

Mathematics into School - Project Report

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April 2, 2025

Abstract

This report details a project delivered in partnership with Our Lady and st Thomas Catholic primary school with the aim of increasing girls confidence in maths and decreasing cases of maths anxiety. Over a series of six sessions a group of girls were introduced to a variety of mathematical content. The pedagogical insight behind the mathematical content, design and delivery of these sessions will be examined. Finally the report will evaluate the success of the project in regards to confidence anxiety, along with the legacy to the students.

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1 Introduction

1.1 Context

This project was conducted in partnership with Our lady and st Thomas school (OLST), a co-educational Catholic primary school consisting of around 120 students. The school has strong academic results with the percentage of students achieving expected or higher standard in reading, writing and maths is above the national and local average [1]. However it has been observed that some girl in the year six class lack confidence in maths lessons and interact less than hoped.

1.2 Aims

There were two main aims for the project, although they may appear similar and overlap in some aspects they are distinct.

Aim 1 – Increasing self-confidence in girls in maths

Confidence within any subject is the belief that you can rely on you own abilities. It appears that there are two ways to increase self-confidence; either improve students abilities or improve the belief in their own abilities. Nationally and in the North East the percentage of girls and boys achieving the expected standard in their maths SATs has been within 2 percentage points of each other since 2018/19 [2]. This suggests that while increasing girls abilities in maths may increase their confidence this may not be the main cause of a lack of self-confidence. One study [3] found two differences in the mindset of girls and boys. Firstly "girls tend to attribute failure in mathematics to a lack of ability whereas boys attribute failure to a lack of effort", and second girls are more likely to attribute success to external factors, such as an easy exam. This leads to a dichotomy where many girls take responsibility for their failures but do not take credit for their successes. So it was decided the best way to tackle self-confidence was in the mindset of girls.

Aim 2 – Decreasing maths anxiety in girls

Maths anxiety is in the broadest sense a feeling of worry or nervousness combined with physiological reactivity to current or future situations involving maths [4]. While this is related to low self-confidence in maths, it is possible to have one without the other. Similarly to self-confidence girls seem to be disproportionately affected. The National Numeracy survey found that women were twice as likely to experience maths anxiety as men [5], however it is important to note general anxiety is also higher amongst girls. It has been found that there is a negative relationship between maths anxiety and maths performance, that is higher maths anxiety can lead to poor performance. There are various studies around the cause and effect relationship between maths anxiety and maths performance, it is unknown if one causes the other or many believe that the relationship is cyclic. This again means that one cannot simply treat maths anxiety by improving maths performance. When dealing with maths anxiety it is important to treat both the cause and the symptoms, treating the symptoms of anxiety is more aligned with behavioural therapy, this report will focus on treating the cause of maths anxiety.

1.3 Introduction to Students

Due to the nature of the aims, this project is very individual. It was decided to to spend some time to learn the experiences of the students who would be taking part in the

sessions. One session was spent talking to the girls in the class to find out more about what the prevalence of maths anxiety was amongst the girls and what are the causes of the maths anxiety. All of the students in the session agreed with each other that they had been worried in maths lessons before. It was clear that all of the students had experienced maths anxiety before it was not appropriate or necessary to find out more about individual experiences of anxiety, it was more important to find out the causes of the the anxiety.

The girls identified three main causes of maths anxiety: fear of failure, judgement, and being left behind. One student added that maths feels frustrating because when they don't understand something, they feel stuck and unable to progress. It was with these insights in mind that the sessions were designed.

2 Activities

2.1 Structure

The year 6 class this project was taking part with had 8 girls in it, it was decided to include all of the girls from the class in the sessions. This may have reduced the amount of time that could be spent with each student, however in such a small class excluding only a few students would be unfair.

It has been found that maths anxiety is often linked to teaching style, in particular in a traditional classroom setting the teacher takes an authoritative role [6]. To mediate this the sessions would be delivered around a group table with everyone sitting to reduce my presence as a directive role.

2.2 Session 2: Möbius strips

2.2.1 Design and Delivery

This session was designed with two strategies for dealing with maths anxiety in mind. The first stems again from the link between delivery methods and maths anxiety, in particular traditional delivery methods focus on the outcome of a lesson, whether that be students gaining specific knowledge or being able to answer certain questions correctly. The remedy to this is a more constructivist approach to teaching focusing on the process rather than the product [6]. The second strategy is focused on Expectancy-Value Theory, "ACER's Mathematics anxiety and Engagement Strategy" [7] outlines four different types of value that are important motivation, we shall focus on intrinsic value in this session and utility value later on. Intrinsic value comes simply from finding value in maths because you find it interesting or enjoyable.

To align with the goal of focusing on the process of learning, the first session was created with no learning outcome in mind, that is there is no expectations for the students to learn or recreate anything from the session. The intrinsic value of the session comes from exploring a shape the students will most certainly never have seen before, with properties they will never have seen before.

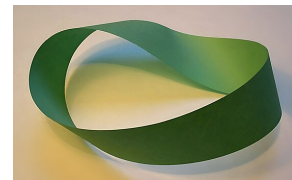


Figure 1: Möbius strip

A Möbius strip is created by taking a strip of paper, giving it a half-twist, and then joining the ends together. This creates a one sided, one edged surface. The session consisted of the students working in pairs to: make, draw on and cut the Möbius strips. These aspects of the session align

with two constructivist methods, group work and manipulation of materials as a primary source.

There was demonstration in front of the children of how to create a Möbius strip, they then worked in pairs, sometimes with external help to construct their own Möbius strip. The children were then told to draw length ways along the Möbius strip until they get back to the start. This appears to end up with a line on "both" sides of the shape even though the students only drew one line. Through this task alone the students didn't realise the surface only had one side, so they were asked a slightly incorrect question of "You only drew on one side but there is a line on both sides, how is this possible?". Through constructing a destructing more Möbius loops the students explored how a surface can have only one face.

The next task involved the students cutting down the line they had drawn. Unexpectedly the surface does not end up in two pieces, but stays as one loop with more twists in it. This property was impossible for the students to miss when they completed this task. This property was more difficult to explain simply by building Möbius strips, so in the session a prop was created by writing left and right at the end of the end of the strip so that left would align with left and right with right when the end were joined without a twist. The students could then observe that when we add a half-twist to make a Möbius strip that left joins with right and vice versa. This showed that when they cut the strips there is no left and right side for them to split into. Note, here left and right do not have any meaning and are only to show that the sides do not join as expected.

2.3 Session 3/4: Statistics

Whereas the previous session was designed with intrinsic value in mind, this activity taking place over two sessions was designed, amongst other things, around utility value intervention. This is finding value in maths because you consider it useful for future or present goals [7].

2.4 Session 5: Coordinate Grid

2.5 Session 6: 1-2 Nim

3 Evaluation

This is what will go in the evaluation

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