

SOLVING EQUATIONS, UNLOCKING CONFIDENCE: THE IMPACT OF PRE- TEACHING ON YEAR 10 SEND LEARNERS IN MATHEMATICS

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Abstract

This research examines the impact of a structured pre-teaching intervention on the mathematical confidence, engagement, and concept knowledge of Year 10 students with Special Educational Needs and Disabilities (SEND). A qualitative case study in a British international school in Dubai which spanned eight weeks, involved two SEND learners who were pre-taught before their classroom lessons. The research is underpinned by Vygotsky's (1978) Zone of Proximal Development (ZPD) and Sweller's (1988) Cognitive Load Theory (CLT), integrated with dual coding and retrieval strategies. Information was obtained from interviews, queries, and confidence rating cards. Results indicate significant gains in learner confidence, task initiation and classroom participation. Additionally, affective gains were seen, including decreases in maths anxiety and increase in student self-image. Although the research is small in scale and duration, the findings provide implications for scalable and low-cost inclusive teaching practices. Ethical considerations and researcher reflexivity are imbedded into study design and add to the credibility of the study.

Introduction

Pupils with special educational needs and disabilities (SEND) may experience many difficulties in relation to accessing and engaging with mainstream mathematics teaching. Mathematics, with its seemingly abstract requirements and accumulatory recursive structure, is a subject which can easily "get on top" of a pupil who needs time, varied input and moral support. In this way, anticipatory techniques—such as pre-teaching—can hold the potential to overcome cognitive and affective barriers to learning. Pre-teaching is presenting important concepts, terms, and skills to students before they receive instruction in the classroom. This method is thought to alleviate anxiety, promote preparedness, and promote understanding through the activation of prior knowledge and structured supports (Frederick, 2020; Gore & Thomas, 2022). Although pre-teaching has been shown to be effective in intervention studies at primary level, its use at secondary level, particularly with older SEND students preparing for high stakes exams, has been relatively unexplored. It is to this gap that this research aims to contribute, by exploring how a structured pre-teaching approach could impact the confidence, engagement and conceptual understanding for Year 10 SEND learners in a mathematics classroom.

Background and Rationale

The idea of scaffolding learners in their ZPD is a core principle in a range of inclusive pedagogies. Vygotsky's ZPD is a way to think about moving students from what they can do alone to what they can do collaboratively and scaffolding that support. Within SEND education the concept of pre-teaching is a scaffold that closes the gap caused by this development difficulty. Introducing ideas before whole class instruction begins enables students with cognitive, emotional, or language-focused challenges to be more successful in learning new material with their classmates. This line of reasoning is consistent with Sweller's CLT which assumes that students are better able to process information when extraneous load on working memory is reduced. Pre-teaching lightens this by manipulating the information being given in smaller bites of knowledge, thus avoiding an overload and encouraging construction of schema. The use of visual and verbal representations to enhance understanding, a primary feature of this intervention, is consistent with Paivio's (1990) dual coding theory. It was a British international school in Dubai which follows the UK National Curriculum alongside a SEND department. It is consistent with the UAE National Policy for Inclusive Education (2017), which prescribes differentiated instruction for all learners. This nexus of British

pedagogy and UAE policy renders the case-study of the school a powerful site to try out some low-cost, scalable ways of inclusive education.

Literature Review

The study is built upon the strong theoretical underpinnings of sociocultural, cognitive and pedagogical perspectives. ZPD is crucial in SEND education, and it highlights the significance of mediation, and its contribution with respect to learning. Without engagement with pre-teaching, through favourable social learning environment, marginalised learners, whose prior knowledge is often equally or more limited than their mainstream peers', have diminished access (Walton, Carrington & Siggers, 2022). Also, Sweller's (1988) Cognitive Load Theory has great bearing on MIE since in many MIE settings learners must sequence steps, apply rules and remember formulas in time pressure (Banerjee and Gautam, 2024). Banerjee and Gautam, 2024, emphasises that minimising extraneous load is crucial for SEND students to construct strong mathematical schemas. According to Paivio (1990) and Black and William (1998), learning with dual coding and retrieval practices provide additional support for the effectiveness of combining visual aids, verbal explanations, and retrieval-based recall as strategies that can promote both memory and understanding. These theories both underpin the justification for pre-teaching and drive the applied construction of the intervention.

At the national level, UAE has also taken huge strides in walking the path of inclusive education by introducing, Federal Law No. 29 and the National Policy for Inclusive Education of 2017. These approaches demand that schools take proactive, differentiated action to support students with disabilities. British curriculum schools, such as this case study, located in Dubai are evaluated for their capacity to meet such requirements. Keys to this were the school's inclusive philosophy membership and SEND population and provision. Globally, the Graduated Approach is advocated in the UK's SEND Code of Practice (Department for Education, 2015), where preventive instruction, such as pre-teaching, is an endorsed intervention. In Australia, Walton et al. (2022) found pre-teaching beneficial in maths contexts with individuals who had processing and language impairments. Meanwhile in the Scandinavian school systems, we see no stand-alone approaches, but a more inclusive approach in Norwegian school education systems and inclusive exploitation of these methods within universal classroom education (Bjørnsrud & Nilsen, 2011). These international similarities indicate that the pre-teaching concept can be widely applied, while applying it does not transfer directly but is culturally and situationally specific.

Methodology

Aim and Research Questions

This research is meant to test the effect of structured pre-teaching on a group of SEND Year 10 student learning experience in mathematics. More specifically, it is an inquiry into how pre-emptive pedagogy will affect student confidence, understanding, and participation in the classroom over the space of eight weeks. The research questions form the basis of the study:

1. Does pre-teaching enhance children's math self-confidence?
2. Does it increase comprehension and retention of these mathematical concepts?
3. It then follows that how to the student's experiences of pre-teaching compare with that of mainstream class participation?

Methods

This study used the qualitative case study method in an eight-week period at a British international secondary school in Dubai. Two Year 10 students with identified SEND profiles were also purposefully chosen along with the school's SEND department. The research was informed by constructivist beliefs about listening to students' voices and genuine observation.

The pre-teaching intervention was 3 × 20-min sessions per week before normal maths lesson. These sessions were of various types including explainer videos, retrieval practice (whiteboard retrieval task), scaffolding questions, flashcards and visual recap. Every week, students encountered information in material that was to be covered later in class, giving them a cognitive and emotional ahead start.

Three primary data collection methods were employed: (1) pre- and post-intervention semi-structured interviews; (2) weekly classroom observations captured through researcher structured field notes; and (3) a self-assessment confidence rating scale ranging from 1 (low confidence) to 5 (high confidence). The phenomenon of triangulation was used to achieve strong interpretation of trends. Moral considerations were strictly observed and researcher reflexivity was incorporated to recognise positionality and impacts on the outcomes.

Reflexivity Statement

As the researcher, my conflicting roles as a (HLTA) and a researcher may have brought biases to the research. I had pre-existing relationships with each participant which built trust and openness but may have demotivated each guest's willingness to express feelings of discomfort or failure. To serve this purpose, I maintained a reflexive journal to record assumptions, impressions, and personal experiences as they surfaced during the study. I also worked to interpret data judiciously and triangulate it with observable behaviour and student comments. Although this closeness enabled greater understanding of the students' learning to develop, it required self-critique and transparency at every stage of the research.

Ethical Considerations

Ethical clearance for the research was granted by the school head, Yet the school is not formally collaborating with the university which offers the degree programme at which this project originated; nor were the university ethics committee involved in the student intervention of which the study reported here forms a part. Written informed consents were obtained from the parents of both students and assents from the subjects. Anonymity was maintained by means of pseudonyms. All information was kept on password-protected devices and deleted following analysis. Participants were advised that they had a right to withdraw without academic consequence at any time. All communication was done in school as part of normal safety procedures. No individual identifying information was included, and results were volunteered respectfully and anonymously.

Results

The intervention has demonstrated benefits in confidence, engagement, and perceived understanding. The confidence of both students increased from 2 to 4 on the self-assessment scale. They reported feeling more prepared and less anxious in their routine maths lessons. ...it's like I already know what's going on when I walk in... This supports the concept of anticipatory schema activation (Nebesniak, 2007). Observational data were consistent with these reports, with both students beginning tasks more quickly and being more actively involved in classroom conversational interactions in the fourth week of the intervention.

There was also a significant decrease in mathematics anxiety among students. Although both learners were not initially willing to share and ask questions, they started to exhibit risk-taking behaviour, for example, doing more challenging questions or asking for clarification. Teachers observed an increase in eye contact, length of attention, and peer interaction. These findings support those found throughout literature regarding the affective rewards of pre-teaching for SEND students (Glazzard, 2024; Frederick, 2020). Crucially, the students took ownership of their own learning as demonstrated by their keen participation with the use of flash cards and check-in processes during the last few weeks.

Discussion

The results of the study indicate that pre-teaching is beneficial for the academic readiness of the learners and it has a beneficial impact on the emotional welfare of SEND learners. The key was that entering content on a no-pressure basis effectively 'zone of-proximal' the students and gave them the necessary cognitive and affective tools to participate more fully in mainstream classes. The results are largely in agreement with Vygotsky's theoretical model, in that the pre-teaching acts as scaffolding to assist learners with respect to their proximal development zone. Further, relevant to that were stages where information was chunked and simplified, decreasing the load on WM and encouraging deeper involvement.

But some caveats need to be noted. There is likely to be limitations to generalisation of the findings due to the small sample size and close relationship between researchers and subjects. Second, the confidence rating scale was based on subjective self-report and might not fully represent long-term benefits of increasing mathematical understanding. Limitations and future research A larger mode sample alongside random control trials, and mixed methods would add to the internal and external validity.

However, even if these samples cannot be representative, the results correspond with national and international studies that argue the need for proactive, differentiated work on inclusion (Walton et al., 2022; Bjørnsrud & Nilsen, 2011). The successful outcome of this intervention provides evidence that, through the application of a theoretical framework and integrated within curriculum planning, pre-teaching can be used as a lever to change outcomes for SEND learners.

Conclusion and Implications

The findings in the present study strongly suggest that pre-teaching can bolster both the cognitive and affective preparedness of SEND mathematics students. This encouraged students to feel more comfortable, participate more eagerly, and tackle previous fears they might have had about the course material. The implications of this study support the use of pre-teaching as an inclusive pedagogical strategy, particularly in potentially diverse educational contexts such as British international schools in the UAE.

The results advocate that pre-teaching is a successful, cost-effective and disseminable intervention within mainstream education. It is recommended that teachers and school administrators consider using structured anticipation instruction as an element of differentiated classroom practice. It is also recommended that professional development should offer training on promoting the use of scaffolding techniques and visual supports that are grounded in theories of information processing. Long-term retention of pre-teaching should be the subject of further study, as well as its applicability to different subjects and age groups.

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