Illinois Mathematics and Science Academy
A Pioneering Educational Community

Course Information Sheet – Spring 2018

Course Title: Methods in Scientific Inquiry (MSI)

Instructors:

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By appt.	By appt.	By appt.	By appt.	By appt.	By appt.

Classroom: A200

Meeting Times:

Anjur:	B day, Mods 5-6; I day (10:00-11:30)
DeVol:	B day, Mods 3-4; I day (8:30-10:00)
Dosch:	C day, Mods 7-8; I day (8:30-10:00)
Golab:	C day, Mods 3-4; I day (10:00-11:30)
O'Leary-Driscoll:	B day, Mods 1-2; I day (10:00-11:30)
Randall:	C day, Mods 5-6; I day (8:30-10:00)

Text(s)/Materials: All texts/materials are posted on Moodle or the Student Server

Course Description:
Methods in Scientific Inquiry is a one-semester course that is required of all IMSA sophomores. The course explicitly addresses three broad areas encompassed by the nature of science: data acquisition and analysis, experimental design, and written and oral communication. Activities will support the development of basic skills across the science disciplines and promote an understanding of scientific inquiry and the nature of research.

Essential Content:

I. Statistical Analysis
- Descriptive statistics
- T-test
- Correlation and regression
- Other statistics as related to individual student projects

II. Knowledge of Scientific Literature
- Evaluation of scientific sources
- Understanding the peer-review process
- Importance of credit (citations, literature cited)
- APA formatting and style

III. Conducting a Research Project
- Developing questions and hypotheses
- Writing a proposal
- Collecting and analyzing data
- Supporting conclusions with evidence

IV. Writing a Scientific Paper
- Introduction
- Materials and methods
- Results
  - Tables
  - Figures
- Discussion
- Literature cited
- Citations

V. Creating a Poster
- Appropriate size and amount of content
- Sufficient detail to support conclusions

VI. Giving a Presentation
- Appropriate use of PowerPoint
- Choice of information to convey
- Speaking with clarity
- Answering questions

Student Learning Objectives:
- To enhance student learning and understanding in the following areas: data acquisition and analysis, experimental design, and written and oral communication.
- To develop students' skills and levels of understanding and proficiency in the following Standards of Significant Learning (SSLs):

  IA. Students are expected to demonstrate automaticity in skills, concepts, and processes that enable complex thought
  - by designing and implementing inquiry projects, including search of the literature, experimentation, analysis, and presentation

  IB. Students are expected to construct questions, forge connections and deepen meaning through
  - incorporation of questions in the inquiry project design
  - multiple assessments of questions which shape the inquiry as part of inquiry project

  IC. Students are expected to precisely observe phenomena and accurately record findings
  - in formative data collection and analysis
  - as part of inquiry project

  ID. Students are expected to evaluate the soundness and relevance of information and reasoning through
  - collection and analysis of data
  - self-evaluation of their own writing
  - revisions which incorporate feedback from instructors
  - evaluation of literature search
  - evaluation of web search

- holistic instructor assessment of final project

IIA. Independent inquiry projects require students to evaluate their own personal assumptions or to look into historical perspectives on specific issues and subjects and challenge their ability to remain unbiased and/or address these assumptions as necessary.
IIB. Independent inquiry projects require students to use and evaluate scientific resources extensively. They must also analyze their own data for ambiguities.
IIIA. The students use of technologies as extensions of the mind will vary, but at the very least, all students will use computer programs to analyze (and most will use them to collect) their data.
IIIB. All students are expected to make connections between their own research and the literature, previously performed experiments, and what is already known and substantiated in the area in which they are researching.
IIIC. In the projects, students create conceptions reflective of their understanding of the chosen topic area, built through statistical analysis, research into the literature, and finding answers for their inquiry questions.
IVA. Inquiry projects represent the students' progress in the ability to construct and support judgments based on evidence.
IVB. Students create a final paper, written in a scientific format, as well as giving an oral presentation.
IVC. Students identify and characterize the composing elements of dynamic and organic wholes through the creation of a final project which is a "whole" of different elements, including search of the literature, experimentation, analysis, etc.

Teaching and Learning Methodology and Philosophy:
Students will develop the skills necessary to conduct an inquiry project through a variety of learning activities that deepen with time. These activities will support the development of research skills, as well as demonstrate discipline-appropriate scientific thinking. Student assessments for these learning activities will be completed individually will include homework assignments and in-class quizzes.

While building inquiry and research skills, students will work with a partner to define and conduct their own inquiry investigation and will report the results of that investigation in the form of a research paper, poster presentation, and oral presentation. Students will work with their partner to complete the poster and oral presentations, but the final research paper will be written individually.

Student Expectations:
The students enrolled in *Methods in Scientific Inquiry* will:

1) bring their laptop computers to class every day,
2) participate in class discussion sessions by asking or answering questions or sharing relevant comments,
3) attend and participate as an attentive audience member during all student presentations,
3) complete all assigned work within specified deadlines,
4) arrive to class on time and prepared for each day's activities (the Academy's Student Attendance Policy is strictly enforced), and
5) follow all safety procedures and guidelines such as
    - wearing goggles during laboratory activities,
    - wearing shoes that cover your feet when in the laboratory, and
    - keeping all food and drink outside the classroom and laboratory.

Assessment Practices, Procedures, and Processes:

Student performance and learning in this course will be assessed using a variety of methods, which include the following: in-class quizzes, formative and summative written assessments, homework assignments, multimedia presentations, poster presentations, oral reports, and written papers.

Please note that in order to pass the MSI course, a student must have an above passing assessment average and a passing grade on the final paper.

Letter grades will be assigned as follows:

90% and above = A (exceeds expectations)
80-89.99% = B (meets expectations)
70-79.99% = C (above passing but below expectations)
Below 70% = D (below passing)

The teacher may modify these percentages at the end of the semester so as to better overlap the grade ranges with the distribution of assessment averages. Any modification made will not penalize students with respect to their final letter grade.

Plagiarism is a serious issue. The first act of plagiarism will result in a grade of zero on the assignment and notification of the Dean of Discipline. A second offense will result in failure in the course and notification of the Dean of Discipline.

Late work is also a concern. All work is to be submitted/uploaded before or by the specified deadline, which is often the beginning of class on the day the assignment is due. Late work will be accepted with a 10% penalty for each day (24-hour period) the work is late. Once an assignment has been returned to students by any MSI teacher, it may not be submitted for late credit.

Specific Assessments:

Note: Point values for assessments are approximations and are subject to change.

Learning Activities and In-class Assessments

Homework and Misc. Assignments	=	5-10 points *each*
Mini-Quizzes	=	5-10 points *each*
Summative Quizzes	=	15 points *each*
Participation	=	10 points

Benchmark Assessments for Inquiry Project

Draft of Project Proposal	=	5 points
Project Proposal	=	10 points
Preliminary Notebook Check	=	5 points
Final Notebook Check	=	5 points
Draft of Annotated Bibliography	=	10 points
Draft of Introduction	=	10 points
Draft of Materials & Methods	=	10 points
Draft of Results	=	10 points
Draft of Discussion and Literature Cited	=	10 points

Final Assessments for Inquiry Project

Project Poster	=	15 points
PowerPoint Presentation	=	15 points
Final Research Paper	=	30 points

Sequence of Topics and Activities:
During the first several weeks, much of the time in the MSI class is spent completing activities that are designed to help students develop specific inquiry skills. The remainder of the semester is spent working on an independent research project. The culmination of this research project is a written research paper, a poster presentation, and an oral presentation. ***Please see the schedule below for specific details regarding the "tentative" dates for activities and assessments in the MSI course.***

Dates	Activities and Assessments
January 15-19 no I-day	• Course introduction and expectations • Format of a scientific paper • Discuss journal article and peer review process
January 22-26	• IRC Day: Learning how to use research databases • IRC search challenge is due • Select partners and brainstorm project ideas
January 29 – February 2 no I-day (course selection)	• Discuss experimental design, controls, and bias • Mini-quiz on journal article, peer review and database searching • Collect data for descriptive statistics activity
February 5-9 no I-day (AMC)	• Formally assign project proposals and annotated bibliography • Introduce and start lab notebooks
February 12-16 condensed C-day	• Descriptive statistics worksheet due • Annotated bibliography is due
February 19-23 no B or C-day	• Project proposal draft due • Descriptive statistics quiz • Discuss inferential statistics, null hypothesis and P values • Do t-test activity • Work on t-test worksheets
February 26 – March 2 no I-day (PD day)	• Project proposal revision due • Do correlation and regression activity • Work on correlation and regression worksheet • Begin gathering and designing project materials
March 5-9	• Inferential statistics quiz • Assign introduction section • Project work

March 12-16	• Introduction draft due • Assign materials and methods section • Project work
March 19-23	• Work on materials and methods • Project work
April 2-6 no I-day	• Materials and methods draft due • Assign results section • Project work • Lab notebook check
April 9-12	• Tables, figures and captions • Project work
April 16-20	• Assign discussion section • Project work
April23-27 no I-day (SIR)	• Project work • Work on project data analyses
April 30 – May 4	• IRC follow-up • Results and Discussion drafts due
May 7-11	• Work on paper, posters, presentations
May 14-18	• Final paper due • Final notebook check
May 21-25 condensed C-day	• Poster due • Student presentations
May 28 – June 1	No Final Exam in MSI