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Differentiated pedagogy for early-grade learners with executive function and visual processing challenges

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Abstract. This study is relevant as it enhances cognitive skills that are vital in a technology-driven society and promotes equitable learning by addressing executive function and visual processing challenges. Thus, the research aimed to provide various pedagogical approaches to mitigate the learning challenges of young learners with executive function and visual processing challenges. Adopting a qualitative research method, a simple random sampling of twelve participants (eight teachers and four parents) from eight public primary schools was conducted to explore teachers' experiences and parents' perceptions of the research phenomenon. Semi-structured interviews were used for data collection. Findings indicated that while teachers employ various differentiated strategies, including flexible grouping and multi-sensory approaches, they face significant challenges such as time constraints, resource limitations, and insufficient specialist training. The study highlighted the importance of positive teacher-student relationships and parent-teacher collaboration in successfully implementing differentiated instruction. Teachers of primary school learners who implemented structured interventions and individualised learning approaches reported improved student engagement and academic performance. The research contributed to understanding how differentiated pedagogy can effectively support early-grade learners with specific learning challenges. It recommends enhanced professional development programmes, improved resource allocation, structured assessment systems, and strengthened parent-teacher partnerships. The findings established that differentiated instruction enhances academic performance while fostering learners' self-regulation skills and task confidence. The prioritisation of inclusive practices and teacher development by school leadership emerged as a pivotal institutional enabler. The approach advanced SDG 4 by reducing learning disparities in early education through pedagogically responsive frameworks. These findings significantly impact educational policy, teacher training, and classroom practice in supporting diverse learning needs in early-grade education

Keywords: cognitive control; visual perception; young learners; learning difficulties; teacher development

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INTRODUCTION

Learning difficulties are globally recognised phenomena that significantly impact learning outcomes for students. These challenges, particularly prevalent in early-grade learning, remain a concern for teachers and parents due to a lack of understanding of how best to address them. The

importance of the study cannot be overestimated as it offers a solution for learners with executive function challenges, enabling them to navigate their difficulties and enjoy equal educational opportunities to their peers without such challenges. Considering that society is now technologydriven,



this study aims to enhance learners' cognition as they engage with digital tools and educational resources. Therefore, early identification and appropriate support are crucial for these learners.

As noted by J.M. Fletcher *et al.* (2007) and J.S. Barrot *et al.* (2021), many learners struggle to overcome their problems due to delayed identification or inadequate pedagogical strategies. Various factors contribute to learning difficulties, including dyslexia, dyscalculia, attention-deficit/hyperactivity disorder (ADHD), speech and language disorders, visual processing disorder, auditory processing disorder, autism spectrum disorder, and executive functioning difficulties. Each child's unique manifestation of these challenges underscores the need for individualised approaches to support their learning journey. Moreover, learning difficulties present differently across individuals. For instance, dyslexia affects reading and language processing skills. Children with dyslexia may find it difficult to decode words, recognise letters, and comprehend written information (Snowling *et al.*, 2020; Prior, 2022).

Conversely, learners with dyscalculia may struggle to understand and apply mathematical concepts, identify numbers, and perform calculations. Similarly, learners with attention-deficit/hyperactivity disorder (ADHD) have difficulty focusing on tasks, staying organised, and following instructions. Visual processing challenges significantly impact early childhood learning and development. Children with visual processing difficulties may struggle to recognise shapes, letters, and words, leading to issues with reading fluency and comprehension. These difficulties extend beyond literacy, affecting a child's ability to interpret graphs, maps, and geometric shapes in mathematics and science. It is crucial to distinguish visual processing disorders from visual acuity problems, as they may persist even in children with perfect eyesight. This distinction makes identification and intervention challenging without specialised assessment tools and strategies (Dawson & Guare, 2018). Other learners may need help articulating sounds, understanding language, or expressing themselves verbally. These difficulties can affect their communication skills and, consequently, their academic progress. Such challenges may hinder their learning in various subjects, creating complex obstacles that educators must navigate to provide adequate support. The interplay between visual processing difficulties and other learning challenges, such as executive function deficits, can exacerbate learners' obstacles, necessitating a comprehensive and nuanced approach to intervention and support.

Executive function (EF) is another crucial cognitive process that plays a significant role in early childhood development and academic success. As defined by E.K. Goh & H.J. Jeon (2022), executive function encompasses the mental regulation of a learner's behaviour to accomplish tasks. Similarly, environmental factors play a critical role in developing visual processing skills and executive function. Researchers have highlighted that a low-income family environment can inhibit executive function development. The absence of learning stimuli, such as books, toys, and other

necessary infrastructure in home and school environments, can negatively impact a child's executive function (Zulkifli *et al.*, 2021). Moreover, psychological factors such as parental conflicts, bullying at school, and an unsupportive learning environment can significantly hinder the development of executive function skills (Ekeh & Venkatesamy, 2021).

The home environment, in particular, contributes significantly through sensitive parenting behaviour, emotional support, and cognitive stimulation. These factors highlight the interplay between a child's environment and cognitive development, emphasising the need for comprehensive support systems at home and in educational settings. Recognising the impact of environmental factors is important for developing effective interventions and support strategies for learners with visual processing and executive function challenges. This study aimed to explore how differentiated pedagogy supports early-grade learners with executive function and visual processing challenges. It examines the effectiveness of instructional methods, teachers' experiences, and parents' perceptions to provide insights into improving support for these learners at school and home.

LITERATURE REVIEW

Differentiated pedagogy, also referred to as differentiated instruction or differentiated learning, is an educational approach that acknowledges and accommodates the diverse needs, abilities, learning styles, and interests of individual students within a classroom (Aftab, 2016). The concept of differentiated pedagogy is based on the understanding that students are unique and have varying levels of readiness, preferences, and strengths in learning. Primarily, differentiated pedagogy aims to create a learning environment that accommodates these differences and allows each student to engage with the content, process information, and demonstrate their comprehension in ways that are most effective and meaningful for them (Benjamin, 2014). It goes beyond the traditional one-size-fits-all teaching approach and seeks to address the diverse learning needs of students within a single classroom. The conventional one-size-fits-all teaching approach assumes that all students in a class possess the same level of readiness and can learn at the same pace and in the same manner. However, students possess varying prior knowledge, skills, and learning preferences. Some students may grasp concepts quickly and need more challenging material, while others may require additional support and more time to understand the same concepts (Tomlinson, 2017). Differentiated pedagogy involves adjusting various aspects of teaching, such as content, process, and assessment, to cater to the individual learning profiles of students (Dawson & Guare, 2018).

Differentiated pedagogy offers numerous benefits for students and educators, allowing teachers to tailor their instruction to meet each student's unique needs, abilities, and interests (Tomlinson, 2017; Bahno & Serhiichuk, 2023). This personalised approach enhances students' learning experience and ensures they are appropriately challenged and supported (Benjamin, 2014). Students are more

likely to engage in learning when presented with content and activities that align with their interests and learning styles. A deeper understanding of the material and more enthusiasm for learning can lead to heightened engagement. S.W.Y. Wan (2016) argues that by catering to students' diverse learning needs, differentiated pedagogy can help improve academic performance. He further notes that when students feel that their learning is meaningful and relevant to them, they are more likely to excel in their studies. Differentiated instruction fosters an inclusive classroom environment where all students are valued and respected for their unique contributions. It helps create a sense of belonging and ensures that no student feels left behind. Differentiated pedagogy reflects the diversity of the natural world, where people have different strengths and abilities. When students experience personalised classroom learning, they develop skills that prepare them to navigate a diverse and complex world beyond school (Kotob & Abadi, 2019).

Students learn at different rates, and differentiated pedagogy accommodates these differences by allowing students to progress at their own pace. This flexibility can help prevent students from feeling rushed or bored while enabling them to develop a deeper understanding of the material. In their research, X. Li *et al.* (2022) assert that when teachers take the time to understand and address their students' individual needs, it leads to stronger teacher-student relationships. This rapport can enhance communication, trust, and overall classroom dynamics for students. Differentiated pedagogy benefits students with various learning styles, abilities, and cultural backgrounds. According to C.A. Tomlinson (2017), differentiated pedagogy particularly benefits students with learning disabilities as well as gifted students, as it offers individualised support to suit their needs. Providing various learning opportunities and challenges through differentiated instruction encourages critical thinking and problem-solving skills. Students are encouraged to think independently and apply their knowledge to real-world situations. Addressing individual learning needs early helps prevent academic gaps from widening. Furthermore, teachers help struggling students catch up to their peers by providing appropriate support and intervention.

Teachers seeking to enhance their understanding and implementation of differentiated pedagogy can explore various resources and professional development opportunities that enable them to tailor instruction to meet their students' diverse needs and learning styles. For instance, workshops, seminars, and conferences featuring expert speakers, hands-on activities, and opportunities to network with other educators who focus on differentiated instruction help teachers improve their practice (Blaz, 2023). According to D. De Neve & G. Devos (2016), professional learning communities composed of teachers interested in differentiated pedagogy provide an effective means of developing and refining differentiated practices. Additionally, many educational platforms offer online courses on differentiated instruction. These courses allow participants to learn at

their own pace and often include practical strategies and real-world examples. C. Redecker & Y. Punie (2017) state that participating in educational webinars and exploring websites providing resources, lesson plans, and methods for differentiated instruction is an effective way of gaining an understanding of and implementing differentiated pedagogy in the classroom. Similarly, K.L. Martin *et al.* (2016) emphasise that observing experienced teachers who successfully implement differentiated strategies in their classrooms and seeking guidance from a mentor or professional colleague is highly beneficial.

High academic performance serves as a powerful motivator force for learners, teachers, and parents; thus, every effort should be made to achieve this goal. Whereas the learner, as the focal point of learning, is expected to perform brilliantly, some cognitive processes may impact academic performance. In this study, the cognitive process under consideration is executive function (EF). According to E.K. Goh & H.J. Jeon (2022), executive function refers to the mental modulation of a learner's behaviour to accomplish a task. Executive function encompasses cognitive processes that allow learners to plan, supervise, regulate, organise, focus their attention, self-monitor, and coordinate their actions (Titz & Karbach, 2014; Clements *et al.*, 2016). Executive function also improves learners' critical thinking and memory retention, consequently enhancing academic achievement. According to D.H. Clements *et al.* (2016), executive function processes rapidly develop during early childhood, highlighting their importance in early education.

Although executive function positively influences learners' overall academic development, the National Research Council (2001) asserts that executive function significantly impacts mathematical proficiency. The research council identified five interwoven strands that contribute to proficiency in mathematics: conceptual understanding, strategic competence, procedural fluency, adaptive reasoning, and productive disposition (National Research Council, 2001). These strands form the foundation for learners' logical reasoning, justification, explanation, and reflection. According to X. Zhang *et al.* (2020), enhancing mathematical proficiency in early education serves as a predictor of greater achievement in later years. Similarly, evidence suggests that learners' early knowledge of mathematics strongly influences their performance in both primary and secondary education (Ten Braak *et al.*, 2022). Therefore, differentiated pedagogy plays a crucial role in improving learners' executive function to develop domain-specific problem-solving competencies.

Regarding difficulties in executive function, the environment plays a significant role. E.K. Goh & H.J. Jeon (2022) state that a low-income family environment inhibits executive function. A child's executive function development is negatively affected when the home or school environment lacks learning stimuli such as books, toys, technological tools, and other necessary resources (Yogman *et al.*, 2018). Specifically, an unfavourable psychological environment, characterised by parental conflict, domestic violence and

persistent bullying at school, can severely impair a child's executive function (Ekeh & Venketsamy, 2021). Conversely, meaningful interactions between parents and children, teachers and learners, and among peers provide essential stimuli and diverse experiences, leading to improved executive function. Notably, the home environment plays a fundamental role in shaping learners' executive function, considering the influence of responsive parenting behaviour, emotional support, and cognitive stimulation (Kim & Kwak, 2015). Furthermore, encouraging attention-oriented engagement, reducing conflict and domestic violence, eliminating aggressive behaviours that lead to depression, and fostering family cohesion contribute to the enhancement of executive function in young learners.

MATERIALS AND METHODS

The research adopted a qualitative methodology with a phenomenological design to provide a thorough exploration and understanding of the research subject. This approach was chosen to gain deeper insight into teachers' and early-grade learners' experiences, perspectives, and interactions within public primary schools in Owerri Municipal, Imo State, Nigeria. Through interviews and document analysis, the researcher sought to provide a detailed and nuanced description of how differentiated pedagogy is implemented and perceived in early-grade classrooms in these schools.

Teachers and parents of early-grade learners in Owerri Municipal public primary schools comprised the research participants. The researcher employed simple random sampling to select eight schools out of twenty-five in the area and chose one early-grade teacher from each school. Four parents were also selected randomly from the same schools, bringing the total to twelve participants. The simple random sampling technique ensured an unbiased selection of schools and participants. The researcher considered this sample size adequate as the study aimed to provide a comprehensive exploration and deeper insight into teachers' use of differentiated pedagogy in addressing learning difficulties in early grades. The study focused on early-grade educators within this school system, who formed the core research participants. Using a systematic approach, the researcher applied simple random sampling to carefully select a representative sample of schools from a larger group of twenty-five institutions within Owerri Municipal. A single early-grade teacher was chosen from each school, resulting in eight participants to align with the research's defined scope. The deliberate use of simple random sampling ensured an unbiased selection process, allowing for a diverse representation of educational contexts and teaching practices.

The researcher gathered data for this study through interviews. This method facilitated in-depth engagement with participants, making it particularly suitable for the study. The conversations were audio-recorded to ensure accurate documentation of information. Subsequently, transcribing the interview recordings into text enabled data analysis. The study employed a word cloud and an integrated

thematic analysis approach to determine the meaning of the collected data. After transcription, the researcher familiarised himself with the participants' responses, coded the data, and identified emerging themes within the dataset. A rigorous validation process was employed to ensure the reliability and credibility of the gathered data. The researcher utilised member checking and peer debriefing to enhance the trustworthiness of the data. Through peer debriefing, experts in the field were engaged to review and provide feedback on the research process and findings. This collaborative approach helped identify potential biases or oversights, strengthening the overall integrity of the study.

Additionally, member-checking was employed to validate the accuracy and authenticity of the data from the participants' perspective. Participants were given the opportunity to review and verify the researcher's interpretations of their responses. This approach helped the researcher ensure that participants' voices were accurately represented in the findings. The iterative feedback and validation process fostered a sense of collaboration and mutual respect between the researcher and the participants, further enhancing the credibility of the data. Moreover, to validate the interview questions used in the study, two experienced early childhood education specialists were consulted. These experts provided valuable insights and feedback on the relevance, clarity, and comprehensiveness of the interview questions. Their input helped refine and improve the interview protocol, ensuring it effectively captured the desired information and yielded meaningful data. By employing these validation techniques, the researcher upheld trustworthiness and credibility in the research process, contributing to the rigour and reliability of the study's findings.

The researcher diligently adhered to the ethical guidelines outlined by J.W. Creswell & C.N. Poeth (2016) throughout the study, prioritising the well-being and privacy of the participants. Before the research commenced, formal approval was obtained from the Faculty of Specialised Education Research Ethics Committee at Alvan Ikoku Federal University of Education, ensuring the study met rigorous ethical standards. The study obtained informed consent from all participants, with strict adherence to ethical protocols that ensured anonymity through the pseudonymisation of all personal identifiers and maintained confidentiality using tiered data security measures. Interviews were scheduled exclusively during non-teaching periods (breaks, after-school hours) to avoid disrupting pedagogical activities, with strict adherence to the principles of voluntary participation, as outlined in the Belmont Report (1974). No financial incentives, refreshments, or compensatory measures were provided to participants, eliminating potential coercion risks and safeguarding data integrity against response bias. Written consent protocols explicitly affirmed participants' right to withdraw at any stage without academic or professional repercussions. Each participant was assigned a unique pseudonym, denoted as Teacher Participant 1 (TP 1), Teacher Participant 2 (TP 2), and so forth, up to TP 8. Similarly, Parent Participants were

coded as PP 1, PP 2, and so forth, up to PP 4. The study employed pseudonyms to refer to individual participants, safeguarding their privacy and confidentiality.

Furthermore, to protect the identities of the schools involved in the study, a similar coding system was employed. Each school was assigned a coded identifier: Sch 1, Sch 2, Sch 3, Sch 4, Sch 5, Sch 6, Sch 7, and Sch 8.

RESULTS

This study integrates empirical research, participant experiences, and critical interpretation to provide a comprehensive understanding of the implementation of differentiated pedagogy in early-grade education. The study presents four major themes that emerged from the data, supported by relevant empirical evidence and participant narratives.

Theme 1: Teachers' experiences and perspectives on implementing differentiated instruction for diverse learners

Identifying diverse learning challenges is a crucial first step in implementing differentiated instruction. The participant teachers consistently reported a range of learning difficulties among their students. As TP1 notes:

"Yes sir, I have, like some of them are slow in writing, as they are in the class together, their learning or intellectual ability are not the same, so those slow learners, you have to give them time, like when you write on the board, you have to wait for them to finish writing. Also, some of them are visually impaired, some of them have attention deficit hyperactive disorder(lack of focus)"

These observations align closely with the findings of J.S. Barrot *et al.* (2021) and J.M. Fletcher *et al.* (2007), who emphasise the prevalence and impact of learning difficulties in early education. The diversity of challenges identified by teachers, including visual impairment, slow writing, and attention deficits, reflects the complex nature of learning difficulties described in the literature.

TP3's experience further illustrates this complexity: *"Yes, I have [encountered learners with difficulty], like visual impairment, slow writing, slow reading and lack of concentration..."* These observations correspond with G.W. Humphreys & V. Bruce's (2021) research on visual processing disorders and executive function challenges in early learners. Teachers' ability to identify these varied challenges is crucial for implementing effective differentiated instruction.

The consistency in teachers' observations across different classrooms suggests a widespread need for differentiated instruction. However, the variation in how teachers describe these challenges indicates a potential need for standardised assessment tools and professional development in identifying specific learning difficulties.

Teachers reported employing various differentiated instructional methods to address diverse learning needs. TP4 describes a multi-faceted approach:

"I emphasise on them, like yesterday I found out that some of them cannot write or read. I started teaching them how to read using syllables, like I will cut some words and tell them to complete and pronounce them, sometimes I will tell

them to write numbers and figures from 1 to 200 just to keep them busy. I also grouped them so that those that knows it will also teach them how to do it"

This approach exemplifies the principles of differentiated pedagogy outlined by A. Benjamin (2014), which emphasises adapting content, process, and product according to students' readiness, interests, and learning profiles. The use of syllable-based reading instruction and peer teaching reflects evidence-based practices in literacy development (Aftab, 2016).

TP5 describes another strategy:

"OK like those finds it difficult to write, the visually impaired, you make sure you keep them at the front sit because when they sit at the back, they will not see what is on the board. You can also use the think-pair-share method whereby in the class, you share them into groups; in each group, you have a leader or coordinator, so you give them work to do"

This approach incorporates environmental modifications and collaborative learning strategies, reflecting the multi-faceted nature of differentiated instruction as described by D.S.Y. Choi & P. Morrison (2014). While teachers implement various differentiated strategies, there appears to be a need for more systematic and evidence-based approaches. While valuable, relying primarily on seating arrangements and group work could be supplemented with targeted interventions for specific learning difficulties.

Both teachers and parents reported positive impacts from differentiated instruction. TP7 observes: *"Yes, it helps the children a lot in terms of improvement and changes. You will see the children concentrating for those that are not concentrating, and those that are not writing well will start writing well"*. This outcome corroborates the research of S. Kim & K. Kwak (2015), which found significant positive effects of differentiated instruction on student achievement. PP1's feedback further supports this: *"It has improved maximally, she's now comfortable to learn, she is now eager to do her assignment unlike before"*.

These observations reflect the potential of differentiated instruction to enhance academic performance and student engagement, as noted in the literature (Goh & Jeon, 2022). The positive feedback from both teachers and parents suggests that differentiated instruction has a meaningful impact. However, a more comprehensive long-term assessment of these impacts would be beneficial to fully evaluate the effectiveness of these strategies.

Despite the positive impacts, teachers face significant challenges in implementing differentiated instruction. TP4 describes: *"Hmm, it's not really easy, it's time-consuming, we have to put more effort and work to achieve it, and also observation for them to do the work very well and so many other things involved"*.

This echoes the findings of A.I. Gambari *et al.* (2018), who identified time constraints and increased workload as significant barriers to implementing differentiated instruction. TP2 adds:

"Ok, it consumes time because it's time we used to do it. For instance, if you are teaching mathematics, it will take

more time to teach the slow learners to understand, so you have to put more time into them to understand."

These challenges highlight the need for systemic support and resources to enable effective differentiated instruction, as emphasised by A.I. Gambari *et al.* (2018). The recurring reports of time and resource constraints across multiple teachers suggest a systemic issue that needs addressing at an institutional or policy level. Without adequate support, the full potential of differentiated instruction may not be fully realised.

Theme 2: Parent involvement and communication

The degree of parental involvement and communication between teachers and parents varies. TP8 describes their approach:

"OK, you have to invite the parents because it's teamwork between the parents and the teachers, so you invite the parents and tell them the problem the child is having in the class, then you tell the parents what to do at home to help the child improve".

This aligns with research by S. Kim & K. Kwak (2015) on the importance of home-school partnerships in supporting students with learning difficulties. PP2's experience reflects some success in this area:

"Yes, it was last session when they did open day; they called parents to interact with their class teachers and the areas where their children are having difficulties so they will know how to help them in their studies..."

While efforts are being made to involve parents, the variation in approaches and experiences suggests a need for more structured and consistent parent-teacher communication strategies. Developing standardised protocols for parental involvement could enhance the effectiveness of differentiated instruction.

Theme 3: Enhancing educational quality through teacher capacity building and inclusive practices

Teachers express appreciation for professional development opportunities. TP5 shares:

"So, like recently, I have been doing different seminars. The lecturers in the university's primary education department help teach us, so periodically, they conduct seminars and workshops for us. So with training like that, you can be equipped to assist the children when you come back..."

This aligns with research by D.S.Y. Choi & P. Morrison (2014) on the importance of ongoing professional development in enhancing teachers' ability to implement differentiated instruction effectively. While teachers value these opportunities, there appears to be a need for more targeted training specifically focused on differentiated instruction for students with executive function difficulties and visual processing challenges. Developing a comprehensive and continuous ongoing professional development programme could significantly enhance teachers' capabilities in this area.

There is growing awareness of and increasing implementation of inclusive education practices. TP2 describes their approach:

"OK, that's mainstreaming, when I teach, I will make sure they will be at the same level, the same level in the same

that I have extra time to drill the special ones and the ones with challenges, and I set a goal, questions, I give assignments and call the child privately and also with the help of the parents, we will move hand in hand to get the child".

While there is a clear commitment to inclusive practices, there appears to be a need for more structured, evidence-based approaches. Developing clearer guidelines and targeted strategies for inclusive education could enhance the effectiveness of these efforts.

Teachers use various assessment methods to gauge the effectiveness of their strategies. TP1 describes:

"I assess it by evaluating the children, and I will write questions after teaching. They will answer and pass, then I will mark and do the corrections, so with their feedback, I will know those that are doing well or lagging behind".

This approach aligns with the principles of formative assessment as described by P. Dawson & R. Guare (2018), which emphasise the importance of ongoing feedback in the learning process. While teachers employ various assessment methods, there appears to be a need for more systematic and standardised assessment approaches. Developing a comprehensive framework that integrates both formative and summative assessment elements could provide more robust data on the effectiveness of differentiated instruction.

Theme 4: Educational support systems – resources and relationships in teaching and learning

Both teachers and parents identify the need for more resources to support differentiated instruction. PP3 emphasises:

"You know they say that a hungry man is an angry man; for these things now to work, there must be something to be done; in such a school now, all these materials should be made available, like blackboard, chalk, marker even the seats because there is a way a student will sit in the class he or she may not pay attention to what the teacher is teaching, the students should be comfortable where they are sitting".

This aligns with research by A.I. Gambari *et al.* (2018) on the importance of adequate resources in implementing effective differentiated instruction. The consistent identification of resource needs across multiple participants suggests a systemic issue requiring institutional or policy level intervention. Addressing these resource gaps could significantly enhance the effectiveness of differentiated instruction.

Participants emphasised the importance of positive teacher-student relationships in facilitating learning. PP4 shares:

"Ok, initially she had some learning challenges while she was in primary one because she is the type that if you scold her, she gets withdrawn, you can ask her questions she will not answer, so the teacher at that time was much more like harsh to her so she began to be backward until I intervened in the matter and told her the temperament of the girl that if she continues this way you will lose her, I did that until she subpedalled and made her a friend and she started coming up"

This aligns with X. Li *et al.* (2022), who highlight the significant impact of teacher-student relationships on student engagement and achievement, particularly for

students with learning difficulties. The emphasis on positive relationships suggests the need for additional training and support for teachers in developing effective interpersonal skills and understanding diverse student needs. Integrating this aspect more explicitly into teacher training and professional development could enhance the overall effectiveness of differentiated instruction.

Personal experiences often illuminate learners' struggles with executive function difficulties and visual processing challenges. As a high school student, the author faced significant difficulties with executive function and ADHD while attending a boarding school where teachers and prefects expected uniform conformity to school activities. The rigid, one-size-fits-all approach and the absence of close student-teacher relationships meant that difficulties with task focus, organisation, and self-regulation went unnoticed, significantly impacting academic performance. It was not until a teacher took a personal interest and applied differentiated learning strategies that the author overcame these challenges. This experience underscores the transformative potential of individualised support and differentiated instruction for learners facing cognitive processing difficulties. The journey from struggling with unrecognised learning challenges to achieving academic success through targeted interventions highlights the critical importance of educator awareness and appropriate instructional adaptations. Personal narratives such as this not only illustrate the real-world impact of learning difficulties but also emphasise the potential for positive outcomes when students receive the right kind of support at the right time.

Differentiated pedagogy emerges as a promising approach to addressing the diverse learning needs and abilities of students, particularly those experiencing learning difficulties in early grades (Suprayogi & Valcke, 2016; Wan, 2016). When applied effectively, this teaching approach can promote inclusive education and ensure all learners receive the necessary support. Implementation requires teachers to employ various assessment tools to evaluate students' strengths, weaknesses, and learning styles, thereby identifying specific areas of struggle (Dawson & Guare, 2018). This study focuses on visual processing and executive function difficulties, recognising that learners with these challenges may struggle with tasks involving the recognition of shapes and letters, reading comprehension, organisation, planning, and time management. By exploring the application of differentiated pedagogy in addressing these specific learning difficulties, this research aims to contribute to more effective educational strategies for early-grade learners. The ability of differentiated pedagogy to accommodate the unique needs of each learner, particularly those with visual processing and executive function challenges, offers a pathway towards more inclusive and effective educational practices. This approach not only addresses the immediate academic needs of students but also has the potential to foster long-term learning skills and strategies that can benefit learners throughout their educational journey and beyond.

The importance of executive function in early education cannot be overstated, as it forms the foundation for critical thinking, memory skills, and overall academic development. The development of executive function skills – such as planning, monitoring, self-regulation, organisation, attention control, and coordination – (Titz & Karbach, 2014; Clements *et al.*, 2016). is particularly rapid during the early years, making it a critical focus area for early-grade education. Research has shown that executive function significantly influences mathematics proficiency (National Research Council, 2001). The five strands of mathematics proficiency – conceptual understanding, strategic competence, procedural fluency, adaptive reasoning, and productive disposition – all rely heavily on executive function skills. This underscores the importance of addressing executive function challenges early in a child's educational journey, as deficits in these areas can have far-reaching consequences across various academic domains and beyond.

Learners with visual processing difficulties may encounter numerous obstacles that adversely affect their academic performance and overall learning experience. Visual processing refers to the brain's ability to accurately interpret visual information from the environment. Issues with visual processing can hinder learners' abilities to recognise and differentiate letters, words, and symbols (Janarthanan, 2017). Learners may experience difficulties decoding words, tracking lines of text, and comprehending learning materials. Handwriting and spatial organisation skills are also affected, as these learners often struggle with letter formation, sizing, spacing, and overall legibility (Humphreys & Bruce, 2021).

Another challenge associated with visual processing difficulties is the need for learners to remember and recall visual information, such as shapes, colours, and images. This challenge hinders learners' ability to recognise familiar objects or remember details from visual learning materials. Consequently, difficulties in coordinating visual information with motor skills lead to problems with activities such as copying from the board, drawing, or completing puzzles. Furthermore, learners with visual processing difficulties struggle to sustain their attention on visual tasks, leading to problems with focus and concentration in the classroom. Visual processing issues impact learners' ability to perceive and interpret visual stimuli accurately, as demonstrated by their trouble in recognising shapes, forms, and patterns (Janarthanan, 2017).

Accordingly, they struggle to understand spatial concepts, such as directionality, left-right orientation, and spatial relationships between objects. A learners' ability to understand and follow sequential information, such as steps in a mathematical problem or directions for a science experiment, is impacted by visual difficulties (Janarthanan, 2017). Processing visual information can be overwhelming for learners with these difficulties, especially in visually busy or cluttered environments (Humphreys & Bruce, 2021). Visual processing issues significantly affect learners' performance

across various subjects that heavily rely on visual information, such as reading, mathematics, science, and art. Struggling with visual processing challenges can lead to frustration, anxiety, and a decline in self-confidence, potentially affecting students' social interactions and overall well-being.

Flexible grouping of students based on their needs and abilities is an effective approach to supporting learners with visual processing and executive function difficulties (Choi & Morrison, 2014). In their research, G. Colón *et al.* (2022) noted that forming flexible small groups or pairing where students with different abilities provide opportunities for struggling students to learn from their peers, allowing for collaborative learning and peer support. Similarly, A.I. Gambari *et al.* (2018) state that using varied instructional materials and techniques caters to different learning styles. For instance, incorporating visual aids, hands-on activities, technology tools, and manipulatives engages students and enhances accessibility. Author D. Blaz (2023) argues that this approach to learning is more accessible by offering multiple pathways for students to demonstrate their understanding, such as written assignments, oral presentations, or multimedia projects. Comparably, L.F. Skaff *et al.* (2016) argue that developing Individualised Learning Plans (ILPs) for students with specific learning difficulties is an effective strategy to support students with learning challenges. ILPs allow teachers to outline targeted goals, strategies, and accommodations tailored to students' needs. Regularly reviewing and updating these plans based on ongoing assessments and progress monitoring ensures that teachers remain informed about learner support progress (Dawson & Guare, 2018).

Scaffolding instruction for learners with learning disabilities is an essential support system for students, as teachers break down complex tasks into smaller, manageable steps. According to J.R. Boyle *et al.* (2016), teachers must provide scaffolds, such as graphic organisers, checklists, or step-by-step instructions, to guide students through learning. These supports should be gradually removed as students become more independent and confident in their abilities. S.L. Benton & S. Young (2018) highlight that providing timely and specific feedback to students helps them understand their strengths and areas for improvement while offering additional support through one-on-one or small-group interventions, which provide targeted instruction and guidance. Similarly, S. Kim & K. Kwak (2015) emphasise the importance of collaboration with parents and caregivers to gain insights into students' learning difficulties and establish a partnership that supports student progress. Sharing information about strategies used in the classroom and providing resources that parents can use to reinforce learning at home is essential. In contrast, teachers must remember that differentiated pedagogy is not a one-size-fits-all approach: it requires continuous reflection, flexibility, and adaptation to meet the evolving needs of each student (Benjamin, 2014). A comprehensive study on differentiated pedagogy for early-grade learners with executive function and visual processing challenges reveals

several critical recommendations that warrant immediate attention and implementation. These recommendations are designed to enhance the learning experience and outcomes of affected students.

Professional development and teacher training emerge as primary recommendations from this research. Educational institutions must prioritise regular, specialised training to equip teachers with the skills needed to identify and address executive function and visual processing challenges. These programmes should include mentorship opportunities, where experienced teachers can guide newer colleagues in implementing differentiated instruction strategies. Additionally, workshops focusing on the latest research-based interventions and technological tools would help ensure that teachers remain current with best practices for supporting diverse learning needs.

Resource allocation and infrastructure development constitute another crucial area for improvement. Schools must invest in appropriate learning materials and assistive technologies to support learners with visual processing challenges. Creating dedicated resource rooms equipped with specialised learning tools and ensuring adequate funding for assessment tools and intervention resources is essential. Furthermore, implementing digital learning platforms that support differentiated instruction would enhance the learning experience for students with these specific challenges. The study emphasises the importance of effective assessment and monitoring systems. Educational institutions should develop standardised screening tools for the early identification of executive function and visual processing challenges. Regular progress monitoring systems must be implemented to track student development systematically. Creating Individualised Learning Plans with specific, measurable goals for each affected student and establishing systematic documentation procedures for tracking intervention effectiveness would support more targeted and successful interventions.

Parent-teacher collaboration is a vital component of successful intervention strategies. Schools should establish regular communication channels through various platforms to keep parents informed and involved in their child's learning journey. Hosting workshops to educate parents about executive function and visual processing challenges would enable them to provide better support at home. Creating parent support groups and developing home-school partnership programmes would ensure consistency in intervention approaches and create a more supportive learning environment for affected students. The classroom environment and teaching strategies require careful consideration and modification. Teachers should implement flexible seating arrangements that accommodate visual processing needs and utilise multisensory teaching approaches to support different learning styles. Incorporating technology-enhanced learning tools that support executive function development and creating structured daily routines would help students develop essential skills while accommodating their specific needs.

This integrated analysis reveals a complex landscape of differentiated instruction implementation in early-grade education. While teachers employ various strategies and observe positive impacts, significant challenges remain regarding time constraints, resource availability, and systematic implementation. The voices of teachers and parents highlight the critical need for ongoing professional development, enhanced resources, and stronger home-school partnerships. Moving forward, there is a clear need for more structured and evidence-based approaches to differentiated instruction, particularly for learners with executive function and visual processing challenges. This should involve developing comprehensive assessment frameworks, enhancing teacher training programmes, and addressing systemic resource gaps. By integrating these elements, schools can create more effective and inclusive learning environments that truly meet the diverse needs of all students.

CONCLUSIONS

The research conclusively demonstrates that addressing executive function and visual processing challenges in early-grade education requires a multifaceted approach involving educators, parents, and educational administrators. Early identification of learning challenges is crucial, as intervention in the early stages leads to better outcomes and prevents the widening of achievement gaps. Teacher preparedness through continuous professional development significantly impacts their ability to implement effective differentiated instruction strategies and support student success. The study's findings emphasise that adequate resources, both material and human, are essential for implementing effective differentiated instruction strategies. Schools must prioritise resource allocation to support these needs effectively. Success in supporting learners with these challenges requires strong collaboration between teachers, parents, and other stakeholders in

the educational system. Moreover, the research underscores that each learner's needs are unique and require personalised intervention strategies, making a one-size-fits-all approach ineffective.

This study reveals that differentiated pedagogy effectively addresses the diverse learning needs of early-grade students. Teachers' observations and participant feedback demonstrate that adaptive instructional methods lead to improved student engagement and academic performance, particularly for learners facing challenges such as visual processing difficulties and executive function deficits. Both educators and parents highlight the positive impact of these tailored strategies, noting increased confidence and better classroom outcomes. However, the study also identifies persistent challenges, including time constraints, resource limitations, and the need for more systematic assessment tools. Overall, the findings underscore the promise of differentiated instruction while emphasising the necessity for enhanced professional development, structured support systems, and robust home-school partnerships to fully realise its benefits. Future research should focus on enhancing understanding and improving intervention strategies. These include examining the longterm effectiveness of specific intervention strategies, evaluating the impact of technology-enhanced learning tools on student outcomes, understanding the role of cultural factors in intervention effectiveness, conducting cost-benefit analyses of various intervention approaches, and developing more efficient assessment tools.

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CONFLICT OF INTEREST

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Диференційована педагогіка для учнів молодших класів з проблемами виконавчої функції та візуальної обробки інформації

Анотація. Це дослідження є актуальним, оскільки воно покращує когнітивні навички, життєво важливі в суспільстві, керованому технологіями, і сприяє рівноправному навчанню, вирішуючи проблеми виконавчої функції та зорового сприйняття. Таким чином, дослідження мало на меті запропонувати різні педагогічні підходи для пом'якшення труднощів у навчанні молодих учнів з проблемами виконавчої функції та зорової обробки. Застосовуючи якісний метод дослідження, за допомогою простої випадкової вибірки з дванадцяти учасників (вісім вчителів і чотири батьки) з восьми державних початкових шкіл було вивчено досвід вчителів і сприйняття батьками досліджуваного явища. Для збору даних використовувалося напівструктуроване інтерв'ю. Результати показали, що, хоча вчителі застосовують різні диференційовані стратегії, включаючи гнучке групування та мультисенсорні підходи, вони стикаються зі значними проблемами, такими як брак часу, обмеженість ресурсів та недостатня спеціалізована підготовка. Дослідження підкреслило важливість позитивних стосунків між вчителями та учнями, а також співпраці між батьками та вчителями для успішного впровадження диференційованого навчання. Вчителі початкових класів, які впроваджували структуровані інтервенції та індивідуалізовані підходи до навчання, повідомили про покращення залучення учнів та їхньої академічної успішності. Дослідження сприяє розумінню того, як диференційована педагогіка може ефективно підтримувати учнів початкових класів з особливими навчальними проблемами. Рекомендовано вдосконалювати програми професійного розвитку, покращувати розподіл ресурсів, структурувати системи оцінювання та зміцнювати партнерство між батьками та вчителями. Встановлено, що диференційоване навчання підвищує академічну успішність, розвиваючи в учнів навички саморегуляції та впевненість у виконанні завдань. Пріоритетність інклюзивних практик та підвищення кваліфікації вчителів з боку керівництва шкіл виявилися ключовими інституційними факторами, що сприяють цьому. Цей підхід сприяє досягненню ЦСР 4, зменшуючи нерівність у навчанні в ранній освіті за допомогою педагогічно чутливих рамок. Результати дослідження суттєво впливають на освітню політику, підготовку вчителів та практику роботи в класі, спрямовану на підтримку різноманітних навчальних потреб у початковій освіті

Ключові слова: виконавча функція; візуальна обробка інформації; учні молодших класів; труднощі у навчанні; розвиток вчителів