

# Aligning mathematical pedagogical practice education essay

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to Exploit the Characteristic Behaviours of Attention Deficit Hyperactivity Disorder to Enhance Learning. The challenge that teaching students diagnosed with ADHD brings is often viewed through a deficit model and frequently behaviour management techniques are utilised within schools to manage behavioural difficulties. In contrast to this approach, I intend to research whether there are pedagogical approaches that increase the opportunities for students diagnosed with ADHD to engage more effectively in mathematical learning and that could develop their engagement and understanding in lessons. My research will focus on ascertaining whether there are pedagogical practices, specifically for teaching mathematics, that are more closely aligned with or could exploit the characteristics of ADHD to enhance learning. I intend to elicit the views of students diagnosed as having ADHD as to what they feel helps them learn mathematics. Having researched the effectiveness of educational strategies for the teaching of mathematics to students diagnosed with ADHD in my Critical Analytical Study last year, I wish to evaluate the veracity of this empirical based research for a particular group of students diagnosed with ADHD. This is an area of professional practise that I am particularly interested in developing and expanding my knowledge and understanding of. I have worked as a teacher of mathematics in a special needs school that caters for students categorised as having Social, Emotional and Behavioural Difficulties (SEBD) for the last 14 years with children who can display difficult to manage behaviours. As a trained special needs teacher I have never received any specific training or information surrounding the issues of effectively engagement of ADHD diagnosed pupils. Research by Bekle suggests that

only 10% of practising teachers have ever received any training in ADHD. Research has also shown that teachers are more amenable to working with ADHD diagnosed students when their knowledge of the condition increases . Viewing the characteristics of ADHD as an opportunity rather than as a deficit is an approach recommended by Copper , he advocates:

- This approach contrasts with educational research that focuses on making the student identified as having ADHD ' fit' into the classroom environment by requiring them to change their learning behaviours. Such work includes the use of sticky notes as an organisational tool to improve attention , ADHD learners being taught effective ways of listening and taking notes or self-regulation where students manage and monitor their own learning . These approaches assume that it is the student who needs to adapt to the school environment. Thomas (2004) suggests that the origins of many difficulties children experience lie less within the child ' but more in the character of the organisation which we ask them to inhabit for a large part of their lives' (p. 72). Similarly, Prosser argues that: Addressing the effectiveness of mathematical learning strategies for students identified as having ADHD, I believe, is of paramount importance as the issue of academic underachievement amongst this group of learners is a well documented problem . It is also reported that a further barrier to learning for students diagnosed as ADHD is that approximately 20 -30% of them have a specific learning disability in reading, mathematics, or writingAn unfortunate consequence of working in a special school that caters for SEBD pupils is that staff discussions regarding individual student's progress tend to focus on

their behaviour and less on academic achievement or meeting a personal learning target. A pupil is said to have had a good day if no incidents of poor behaviour have been recorded; a student grasping a key concept of algebra can often seem incidental and of minimal concern. This focus on behaviour rather than learning is mirrored in the amount of research carried out on ADHD as Jitendra et al report: As a mathematics teacher, I intend to look specifically at how learning can be improved for children diagnosed with ADHD. Defining what constitutes pedagogy is complex and definitions of the word vary, it most often refers to the quality of a particular teaching strategy . For the purpose of this project, I will take Lusted's definition of pedagogy as the relationship between student, teacher and knowledge that foster learning. Lusted comments: Although there is a strong link between ADHD and academic underachievement pedagogy must certainly play a major contributing factor. Barkley describes the characteristics of pedagogical practices that have been shown to improve performance for ADHD diagnosed pupils - frequent and immediate feedback, instant reinforcement and constant opportunities to respond to academic stimulation. Research that focuses on improving the educational experience of students identified as having ADHD is scarce and even fewer studies seek to document the child and young person's perspective . As Davis et al. comment:

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I have structured my research proposal in the following way. Chapter 2 describes the context in which the proposed research will be carried out, in terms of the school and students. In reviewing the field of literature about the learning of mathematics, chapter 3 focuses on effective pedagogical

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approaches in relation to the teaching of both mathematics and students diagnosed with ADHD. This section also considers whether there are particular characteristics of ADHD that make mathematics difficult for ADHD diagnosed students to learn. The research questions that I hope to answer by completing this study are identified and posed in chapter 4. Chapter 5 discusses the methodological stance and approach, with information on intended sources of data and analysis. Ethical considerations are also discussed in this final section.

2. Context of the Study

I intend to carry out the research at my place of work which is a special school that caters for learners categorised as having Social, Emotional and Behavioural Difficulties (SEBD). The students who attend the school come with significant histories of difficulties with school attendance, behaviour and engagement in learning as a result of complex emotional and social challenges they have to overcome. The school is under local authority control and is situated in a large town in the South-East of England. The school is co-educational, there being 31 male and 10 female pupils on role, aged between eleven and sixteen. The school offers access to the National Curriculum by following a mainstream secondary school model; curriculum subjects are timetabled and taught by specialist subject teachers. However, with such a complex range of needs, learners are offered individualised opportunities to achieve both vocational and academic qualifications. Demographically, 44% of students are entitled to free school meals and 38% of pupils have a youth offending order. The majority of students ethnicity is described as White - British (83%). Although 20% of students are officially categorised as being 'looked after' by the local authority, a further 15% of students are cared for and live

with an extended family member, leaving a remainder of 65% of students living with a least one of their biological parents. The school is fortunate in having a dedicated team of staff, the Behavioural Emotional Support Team (BEST), who are responsible for supporting children in dealing with life and social issues. The BEST works with children, their families, schools and external agencies to help ensure that all children feel happy and secure. Where there are concerns about a child's behaviour or emotional well-being they provide individual support for that child and family. All of the students attending the school have an educational statement of SEBD and a significant proportion also have a further diagnosis of ADHD. Although the veracity of ADHD is still contested by academics and researchers[1]I intend to use the label ' ADHD' as defining a set of behaviours, that around 5% of children demonstrate regularly. I believe that the label ADHD makes it possible to focus discussion and research of this phenomenon. In this school, students are taught in classes of no more than eight and were until recently, grouped to reduce problematic behaviours between students. With a recent change in school's leadership strategy, students are now assessed academically and grouped accordingly, as it is believed that behavioural issues could be exasperated as a result of a lack of challenge in learning. In discussing the issues surrounding grouping by ability as a pedagogical practice, Altendorff suggests that this can be problematic. The school is obliged to follow the programmes of study contained within the National Curriculum. Each group is therefore timetabled of one lesson of English, Maths, Science and Personal, Social Development each day. Although the school is a special school, teaching and learning is still driven by the same

expectations as any mainstream school - demonstrating student progress, implementation of National Strategies and is judged by inspection framework, success measured in terms of students' exam performance. As a consequence, the mathematics curriculum that is taught mirrors that of any other English Secondary School. By the end of Key Stage 3, students are entered for Entry Level Certification in mathematics and by the end of Key Stage 4 students are then entered for GCSE in Mathematics and/or functional skills qualifications. Mathematics is an essential and compulsory area of learning for all school students and should be accessible to all, and it is with this in mind, that the next section of this proposal is concerned with what is known about how students 'acquire' mathematics. 3. Review of the Field

### **3.1 Theories of Learning Mathematics**

There is no singly accepted theory that can explain how mathematics is learnt. However, competing theories are generally divided into two categories - those which focus specifically on mathematical learning such as the work of Dienes and Ausubel et al and secondly, general learning theories such as behaviourism and constructivism, which can be applied to the learning of mathematics.

#### **General Learning Theories**

There are three main general theories of learning - behaviourism, cognitivism and constructivism, each with differing epistemological viewpoints about the world, which in turn, shape their practices in the classrooms. Whilst behaviourism focuses on the external behaviour of learners, cognitivism emphasises on the internal mental structures of the

student. In contrast, constructivism views learning as an active process in which learners are engaged in constructing new concepts based on past knowledge. Behaviourism asserts that learning takes place through stimuli and the subsequent responses made by an individual. Behaviourist psychologists such as Watson, Thorndike and Skinner studied the human learning process based on the training of animals. In relation to mathematics teaching, Thorndike proposed his 'law of exercise' for the mastery of arithmetical skills. He believed that by repeatedly practising a skill, a learner will reinforce and strengthen their ability. Drill and practice of mathematical facts and procedures is based on a belief that repetition establishes competence. An argument levelled at Behaviourism, as a theory of learning, is that it is too simplistic in that, if learning occurs only as a response to a stimulus, how can people be creative or inventive enough to think of new solutions to mathematical problems? Furthermore, the behaviourism does not explain why people attempt to organise and make sense of the information that they learn. Behavioural learning theories offer useful ways to explain human behaviour, but behaviourism is limited as it focuses exclusively on observable behaviour and cannot therefore explain invisible cognitive learning processes. Cognitivist learning theories are concerned with understanding the mental processes or cognition of the human mind to explain how people learn. Viewing learners as information processors, a cognitivist views learning as the transformation of information in the classroom into knowledge that is stored in the brain. Learning happens when new knowledge is acquired or existing knowledge is modified by experience. Two main cognitivist theories of learning are Piaget's cognitive



developmental theory and Vygotsky's sociocultural cognitive theory. Constructivist theories of learning however represent some of the most important ideas in current educational psychology and are regarded as the dominant theory of learning mathematics. Piaget is credited as one of the major contributors to the development of constructivism. Orton reports that 'the work of Piaget has probably been more influential than has the work of any other theorist in terms of mathematics curriculum development in Britain'. A central tenet of Piaget's developmental theory is that knowledge is not just transmitted verbally but must be constructed and reconstructed by the learner. Piaget asserted that for a child to know and construct knowledge of the world, the child must act on objects and it is this action which provides knowledge of those objects. Constructivism as a paradigm supports active learning. Bruner is credited for developing an inquiry-based constructivist approach to learning, known as discovery learning, which argues that it is best for learners to discover facts and relationships for themselves. Learning is best achieved through a hands-on approach.

## **Mathematical Learning Theories**

There are many theories that attempt to explain how students learn mathematics, but as Campbell states:

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Although this research will not necessarily be theory-driven, understanding how children learn mathematics is an essential element in bringing about

effective learning. Some of the main issues surrounding the learning of mathematics are now discussed.

## **Doing and Knowing**

An important issue in learning mathematics is that of understanding.

Children often claim that they understand a mathematical concept, but in fact this can mean that they know how to follow a procedure that leads to a solution. Skemp defines two types of mathematical learning. Instrumental learning which involves learning processes by rote; this is usually performed by the teacher demonstrating how to solve a particular problem, followed by the students applying this knowledge to very similar problems. Relational learning however, involves understanding the concepts and the reasoning underlying the knowledge rather than just applying rules. Instrumental understanding produces procedural understanding -the ' how' knowledge, whereas relational understanding produces conceptual understanding - the ' how' and ' why' knowledge. He theorised that both types of learning are important as they both teach the student the rules of mathematics. For example, in calculating the area of a rectangle, students need to know that the area is length multiplied by width - this is instrumental knowledge; being able to see why this rule always works, requires relational understanding.

Area = 6 columns of squares all 4 squares high = 24 squares

## **Readiness**

Piaget postulated that people progress cognitively through four developmental stages, from birth to young adulthood. He claimed that children pass through these stages in a defined order and that no child can

jump a stage. Before moving to the next developmental stage, the previous one must be mastered. An implication of Piaget's developmental stages, in relation to learning mathematics, is that students need to reach a certain developmental maturity in order to understand higher order abstraction and reasoning. As Orton comments: Diagnoses of ADHD are generally made between the ages of 7 - 12 which corresponds to working at the concrete operational stage of development. ADHD is often identified by inattention which could make sustaining information long enough to master new skills and move on to the next level more problematic. Unlike Piaget however, Bruner believed that there was no need to wait until a child was ready to be taught a particular topic in mathematics. Bruner said that anybody can learn anything at any age, provided it is stated in terms they can understand .

## **Social Interaction**

In developing his theory of social constructivism, Vygotsky believed that social interactions between the learner and physical world play an essential role in the process of cognitive development. One of Vygotsky's major themes that he developed is the theory of the Zone of proximal development, which is the distance between where a learner is at developmentally on their own and where a learner could be with the help of a more knowledgeable other. A more knowledgeable other can be an adult or a peer, helping a learner by scaffolding their learning whilst they construct meaning from their experience. Scaffolding is made available for a pupil until they can assimilate the knowledge into their own cognitive structure and is then gradually taken away. Vygotsky believed that learning is enhanced when adults and peers provide feedback while learners process experiences.

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One of the main implications of Vygotsky's work, that may be problematic for students diagnosed with ADHD, is that of learning effectively from one another and that discussion and social interaction both play an important part in the understanding of mathematical ideas.

## **Levels of Representation**

Bruner (1960) was interested in how children recognise and represent concepts. His learning theory describes three stages of knowing: enactive (action-based), iconic (image-based), and symbolic (language-based). Bruner suggests that when children learn mathematical concepts, they need to go through these stages - from concrete objects to pictorial images and then to abstract symbols . Take for example the concept of addition. A student working at the enactive stage would physically move objects into a single pile in order to find out how many there are. At an iconic level: At a symbolic stage: and  $3 + 4 =$

## **A Priori Knowledge**

Theorists such as Ausubel , Bruner Skemp and Gagné all agree that previous learning plays an vital role in the acquisition of new mathematical learning. According to Skemp , students construct schemata to link what they already know with any new learning. As an example, in teaching a student to round a number to the nearest 10, the student needs to use their understanding of place value and their concept of number magnitude to the learning. He suggests that mathematical concepts are hierarchical in nature - a student cannot understand a higher concept until the earlier building blocks which it is dependent on, are understood first. Ausubel et al. (1968) theory of

Assimilation states that it is essential to relate new knowledge to previous learning. Teachers should facilitate learning by organising information so that new ideas are easily related to concepts already learned. Ausubel believed that it was important for teachers to give a brief overview of the knowledge that students will learn beforehand, he refers to this as giving students the 'big picture'. This then enables learners to link new concepts and vocabulary to existing known ideas. Existing knowledge provides a framework into which the new learning is related. Bruner believes that learning is a cumulative process and therefore requires previous learning to be frequently revisited. Bruner refers to this notation as the spiral curriculum; this approach is not currently advocated by National Curriculum which is layered in nature.

## **Didactical Considerations**

Theorist Robert Gagné's work focused on the assumption that there are five different types of learning, each requiring a different type of teaching in order for it to occur. Gagné's 'Conditions of Learning' outlines the five categories as: verbal information, intellectual skills, cognitive strategies, motor skills, and attitudes. Gagné suggested that learning is most effective when students move from mastery of the smallest conceptual units to the most general concepts. For this to happen, teachers must carry out a learning task analysis - Identify learning skills, analyze learning tasks, then sequence the teaching of the learning skills in a hierarchical order. Diene's theory outlines four principles that he believes applies to the learning the mathematics. First is the Dynamic Principle - Learning is an active process that requires opportunities to be provided for students to interact. He states

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that to be able to understand a concept, there are three essential steps - the play stage, the structure stage and finally the practice stage. The second principle is Constructivity - students need to construct their knowledge before analytical activity. The Mathematical Variability principle states that when knowledge is imparted, all other irrelevant facts should be systematically varied whilst keeping the relevant variables the same. For example, in teaching the definition of what a triangle is, the teacher should change the size, the angles and orientation of the triangle so that the students understand that it is three sides that and three angles that define a triangle. The final Perceptual principle states that different kinds of teaching materials should be used to teach the same concept or idea.

## **Summary**

Although mathematical theorists tend to focus on a particular aspect of learning, there is much agreement in what they believe. For example, Skemp , Ausubel and Bruner believe that mathematics is hierarchal in nature. Similarly, the use of concrete models to help learners formulate mathematical ideas is advocated by many theorists such as Bruner , Van Hiele , and Dienes . Difficulties in learning mathematics can arise of a variety of different reasons such as emotional, learning or cognitive disabilities. None of the theorists however consider the difficulties that learning mathematics may cause students diagnosed with ADHD.

## **3. 2Effective Mathematical Pedagogy**

The theorisation of mathematics learning, over the last century, has moved away from behaviourists approaches of students working passively on drill

and practice exercises towards a more active paradigm where meaning is constructed through social interaction. The assumption that students gain knowledge by 'being told' is flawed, as both Piaget and Vygotsky surmise that children learn by constructing knowledge through interaction with their physical and social environments. In a report produced for the Department for Education and Skills investigating the underlying principles of teaching mathematics effectively, Swan advocates the use of active rather than passive teaching of mathematics. He states that the most dominant pedagogical practice observed in the teaching of mathematics is 'chalk and talk', where learners are forced to adopt a passive learning strategy. In commenting about learners, he says: Research shows that pedagogy that does not allow for the development of understanding, leads many students to view mathematics as a series of unrelated procedures and techniques that have to be committed to memory. Mathematics education research continues to demonstrate that good mathematical pedagogy incorporates both conceptual and procedural understanding in order for students to have a complete understanding of topics. In their best evidence meta-analysis of 189 studies, Slavin et al. concluded that mathematics learning is significantly enhanced by the use of co-operative learning methods that encourage pupil interaction. Co-operative learning is an approach to organising classroom activities into both academic and social learning experiences. As a pedagogical approach it involves students working together in small groups on a structured activity, with the aim of creating meaningful knowledge. Cooperative learning encourages active student learning which is an

important element of mathematics learning and research suggests that academic achievement is improved .

### **3. What is ADHD?**

As mentioned earlier, ADHD is a contested and controversial condition with an unknown aetiology. As there are no medical tests or physical indicators to verify the existence of the disorder, it is difficult to dispute statements by Baughman and Hovey who describe ADHD as ‘ the behaviours that normal children do that irritate adults’. A common criticism of the DSM-IV criteria (see Appendix A) used to diagnose ADHD is that the criteria is subjective and relies on the construction of ‘ normality’ for comparison purposes. Drawing a line between what is normal and what is not, a Foucauldian premise is decided by society and is not an absolute. Rates of diagnosis of ADHD however in the UK range from between 3-5% of the school’s student population . There are broadly three competing discourses that attempt to frame the veracity of ADHD. First, there is the bio-medical perspective which asserts that ADHD is the result of a neurological impairment of the brain that can be ‘ cured’ by the use of psycho-stimulant medication . Secondly, a sociological discourse which argues that ADHD is a social cultural construct, whereby disorders in society have created disorders in children . Finally, viewing ADHD through a bio-psychosocial lens, argues that ADHD is caused by a biological process, but by being placed in a socially constructed situation such as school, some children exhibit ADHD behaviours that are then considered ‘ disordered’ . Having worked with children with ADHD for a considerable time, I personally believe that ADHD is a combination of both biological and social factors, that is, the condition is caused by the



interaction of neuropathy and psychosocial issues. ADHD cannot be explained by biological factors alone. The National Institute for Clinical and Health Excellence produced guidelines detailing the most effective treatment plan for ADHD . They suggest that, except in the most severe cases, medication should only be used in conjunction with social, behavioural and psychological treatments. There are many competing discourses, which are perpetuated by different groups of stakeholders, such as pharmaceutical companies, educationalists and parents. Acceptance of a bio-psychosocial model of ADHD would appear to be the most beneficial as it would imply a multi-faceted approach to treatment - both medication and psychosocial intervention.

### **3. 4An ADHD pedagogy?**

From research conducted for my Critical Analytical Study, there is evidence to suggest that the use of computer technology as a pedagogical approach with students diagnosed with ADHD can lead to successful mathematical learning . Research on peer tutoring with ADHD diagnosed students is limited to just two studies - DuPaul et al. and Robinson et al. which both reported limited effectiveness. Kinaesthetic and physically based approaches have also been shown to improve engagement with ADHD diagnosed students . Dr Russell Barkley, an ADHD research psychologist and Professor of Psychiatry, believes that, ' ADHD has more to do with lost interest than with an inability to concentrate' and suggests that increasing the interest of a topic or subject will increase an ADHD diagnosed student's ability to concentrate and focus. Sydney Zentall , a prolific writer in the field of ADHD put forward a theory of optimal stimulation, suggesting that ADHD diagnosed students may have a

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greater need for stimulation and would benefit from a more active learning environment. This theory suggests that for a given task, ADHD diagnosed students require increased stimulation, compared to non-diagnosed ADHD pupils, in order to reach optimal cognitive arousal levels. Research carried out by both Norwich and Lewis and Rix et al. attempted to answer the question of whether there is a particular pedagogy that is specifically effective in educating Special Educational Needs (SEN) students. It is important to note, that both and Lewis' and Rix's et al. definition of SEN requires there to be a learning difficulty present, which is certainly not a necessity for a diagnosis of ADHD; neither of these studies refer to ADHD as being a special education need. Not surprisingly then, by encompassing such a diverse and broad range of need, they summarised their findings thus:

- In reporting specifically about ADHD and pedagogy, Davis and Florin were disappointed to note that there was no long-term studies available that examined the effects of different pedagogical approaches, they concluded that ADHD strategies merely focus on changing 'deficiencies' within students. In summary then, available research would suggest that pedagogy can be adapted to meet the needs of ADHD diagnosed students, but not generally for the wider SEN population.

### **3. 5Does ADHD make Mathematics difficult?**

Higher rates of mathematical learning difficulties for pupils diagnosed with ADHD of 31% are reported by Shalev and colleagues compared to between 6%-7% for the general school aged population. Research by Rubinsten et al.

further suggests that 4% of children identified as having ADHD also meet the criteria for developmental dyscalculia which is defined as a specific learning disability affecting the normal acquisition of arithmetic skills. Many theorists have put forward hypotheses of the relationship between mathematical skill acquisition and ADHD. For example, Ackerman et al. proposed that children diagnosed with ADHD struggle with mathematics due to a failure to automate arithmetical processes because of a major cognitive memory deficit. They believe that this poor automaticity then impairs acquisition of numerical information which in turn restricts the learning of more advanced mathematical procedures. A further theory, proposed by Marshall et al. suggest that mathematic skills are best learnt by repetitive practice, this learning mechanism however is often shunned by ADHD diagnosed learners who have limited attentional abilities. Current research suggests that deficits in executive functioning (such as working memory), offers a direct link between ADHD and difficulties with learning mathematics. Several research studies have shown that working memory deficit are closely associated to performance in mathematics . Bull and Scerif comment on their research: This, combined with research by Schachar et al. who report that a primary deficit in executive functioning is thought to be solely responsible for causing the symptoms of ADHD makes a suggested link clear. Working memory deficits are considered to be the single best predictor for identifying and categorising students as having ADHD .

#### **4. Focus and Research Questions**

The focus of my research is to identify whether aligning mathematical pedagogical practice to exploit the characteristic behaviours associated with

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a diagnosis of ADHD will enhance learning. Many researchers have identified pedagogy as a major contributor to the success of students identified as having ADHD . Researchers Schirduan and Case found that children diagnosed with ADHD are ‘ successful in situations in which their unique learning patterns and strengths are identified.’ Similarly, Hartmann suggests: The research questions for this study are therefore based around these issues: a)How do students with a diagnosis of ADHD view their learning of mathematics? b)Is it possible to develop a pedagogical approach that enhances the learning of mathematics for students diagnosed with ADHD? There is currently a very limited amount of research that focuses on ways of improving the educational experience of students with a diagnosis of ADHD. The vast majority of studies on students diagnosed with ADHD focus on primary aged children. I intend for this research to add to the knowledge base of adolescent students diagnosed with ADHD by actively seeking their feelings, understanding and viewpoints on how and why they learn best. Throughout my research on the educational doctorate programme, I have not encountered any research of this nature and therefore believe that this project will make an original contribution to knowledge in this field. This proposed research does not endeavour to evaluate the contribution that schools can make to the creation of ADHD symptoms, but it more importantly looks at its capacity to provide solutions.

## **5. Methodology and Methods**

### **5.1Methodological Approach**

Cohen et al. assert that the choice of research methodology must be guided by the question of how the research question would be best answered.

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Qualitative methodology generally generates in-depth and detailed data of a small number of subjects by gathering information that is rich and descriptive in nature, and which illustrates the phenomenon being studied . Qualitative research is often conducted in natural settings where the researcher wishes to gain an understanding of the social world from the viewpoint of the insiders . The classroom environment is a complex arena in which to carry out research as there is a rich array of interaction and nuances at play. This fact, combined with students who can often display emotional and behavioural challenges, which are not necessarily due to the issues being researched, makes a qualitative methodology seem more appropriate. Variability in student behaviour towards learning would render more scientific quantitative pre and post testing methods unsuitable. I wish to include the student's views to elicit their views of what they believe makes learning mathematics difficult. Students would therefore be part of the process rather than it just happening to them. This proposed research is a single case study as it is an investigation of one group of students in one particular school. Case study methodology allows the use of both qualitative and quantitative approaches but is not itself a research method, but a strategy, which covers the design, data collection techniques and specific approaches to data analysis . Cohen et al. (2000) define it to be: Case study offers an ideal methodology when a holistic, in-depth investigation is needed . The definition of case study is important, as different definitions have implications on how they are conducted. I intend to adopt a case study research methodology whilst using the method of action research as a tool, as this would seem to offer a greater range of research possibilities. Action

research has as its broad premise the belief that research with human beings should be participative and democratic . I believe that the ontological and epistemological assumptions of action research provide the flexibility that is required to implement effective change within the classroom, while at the same time would enable the views and opinions of the participants to be voiced. An important characteristic of any action research model is that both the action (change) and the research (understanding) are intended outcomes. Carr and Kemmis define action research to be

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I am conscious that as having worked as a teacher for over 17 years, I bring to this research my own beliefs on which pedagogical practices are likely to be successful. An advantage of adopting an Action Research approach is that it reduces the possibility of producing preconceived outcomes. In order to claim validity, I will use the method of data triangulation of the opinions of all participants, as described by Denzin to validate my data. Action research has been a distinct form of inquiry since the 1940s and was first developed by Kurt Lewin . His model involves four distinct parts, reflection - what do you know about the problem; plan- how you intend to proceed; act - act out your plan then finally observe the results of your actions. Elliott however, argues that Lewin's model is too restrictive in the fact that the research question is fixed in advance and that the initial step of identifying the problem is simply a fact finding activity. Elliot offers an alternative cycle where the initial reconnaissance step is repeated and can be both a fact finding and an analytical process. Using Elliott's model, I have detailed my proposed implementation of his action research approach.

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## **IDENTIFYING INITIAL IDEA**

Can pedagogical approach be effectively aligned to enhance the learning of mathematics for students diagnosed with ADHD.

## **RECONNAISSANCE**

Ascertain student's beliefs and views about how they learn mathematics best

## **GENERAL PLAN**

Develop a teaching strategy and deliver lesson(s) that implements suggested pedagogical characteristics

## **IMPLEMENTATION**

## **SECOND RECONNAISSANCE**

Analysis of data sources – interviews, pupil work and journals. Plan next step.

## **MONITOR IMPLEMENTATION & EFFECTS**

## **REVISE GENERAL PLAN**

## **IMPLEMENTATION**

### **5. 2Data Collection**

For this research project, I intend to select four students aged between 13-15 that currently attend the school. The students who attend the school come with significant histories of difficulties with school attendance, behaviour and engagement in learning as a result of complex emotional and social challenges they have to overcome. The criteria for selection will be that they have been statemented under Section 324 of the Education Act 1996 as having Social, Emotional and Behavioural Difficulties as well as having a <https://assignbuster.com/aligning-mathematical-pedagogical-practice-education-essay/>

further diagnosis of ADHD. In order to reduce complications and difficulties with this study, I have decided to only include students who are taking their prescribed ADHD medication, are not currently subject to any Children Protection issues, have good attendance and are not at risk of being excluded from school. If there are more than four students who meet this selection criterion, participants will be requested to join the study in a randomised fashion and reflect an appropriate gender balance. The fieldwork and data collection that will inform the initial reconnaissance step will be carried out during mathematics lessons in the Spring term of 2013 and will be part of the normal timetabled lesson that lasts for 45 minutes. Empirical qualitative data sources will include students' written work, semi-structured paired or individual interviews between students and myself, my reflexive journal and lesson planning documents. I believe that qualitative research can help the researcher to construct an insider's perspective, which is important for obtaining a clearer insight of the participants' viewpoints. Denscombe reminds us that the action research approach allows for and encourages the use of a variety of research methods and fosters the use of multiple sources of data. Action research can take a more holistic approach to finding truths, rather than using a single method for collecting and analysing data, evidence is gathered through more qualitative means.

## **Data Sources**

I intend to keep a reflexive journal to record thoughts and events that occur during the process of research. I hope to capture any changes in my own values, understanding and beliefs and well as to record my reasoning behind the decision I make. I also intend to record any spontaneous conversations

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that occur between myself and students during the school day. All mathematics lessons are supported by the same Learning Support Assistant who will also be asked to keep a journal charting his perception, opinion and thoughts on how each lesson went. The views of the students are of paramount importance in understanding the impact of classroom interaction. Although questionnaires can be a useful source of data, their appropriateness as a research tool with students in this present study is likely to be limited. Firstly, when presented with open-ended questioning that requires fuller written responses, student's literacy skills may limit their willingness to respond or could at the very least, reduce the depth and detail of their answers. Secondly, closed likert-style responses tend to lead pupils to tick boxes without considering fully or reading the questions. Semi-structured interviews with the students, at both the start and during the research, will be undertaken. Although there are many advantages to being an insider researcher, I am concerned that the social structure that a school environment creates, may pose an issue with regard to the reliability of the interview data collected. Students are, to a certain extent, entrenched in the concept of compliance, due to the way in which schools function. It could be argued that in any teacher / researcher and student interaction, the pupil may be inclined to respond to a question in the way in which they believe the teacher is expecting them to answer. These issues are discussed in more detail in Section 5. 3. However, to reduce this potential perception, students will be given the choice of being interviewed individually or as part of a pair. The initial reconnaissance phase will also pay due regard to any empirical

class based research carried out with ADHD diagnosed students that monitors any aspect of pedagogical approach in some form or other.

## **5.3 Ethical Considerations**

Sieber (1993) as cited in Morrow and Richards sees ethics in research as The National Children's Bureau has produced guidelines to consider when carrying out research with children. They list four essential areas that should be addressed in all research studies; they are informed consent, child protection and confidentiality, rewards for participation and the importance of monitoring the impact of research on the children. The regulatory, ethical and legal context of informed consent amongst vulnerable groups is considered by Wiles et al. ; they state that children under 16 are not automatically legally competent to give consent, unless the child can be judged to understand the implications of taking part in the research . With this in mind, I will seek consent from both students and parents/carers, and in the case of children who are in local authority care, of those with parental responsibility. Approval will also be sought from the Chair of the school's Interim Executive Board as well as that of the Interim Head Teacher. Ethical approval will need to be obtained through the University of Sussex research governance committee for this project. I consider this project to fall into the category of High Risk due purely to the nature and educational needs of the intended participants. As an insider researcher, I believe that I am in a unique position to research issues within my own classroom; however I am aware that my perspective as a researcher will inevitably make a difference to the research. There is much literature regarding the difficulties surrounding being an insider researcher investigating within their own

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institutions . Vulliamy and Webb comment specifically regarding insider teacher research in special education:

- I am also aware that the dual role of teacher and researcher can cause a conflict of interests due to the differing agendas that each of these positions hold. I will need to be mindful of issues that Hammersley talks of, such as difficulties of objectivity, over familiarity and ethical issues regarding the change in relationships and status between students and teacher / researcher. Student-teacher relationships inevitably involve power differentials between the student participant and teacher researcher . A consequence of this power relationship is that a student may not feel comfortable refusing to participate in any research. Since this research project forms part of the participant's normal lesson, it will not be possible for participants to withdraw from the lessons. However, students will be informed of their right to not have their class-work or personal information used within this project, if they so wish, and without prejudice. An information sheet explaining the purpose of the project will be given to participants so that it is explicit how this research will impact on them and what their involvement will be. Since this research project is primarily concerned with enhancing the student's learning experience, I would expect the impact to be something they would benefit from.