University of Essex
Department of Mathematical Sciences

MA838: Capstone Project Dissertation

Communicating Mathematics and Data Science

Karen Yim
1705960

Supervisor: **Dr. Joe Bailey**

April 2022
Colchester

Contents

List of Figures

List of Tables

Abstract

Abstract of approximately 300 words summarizes the aims, scope, and the conclusions of a dissertation.

Abstract (500 words roughly), brief rationale (meaning behind) why are you doing the study, method (explain audience, age, whatever, like experiment), results (data findings), discussions (conclusions, explain what the findings mean in context, how is it applied to the research project), limitations (what would you do to improve, or further research)

The aim of the project is to conduct a study on how to engage with students on communicating mathematics and data science. I've chosen this project as of previous interest in mathematics education and the possibility of showcasing new career options and topics to share to different age groups. The main project is communicating mathematics and data science which will be divided into sections as to use two different engagement methods. As a result

CHAPTER 1

Introduction

Introduction introduces a specific research topic, its scope, and significance, gives a review of relevant literature, and briefly outlines the logical structure of your dissertation

You can start with some introduction of your project and background.

You can make figures from files as you can see in Figure **??**. For this you need to use include graphics.

My project consists of two sections, the first is communicating mathematics to Year 9 students on the topics of Origami and Mathematics.

To communicate mathematics and data science is to ask - how did I find mathematics in secondary school and how was it interesting to learn? Many have spoken about the difficulties of understanding mathematics as it can be too "logical" that the more creative students were unable to comprehend. However, I believe this to be wrong if the teacher was able to evidently show the similarities between the arts and sciences. As of this, I have chosen to put my dedication into mathematics education and specifically on combining and sharing to others the benefits and how similar arts and sciences are. In this case, it will be origami and mathematics to communicate mathematics.

Figure 1.1: The Gauss map g_K takes $x \in \partial K$ to the outer normal $n_x \in \mathbb{S}^{n-1}$ at that point

While writing be clear and precise and give references whenever necessary. You may like to use theorem, definition, lemma, and example environments provided by LaTeX. For example,

Pioneering work of Emmy Noether [**?**] provides a connection between symmetries and conservation laws. This result, known as Noether's theorem states that

Theorem 1.0.1 (Noether, [?]) *Every differentiable symmetry of the action of a physical system has a corresponding conservation law.*

Example 1.0.2 *This is an example.*

Lemma 1.0.3 *This is a lemma.*

Definition 1.0.4 *In 1950, Alan Turing published an article [**?**] in Mind titled "Computing Machinery and Intelligence" where he considered the question "Can machines think?". This is known as* **Turing's Test**.

Remark 1.0.5 *This is a very important remark.*

You can also make figures using LaTeXpackages for figures (e.g. the `TikZ package`) as you can see in Figure **??**.

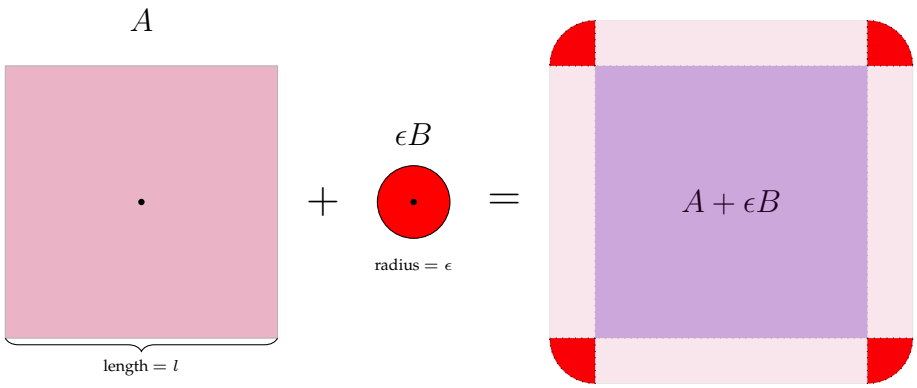

Figure 1.2: Minkowski sum of a square and ball with radius ϵ

CHAPTER 2

Literature Review

2.1 Researching Pedagogy

The text goes here ...

2.2 Good teaching practice

2.3 Different teaching methods

2.4 Presentation

2.5 Pedagogy - profession of teaching

CHAPTER 3

The National Curriculum

3.1 Overview

As this project is on the communication of mathematics and data science, the first and foremost important chapter is the national curriculum. As defined [1], The project aim is to create outreach activities that are suitable in engaging with students of appropriate age groups whilst adhering to the standards children should reach in mathematics. However, please note that there is not a fixed chronological order in which it must be taught at schools. As a result, teachers need to be aware that certain topics may not have been covered yet.

3.2 Key Stage 3 (KS3)

Key Stage 3 is the age group of 11 - 14 year olds in Year 7 - 9. My presentation for mathematics is designed in mind to be presented to Year 9 which are 13-14 year olds.

https://www.gov.uk/government/publications/national-curriculum-in-england-mathematics-programmes-of-study/national-curriculum-in-england-mathematics-programmes-of-studykey-stage-3

3.3 Key Stage 4 (KS4)

KS4 is where some children may take GCSEs at the age of 14-15 in Year 10, whereas majority take GCSEs or other national assessments in Year 11 at the age of 15-16.

3.4 Key Stage 5 (KS5)

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment$_data/file/$

CHAPTER 4

Communicating Mathematics

4.1 Topic of mathematics

The first form of communication was directed at mathematics. Whilst researching, there were a few options that had been considerable when communicating mathematics. Primarily, these were influenced by personal interests and further exploration which led to potentially creating a presentation on 'Music and Maths' and 'Origami Maths'. Consequently, the latter was chosen due to the former being used in communicating data science which with its intrinsic patterns and understanding meant that it felt more in-tune with an older age group - in this instance, sixthformers aged 16 - 18. As for communicating mathematics, the topic of 'Origami Maths' felt more hands-on and interactive which led to the lower age group of Year 9s with the teaching of Pythagoras' Theorem.

4.2 Preparation of communication

Presentation research

4.3 Making a presentation

Making the presentation slides

4.4 Realisation of other things to prepare

Preparing a detailed handover, lesson plans, handout sheets, presentation slides

4.5 Practice communication

Practicing the presentation beforehand

Leading up to the the presentation that was to be presented to the origami society, I had been practicing beforehand with a friend. During this process, I was consistently making changes whilst understanding what needs to be solidified before the presentation at the origami society. I was moving a lot to practice speaking. It was more overwhelming than I had thought as I wanted to try to make it perfect. My energy was seen but my knowledge content was still lacking. Furthermore, I was rambling during the start of the introduction which meant I was taking a lot longer for the slides that were not important. In this case, I was waffling and unable to demonstrate as well as I intended to. My face was making a lot of emotions but it was not always ideal for a school situations.

4.6 Reflections

CHAPTER 5

Communicating Data Science

The text goes here ...

5.1 Form of communication

Communicating mathematics to sixth form students in the form of a blog post.

5.2 Understand how to present a blog post

... goes here.

5.3 Preparation of a blog post

5.4 Making the blog post

5.5 Reflections

CHAPTER 6

Conclusions

And here is the final chapter showing how clever you are ....

Conclusion restates the main arguments, tells about the consequences, and provides suggestions for future work.

I would like to thank my supervisor Dr. Joe Bailey for his guidance and support during the period of writing my dissertation, my personal tutors Dr. Jess Claridge and Professor Peter Higgins for supporting me throughout the course of the degree and their advice to help me get to where I am today and finishing my modules and this project in time.

Appendix

.1 Detailed Handover

Insert detailed table of lesson plan next to presentation slides

.2 Lesson Plan

Insert lesson plan

.3 Handout sheets

Insert handouts

.4 Presentation

Insert presentation slides

.5 Presentation video

Insert video link of presentation

Text goes here https://www.gov.uk/national-curriculum

Bibliography

[1] Gov The national curriculum. *https://www.gov.uk/national-curriculum*

[2]

[3] E. Noether. Invariante Variationsprobleme. *Nachr. d. König. Gesellsch. d. Wiss. zu Göttingen, Math-phys. Klasse, Seite 235-157*, 1918.

[4] A. M. Turing. Computing machinery and intelligence. *Mind*, 59:433–460, 1950.