

A research project to explore the maths curriculum access for learners with Foetal Alcohol Spectrum Disorders (FASD) at KS3 and 4

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Foetal Alcohol Spectrum Disorders (FASD) is a disability caused by alcohol consumption during pregnancy. Neuroscience shows that the teratogenic effects of alcohol on the brain in utero significantly affect the parietal lobe, which is the brain's centre for numeracy and mathematical calculation. Although there has been some progress in educating children with FASD, very little appears to have been conducted in the UK on access to the maths curriculum for pupils with FASD, especially at KS3 and KS4. FASD is not a condition recorded at birth, so the actual number of affected pupils remains unknown. Studies suggest it could impact around 3% of the school population. It is one of several complex needs and falls within the Special Educational Needs and Disabilities (SEND) spectrum. Although the condition is neurologically based, my focus remains on teaching and learning. My research will aim to identify effective approaches used by teachers.

Keywords: SEND; FASD; KS3&4; Rythmanalysis

Introduction

Foetal Alcohol Spectrum Disorder (FASD) occurs when alcohol is knowingly or unknowingly consumed during pregnancy. Many people working in this area have family members diagnosed with FASD. In my case, it is my granddaughter. From an early age, issues began to emerge, such as reluctance to attend school, a lack of interest in learning, and difficulty socialising in the expected manner. This led to a formal diagnosis and the obtaining of an Education and Health Care Plan (EHCP).

It matters to us as maths educators because alcohol harms the part of the unborn child's brain that is responsible for calculation and maths skills (Lebel et al, 2010). As a result, a pupil may find it difficult to keep up with their peers, thus needing special arrangements. While FASD is a spectrum of disability, ranging from mild to severe, everyone with a diagnosis is affected.

My research project aims to explore at the curriculum access that learners aged 11-16 have of the maths curriculum, the learning environment and teaching approaches used in England. In this paper, I will explore the background and outline the plan for the research project.

My Background and Positionality

I'm a retired maths teacher. I started teaching in September 1978 and retired in May 2016. During that time, I mainly worked in 11-16 and occasionally in 11-18 schools.

My personal beliefs stem from a mix of influences from my social background and my experiences as a teacher. My background reflects values linked to a close-knit working-class community, such as honesty, morality, and hard work. Similarly, in my teaching career, I emphasised the school as a community and adopted a caring

approach when working with children and fellow teachers. I am an elderly white man with no strong religious or political views. I'm in year 2 of an EdD course and will be doing a pilot project this year. The main study and thesis will follow in future years.

What the Literature tells us:

Children with FASD often have “Complex Learning Difficulties and Disabilities (CLDD). CLDD describes children with coexisting conditions that include Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorder (ASD) and FASD” (Blackburn, 2021, p. 395).

In several studies, Crocker et al. (2015) and Lebel et al. (2010) found that the parietal areas of the brain, particularly the left area have been linked to cognitive development in mathematics. Other studies in the USA and Canada have shown that maths achievement is lower for pupils with FASD. “mathematical ability is more strongly correlated with the amount of prenatal alcohol exposure than are other academic skills” (Lebel et al., 2010, p.354).

There are programs in the USA and Canada that have shown to have positive benefits for learners with FASD. The MILE program has demonstrated sustained improvements in children's learning in mathematics (Kully-Martens et al., 2018). MILE is an abbreviation for Maths Interactive Learning Experience. MILE worked with learners between the ages of 3 and 10. So, they did not work with children aged between 11 and 16 as this study aims to do.

Welsh (2024) links neurons in the brain and sensory input to working memory. With rehearsal, this should lead to long-term memory. Forming connections is an important part of this process. Choat (2024) describes how important the learning environment is in reinforcing those connections and ultimately to the child's development. Berry and Pritchard (2024) reinforce this and describe a constructivism approach which places less emphasis on the sequence of instruction but more on the learning environment. They say that learners will construct their understandings from their experiences. Furthermore, the learner will use their existing cognitive structures and use their way of seeing to organise these experiences and use them to build their learning. This illustrates that the traditional roles in the classroom may not apply to these pupils. Ting Wai Chu conducted a survey of teachers in New Zealand and found there is a greater need for training for teachers who work with pupils with FASD (Chu et al., 2023).

As FASD is not a condition recorded at birth, there is no definitive data on how many children have this disability. Research conducted in the North of England suggests it is approximately 3% of the population. (McCarthy et al., 2021).

Understandably, the majority of research is led by SEND specialists. However, Sivadasan et al. (2016) argue the need for mathematical education specialists to research this area as well to explore the theoretical approaches to teaching and learning mathematics.

There are key documents and legislation from the UK government relevant to SEND provision and school settings for pupils with FASD. These include “The Special Educational Needs and Disability (SEND) Code of Practice from 0 to 25 years”. It brings together legislation from the Children and Families Act 2014, the Equality Act 2010, and the Special Educational Needs and Disability Regulations 2014. The code of practice enables parents to request an EHCP (Education, Health and Care Plan) from the local authority if they believe their child requires additional support. (Department for Education, 2014).

Teaching approaches

The teaching methods commonly used in 11-16 schools in England include whole-class teaching, group work, individual tasks, and paired activities. Their aim is to develop understanding, promote problem-solving, connect ideas, encourage discussion, and employ other strategies. However, for pupils with FASD, who find it hard to retain concepts, different approaches will be needed. The Maths Interactive Learning Experience (MILE) program in the USA has demonstrated positive benefits for pupils. It uses these key approaches: To improve working memory, present small pieces of information, such as rhymes, songs, cues, and repetition, then allow time for practice and time for recall. Teachers encourage pupils to reflect and talk about their learning. To support general learning, a slower pace of instruction is adopted, incorporating active learning, touch, talk, and experimentation. For visuo-spatial tasks, tactile objects and manipulatives are used to direct visual attention. Structure is added to paper; for example, a vertical number line is used instead of the traditional horizontal one. Guides are employed to assist with handwriting and organisation. They call this “handwriting without tears”. FAR is the core principle in the MILE program, designed to enhance metacognition and executive functioning, thereby supporting greater self-regulation and reflection. F stands for Focus, A for Act, and R for Reflect (Rasmussen 2015). Also, parents receive instruction and guidance on FASD to enable them to assist and support their children at home. However, the pupils are younger than in my study and it is based in the USA rather than England.

There are inevitable impacts on parents and home life. Parents often struggle with behaviour at home and feel frustrated with the lack of help and support from the authorities. As a result, parents form local support groups. Would support similar to that in the MILE program help parents in the UK?

What we don't know – the gap

There is little, if any, research in the UK on FASD and learning mathematics at the secondary level, Key Stages 3 and 4, which provides justification for this research.

My research questions are:

RQ1: What approaches to teaching and learning, along with the classroom environment, are best for children with FASD and complex learning difficulties?

RQ2: Which teaching and learning strategies are currently regarded as effective by practitioners?

RQ3: What is the level of knowledge among maths teachers, and what are the implications for training?

My research design is:

Whilst I recognise the child's difficulties with learning stem from damage to part of their brain, I don't propose following a neurological or psychological approach. Instead, my approach will be sociological, recognising the complex needs and individual nature of each child. I want to explore their lived experience and its impact on their learning, and then focus on the strategies teachers use to overcome these

difficulties. It is likely that the traditional model of clearly defined roles within the classroom may not apply to these pupils. Therefore, I plan to examine the nature of the classroom environment, the materials used and the ways in which teachers work with the learners.

Therefore, to address RQ1 and RQ2, I will use a qualitative approach involving semi-structured interviews with parents and teachers, as well as observations of the classroom environment, materials, approaches used, pupil responses, and their access to the mathematics curriculum. For RQ3, I will employ a quantitative method using online questionnaires. Overall, this will be a mixed-methods approach, with a primary focus on qualitative methodology.

I plan to use a pragmatic paradigm to allow flexibility. Kivunja & Kuyini, (2017) describe this as “workability” and “what works” to facilitate an understanding of the situation. A phenomenological methodology to understand lived experiences, and rhythmanalysis to examine how the rhythms and patterns of everyday life differ for these pupils. Rythymanalysis focuses on the patterns (eurythmia) and disruptions (arrhythmia) in daily school life, analysing recurring (cyclical) patterns and linear progressions (such as exams) to explore belonging, stress, and the lived reality of pupils and teachers (Lefebvre, 2004). Heidegger (1962) also emphasises the importance of “being”, temporality (non-chronological time) and historicity in understanding the impact of time, space and background influences on pupils’ lives.

I anticipate, but will observe whether, a caring and relational approach as outlined by Noddings (2013), is used to foster a supportive environment in which pupils can learn and grow. It is important to recognise that knowledge is likely a dynamic process of understanding, influenced by both the researcher’s and participants’ perspectives and contexts. Furthermore, knowledge will be acquired through subjective interpretation and understanding rather than through objective observation. This is referred to as the “double hermeneutic”, which describes the understandings of each partner in the research. Gadamer (1975) refers to this as a “fusion of horizons”. Dibley et al. (2020) endorse this view and regard accommodating the researcher’s views as a means of eliminating bias and enabling “no bracketing” in hermeneutic and phenomenological approaches.

The methods to be employed will include a case study, semi-structured interviews with teachers and parents, and observations of children working in the classroom. I will also distribute an online questionnaire to a convenience sample of 30 KS3 and KS4 maths teachers to assess their knowledge of effective teaching approaches for pupils with FASD. In using observations, I recognise the potential anxiety pupils may experience when an unfamiliar person is in the classroom. One-to-one clinical interview techniques may help to address this issue (Ginsburg, 1998). Prior to the main research, I will do a Pilot Study to test the methods and data analysis techniques. I will use local schools and parent support groups to identify where the pupils are learning. To obtain ethical clearance for the Pilot Study, I will focus on conducting semi-structured interviews and discussions with teachers and parents. I will work with two parents and two teachers who are working directly with pupils with FASD. I will only use Research Question 1. In the main study, I will extend this to the parents and teachers of 4 pupils in KS3 and 3 in KS4. I will also examine options for observing the learning environment and the materials and approaches used and address all 3 research questions.

Data Analysis

The semi-structured interviews and discussions with teachers and parents will be recorded as narratives. Reflexive Thematic Analysis following Braun and Clarke's framework (Braun & Clarke, 2014) and the Interpretative Phenomenological Approach (IPA) (Smith et al., 2022) will provide a structured method for analysing the narratives and identifying emerging common themes. The reflexive approach will enable further refinement of the themes until convergence and confidence that they align with the narratives of parents and teachers are achieved. The aim for the emerging themes identified by teachers and parents in the pilot study is to address RQ1. This will then inform the next steps in designing the main study. Additionally, in the main study, RQ2 and the questionnaire responses from the teachers not working with pupils with FASD will be analysed to answer RQ 3.

My hopes for the study

My hopes for the study are that the findings will reveal information that is not currently widely known about how pupils with FASD approach learning maths at KS3 and KS4 in the UK, what teaching approaches and strategies are effective and what barriers exist. It will, therefore, either confirm or challenge the theories outlined in the literature review. The results for the questionnaires from serving teachers may suggest the need for additional input in the Initial Teacher Training (ITT) programme or extra In-Service Training (INSET) for serving teachers.

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