Sophomore Research: Basic Tools of Science Research & Discovery

Course Syllabus 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. Famous scientists posters 2. Lab notebook 3. Journal entry 4. Science inquiry research project 1 5. Science inquiry research project 2 6. Lab safety video /permission slips	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 understanding of a

	peer-reviewed articles as introductions for science research questions. 4. Identify hypothesis within an experiment 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 variables for experimental procedures 11. Contribute scientific research by creating posters. 12. Communicate like scientist and composing professional emails			projects, projectbased 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.	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. Discuss library science 2. Identify databases: google scholar, science.gov, microsoft academics 3. Academic University research journals 4. Identify how universities such as Syracuse University have research databases that allow you to narrow searches. They also allow you to access free published research 5. Use a database to conduct background research 6. Identify and use boolean phrases to search for articles 7. Annotate and synthesize information from a research paper 8. Construct an annotated bibliography 9. Identify bias within research and published research. 10. Use research indexes to identify bias search engines	**Research Methodology:** A Step-by-Step Guide for Beginners - 4th edition	Entrance and exit tickets Science notebook Citation machine project Annotated bibliography Research proposal	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 where 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)** **4.** Write informative/explanatory texts, including the

	11. Construct a scientific question and create a research proposal 12. Analyze parts of a research paper and use cartooning methods to annotate			that is inclusive of multiple perspectives.	narration of historical events, scientific procedures/ experiments, or technical processes. **(HS-ESS3-1)**
Unit 3: Statistics **Essential Question:** **Why do scientists use statistics to gather, review, analyze, and draw conclusions from data and apply mathematical models to variables?**	1. Identify statistical symbols and basic equations 2. Sampling 3. Analyzing samples with descriptive statistics 4. Variables and tidy tables 5. Research questions, hypothesis, and predictions 6. Inferential Statistics and The Student's t-Test 7. Biostatistics and experimental design	**Research Methodology:** A Step-by-Step Guide for Beginners - 4th edition	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	**1. S.ID.A.1:** Represent data with plots on the real number line (dot plots, histograms, and box plots). **2. S.ID.A.2:** Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. **3. S.ID.A.3:** Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). **4. S.ID.B.5:**Summarize categorical data for two categories in two-way frequency tables. Interpret

				connect in-school learning with the world outside the classroom. Share these questions and any related ideas with your teachers and school leaders.	relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data (linear focus, discuss general principle). **5. 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.ID.C.7:** Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. **S.ID.C.8:** Compute (using technology) and interpret the correlation coefficient of a linear fit. **S.ID.C.9:** Distinguish between correlation and causation. **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.IC.A.1:** Understand statistics as a process for making inferences 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. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?*

					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 simulations to decide if differences between parameters are significant. **S.IC.B.6:** Evaluate reports based on data.
Unit 5: Independent research projects **Essential Question:** **How do I want to contribute to science research?**	1. Design a research question 2. Begin field research or independent research 3. Carry out an experiential	**Research Methodology:** A Step-by-Step Guide for Beginners - 4th edition	Research question assignment Journal entries Research paper Research synthesization and progress- 1-1 meetings	1. Take ownership of the physical space and learning environment in the school community, welcoming others, taking on leadership roles as school ambassadors, and	1. Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information

	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			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.	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 designs that appear in scientific and technical texts or media reports, verifying the data when possible. Communicate

				6. Challenge yourself to learn about people, cultures, languages, orientations, abilities, and socioeconomic backgrounds different than your own.	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, microsoft office, canva 2. Design a science poster to explain science data	**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 ambassadors, and creating and engaging in activities that improve the school climate and culture for	Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or designs that appear in scientific and technical texts or media reports, verifying the data when possible. Communicate scientific and/or technical information

	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			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. 6. Challenge yourself to learn about people, cultures, languages, orientations, abilities, and socioeconomic	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).

				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.	