units) or is a service course for other units

Previous Value

The course is an elective (for this or other units) or is a service course for other units

Course Details

Course goals or learning objectives/outcomes

- Students will understand the basic mechanisms by which AI language models work
- Students will be able to explain what AI language models can and cannot do
- Students will understand how humans approach language differently from AI models

Content Topic List

- AI models
- ChatGPT
- Human language processing
- Human mind
- Memory
- Probability
- Attention

Sought Concurrence No

Previous Value **Yes**

Attachments

- LING 3804 submission number-nature-mind.pdf: GE Theme worksheet

  (Other Supporting Documentation. Owner: McCullough,Elizabeth Ann)

- 3804 syllabus 2025.09.pdf: Syllabus

  (Syllabus. Owner: McCullough,Elizabeth Ann)

Comments

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	McCullough,Elizabeth Ann	09/10/2025 09:45 AM	Submitted for Approval
Approved	McCullough,Elizabeth Ann	09/10/2025 09:45 AM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	09/24/2025 05:27 PM	College Approval
Pending Approval	Jenkins,Mary Ellen Bigler Neff,Jennifer Vankeerbergen,Bernadette Chantal Steele,Rachel Lea	09/24/2025 05:27 PM	ASCCAO Approval

Syllabus template document

1 Course number and title

LING 3804: AI Models of Language

2 Format of instruction and number of contact hours per week

Lecture, 3 credits

3 Prerequisites

None – the math required for this course will be taught within this course.

4 GEN category

Number, Nature, and Mind: This course fits within the *Number, Nature, and Mind* theme because it explores how A.I. language models express the *nature* of one of the most important characteristics of the human *mind* — language — using lists and tables of *numbers*. More specifically, this course explores how complex ideas can be expressed as re-occurring patterns of large and small numbers in vectors and matrices used in matrix multiplication.

Goal	Expected Learning Outcome	How course satisfies GE ELO
1. Successful students will analyze an important topic or idea at a more advanced and in-depth level than in the Foundations component. [Note: In this context, "advanced" refers to courses that are e.g., synthetic, rely on research or cutting-edge findings, or deeply engage with the subject matter, among other possibilities.]	1.1. Engage in critical and logical thinking about the topic or idea of the theme.	Students will engage in critical thinking about the application of mathematical reasoning as they compare human and AI language models. Students will engage in logical thinking about the application of mathematical reasoning as they derive predictions of formal language models in problem sets and in-class discussion. Early problem sets will focus on cued association formation, holistic memory, and memory reconstruction using the mechanics of the linear algebra concept of an outer product, but lectures and problem sets will represent this visually as dark and light bands in greyscale patterns formed by larger and smaller numbers. This representation is appropriate for problem sets, as occasional arithmetic mistakes will typically preserve the pattern. Later lectures and problem sets will connect these pattern manipulations to probability and logical reasoning and goal formation in decision theory and reinforcement learning.

	1.2. Engage in an advanced, in-depth, scholarly exploration of the topic or idea of the theme.	The topic of language modeling engages students in an advanced, in-depth, scholarly exploration of the application of mathematics in understanding the natural world. Through lectures and problem sets, students will apply some of the foundations of mathematics, philosophy, and cognitive science to logically represent complex ideas, including probability spaces, logic, and logistic regression as a means of learning.
2. Successful students will integrate approaches to the theme by making connections to out-of-classroom experiences with academic knowledge or across disciplines and/or to work they have done in previous classes and that they anticipate doing in future.	2.1. Identify, describe, and synthesize approaches or experiences as they apply to the theme.	The subject matter invites students to think about language comprehension and complex idea formation in terms of millisecond-to-millisecond neural computations using a variety of mathematical models. The course studies processes that students may not have thought about in such a mechanistic way before, and as such gives students practice thinking of new phenomena as formal and measurable.
	2.2. Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior experiences to respond to new and challenging contexts.	Students primarily interact with the models through problem sets in coursework. The problem sets start by introducing basic operations like matrix multiplications, which may be review for some students, then apply these standard tools to show, for example, how multiple ambiguous meanings may be propagated across several words as patterns of activation in sets of neurons in the brain. Students will build on prior experiences of defining and propagating vector patterns from early problem sets when observing how they combine in attention matrices in transformer language models. Students will be asked to reflect repeatedly in problem set questions, graded for completion, along the lines of "What is a new skill that you used in this assignment?"

3. Successful students will experience and examine mathematics as an abstract formal system accessible to mental manipulation and/or mathematics as a tool for describing and understanding the natural world.	3.1. Analyze and describe how mathematics functions as an idealized system that enables logical proof and/or as a tool for describing and understanding the natural world.	Students will have the opportunity to see how sentences in natural language can be given precise meanings that correspond to probabilistic (and in this sense vague) claims. This will teach students to distinguish precision of the sentence processing model from the less precise nature of the modeled content. The course material also explores models of phenomena at different levels of detail. For example, sentence processing can be modeled at a low (algorithmic) level using vectors of neural activations which may consist of several distinct patterns simultaneously superposed (added together) in the same vector, or at a higher (computational) level, as discrete distributions of partial analyses, each with a distinct probability. The fact that different models are needed to model different levels of detail shows students that the idealization of the simpler models is sometimes helpful in understanding cognitive phenomena, but for some applications a less idealized model is more appropriate.

5 Description of course

This non-programming course introduces students to AI language models like ChatGPT, explains how they work and what kinds of things they can do, and contrasts them with models of human language and mind.

The course has the following expected learning outcomes:

1. understand the basic mechanisms by which AI language models work;
2. be able to explain what AI language models can and cannot do.

6 Required texts

Due to the novelty of A.I. large language models, there do not seem to be any textbooks at an appropriate level. The course will be therefore be taught primarily from lecture notes, which will be made available on the course web site.

7 Length and format of all papers, homework, laboratory assignments, and examinations

Successful course participation involves:

- Regular attendance and active participation (10% of grade).
- Completing six problem set assignments (handed out about a week and a half before they are due), handed in through Carmen (10% each, 60% total). Late assignments are only accepted

if extensions are requested and granted, and are penalized 20% on a per-question basis, so try to submit as many questions as possible on time.

- Two non-cumulative midterm exams, administered during the course meeting time (15% each, 30% total).

The problem sets each contain about 5-6 problems with numerical answers or sometimes drawings of graphs or networks. Most questions on problem sets are similar in format to practice questions asked during lecture for completion credit. Exam questions are also similar in format to problem set questions or practice questions in lecture.

8 Grading information, indicating the percentages assigned to various requirements

See Section 7.
Grading scale:

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

9 Weekly topical outline of course meetings, topics, readings, film screenings, and homework

Weekly calendar (students will have access to the lecture notes as links on the calendar):

Week	Mon 11:59pm	Tue	Wed 11:59pm	Thu
1		Lecture Notes 1: Biological Neurons – ions, ligands and neurotransmitters		Lecture Notes 1: Biological Neurons – a formal model of a neuron (McCullough Pitts), Problem Set 1 handout (on cued association formation and cueing).
2		Lecture Notes 2: Concepts as Activation Patterns – long-term potentiation, models of memory formation as cued associations between concepts,		Lecture Notes 2: Concepts as Activation Patterns – matrices of synaptic weights, properties of cued associations in distributed associative memory.
3		Lecture Notes 3: Probability and Bayes Law, Review Problem Set 1	Problem Set 1 due	Lecture Notes 4: Generative Probability Models, Problem Set 2 handout (on probability).
4		Lecture Notes 5: Biological Models of Uncertainty – a vector superposition model of uncertainty,		Lecture Notes 5: Biological Models of Uncertainty – propagation and resolution of uncertainty

5	Problem Set 2 due	Lecture Notes 6: Models of Learning – single neuron model of generalization (McCullough Pitts), Review Problem Set 2		Lecture Notes 6: Models of Learning – single neuron model of generalization (McCullough Pitts) Problem Set 3 handout (on introduction, propagation and resolution of ambiguity through matrix multiplication).
6		Lecture Notes 7: Models of Complex Learning – backpropagation, human limits on backpropagation		Lecture Notes 7: Models of Complex Learning – formal limits (vanishing and exploding gradients)
7	Problem Set 3 due	Lecture Notes 8: State Machines and Probabilistic Sequence Models, Review Problem Set 3		Lecture Notes 9: Recurrent Neural Networks
8		Midterm 1 review session		Midterm 1
9		Lecture Notes 10: Attention Models – biology of attention, a formal model of attention Problem Set 4 handout (on single neuron learning).		Lecture Notes 10: Attention Models – models with multiple attention heads, transformer models,
10		Lecture Notes 11: Sequence Memory – biological sequence memory, biological limits on sequence memory	Problem Set 4 due	Lecture Notes 11: Sequence Memory – positional encoding in transformer models Review Problem Set 4 Problem Set 5 handout (on attention models).
11	Reading: Wei et al. (2023)	Lecture Notes 12: What AI Language Models Do Well		Lecture Notes 12: What AI Language Models Do Well
12	Problem Set 5 due	Lecture Notes 13: What AI Language Models Do Poorly – logic and reasoning, Review Problem Set 5 Problem Set 6 handout (on logical inference, decision theory or reinforcement learning).	Reading: McCoy et al. (2019)	Lecture Notes 13: What AI Language Models Do Poorly,
13	Reading: Bender et al. (2021)	Lecture Notes 14: What AI Language Models Do Poorly,		Lecture Notes 14: What AI Language Models Do Poorly,
14	Problem Set 6 due	Lecture Notes 15: What AI Language Models Do Poorly, Review Problem Set 6	Reading: Inan et al. (2023)	Lecture Notes 15: What AI Language Models Do Poorly,

15		Midterm 2 review session		Midterm 2

References

Bender, E. M., Gebru, T., McMillan-Major, A., & Shmitchell, S. (2021). On the dangers of stochastic parrots: Can language models be too big? In *Proceedings of the 2021 ACM Conference on Fairness, Accountability, and Transparency* New York: Association for Computer Machinery – ACM.

Inan, H., Upasani, K., Chi, J., Rungta, R., Iyer, K., Mao, Y., Tontchev, M., Hu, Q., Fuller, B., Testuggine, D., & Khabsa, M. (2023). Llama guard: Llm-based input-output safeguard for human-ai conversations.

McCoy, T., Pavlick, E., & Linzen, T. (2019). Right for the wrong reasons: Diagnosing syntactic heuristics in natural language inference. In A. Korhonen, D. Traum, & L. Màrquez (Eds.), *Proceedings of the 57th Annual Meeting of the Association for Computational Linguistics* (pp. 3428–3448). Florence, Italy: Association for Computational Linguistics.

Wei, J., Wang, X., Schuurmans, D., Bosma, M., Ichter, B., Xia, F., Chi, E., Le, Q., & Zhou, D. (2023). Chain-of-thought prompting elicits reasoning in large language models.

10 Statement on academic misconduct

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-48.7 (B)). For additional information, see the Code of Student Conduct.

11 Statement about disability services

The university strives to maintain a healthy and accessible environment to support student learning in and out of the classroom. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion.

If you are ill and need to miss class, including if you are staying home and away from others while experiencing symptoms of a viral infection or fever, please let me know immediately. In cases where illness interacts with an underlying medical condition, please consult with Student Life Disability Services to request reasonable accommodations. You can connect with them at slds@osu.edu; 614-292-3307; or slds.osu.edu.

12 Statement about religious accommodations

Ohio State has had a longstanding practice of making reasonable academic accommodations for students' religious beliefs and practices in accordance with applicable law. In 2023, Ohio State updated its practice to align with new state legislation. Under this new provision, students must be in early communication with their instructors regarding any known accommodation requests for religious beliefs and practices, providing notice of specific dates for which they request alternative accommodations within 14 days after the first instructional day of the course. Instructors in turn shall not question the sincerity of a student's religious or spiritual belief system in reviewing such requests and shall keep requests for accommodations confidential.

With sufficient notice, instructors will provide students with reasonable alternative accommodations with regard to examinations and other academic requirements with respect to students' sincerely held religious beliefs and practices by allowing up to three absences each semester for the student to attend or participate in religious activities. Examples of religious accommodations can include, but are not limited to, rescheduling an exam, altering the time of a student's presentation, allowing make-up assignments to substitute for missed class work, or flexibility in due dates or research responsibilities. If concerns arise about a requested accommodation, instructors are to consult their tenure initiating unit head for assistance.

A student's request for time off shall be provided if the student's sincerely held religious belief or practice severely affects the student's ability to take an exam or meet an academic requirement and the student has notified their instructor, in writing during the first 14 days after the course begins, of the date of each absence. Although students are required to provide notice within the first 14 days after a course begins, instructors are strongly encouraged to work with the student to provide a reasonable accommodation if a request is made outside the notice period. A student may not be penalized for an absence approved under this policy.

If students have questions or disputes related to academic accommodations, they should contact their course instructor, and then their department or college office. For questions or to report discrimination or harassment based on religion, individuals should contact the Civil Rights Compliance Office. (Policy: Religious Holidays, Holy Days and Observances.)

13 Statement about mental health

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing.

If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting http://ccs.osu.edu or calling 614-292-5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on-call counselor when CCS is closed at 614-292-5766 and 24 hour emergency help is also available 24/7 by dialing 988 to reach the Suicide and Crisis Lifeline.

14 Statement about intellectual diversity

Ohio State is committed to fostering a culture of open inquiry and intellectual diversity within the classroom. This course will cover a range of information and may include discussions or debates about controversial issues, beliefs, or policies. Any such discussions and debates are intended to support understanding of the approved curriculum and relevant course objectives rather than promote any specific point of view. Students will be assessed on principles applicable to the field of study and the content covered in the course. Preparing students for citizenship includes helping them develop critical thinking skills that will allow them to reach their own conclusions regarding complex or controversial matters.

GE Theme course submission worksheet: Number, Nature, Mind

Overview

Courses in the GE Themes aim to provide students with opportunities to explore big picture ideas and problems within the specific practice and expertise of a discipline or department. Although many Theme courses serve within disciplinary majors or minors, by requesting inclusion in the General Education, programs are committing to the incorporation of the goals of the focal theme and the success and participation of students from outside of their program.

Each category of the GE has specific learning goals and Expected Learning Outcomes (ELOs) that connect to the big picture goals of the program. ELOs describe the knowledge or skills students should have by the end of the course. Courses in the GE Themes must meet the ELOs common for **all** GE Themes and those specific to the Theme, in addition to any ELOs the instructor has developed specific to that course. All courses in the GE must indicate that they are part of the GE and include the Goals and ELOs of their GE category on their syllabus.

The prompts in this form elicit information about how this course meets the expectations of the GE Themes. The form will be reviewed by a group of content experts (the Theme Advisory) and by a group of curriculum experts (the Theme Panel), with the latter having responsibility for the ELOs and Goals common to all themes (those things that make a course appropriate for the GE Themes) and the former having responsibility for the ELOs and Goals specific to the topic of **this** Theme.

Briefly describe how this course connects to or exemplifies the concept of this Theme (Number, Nature, Mind)

In a sentence or two, explain how this class "fits' within the focal Theme. This will help reviewers understand the intended frame of reference for the course-specific activities described below.

(enter text here)

This course fits within the Number, Nature, and Mind theme because it explores how A.I. language models express the nature of one of the most important characteristics of the human mind — language — using lists and tables of numbers. More specifically, this course explores how complex ideas can be expressed as re-occurring patterns of large and small numbers in vectors and matrices used in matrix mulitplication.

Connect this course to the Goals and ELOs shared by *all* Themes

Below are the Goals and ELOs common to all Themes. In the accompanying table, for each ELO, describe the activities (discussions, readings, lectures, assignments) that provide opportunities for students to achieve those outcomes. The answer should be concise and use language accessible to colleagues outside of the submitting department or discipline. The specifics of the activities matter—listing "readings" without a reference to the topic of those readings will not allow the reviewers to understand how the ELO will be met. However, the panel evaluating the fit of the course to the Theme will review this form in conjunction with the syllabus, so if readings, lecture/discussion topics, or other specifics are provided on the syllabus, it is not necessary to reiterate them within this form. The ELOs are expected to vary in their "coverage" in terms of number of activities or emphasis within the course. Examples from successful courses are shared on the next page.

Goal 1: Successful students will analyze an important topic or idea at a more advanced and in-depth level than the foundations. In this context, "advanced" refers to courses that are e.g., synthetic, rely on research or cutting-edge findings, or deeply engage with the subject matter, among other possibilities.

Goal 2: Successful students will integrate approaches to the theme by making connections to out-of-classroom experiences with academic knowledge or across disciplines and/or to work they have done in previous classes and that they anticipate doing in future.

	Course activities and assignments to meet these ELOs
ELO 1.1 Engage in critical and logical thinking.	Students will engage in critical thinking about the application of mathematical reasoning as they compare
ELO 1.2 Engage in an advanced, in-depth, scholarly exploration of the topic or ideas within this theme.	The topic of language modeling engages students in an advanced, in-depth, scholarly exploration of the application of mathematics in understanding the natural world. Through lectures and problem sets, students will
ELO 2.1 Identify, describe, and synthesize approaches or experiences.	The subject matter invites students to think about language comprehension and complex idea formation in terms of millisecond-to-millisecond neural computations
ELO 2.2 Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior experiences to respond to new and challenging contexts.	Students primarily interact with the models through problem sets in coursework. The problem sets start by introducing basic operations like matrix multiplications, which may be review for some students, then apply these standard tools to show, for example, how multiple ambiguous meanings may be propagated across several

Example responses for proposals within "Citizenship" (from Sociology 3200, Comm 2850, French 2803):

***ELO 1.1** Engage in critical and logical thinking.*	*This course will build skills needed to engage in critical and logical thinking about immigration and immigration related policy through:* *Weekly reading response papers which require the students to synthesize and critically evaluate cutting-edge scholarship on immigration;* *Engagement in class-based discussion and debates on immigration-related topics using evidence-based logical reasoning to evaluate policy positions;* *Completion of an assignment which build skills in analyzing empirical data on immigration (Assignment #1)*

	Completion 3 assignments which build skills in connecting individual experiences with broader population-based patterns (Assignments #1, #2, #3) *Completion of 3 quizzes in which students demonstrate comprehension of the course readings and materials.*
***ELO 2.1** Identify, describe, and synthesize approaches or experiences.*	*Students engage in advanced exploration of each module topic through a combination of lectures, readings, and discussions.* *<u>Lecture</u>* *Course materials come from a variety of sources to help students engage in the relationship between media and citizenship at an advanced level. Each of the 12 modules has 3-4 lectures that contain information from both peer-reviewed and popular sources. Additionally, each module has at least one guest lecture from an expert in that topic to increase students' access to people with expertise in a variety of areas.* *<u>Reading</u>* *The textbook for this course provides background information on each topic and corresponds to the lectures. Students also take some control over their own learning by choosing at least one peer-reviewed article and at least one newspaper article from outside the class materials to read and include in their weekly discussion posts.* *<u>Discussions</u>* *Students do weekly discussions and are given flexibility in their topic choices in order to allow them to take some control over their education. They are also asked to provide* *information from sources they've found outside the lecture materials. In this way, they are able to* *explore areas of particular interest to them and practice the skills they will need to gather information* *about current events, analyze this information, and communicate it with others.* *Activity Example: Civility impacts citizenship behaviors in many ways. Students are asked to choose a TED talk from a provided list (or choose another speech of their interest) and summarize and evaluate what it says about the relationship between civility and citizenship. Examples of Ted Talks on the list include Steven Petrow on the difference between being polite and being civil, Chimamanda Ngozi Adichie's talk on how a single story can perpetuate stereotypes, and Claire Wardle's talk on how diversity can enhance citizenship.*
***ELO 2.2** Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior experiences to respond to new and challenging contexts.*	*Students will conduct research on a specific event or site in Paris not already discussed in depth in class. Students will submit a 300-word abstract of their topic and a bibliography of at least five reputable academic and mainstream sources. At the end of the semester they will submit a 5-page research paper and present their findings in a 10-minute oral and visual presentation in a small-group setting in Zoom.* *Some examples of events and sites:* *The Paris Commune, an 1871 socialist uprising violently squelched by conservative forces*

	Jazz-Age Montmartre, where a small community of African-Americans–including actress and singer Josephine Baker, who was just inducted into the French Pantheon–settled and worked after World War I. *The Vélodrome d'hiver Roundup, 16-17 July 1942, when 13,000 Jews were rounded up by Paris police before being sent to concentration camps* *The Marais, a vibrant Paris neighborhood inhabited over the centuries by aristocrats, then Jews, then the LGBTQ+ community, among other groups.*

Goals and ELOs unique to Number, Nature, Mind

Below are the Goals and ELOs specific to this Theme. As above, in the accompanying Table, for each ELO, describe the activities (discussions, readings, lectures, assignments) that provide opportunities for students to achieve those outcomes. The answer should be concise and use language accessible to colleagues outside of the submitting department or discipline. The ELOs are expected to vary in their "coverage" in terms of number of activities or emphasis within the course. Examples from successful courses are shared on the next page.

GOAL 3: Successful students will experience and examine mathematics as an abstract formal system accessible to mental manipulation and/or mathematics as a tool for describing and understanding the natural world.

	Course activities and assignments to meet these ELOs
ELO 3.1 ELO 1.1 Analyze and describe how mathematics functions as an idealized system that enables logical proof and/or as a tool for describing and understanding the natural world.	Students will have the opportunity to see how sentences in natural language can be given precise meanings that correspond to probabilistic (and in this sense vague) claims. This will teach students to distinguish precision of the sentence