Mathematics into School - Executive Summary of Reflective Journal

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Introduction

I spent 9 weeks at Our Lady and st Thomas catholic primary school, and as part of my time there I delivered 6 sessions to a group of girls in the year 6 class. During my time in the classroom and running my sessions I had many of my preconceptions around teaching challenged. I would like to discuss these, starting with the use of competition in the class, including both students competing against themselves and against other students.

Competition in the Classroom

During the later weeks of my placement I observed the class I was in playing a "times tables league". This consisted of the students completing a 12 by 12 grid of times tables against the clock (Journal, Week 16). They then read out their times and they were rewarded points based on their time, with a bonus point for moving down into a new minute bracket. Their scores were kept track of over the year, with a prize awarded to people with the most points at the end of each term. I initially thought that this kind of competition was detrimental to students learning due to a few reasons. Firstly, some students may become demotivated as it is impossible for them to catch up to the students with the most points. Secondly, competition may increase students fear of failure or lead to low self-esteem.

One study found that students in "competitively structured discussion" are more anxious and lose self-assurance [1]. This is something my observations from the classroom agree with. Earlier in my placement the students took a 10 minute arithmetic test, where similarly their scores where read out. Afterwards I heard two students exchange "What did you get?", followed by "I don't know" (Journal, Week 12). This clearly shows how even when students aren't directly competing, simply having their score shared with their peers can make them feel anxious.

In my last week at the school, one of the more maths-confident students asked to do a "Times tables league", to my surprise when it was put to a vote the vast majority of the class wanted to take part (Journal, Week 19). It appears that competition does act as an effective form of motivation for the children. Shindler agrees that competition is an extremely powerful tool for motivation, but there are features of competition that make it healthy or unhealthy [2]. Most importantly a competition must be short term, have no real or significant reward, all individuals have a reasonable chance of winning and the goal is primarily fun. The "Times tables league" met some of these criteria, but the combination of the long term points system and it being almost impossible for some students to win pushes it closer to unhealthy competition.

One study of undergraduates found that introducing a competitive element to game based learning improves learning outcomes and motivation of participants [3]. I hoped to recreate the benefits seen in this study in my last session with the students. The session involved the students playing a simple game against me and their peers, importantly their was no prize, the game was simple enough that all students could win and the competition was only 20 minutes. This proved extremely effective as some of the more uninterested students put more effort into this session than previous ones (Journal, Week 19). The two main things that differentiated this from standard competition is that the students gained something when they lost, and the only thing the students were competing for was the pride of winning. As the main aim of the session was to develop a strategy for the game, the children learn by losing which likely took the fear of failure away. A standard competition involves a resource or goal that cannot be shared by everyone competing, in this case this is only the pride of winning, which is minimal as the competition was so short.

How to Write a Good Question

Questions are usually only thought about as a way to examine knowledge not a way to teach, but a good question can help students understanding and a bad question can set students back. It was in my second week at the school that I noticed the first badly written questions given to the students. The students were studying ratios, and were given a question similar to "If it takes 6 builders 9 days to build a kitchen, how many days would it take 2 builders?" (Journal, Week 12). While there is nothing inherently wrong with this question, none of the children answered it correctly showing that it did not provide a learning opportunity.

According to Sullivan there are three features a good question should have, it should be more than recall or repeating a skill, students should learn from answering the question (and teachers should learn from students answers) and there may be several acceptable answers [4]. I think the most important feature here is the ability for students to learn from a question, if a student can learn from a question it inherently includes more than recall. One paper on how to write valid maths questions posits that one reason students get maths questions wrong is because they identify the wrong schema [5]. Students will often store models of how to answer certain questions in their working memory, and when they recognise a similar problem they will call upon the schema most closely related to it.

In the earlier example, the only similar schema the children had was how to solve a simple ratio problem, so that is the one they called upon. In this example the ratio 6:9 is the same as 2:3, so the incorrect answer is it would take three days. This question fails to recognise that the students would need guidance to build a new schema which they can call upon in the future. This question should have at least two parts, one asking how total days it took to build the kitchen, and then the second using this answer to solve a simple ratio problem.

One article classifies the types of errors students make into: translation and understanding, understanding and calling upon relevant knowledge, planning, and execution [6]. This respectively relate to the knowledge requirements: linguistic and factual, schematic, strategic, and algorithmic. Linguistic, factual, and algorithmic knowledge are the most basic, that is a question to recall a fact or reproduce an algorithm does not necessarily require schematic or strategic knowledge. Questions used in the classroom should focus more schematic and strategic knowledge, in particular scaffolding and structuring questions to help students build schemas. Maths questions often have the property of being

all or nothing, they are like a puzzle in which students try different approaches until one works [5].

Even when a question is split into multiple parts, often times it can still be unnecessarily confusing. During my third week at the school the students were learning about scale drawings. They were given a question that involved a 18cm square that had been drawn to scale on a square grid as a 3 by 3 square. The question was a) $18 \div \_\_\_ = 3$ and b) One small square is worth $\_\_\_$ cm. All of the students could solve the first part easily, but had no idea how the two parts linked together. I think the question would achieve a better desired effect if the first part was a) $3 \times \_\_\_ = 18$. While they convey the exact information, I think the structure emphasis the link in a more natural way as multiplication is more intuitive to most people than division. This means the students are morel likely to learn from the qeustion and develop a schema they can use in the future.

Girls & Boys

Conclusion

References

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