

# Illinois Mathematics and Science Academy

A Pioneering Educational Community

## Syllabus – Spring 2020

Course Title: Methods in Scientific Inquiry (MSI)

Instructors for Spring 2020:

Mark Carlson	Peter Dong	Eric Hawker	Laura Kopff	Melissa Tolla
x5975	X5476	x5049	x5901	X5689
mcarlson @imsa.edu	pdong @imsa.edu	ehawker @imsa.edu	lkopff @imsa.edu	mtolla @imsa.edu
B104A	B117	B117	B147	B150

**Classroom: A200**

### Fall Meeting Times:

Dr. Carlson           BD Mods 5-6;  
Dr. Dong               BD Mods 1-2  
Dr. Hawker            AC Mods 3-4;  
Dr. Kopff              AC Mods 5-6;  
Dr. Tolla              AC Mods 7-8  
                              BD Mods 7-8;

**Text(s)/Materials:** All texts/materials are posted on Moodle or Google Classroom

### 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,
- 4) complete all assigned work within specified deadlines,
- 5) arrive to class on time and prepared for each day's activities (the Academy's Student Attendance Policy is strictly enforced), and
- 6) 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, case studies, 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)
- 80-89.9% = B (meets expectations)
- 70-79.9% = 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**

<b>Misc. Assignments</b>	<b>=</b>	<b>5-10 points each</b>
<b>Case Studies</b>	<b>=</b>	<b>10-15 points each</b>
<b>Mini-Quizzes</b>	<b>=</b>	<b>5-10 points each</b>
<b>Summative Quizzes</b>	<b>=</b>	<b>15 points each</b>
<b>Participation</b>	<b>=</b>	<b>10 points</b>

### **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