Course Name:	Scientific Literacy
Language of Instruction:	English
Course Dates:	July 27 to August 22, 2022
English Tutoring Time:	Mondays, Wednesdays, Fridays 6:30-7:00 am, EDT
Course Meeting Time:	Mondays, Wednesdays, Fridays 7:00-9:00 am, EDT
Course Meeting Place:	Zoom

约克大学

约克大学位于加拿大的商业、技术和文化中心多伦多，是加拿大一所著名的综合性大学。作为加拿大的第三大高等学府，约克大学每年有约 55,000 名在校生，国际生将近 20%，来自一百七十多个国家，以其文化和知识的多元化而闻名。

约克大学的教育注重各学科知识的融会贯通与灵活运用，为学生提供了丰富多彩的学习机会，不仅仅考核学生的学习与答辩成绩，更是鼓励学生发现与分析问题。此外，为了进一步促进学生的跨学科综合思考能力，学校还允许学生参与完全不同领域专业的学习。

约克大学现与世界上一百五十多所大学签有合作协议，包括中国的北京大学、北京航空航天大学、中国社会科学院、复旦大学、中欧国际工商管理学院、四川大学等，进行广泛的交流与合作。

课程简介

科学素养是理解关键科学概念和过程的能力，并利用这些知识做出更明智的决定并更好地与社会互动。该科学素养课程以研究框架为基础，概述了研究中涉及的不同方法、考虑因素和挑战。本课程考察研究过程的各个组成部分，包括研究问题或研究假设的制定，文献综述，研究设计，数据收集和数据分析。此外，还探讨进行研究的道德协议。该课程将探索各种方法，用以解释和分析数据，发布研究结果以及有效呈现和传达研究结论。
在课程中，学生将创建一个研究报告的组成元素，其中包括分析数据的方法，以及将研究结果传播给各种受众。

Science literacy is the ability to understand key scientific concepts and processes, and to use this knowledge to make more informed decisions and to better engage with society. Grounded in a research framework, this scientific literacy course offers an overview of the different approaches, considerations and challenges involved in research. This course examines the various components of the research process including the formulation of research questions or a research hypothesis; the review of the literature; research designs; data collection; and analysis of data. In addition, the ethical protocol in conducting research is examined and the course will explore various ways to interpret and analyse data, publish research findings and effectively present and communicate research conclusions.

During the course the students will develop the elements of a research proposal, that includes ways that data can be analyzed, and research findings disseminated to a variety of audiences.

Upon successful completion of this course the student will be able to:

- Differentiate between different methods of scientific inquiry
- Identify research problems worthy of investigation within a specific discipline
- Describe the research process used to investigate research problems
- Discuss the types of research methods best suited for investigating different types of problems and questions
- Discuss ways to use technological tools to support research activities, retrieving and processing information as well as presenting and communicating findings
- Discuss ethical principles to promote responsible research design
- Analyse literature to support the aims of research
- Design a research proposal to explore a research question or hypothesis

Course Design

The format of instruction is a combination of lectures and exercises.

In addition to the hands-on workshops, there will be a group term project (4-5 students per group) that will have a progress presentation on the sixth lecture (middle of the accelerated term) and a final presentation on the twelfth lecture (last lecture) acting as midterm and final grades.

Students are expected to have read the assigned material and review the lecture slides in advance, and come prepared to discuss the subject matter and raise questions on parts they wish to have a better understanding of the content. The time spent doing the class activities is a critical component of the in- class learning process.

Lecture attendance is mandatory. All teaching materials and assignments will be posted on eClass. All communications will be conducted via eClass

Outline of the Topics of the Course

Week 1

Wednesday - July 27, 2022

- Overview of Scientific Inquiry
- What is Science Literacy?
- Course goals and expectations

Friday – July 29, 2022

- Overview of the Research Process
- Ethical Principles for Research
- Defining a Research Question or Hypothesis

Week 2

Monday - Aug 1, 2022

- The Scientific Method
- Qualitative, Quantitative and Mixed Methods research design
- Elements of a Research Proposal

Wednesday – Aug 3, 2022

- Analyzing the Literature
- Finding the Right Sources
- Conducting a Search of a Research Topic using Databases

Friday – Aug 5, 2022

- How to Read a Scientific Paper
- Identifying the Structure of a Scientific Paper
- Creating notes and answering questions to improve comprehension and recall

Week 3

Monday - Aug 8, 2022

- Midterm Project Presentations

Wednesday – August 10, 2022

- Selecting Sources of Data
- Data Collection Methods
- Planning a Research Project

Friday – Aug 12, 2022

- Principles of Data Visualization
- Introduction to Tableau
- Creating Graphs in Tableau

Week 4

Monday - Aug 15, 2022

- Using calculated fields in Tableau
- Creating a Dashboard in Tableau
- Creating a Data Story in Tableau

Wednesday – Aug 17, 2022

- Presenting Research Findings
- How to create and give an effective PPT presentation
- How to design and present a poster

Friday – Aug 19, 2022

- Writing a Research Proposal
- Determining Reliability and Validity of research findings
- Applications and Limitations of Research Studies

Final Presentations

Monday - August 22, 2022

- Final Group Presentations

Evaluation Method

Midterm – Preliminary Research Plan (Due August 8th, 2022): 25%
Research Proposal and Presentations (Due August 19th and August 22nd, 2022): 55%
Class Participation and Weekly activities: 20%

Working in groups of 4 -5 students will be required to consider, write, and submit a research proposal that identifies the plan of a possible research study. A generic outline of the Proposal format will be provided.

August 8, 2022 – Preliminary Research Plan – 25%
The Plan will be 1 – 2 pages in length and include the following:

- A brief overview of the Research project (3-4 sentences)
- Research Questions or Hypothesis – The research questions that you wish to answer through this research study along with a brief explanation of what information or answers your research will aim to provide
- List of the ethical considerations for the study (if applicable)
- A brief description of the proposed methodology – 2 sentences
- Importance of the Research based on the Literature – a paragraph (5 – 10 sentences). A very brief explanation of why (and to whom) the project is of value to your field of study (e.g., why is this important from an Environmental Site Remediation perspective). This section must refer to 2 articles that you gathered for your Literature Review that ***briefly*** describe of what is already known about this area and why you have chosen to do this study.

August 19-22, 2022 Outline of Research Proposal - 55%
Building on the Research Plan, students will provide an Outline for a Research Proposal, 4-5 pages in length that includes the following:

The Plan (**Due August 19th, 2022**) will be 1 – 2 pages in length and include the following:

- **A brief overview of the Research project** (3-4 sentences)
  Research Questions or Hypothesis – The research questions that you wish to answer through this research study along with a brief explanation of what information or answers your research will aim to provide.

- **List of the ethical considerations for the study**

- **Importance of the Research based on the Literature** – 2 paragraphs. An explanation of why (and to whom) the project is of value to you field of study (e.g., why is this important from an Environmental Site Remediation perspective). This section must refer to 5 articles that you gathered for your Literature Review which very briefly summarize what is already

known about the field. Include a summary of the basic background information on the topic extracted from your literature review.

- **A brief description of the proposed methodology.** In this section you will specifically explain:
    - the precise methodology that you will use to obtain the information and/or answers that you identified in the "Proposed Research" section, and
    - why that methodology is the optimal one to help you get the data you need, to answer your Research Question. Explain why you chose qualitative and or quantitative research or experimental research
- **Proposed Data Analysis** - Briefly describe, in one paragraph, what your data analysis plan is and which methods you will use to ensure validity and reliability of the interpretation of your findings. Address if there are any specific steps required to ensure proper handling of your data, e.g. anonymity or confidentiality concerns. Consider carefully what your variables are, are they dependent or independent, if you require any groupings or reshaping of your collected data, are there any data cleaning steps that are required, which calculations need to be performed, what calculations or statistical methods/tests might be required in order to test the proposed hypothesis, what data visualization methods will you use, are there any specific programs that are required for your proposed analysis?
- **Significance and Conclusion**
  Discuss, in general, how your proposed research would lead to a significant improvement over the original studies, and how it would benefit the field. (In other words, why should someone care? If you were applying for money to do this, why would someone fund you? If you wanted to publish your results, why would they be interesting?)
- **A Works Cited page**

Presentation of the Research Proposal – Monday Aug 22, 2022

During the final class each group will also be required to provide a 7-minute presentation to the class about their Research Proposal. Class time will also be devoted to discussing difficulties and opportunities related to each research proposal.

Required Software

TABLEAU - *You need to request a copy of the software.*
Software download link (free for students): https://www.tableau.com/academic/students ;

Course Instructors

Dr. Valerie Lopes

Valerie has expertise in research design, methodology and methods; professional learning and faculty development; the design and development of outcomes based curriculum and courses for a range of credentials; as well as researching and implementing technology that enable learning experience.

Currently she is a Professor at Seneca College, affiliated with *York University* and the lead consultant for the Center for Teaching, Learning and Technology for the *University of Central Asia*. She is a Member of the Council of 3M National Fellows for Teaching and Learning in Higher Education, an advisor on the Curriculum Review Committee for OISE/University of Toronto's Continuing and Professional Learning Programs; and a peer reviewer for the International Journal of Education and Development using Information and Communication Technology (IJEDICT). She has done research and assessment projects for the Higher Education Quality Council of Ontario, Colleges and Institutes Canada, eCampusOntario, and the International Finance Corporation (World Bank Group).

She is focused on engaging students as active participants in learning. She has designed and developed curriculum for colleges, universities and institutes in Kyrgyzstan, Tajikistan, Tanzania, Columbia, Mozambique and China. She has a range of publications and have presented at workshops and conferences locally, nationally and internationally. She has a PhD in Leadership in Higher Education from the University of Toronto, an MA in Education from the University of Central Michigan and a BSc from the University of Toronto.

Dr. Tihana Mirkovic

Dr. Tihana Mirkovic is an Assistant Professor, Teaching Stream, at York University. She has received her B.Sc. in Chemistry and Mathematics and her Ph.D. in Physical Chemistry from the University of Toronto where her interdisciplinary research encompassed the development of nanomaterials and studies of photophysical and dynamical aspects of nanoscale systems.

As a Postdoctoral Fellow and Research Associate, she focused on elucidating the photophysical properties of light-harvesting systems occurring in nature, such as proteins involved in photosynthesis. She has over 10 years of teaching experience, having taught undergraduate courses in Chemistry and Engineering as a Sessional Lecturer at the University of Toronto prior to joining York University. At York, she teaches general chemistry, physical chemistry and leads the third-year chemistry lab courses in which she focuses on advancing students' laboratory skills and puts particular emphasis on the development of their scientific literacy through specifically designed skills building sessions.

Her interest in education spans beyond the classroom, as she has been involved in a number of outreach programs, most notably as a senior mentor for the Canadian Chemistry Olympiad and as a

volunteer for Pueblo Science, a non-profit organization aiming to increase science literacy in developing countries.