

## Scientific Inquiry and Research Skills Rubric

The Scientific Inquiry and Research Skills rubric articulates what Syracuse University students should know and be able to demonstrate by the time they graduate through five learning outcomes and specific indicators. The Scientific Inquiry and Research Skills rubric was created by a community of practice with faculty, staff, and students from across the University. This rubric is intended for institutional-level use in assessing and reflecting on undergraduate student learning. Faculty teaching courses with a Scientific Inquiry and Research Skills course tag may refer to the learning outcomes when developing course learning objectives, signature assignments, and other learning experiences for students. This rubric will continue to evolve as Syracuse University collects feedback from faculty who utilize it to reflect on student learning.

### Scientific Inquiry and Research Skills Framing Language

Application of scientific inquiry and problem-solving in various contexts. Analysis of theories, replication of procedures, and rethinking existing frameworks. Supporting arguments through research, data, and quantitative and qualitative evidence that can generate new knowledge.

### Preamble & Guidance

This rubric is meant to provide faculty and students with specific learning outcomes for Scientific Inquiry and Research Skills. The indicators associated with each learning outcome are broadly worded so each discipline has the flexibility to apply them in their own context. Scientific inquiry and research occurs in every discipline, is constantly evolving, and is practiced differently depending on one's field of study. This rubric represents a continuum of learning; parts of the rubric may be increasingly applicable as students gain foundational skills in their field of study.

The term scientific inquiry is broadly used to describe systematic ways to investigate problems, questions, and interests. The framing language presents problem-solving and/or new knowledge as an outcome of the process. The rubric addresses these elements as questions/objectives, needs, gaps, or newly emerging ideas. Research at the undergraduate level may involve independent research; however, it may also involve research in collaborative or faculty-led settings. Students may need to be prompted to reflect on these learning outcomes and corresponding indicators at an individual and/or collaborative level. Ethics is incorporated throughout the rubric to highlight its importance in all aspects of the inquiry and research process. Ethics encompasses discipline specific ethics as well as legal, regulatory, and contemporary principles.

Learning Outcomes	Indicators	Exemplary	Developing	Emergent	Not Evident
1. Identify the context in which research occurs.	1.1 Indicates the social and/or scientific need for research conducted in one's field of study.	Comprehensively explains the current and future need for research within specific social and/or scientific contexts.	Explains with limitations the current need for research within specific social and/or scientific contexts.	Broadly links a need for research to general social and/or scientific contexts.	Does not indicate the social and/or scientific need for research conducted.
	1.2 Explores biases and impacts of prior research for one's field of study (e.g., historical/social justice/environmental justice).	Critically reflects on the prior research and practitioners to identify limitations (e.g., who is not represented, what is not generalizable, background, methodology, historical, and potential benefits and harm done in society).	Identifies biases and impacts in prior research and practitioners with limitations.	Investigates prior research with minimal reflection on biases but does not identify impacts.	Does not explore biases and impacts of prior research.
	1.3 Identifies personal research biases and mitigation strategies (e.g., racial, ethnic, gender, economic, ability status, religious, sexuality, etc...).	Reflects on personal biases throughout the research process and identifies an effective plan or procedure to minimize impacts of personal biases in research.	Identifies personal biases but ineffectively mitigates the impacts of those biases on the research.	Identifies personal biases but fails to mitigate the impacts of those biases on the research.	Does not identify personal research biases and mitigation strategies.
	1.4 Investigates the institutional and governmental policies that shape academic research ethics and practices in one's field of study (e.g., IRB, CITI training, IACUC).	Comprehensively identifies the appropriate research ethics, policies, and accepted practices.	Identifies appropriate research ethics, policies, and accepted practices with limitations.	Identifies minimal research ethics, policies, and accepted practices.	Does not investigate the institutional and governmental policies that shape academic research ethics and practices.

Learning Outcomes	Indicators	Exemplary	Developing	Emergent	Not Evident
2. Evaluate existing knowledge and theories in relation to one's research interests.	2.1 Locates, integrates, and cites appropriate sources of information.	Synthesizes significant, comprehensive, and relevant information; can locate patterns and themes and derive concepts from prior work; cites appropriate sources of information.	Presents in-depth information from relevant sources representing limited points of view; leaves out some relevant aspects of the topic; cites appropriate sources of information.	Finds sources, summarizes, and cites them appropriately but omits key perspectives or foundational references.	Does not locate, integrate, and cite appropriate sources of information.
	2.2 Evaluates information sources and theories to determine their validity (e.g., review status, impact on the field, potential biases, researcher background, funding source).	Extracts information with a justification for the inclusion and use of sources and theories. Identifies and validates the types of sources needed for the research, contexts, and limitations under which they are produced.	Broadly justifies the inclusion and use of sources and theories. Demonstrates a limited ability to identify and validate the types of sources needed for the research, contexts, and limitations under which they are produced.	Utilizes simple evaluation criteria relevant to the topic and may not consistently determine validity of information sources and theories.	Does not evaluate information sources and theories to determine their validity.
	2.3 Synthesizes information and theories to identify gaps as research opportunities (e.g., overlooked populations, ideas that haven't been fully explored, newly emerging ideas, technology or needs).	Synthesizes information and theories from sources to reveal gaps and generate innovative research questions.	Utilizes different points of view and acknowledges emerging ideas on the topic to identify an information gap but does not identify a research opportunity.	Claims a research gap that does not exist or is of limited importance due to insufficient search strategies (e.g., Wikipedia, web searches, surface-level knowledge).	Does not synthesize information to identify gaps as research opportunities.

Learning Outcomes	Indicators	Exemplary	Developing	Emergent	Not Evident
3. Develop a feasible and ethical research plan based on identified knowledge gaps.	3.1 Develops a focused research question/objective that addresses potentially significant, previously underexplored, aspects of one's field.	Creates a focused research question/objective that effectively addresses potentially significant, previously underexplored, aspects of one's field.	Identifies a well-defined question/objective but addresses previously explored or less significant aspects of one's field.	Identifies a poorly defined question/objective that is too general and wide-ranging or too narrow.	Does not develop a focused research question/objective that addresses potentially significant, previously underexplored, aspects of one's field.
	3.2 Organizes procedural research steps into a plan that addresses research questions/objectives.	Fully develops a detailed research plan that is able to address specific research questions/objectives by using appropriate methods.	Develops a plan that uses appropriate methods but some key elements are not included.	Identifies appropriate methods but is incoherent or incomplete as a plan (e.g., results would be unclear or would not address questions/objectives).	Does not organize procedural research steps into a plan that addresses research questions/objectives.
	3.3 Ensures the feasibility of the research plan within the context of resource limitations, regulatory/ethical/legal considerations, maintaining confidentiality as appropriate, accessibility requirements, and potential risks.	Develops a fully feasible plan within the context of resource limitations and regulatory/ethical/legal considerations, maintaining confidentiality as appropriate, accessibility requirements, and mitigates potential risks.	Identifies and accounts for some of the relevant resource limitations, regulatory/ethical/legal considerations, accessibility requirements, maintaining confidentiality as appropriate, and potential risks of the research plan but not comprehensively.	Identifies some relevant resource limitations, regulatory/ethical/legal considerations, accessibility requirements, maintaining confidentiality as appropriate, and potential risks of the research plan but with significant omissions.	Does not ensure the feasibility of the research plan within the context of resource limitations, regulatory/ethical/legal considerations, maintaining confidentiality as appropriate, accessibility requirements, and potential risks.
	3.4 Gauges the social, ethical, and/or scientific costs and benefits associated with the research process and findings.	Fully explains the social, ethical, and/or scientific costs and benefits of the research and findings.	Identifies many key benefits and costs of the research process and/or findings but some key costs are omitted or some benefits are overstated.	Identifies cursory levels of benefits or costs but is not able to gauge the impact of the research process and/or findings.	Does not gauge the social, ethical, and/or scientific costs and benefits associated with the research process and findings.

Learning Outcomes	Indicators	Exemplary	Developing	Emergent	Not Evident
4. Implement a research plan to respond to research question(s) and inform conclusion(s).	4.1 Ethically collects and analyzes appropriate information (e.g., quantitative/qualitative evidence, artifacts, products, etc.).	Implements a comprehensive and transparent process for collection and analysis of information. Builds and maintains trust with stakeholders.	Implements a collection and analysis process with some limitations with regards to accuracy, transparency, and/or trust with stakeholders.	Implements a preliminary collection and analysis process with significant limitations with regards to accuracy, transparency, and/or trust with stakeholders.	Does not collect and analyze appropriate information.
	4.2 Validates the integrity of methods, results, and findings (e.g., reproducibility, quality assurance/control process, missing data, source validation, primary source verification, outliers, data accuracy).	Thoroughly validates the integrity of methods, results, and findings .	Validates the majority of methods, results, and findings.	Validates some methods, results, and findings with limitations.	Does not validate the integrity of methods, results, and findings.
	4.3 Adapts the research plan in response to risks/setbacks, new information, accessibility needs, unexpected discoveries, and new ethical considerations.	Effectively revises and implements the updated research plan based on the identified risks/setbacks, new information, accessibility needs, unexpected discoveries, and new ethical considerations.	Identifies research risks/setbacks, new information, accessibility needs, unexpected discoveries, new ethical considerations and proposes limited ways to adapt the research plan.	Identifies potential or actual research risks/setbacks, new information, accessibility needs, unexpected discoveries, and new ethical considerations but proposes an insufficient adaptation to the research plan.	Does not adapt the research plan in response to risks/setbacks, new information, accessibility needs, unexpected discoveries, and new ethical considerations.
	4.4 Generates well-supported and transparent conclusions, implications, and recommendations for future research and/or action.	Generates well-supported and transparent conclusions in a precise manner and provides compelling implications and recommendations for future research and/or action.	Generates adequate and/or incomplete conclusions and identifies minimal implications and recommendations for future research and/or action.	Generates surface-level conclusions but lacks transparency and has no recommendations for future research and/or action.	Does not generate well-supported and transparent conclusions, implications, and recommendations for future research and/or action.

Learning Outcomes	Indicators	Exemplary	Developing	Emergent	Not Evident
5. Communicate and engage with relevant audiences about research.	5.1 Prepares research communications that are appropriate to the intended audience(s), considering audiences' prior knowledge, interest, investment in research topic, and accessibility needs.	Prepares research communications in effective formats that demonstrate a clear consideration of the relevant audiences and fully meet accessibility requirements.	Prepares research communications that demonstrate some consideration of relevant audiences, organizational principles, thoughtfulness about format, and basic accessibility requirements.	Prepares research communications that may follow general conventions but that do not demonstrate a clear consideration of the relevant audiences (e.g., too specialized or too general; format poorly suited to the audience) and may lack accessibility features.	Does not prepare research communications that are appropriate to the intended audience(s), considering audiences' prior knowledge, interest, investment in research topic, and accessibility needs.
	5.2 Accurately and ethically represents research to audiences (e.g., transparently represents research process and conclusions, properly credits all collaborators).	Fully exercises accuracy and ethics while representing research to audiences.	Exercises accuracy and ethics while representing research to audiences with some limitations (e.g., fails to credit collaborator, misrepresents research findings or contributions).	Minimally exercises accuracy and ethics while representing research to audiences with some limitations (e.g., fails to credit collaborator, misrepresents research findings or contributions).	Does not accurately and ethically represent research to audiences.
	5.3 Responds to and/or gives feedback on research.	Engages fully and respectfully in critical conversation and generative discussion, including providing constructive criticism; accepts and integrates criticisms and feedback.	Engages in aspects of critical conversation with some limitations; attempts to integrate feedback into research.	Demonstrates gaps in knowledge that limit effective engagement in the critical conversation or may demonstrate resistance to constructive feedback.	Does not respond to and/or give feedback on research.