University Research Pathways (URP 150)- Processes of Science Research

Course Map 2022-2023

Mr. Brandon M. Hart, MS, MA (room 347)
Email: Bhart2789@schools.nyc.gov
Website: https://sites.google.com/schools.nyc.gov/rchssci/home

UNIT TITLE/ESSENTIAL QUESTION(S)	UNIT SKILLS AND CONTENT	CORE TEXTS AND MATERIALS	FORMATIVE & SUMMATIVE ASSESSMENTS	CSRE ALIGNMENT	COMMON CORE/CONTENT STANDARDS
Unit 1: Introduction to research & Scientific Inquiry **Essential Question: What is the current state of the STEM field? How do scientists use inquiry and investigation to contribute to science?**	**Learning Goals 1:** 1. Identify scientists who made important contributions to the field of science in which you can culturally identify with. 2. Discuss the roles of minorities and gender within science research and the adversity that pushes scientific discovery forward 3. Discuss the gaps within minorities in science. **Learning Goals 2:** 1. Appropriately identify the parts of an experiment and scientific method. 2. Discuss how peer-review and science research is published. 3. Use Google Scholar to obtain	**Research Methodology:** A Step-by-Step Guide for Beginners - 4th edition	1. SUPA commitment letters 2. HE3AT commitment letters 3. famous science posters 4. Lab journal with daily notes 5.Experiment 1 - manipulating calcium and magnesium complexes in plants 6. Experiment 2- generating electricity building wind turbine blades	1. Respectfully, and with care, engage in difficult conversations, particularly those that challenge power and privilege in our society. 2. Lean into discomfort, taking emotional and academic risks by engaging in critical conversations. 3. Challenge oneself to do more than what feels academically comfortable. Set high goals and continuously revise them to push yourself out of your academic comfort zone. 4. Promote the group's success and support the participation of everyone in the learning task. 5. Collaborate with teachers, peers, and administrators to create opportunities for meaningful long-term	1. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. **(HS-ETS1-1)** 2. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. **(HS-ETS1-1)** 3. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent

	peer-reviewed articles as introductions for science research questions. 4. Identify hypotheses within an experiment and distinguish between the different types of hypotheses that exist 5. Maintain an organized lab notebook 6. Develop a research question 7. Read and identify parts of a science research paper. 8. Analyze a research paper 9. Discuss scientific findings 10. Manipulate multiple variables for experimental procedures 11. Contribute scientific research by creating posters. 12. Communicate like scientist and composing professional emails 13. Begin internship placements within HE3AT and/or field based partners.			projects, project-based learning activities, and field visits that allow all students to demonstrate their knowledge and growth over time, and align to the varied learning styles and interests of those in the class community 6. Seek help and guidance, when needed, from broader support networks such as peers, family, and trusted adults.	understanding of a process, phenomenon, or concept, resolving conflicting information when possible. **(HS-ETS1-1)** 4. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. **(HS-ESS2-5)** **5.** Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

					(HS-PS3-3)
Unit 2: Researching, using databases, and evaluating sources **Essential Question:** **How is science research published? What are trusted sources to find scientific information?**	1. Use the Syracuse University search library for published research articles. 2. Implement and use boolean search terms to narrow searches 3. Distinguish between periodical and library databases 4. Distinguish between journals, magazines, and newspapers. 5. Use database aggregators to find alternate types of documents 6. Use truncation and quotation marks to narrow searches. 7. Use subject searching and keywords to narrow searches. 8. Familiarize self with different types of databases based on topics 10. Construct an annotated bibliography with an extensive list of sources to defend a hypothesis.	**Research Methodology:** A Step-by-Step Guide for Beginners - 4th edition	Entrance and exit tickets Science notebook Citation machine project Annotated bibliography Research proposal and presentation	1. Express respectful agreement or disagreement with opinions, validating the knowledge of peers, or challenging their viewpoints in constructive ways. 2. Take risks and learn from your mistakes, in order to grow academically and emotionally. 3. Challenge oneself to do more than what feels academically comfortable. Set high goals and continuously revise them to push yourself out of your academic comfort zone. 4. Work cooperatively toward goals and hold each other accountable in supportive ways. 5. Generate ideas about people or concepts that peers may like to learn about and share these ideas with your teachers and school leaders. 6. Challenge power and privilege were present, or absent, in the curriculum by locating other resources or requesting curriculum	1. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. **(HS-ETS1-1)** 2. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. **(HS-ETS1-1)** 3. Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. ***(HS-ESS3-1)*****,(HS-ESS3-2),(HS-ESS3-4) (HS-ESS3-2),(HS-ESS3-4).**

	11. Determine how bias can be presented within research and how to eliminate sources based on bias 12. Propose a research project and question			that is inclusive of multiple perspectives.	
Unit 3: Constructing research papers **Essential Question:** How do scientists communicate ideas and publish articles?	1. Synthesize non-fiction text in order to use the information to defend the research question within the article. 2. Create a research question that is challenged, and rewrite the questions numerous times to identify the base course of procedures 3. Explain the components of a research paper 4. Use of citation machines to keep track of sources for bibliography section 5. Construct a research thesis with the following components: Introduction 1. Review of Relevant Research 2. Methods	Ballenger, Bruce. The Curious Researcher: a Guide to Writing Research Papers. 3rd Ed. Boston: Longman, 2001.	1. Research paper 2. Revisions 3. Rough draft / final draft 4. Entrance / exit tickets 5. Quizzes	1. Challenge power and privilege were present, or absent, in the curriculum by locating other resources or requesting curriculum that is inclusive of multiple perspectives. 2. Seek help and guidance, when needed, from broader support networks such as peers, family, and trusted adults. 3. Take risks and learn from your mistakes, in order to grow academically and emotionally.	1. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. **(HS-ETS1-1)** 1., Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design

	3. Findings (Results/Analysis) 4. Discussion (e.g., Interpretation, Connection to Existing Research, Implications, Limitations of the Study) 5. Conclusion 6. Appendix(es) [only if required by the project; e.g., curriculum project] 7. Distinguish between types of citations MLA, APA, and Chicago in terms of the students' research. 8. Utilize revisions to reconstruct research papers.				accordingly. (HS-PS3-4) 2., evaluate the validity and reliability of multiple claims that appear in scientific and technical texts or media reports, verifying the data when possible. (HS-PS4-4) 3., Communicate technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HSPS4-5) 4., Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that heories and laws that

					describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS1-6),(HSLS2-3)
Unit 4: Research Methods & statistics **Essential Question:** **Why do scientists use statistics to gather, review, analyze, and draw conclusions from data and apply mathematical models to variables?**	**Distributions & presenting data** 1. Construct and display distributions including normality, quantile, and normal plots 2. construct, interpret, relationships in scatterplots, least-square regressions, and causation 3. Produce data via experiments in which samples can apply statistics **Probability** 1. solve equations and problems using randomness,	**None**	Entrance and exit tickets 2 Unit exams divided by Algebra 1 and Algebra 2 standards Quizzes Homework Discussion Explore learning Gizmos	1. Make an effort to build strong relationships across groups, talking to and getting to know a variety of peers and their perspectives. 2. Address implicit bias in the school and community environment. 3. Identify inequity and challenge it when you see it. 4. Draw upon your past learning, prior experiences, and the richness of your cultural background to make meaning of new concepts and apply learning on an ongoing basis. 5. Identify, discuss and dismantle implicit bias in curriculum and assessment. 6. Ask questions about self, community, and society that may serve as opportunities to connect in-school	**S.ID.A.4** Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. **S.ID.B.6** Represent data on two quantitative variables on a scatter plot, and describe how the variables are related (linear focus, discuss general principle). **S.IC.A.1** Understand statistics as a process for making inferences

	models, variances, laws, and proportions **Inferences** 1. Estimate with confidence, select test of significance, single vs two proportions, and Anova. **Inferences for regression** 1. Solve simple linear regressions 2. Select statistical test for analysis including Wilcoxon Rank Sum Test, signed rank test, and the Kruskal-Wallance test. **R- Software** 1. Synthesized large data sets into a computer statistical program			learning with the world outside the classroom. Share these questions and any related ideas with your teachers and school leaders.	about population parameters based on a random sample from that population. **S.IC.A.2** Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. **S.IC.B.3** Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. **S.IC.B.4** Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. **S.IC.B.5** Use data from a randomized experiment to compare two treatments; use

	2. Computer code to create visual representations of data 1. Estimate using confidence - test of significance - use and abuse of tests about inference and power 2. Inferences - calculating mean and comparing means - single proportions and comparing proportions 3. Two-way tidy tables - two-way regressions (relations in categorical data)				simulations to decide if differences between parameters are significant. **S.IC.B.6** Evaluate reports based on data. **S.CP.A.1** Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not"). **S.CP.A.2** Understand that two events *A* and *B* are independent if the probability of *A* and *B* occurring together is the product of their probabilities, and use this characterization to determine if they are independent. **S.CP.A.3** Understand the conditional probability of *A* given *B* as *P*(*A* and *B*)/*P*(*B*), and

					interpret independence of *A* and *B* as saying that the conditional probability of *A* given *B* is the same as the probability of *A*, and the conditional probability of *B* given *A* is the same as the probability of *B*. **S.CP.A.4** Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor*

					science given that the student is in tenth grade. Do the same for other subjects and compare the results. **S.CP.A.5** Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. *For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.* **S.CP.B.6** Find the conditional probability of *A* given *B* as the fraction of *B*'s outcomes that also belong to *A*, and interpret the answer in terms of the model. **S.CP.B.7** Apply the Addition Rule, *P*(*A* or *B*) = *P*(*A*) + *P*(*B*) – *P*(*A* and *B*), and interpret the answer in terms of the model.
Unit 5: Independent research projects	1. Design a research question	**Research Methodology:**	Research question assignment	1. Take ownership of the physical space and	1. Critically read scientific literature

Essential Question: **How do I want to contribute to science research?**	2. Begin field research or independent research 3. Carry out an experiential procedure by deciding next steps 4. Use feedback as informed decisions in research process 5. Explore and use various types of science equipment 6. Utilize basic mathematical conversions and statistics for research 7. Synthesize a research report that explains research 8. Work with teams to generate research products 9. Use search engines to search for background information	A Step-by-Step Guide for Beginners - 4th edition	Journal entries Research paper Research synthesization and progress- 1-1 meetings	learning environment in the school community, welcoming others, taking on leadership roles as school ambassadors, and creating and engaging in activities that improve the school climate and culture for students of diverse backgrounds. 2. Identify inequity and challenge it when you see it. 3. Actively engage in service learning opportunities, when available, to expand learning beyond the classroom. Encourage peers to collaborate with you in these learning opportunities. 4. Ask questions about self, community, and society that may serve as opportunities to connect in-school learning with the world outside the classroom. Share these questions and any related ideas with your teachers and school leaders. 5. Set goals toward future aspirations and collaborate with teachers and families to	adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. 2. Compare, integrate and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem. 3. Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source. 4. Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or

				make plans about achieving them. Work daily toward accomplishing these goals. 6. Challenge yourself to learn about people, cultures, languages, orientations, abilities, and socioeconomic backgrounds different than your own.	designs that appear in scientific and technical texts or media reports, verifying the data when possible. Communicate scientific and/or technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). 5. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. **(HS-ETS1-1)**
Unit 6: Communicating Scientific Information **Essential Questions: How is science communicated?**	1. Use various computer programs including: Padlet, conceptmap, conceptboard, google slides,	**Research Methodology:** A Step-by-Step Guide for Beginners - 4th edition	Research presentation Canva infographics FInal research paper	1. Take ownership of the physical space and learning environment in the school community, welcoming others, taking on leadership roles as school	Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or designs that appear in scientific and technical

	microsoft office, canva 2. Design a science poster to explain science data 3. Compose a science research presentation of data 4. Synthesize a final report of lab data 5. Present and verbally communicate scientific research findings 6. Accept critiques and apply critiques to increase charismatic skills			ambassadors, and creating and engaging in activities that improve the school climate and culture for students of diverse backgrounds. 2. Identify inequity and challenge it when you see it. 3. Actively engage in service learning opportunities, when available, to expand learning beyond the classroom. Encourage peers to collaborate with you in these learning opportunities. 4. Ask questions about self, community, and society that may serve as opportunities to connect in-school learning with the world outside the classroom. Share these questions and any related ideas with your teachers and school leaders. 5. Set goals toward future aspirations and collaborate with teachers and families to make plans about achieving them. Work daily toward accomplishing these goals.	texts or media reports, verifying the data when possible. Communicate scientific and/or technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).

				6. Challenge yourself to learn about people, cultures, languages, orientations, abilities, and socioeconomic backgrounds different than your own. 7. Promote the group's success and support the participation of everyone in the learning task. 8. Strive and take pride in producing high quality work, using feedback to revise work, continuously improve, and set new goals.	