Overview of Scientific and Inquiry Course (IMC543)

Pillar Description

The Scientific Literacy and Inquiry Pillar prepares students to become critical interpreters of scientific literature, engage in evidence-based medicine and research-focused activities, and effectively explain medical knowledge to patients and colleagues. Woven through each phase of the curriculum, this pillar begins in students' first year and culminates with presentations of their Health Sciences Scholarly Project during their fourth year.

Scientific Literacy & Inquiry Curriculum Goals

1. Develop critical thinking and self-directed learning skills
2. Create habits of inquiry and curiosity
3. Develop the skills and knowledge needed to engage in evidence-based practice
4. Apply the scientific framework to both clinical and research scenarios
5. Effectively communicate, educate, and disseminate medical knowledge (i.e., validity, utility, and relevance of literature/research findings) with patients, other health professionals, policymakers, and the community
6. Work effectively in a Team Science setting to achieve team objectives
7. Discuss, develop and utilize foundations of research design and basic data analysis skills
8. Participate in all phases of research design and basic data analysis skills
9. Identify key principles related to research ethics, HIPAA, responsible conduct of research, the important of inclusive research, and participate in the Ethical Review Board process
10. Balance scientific evidence with ethical principles in decisions related to the care of patients, communities, societies, with emphasis on diverse populations

Course Description

IMC543 introduces key concepts, establishes the pillar's structure and overall objectives, and provides students with the foundational skills needed to engage in scientific inquiry and research.

Scientific Literacy and Inquiry Course (IMC543) Objectives

1. Develop critical thinking skills and practice application to clinical scenarios
2. Learn strategies to identify strengths and limitations in one's knowledge, skills, attitudes, and abilities
3. Set self-directed learning and improvement goals related to the Health Sciences Scholarly Project, specifically in preparation to propose, conduct, and present a self-selected, mentored scholarly project that meets the prescribed criteria
4. Identify thinking skills and inquiry processes and utilizing these skills in structured activities
5. Identify new knowledge, guidelines, standards, technologies, products, or services that have been demonstrated to improve outcomes
6. Locate and appraise evidence from scientific studies related to patients' health problems through structured activities
7. Demonstrate respect for patient privacy and autonomy and accountability to patients, colleagues, society and the profession
8. Identify relevant laws, policies, and/or regulations as it relates to research and patient care
9. Demonstrate a commitment to ethical principles to pertaining to informed consent, confidentiality, and provision or withholding of care
10. Identify and appreciate the roles of various team members that contribute to a research project
11. Develop skills needed to provide guidance to others and fulfill one's specific role on a team
12. Identify an area of interest, and demonstrate how to create structured, explorable, scientific questions
13. Recognize the importance of inclusive research and the impact of systemic racism and historical ethical breaches on communities of color and their trust in and willingness to engage in health care

Scientific Literacy and Inquiry Course (IMC543) Assessments

- Participation in group discussions, activities, and projects
- Reflections
- Test questions
- Critical appraisal of literature in a topic of interest

Scholarly Project Training Series

Sessions with didactic portion followed by hands-on session to prepare students for culminating final project. This series prioritizes leading students through the proposal process, formulating research questions, understanding research design, etc.

- Systematically integrate information and AI literacy into the training series
- Emphasize the use of AI as a copilot to help guide, support and develop the scholarly project

Learning Objectives

Align with the framework for Information Literacy and Higher Education

By the end of the Scholarly Project Training Series students will be able to:

- effectively define the scope of a research question and thesis by clearly articulating its key elements and limitations to ensure focused and manageable research.
- identify and articulate a research question or knowledge gap, or idea to explore and contribute new insights to the field.
- determine and articulate key concepts that connect to a specific research question, ensuring a clear and focused direction for the study.
- select and evaluate types of information that relate to key concepts and effectively support answering the research question.
- demonstrate a comprehensive understanding of the ethical and legal limitations regarding the use of published, confidential, and/or proprietary information.

Culminating Assignment

Written Report

- Describe what is known and unknown on your topic as background
- Describe and analyze the results or products of your project
- Critically evaluate your work considering relevant evidence and indicate how it contributes to relevant fields of scholarship
- Identify areas for improvement, further study and exploration.

Additional Deliverable

- Published or unpublished paper
- Presentation from national conference
- New curricular module
- Outreach program
- Legislative campaign

Audience

- MSP Project Presentation

Culminating Assessment: Health Sciences Scholarly Project

The Health Sciences Scholarly Project (HSSP) requirement at Jacobs School of Medicine offers every medical student the opportunity to engage in a mentored scholarly experience, analyzing a medical or health-related question, issue, or problem in depth. Students can explore these issues across various disciplines, including biomedical sciences, clinical sciences, and other fields. The process of discovery is just as crucial as the outcome, and students collaborate closely with their mentors throughout this journey. The HSSP further enhances students' self-directed learning skills, scientific curiosity and team science abilities. It encourages lifelong learning by providing students with the chance to delve into an in-depth scholarly project related to medicine or health care under mentorship of a Jacobs School faculty member.

Example Projects

Evaluation Tool
- Information Literacy VALUE Rubric
- Inquiry and Analysis VALUE Rubric

Scope and Sequence for IMC543
Integrating AI, Technological Innovation, and Ethical Insight in Research

Unit Component	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
Title	Navigating the Research: AI in Methodological Exploration	Thesis Refinement: AI Support for Idea Development	Exploring New Horizons: AI in Knowledge Discovery	AI-Guided Concept Development: Unveiling Research Insights	AI-Navigated Data Expedition in Research Literature	Ethical Exploration: AI in Research Integrity
Topic	Introducing Research Skills	Defining Research Questions and Theses	Identifying Knowledge Gaps and Ideas	Articulating Key Concepts	Selecting and Evaluating Information	Understanding Ethical and Legal Limitations
Time (number of hours & weeks)	2 weeks TBD – number of class sessions and number of hours per week					
Unit Objectives	**Introduce** the fundamentals of research and its significance in academic and professional contexts **Explain** the basic principles and methodologies of research **Illustrate** the application of research skills in both academic and professional settings	**Identify** the central concepts or variables within the research question and thesis **Clarify** the scope of the research question and thesis by defining its boundaries and parameters clearly **Articulate** the specific objectives or aims of the research question and thesis	**Conduct** a comprehensive review of existing literature to identify gaps or areas requiring further exploration **Develop** a clear and focused research question or hypothesis aimed at addressing the identified knowledge gap or idea **Evaluate** the potential impact and originality of the proposed research question or idea in advancing the field's understanding	**Identify** essential concepts related to the research question **Clearly** define these concepts **Determine** how these concepts interconnect to guide and support the research effectively	**Identify** relevant sources of information related to the research question **Evaluate** credibility and reliability of information sources **Determine** the relevance of information sources in addressing the research question	**Identify** the ethical considerations involved in using published, confidential, and proprietary information in research **Discuss** the legal restrictions and guidelines that govern the use of such information **Assess** the implications of ethical and legal limitations on research practices

Unit Component	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
Course Learning Outcomes	**Develop** students' ability to critically engage in scientific inquiry and research through fundamental skill development	**Define** the scope of a research question and thesis by clearly articulating its key elements and limitations to ensure focused and manageable research	**Identify** and **articulate** a research question or knowledge gap, or idea to explore and contribute new insights to the field	**Determine** and **articulate** key concepts that connect to a specific research question, ensuring a clear and focused direction for the study	**Select** and **evaluate** types of information that relate to key concepts and effectively support answering the research question	**Demonstrate** a comprehensive understanding of the ethical and legal limitations regarding the use of published, confidential, and/or proprietary information.
Assessments	Roundtable discussions: evaluate students' understanding of the research articles or case studies, as demonstrated through their ability to summarize key points, identify strengths and weaknesses, and discuss implications.	Analysis activity: evaluate students' ability to critically evaluate the limitations or constraints inherent in each research question or thesis statement.	Research proposal presentation: evaluate students' development of a research proposal that includes background information, rationale, objectives and a brief literature review to support their proposed research.	Concept map: assess the clarity and coherence of students' concept maps in visually representing the key concepts and their connections to the research.	Selection of information sources: assess the appropriateness and comprehensiveness of the information sources selected in relation to the research question.	Mock ethical board review: assess students' ability to evaluate research proposals or projects for ethical compliance e.g., guidelines, criteria, relevant regulations.
Sequence of Activities	Overview of AI technologies relevant to research, such as machine learning and natural language processing. Group discussion on the benefits and challenges of integrating AI into the research process, encouraging critical thinking about potential impacts. Group analysis of case studies and discuss successful applications of AI in different research domains.	Hands-on experience with AI-powered tools for generating and refining research questions. Group exercises to explore the capabilities of AI in identifying research gaps and opportunities, fostering collaboration and critical evaluation. Peer feedback sessions to evaluate the clarity and feasibility of AI-generated research questions, promoting constructive critique and improvement.	Groups review a literature review, identify gaps, and compile a summary report. Using identified gaps, groups brainstorm, refine, and justify research questions or hypotheses. Groups conduct peer reviews to evaluate and improve the impact and originality of their research questions or hypotheses.	Students collaboratively create concept maps to visually organize and connect key concepts related to their research question. A structured debate where students defend the importance and relevance of specific key concepts related to their research question. An exercise where students integrate key concepts into a coherent framework that supports their research question.	Students participate in a structured activity where they "speed date" various types of information sources related to their research question. Students engage in a scavenger hunt to find and evaluate different types of information sources relevant to their research question. Students engage in a peer review process where they evaluate and provide feedback on each other's selected information sources.	Students work in small groups to analyze and discuss case studies that present ethical dilemmas related to the use of information in research. Students participate in a simulation game where they navigate scenarios that require them to make decisions about the ethical and legal use of information in research. Students collaborate to analyze and discuss ethical codes and guidelines related to research practices.
Key Resources	General AI Search Tool: There's An AI For That - Use search parameters: "medical research" and "dental research" and Generative AI Product Tracker Literature Review Mapping Tools: Connected Papers; Inciteful; Litmaps; ResearchRabbit Literature Search Tools: PubMed – "Best Match"; Scopus – Elsevier; Embase - Elsevier Paraphrasing and Summarizing: SpinBot; QuillBot LLM Tools: ChatGPT, Microsoft Copilot					