How can taking learning outside the classroom improve the engagement and attitude of pupils in Mathematics?

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What did you do?

I began term 3 by distributing a pupil questionnaire to ascertain pupils' attitudes towards Numeracy. This acted as a baseline assessment to allow me to determine pupils' views and determine if pupils had a negative view towards Numeracy and their reasons for this. It also allowed me to gain an initial understanding of how pupils would view the proposed Numeracy lessons which were to be held out with the traditional classroom environment.

From here, I planned a block of Numeracy lessons, incorporating lessons which would be delivered within and out with the traditional classroom. Whilst the primary focus of these Numeracy lessons was fractions, acknowledgement was given to the significance of solidifying pupils' recall of times tables and division facts to support their understanding of this new Mathematical concept. As such, lessons for this block of Numeracy alternated between these topic areas. Opportunity was provided for pupils to develop their mental agility, work collaboratively in teams and develop and apply their problem-solving skills. The tasks/activities included textbook work, active station work, games and treasure hunts.

To gather evidence for comparative purposes between lessons delivered within the classroom environment and those out with, I decided that both pupil and practitioner focused data would be appropriate, as it would allow me to gain a broader range of information, granting me a deeper and fuller understanding of this topic. This mixed method approach is best for rationally combining quantitative and qualitative data (Ponce, 2015). Furthermore, a mixed methodology is beneficial, as it allows for a greater understanding of the research problem than any one type of approach would provide alone (Creswell, 2016).

At the end of each lesson, pupils were asked to complete a short feedback questionnaire. To ensure the questionnaire was assessable to all, a pictorial Likert scale, ranging from strongly disagree to strongly agree was adopted, with pupils being given the opportunity to provide written feedback as well. This empowered pupils to share their experiences and attitude about the lessons.

During each lesson, a reflective observational diary was kept, which enabled me to take note of which pupils were engaged throughout, which elements of the lessons did or did not work and overall record the reactions of pupils during the different tasks and activities. To aid me in my reflective process, I utilised the Gibbs' Reflective Cycle framework (1998) to help me organise my thoughts. Furthermore, during the marking processes, pupils' worked examples were analysed from their jotter work and photographs taken during outdoor activities.

At the end of the block of Numeracy lessons, pupils were asked to complete the initial pupil questionnaire again to see if their attitude towards Numeracy had changed. Additionally, feedback was also collected to determine the overall attitude of pupils towards the lessons undertaken inside and outside and how they felt during these lessons.

What are the implications?

Within Scotland, Outdoor learning has become a fundamental aspect of the Scottish Curriculum (Education Scotland, 2009). Outdoor learning permits children the opportunity to engage with learning and try new skills outside the traditional classroom environment (Learning and Teaching Scotland, 2010). Studies have identified the benefits that Outdoor learning can have on pupils' attitude towards both their learning and their engagement during lessons (Waite, 2011; Quibell et al., 2017; Marchant et al., 2019). A particular curricular area which can often be affected by negative attitudes and low engagement is Mathematics. Research has shown that such views can be a direct cause of inappropriate teaching strategies or irrelevant curricula (Attard, 2011). Furthermore, the addition of Maths anxiety can also impact negatively on pupils' attitudes, engagement and achievements in Mathematics. Maths anxiety (MA) has been described as 'a negative emotional response to current or prospective situations involving Mathematics. Those afflicted with MA often present with poor self-confidence regarding Maths, a lack of enjoyment of the subject and may even display an attitude of avoiding the subject entirely (Maloney and Beilock, 2012). Relentless focus upon rigid, formal practices like textbook work distance pupils' from the subject, creating the viewpoint that Maths is a concept only applicable in a classroom setting in the context of the textbook (Boaler, 1998). Without the opportunity to apply the Maths skills gained within the class to real-life problems, pupils struggle to apply their knowledge out with the school environment and thus are unable to transfer these essential skills into their everyday lives.

To overcome this, research has been undertaken to establish how the benefits of Outdoor learning can be applied to Mathematics. Research has suggested that outdoor learning can help to increase pupils' engagement and attitude in Mathematics (Young and Marroquin, 2008; Fägerstam and Samuelsson, 2014; Laird and Grootenboer, 2021). Furthermore, it has been suggested that Outdoor learning in Mathematics can have positive effects on both Maths anxiety and Mathematical proficiency (Grothérus and Fägerstam, 2018).

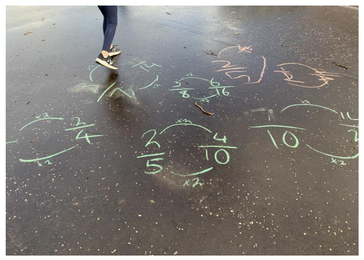
What has happened as a result?

Prior to undertaking this enquiry, my pedagogical approach to Numeracy had been to adopt and incorporate both traditional and active approaches to my planning. With this said however, the main tasks were predominately textbook and worksheet based, with active tasks being utilised as starter and plenary activities. Although this approach was preferred by many of the pupils, it was evident that a small group of pupils did not respond well to this learning approach.

By analysing the initial feedback from pupils', it was evident that a correlation existed between their attitudes to Maths, their view of textbook work and their level of attainment in Numeracy.

Pupils in favour of the textbook and worksheet based tasks commented that they preferred the structured nature of the tasks, as they knew what they were required to do and liked the challenge that these tasks provided. They also stated that during class discussions they felt comfortable and confident to contribute their ideas and provide answers to questions. These pupils encompassed those who were achieving the required Mathematics targets.

Pupils not in favour of the textbook and worksheet based tasks commented that they found the tasks overwhelming and for that reason deviated from the task. Additionally, it was often stated that they "did not like Numeracy", "found Numeracy hard" and that it was a "boring subject". During class discussions, pupils of this opinion were reluctant to contribute their ideas, as they were anxious they would get the answer incorrect and were concerned about how their peers would perceive them. Upon observing and analysing the work produced by this small group of pupils, it was evident that during these types of lessons they became disengaged relatively quickly and did not produce a great deal of work let alone complete the given task. As a consequence, these pupils made for those who were struggling to achieve their targets for Mathematics.



After incorporating the outdoor element to my Numeracy lessons, I witnessed a significant change in pupil attitudes and engagement, particularly in those who had difficulty with Maths. Pupils were more confident when participating in the different tasks and activities. When discussing their work, pupils gave their ideas and answers more freely and had a more positive mindset if their answer was incorrect. In group activities, these pupils voiced that they liked working as a group because "if they got stuck, they could ask their peers for help". From the feedback sheets, the general trend of comments were, "I enjoyed that lesson because it was fun", "I wish we could do that lesson again", "It did not feel as though we were doing Numeracy" and "I enjoyed being out in the fresh air and moving about". From the feedback provided, overall the pupils provided positive words to describe the lessons and how they felt during those lessons. Words such as "interesting", "fun", "interactive" and "happy" were commonly used.

Even pupils who preferred textbook and worksheet based tasks shared the same opinion of doing Numeracy in an outdoor environment and asked to do these types of lessons more often. A recurring comment was that "doing textbook work all the time can become boring".

From the evidence gathered, there was a trend to suggest that pupils were more in favour of the lessons which took place outside. As a result of these lessons, pupils responded more positively to Numeracy as a subject, evident from the final pupils' questionnaire. Additionally, the quality and volume of work produced by the pupils who were struggling in Maths had evidently increased; they had noticeably produced more work when outside in active classes than when inside doing stationary work.

As a result of this enquiry, I have been able to reflect upon my own practice. Witnessing the benefits of outdoor learning, especially within Numeracy, I wish to integrate more opportunities for pupils to have such experiences in an outdoor setting.

I believe this is a novel way of building the confidence of pupils who are anxious and struggle with Maths, altering their attitudes towards the subject itself and thus improving not only their participation and output during Maths lessons but their achievements in the subject entirely. Overall, it assists in my duty as a teacher to ensure that the needs of all pupils are being met and could prove beneficial in the effort to close the attainment gap seen in Numeracy.

Why did you do it?

Upon starting at Kilmacolm Primary School this year, I made myself familiar with the School Improvement plan (SIP) so that I was able to gain an awareness of the priorities for the school that year. From the SIP, I had identified that two of the priorities were developing Outdoor learning and raising attainment in Numeracy.

Furthermore, as I was fortunate to be in a school with exceptional outdoor areas and facilities, I was eager to develop my knowledge and skills in this particular area and wished to establish how outdoor learning could be incorporated into different curricular areas.

Getting to know the pupils, learning their interests and capabilities and the forging of strong relationships with them during term 1 and 2, allowed me to identify areas where pupils were experiencing barriers to their learning. This was particularly evident during Numeracy lessons where the learning environment and tasks/activities themselves were creating a barrier.

I turned to outdoor learning, in line with the SIP to reduce these barriers. Furthermore, having experienced positive outcomes when utilising Outdoor learning in other curricular areas, I wished to investigate how outdoor learning could be incorporated into Numeracy lessons. To ensure that I provide an inclusive educational experience for all pupils, it is my responsibility to use a wide variety of resources and teaching approaches including Outdoor learning to ensure that the pupil needs are being met (GTCS, 2012:14).

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