



Let A be all numerate people, t time in years

$$t \geq 2030 \rightarrow A^c = \emptyset$$



This work is licensed under a Creative Commons Attribution-Non
Commercial-Share Alike 4.0 International License.

Developed by Mary Wall, Pamela Ip, and Candy Ho through the MC - KPU
United Nations Sustainable Development Goals Open Pedagogy Fellowship

Abstract

How we design a world in which all people achieve numeracy is a long standing open problem. It has not been solved. This renewable assignment introduces the objectives of the United Nations Sustainable Development Goals, and then through that framework explores possible impediments to Mathematics learning. It concludes with challenging students to develop strategies for improving an individuals numeracy.

Contents

1	Introduction: United Nations Sustainable Development Goals Renewable Assignment	6
1.1	United Nations Sustainable Development Goals	6
1.2	Montgomery College & Kwantlen Polytechnic Collaboration . .	7
1.3	Innumeracy Assignment Design	8
1.4	A Note on Implementation	8
2	Local Assignment #1: What Does a Mathematician Look Like?	9
2.1	Mathematician Images	9
2.2	Impostor Syndrome in Mathematics	10
2.3	Mathematical Popplet	10
2.4	Wiki Creation and Editing	10
3	Local Assignment #2: A Numerate World	11
3.1	Data Collection	11
3.2	Community Resources	11
3.3	Compare and Contrast Podcast	11
4	Local Assignment #3: MATH I'M SCARED	12
4.1	Class Discussion	12
4.2	Word Cloud	13
4.3	Meditation Mindfulness Speaker	13
5	Local Assignment #4: Choose Numeracy	13
5.1	I'm Aware of my Bad Reputation	13
5.2	Marketing the Impossible	14
6	Global Assignment: Think Globally Act Locally	15

Acknowledgment

I would like to acknowledge faculty and staff at Montgomery College who made this collaboration possible, our fellowship leaders Shinta Hernandez, Dr. Michael Mills, and faculty mentor Dr. Mary Robinson as well as faculty at Kwantlen Polytechnic University, including Dr. Rajiv Jhangiani. Sincerest gratitude for the collaboration between Candy Ho and Pamela Ip of KPU, whose willingness to converse in countless sessions of GoTo Meeting added immense perspective. I have resigned myself to the fact that mathematics is largely unpopular. Though, I can not think of a time in history where mathematical prowess is more necessary for well being, so I persist in teaching.

M. Wall

1 Introduction: United Nations Sustainable Development Goals Renewable Assignment

This essay will give a brief introduction to the United Nations Sustainable Development Goals (UNSDG) as well as the collaboration between Montgomery College (MC) and Kwantlen Polytechnic University (KPU). Additionally, the specific topic chosen for consideration through the framework of the UNSDG with students in classes at both MC and KPU will be presented. The remaining chapters discuss the specific content of the renewable assignment introduced to students in the 2019 - 2020 academic year.

1.1 United Nations Sustainable Development Goals

In 2015, the United Nations developed a design plan for the improvement and sustainability for the the world and the living conditions of all people. This plan is delivered in the form of 17 transformation goals addressing current world issues such as, No Poverty, Zero Hunger, Good Health and Well being, Quality Education, Gender Equality, Clean Water and Sanitation, Affordable and Clean Energy, Decent Work and Economic Growth, Industry, Innovation and Infrastructure, Reduced Inequalities, Sustainable Cities and Communities, Responsible Consumption and Production, Climate Action, Life Below Water, Life on Land, Peace, Justice and Strong Institutions, and Partnerships for the Goals to be accomplished by 2030. Each topic incorporates multiple targets or sub goals meant to address all nations, human issues, and planetary issues. The goals are comprehensive and connected, for example good health and well being cannot be achieved without clean water and sanitation. [1]



Interestingly these goals are based upon, an extension of the Millennium Development Goals a series of 8 similar global issues: Eradicate Extreme Poverty and Hunger, Achieve Universal Primary Education, Promote Gender Equality and Empower Women, Reduce Child Mortality, Improve Maternal Health, Combat HIV/AIDS, Malaria and Other Diseases, Ensure Environmental Sustainability, and Global Partnership for Development. These goals were developed in 2000 with an envision target of achievement in 2015. [2]



1.2 Montgomery College & Kwantlen Polytechnic Collaboration

In Summer 2019 a handful of Montgomery College (US) faculty in collaboration with faculty from Kwantlen Polytechnic University (Canada) gathered to see how we could harness our respective individual discipline related academic skills to address the 17 transformation goals. Faculty were teamed up into groups across nation and discipline, challenged to create renewable assignments aimed at a particular UNSDG for course implementation. A disposable assignment is one that meets a course objective, and is considered only once in a learners life. Our charge, was to create an assignment which students could complete in a semester, but could consider for a lifetime. (Wiley, 2013)[3]

Cross discipline collaboration is a critical component of this work as our varying academic perspective informed a unique approach to assignment creation. Our group consisted of Mary Wall, Candy Ho, and Pam Ip, a Mathematics,

Education and Marketing academician, respectively.

1.3 Innumeracy Assignment Design

Response to Target 4.6

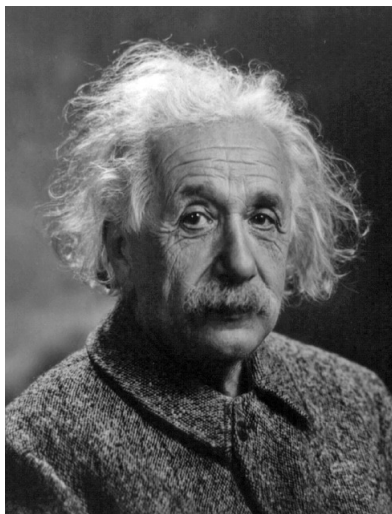
This renewable assignment is created in response to UNSDG #4 Quality Education: Target 4.6 “By 2030, ensure that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy.” [4] While literacy is key, this assignment is restricted to understanding and overcoming the challenges to numeracy.

Definition 1 Numeracy is the ability to understand and work with numbers. [7]

Through a series of class discussions, personal reflection, and group work students will explore the crisis of innumeracy, potential causes, as well as some strategies to accomplish the envisioned goal of reducing the prevalence of innumeracy. Throughout the course students are required to complete a number of local assignments and class discussions culminating in a global assignment completed in groups. During the process students maintain a shared oneNote notebook, or some similar application, to journal their thoughts, contributions and pertinent details as we move through the phases of the assignment.

1.4 A Note on Implementation

This work is an open educational resource (OER). As such, you are free to access, Reuse, Revise, Remix or Redistribute. (Wiley)[3] Students are encouraged to adopt creative commons licensing and 4R permissions for work created through this assignment, in order that it be freely shared with subsequent learners. With this in mind, students should carefully consider the audience while constructing the assignment.



2 Local Assignment #1: What Does a Mathematician Look Like?

These local assignments will address the following course outcome: "Effectively communicate the concepts and applications of linear algebra using the language of linear algebra in a mathematically correct way." The following exercises emphasize the development of a math identity. During this experience, be eager to share with and learn from your peers, while at the same time considering how you might become an agent of change in your community. Some communication formats you will use include publication through web utilizing creative commons copyright, Wikipedia authoring and editing, the organization app Popplet, oneNote, google sheets, google forms, podcasting apps and meme makers. All are freely available to you!

2.1 Mathematician Images

The first local assignment focuses on investigating mathematical figures in history, as well as building our own mathematical identity. Responses will be shared through the course discussion board.

- Share the name of a mathematician or mathematical role model you look up to, and briefly describe why you have chosen that person.
- Share an image that comes to mind when you think of a mathematician. These images could be conveyed through a written or recorded description.

- Read the following article, write a reflection in your oneNote. Be prepared for a follow up class discussion.

What Does a Mathematician Look Like?

2.2 Impostor Syndrome in Mathematics

Definition 2 (Impostor) An impostor is a person who pretends to be someone else in order to deceive others, especially for fraudulent gain. [6]

Read the following opinion pieces relating experience with Impostor Syndrome. Reflect on your thoughts related to the article in your oneNote.

Where Does Math Impostor Syndrome Come From? and On "Impostor Syndrome"

We will consider the following questions:

- What is your experience with Math growing up?
- What obvious advantages might the author have in her upbringing?
- Give examples of a situation that might undermine a student's confidence in their mathematical capability.

2.3 Mathematical Popplet

Research a mathematician of interest and create a Popplet to be shared to the class discussion board. The vertex of the Popplet will require an image of the individual and at least three facts or vignettes of interest. You may create a complex popplet or one as simplified as the following Popplet Example

2.4 Wiki Creation and Editing

Find and analyze the Wiki entry related to the Mathematician in your research. Be prepared to report in class discussion if anything is missing from the entry and what (if any) information should be added. Edit the entry to reflect the gaps. If no entry is available – create one. Consider the guidelines for editing on Wikipedia. Guidelines

3 Local Assignment #2: A Numerate World

3.1 Data Collection

Compile, analyze and interpret data regarding numeracy at the college, in the US, and a country of your choosing. You may find information related to your country of choice in the SDG 4 country profile web page. Save your data in your oneNote and record a brief analysis of your findings. Be prepared to share your thoughts in class discussion. The United Nations Educational, Scientific and Cultural Organization (UNESCO) in partnership with the Institute for Statistics (UIS) maintains the following web resource, housing comprehensive related information to UNSDG 4/ Target 6.

3.2 Community Resources

“Millions of youth and adults are unable to play their full part in the social and economic life of their communities and nations because they lack the skills to read or write a simple sentence or make a simple calculation.” (Montoya, 2018)[5] What resources are available to help individuals grow in numeracy? Share at least three relevant academic or community resources available to assist people in developing numeracy skills. Record the information in our course blog.

3.3 Compare and Contrast Podcast

Compare and contrast US math instruction with an alternate country. Anecdotal information will be welcome in this reflection. Work alone or in a team of no more than 5, to create a 3 + minute “podcast” describing your findings, to share on our math course page.



4 Local Assignment #3: MATH I'M SCARED

4.1 Class Discussion

We will consider the content of the following speakers related to the topic of Math Anxiety

Why do people get so anxious about math? Orly Rubinstein

Overcoming Math Anxiety with Danica McKellar

As you view the above media consider the following questions. We will share our thoughts in class discussion.

- What is math anxiety?
- How can one develop math anxiety?
- What can you do to combat math anxiety?
- What resources might the college provide to combat math anxiety?
- Think of a time when you had struggled with math. Describe your thoughts and emotions around the struggle and only share with the class if you are comfortable.

4.2 Word Cloud

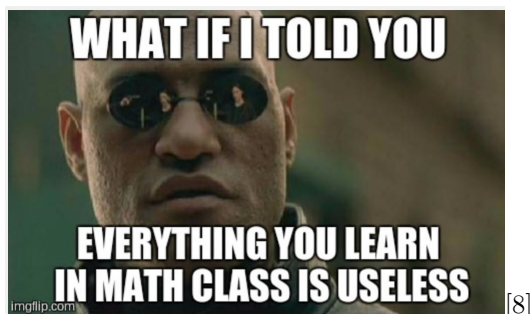
We will create a class word cloud using <https://www.mentimeter.com/features/word-cloud>. All students will have an opportunity to contribute. The theme of the word cloud is Math Anxiety.

4.3 Meditation Mindfulness Speaker

Our class will host a virtual guest addressing meditative practices reducing academic related stress to allow us to be present in the math moment. Students who can attend the livestream are encouraged to do so, the session will be recorded. All students will be asked to provide a reflection in their oneNote journal.

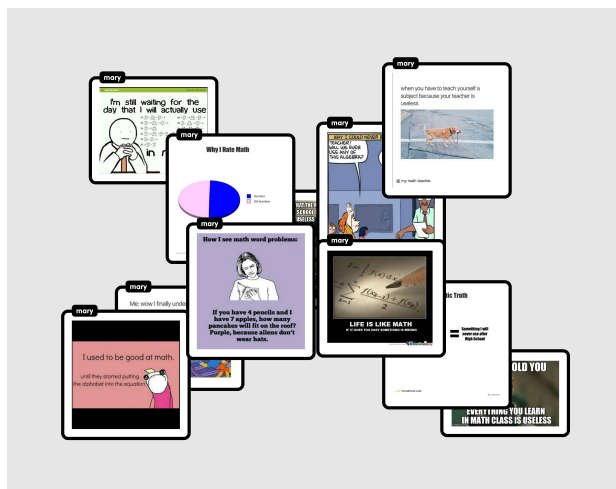
5 Local Assignment #4: Choose Numeracy

5.1 I'm Aware of my Bad Reputation



[8]

Does numeracy have a bad reputation? View the This collection of memes selected from cheeseburger.com, Facebook, imgur.com, Reddit, askideas.com reflect some perceptions related to Maths.



Use the link for an interactive view. <http://popplet.com/app/#/5440581>
 In viewing the interactive meme - note they are arranged in the shape of an x, meant to denote the use of variables in mathematics as a potential stopping block for many students. as you move through the memes notice the central meme covered by all the rest shares a different point of view.

5.2 Marketing the Impossible

Watch the following video What do we mean by numeracy?
 Keep in mind the following questions:

- What are the consequences of innumeracy?
- How is math used in our day to day life?

Write a reflection in your oneNote journal. We will discuss in the course discussion board.

Create a meme or infographic that demonstrates the value of numeracy to share to our course discussion board.



6 Global Assignment: Think Globally Act Locally

Be an agent of change in your community. Based upon class discussion and local assignments 1-4, students will address SDG #4/Target 4.6, with an original strategy of their own creation. The resulting global assignment requires instructor approval with flexibility to suit student interest. The project can be completed individually or in groups. The following recommendations are made. Note, this list is in no way intended to be limiting, however emphasis is placed on the final product utilizing social media, podcast, video, web, app creation or any other mixed media.

- Create a Twitter account and tweet as your researched mathematical role model commenting on the global trend toward innumeracy and the work of Target 4.6
- Create an app to address the challenges to numeracy. For example, considering the emotional effects on logical reasoning discussed in local assignment #3 create an app that sends positive messages to a subscriber regarding their mathematical ability. For inspiration try out the brighten app!
- Create a podcast interviewing various persons using mathematics in their chosen profession.
- Create a marketing campaign via social media to "Sell the Impossible" MATH

- Create a narrated video describing the differences and similarities between mathematics notation or mathematics instruction internationally vs in the US
- Create a video and corresponding hand out to address numeracy resources at the college and in the community.
- Create a game challenging students at any level mathematically. You may consider using a 3D printer if available at your campus for a physical game or create an applet/program. The game could address mathematical topics ranging from balancing a checkbook to stochastic processes and Markov chains
- Create a talk related to Math Anxiety to present to another math class here at the college
- Host a talk on numeracy at your local library and invite the public.
- Design a "Numeracy Survival Kit" that could assist with the challenges at the college, in our location, or in the world. Create a companion video to explain your product.
- Create a narrated power point detailing a day in the life of an innumerate fictitious character

References

- [1] <https://sustainabledevelopment.un.org/?menu=1300>
- [2] <https://www.un.org/millenniumgoals/>
- [3] <https://opencontent.org/blog/archives/2975>
- [4] <https://www.un.org/sustainabledevelopment/education/>
- [5] <http://uis.unesco.org/en/blog/meet-sdg-4-data-measuring-youth-and-adult-literacy-and-numeracy>
- [6] <https://www.lexico.com/en/definition/impostor>
- [7] <https://www.lexico.com/en/definition/numeracy>
- [8] <https://imgflip.com/i/tmb1e>