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Transforming ADHD screening through teachers' strategic use of an Observation-based tool in Grade 9 and 10 Mathematics classrooms in Soshanguve township

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ABSTRACT

Early identification of attention-related behavioural vulnerabilities is critical for preventing cumulative learning failure in Mathematics, particularly within under-resourced township secondary schools. This study explored how Grade 9 and Grade 10 Mathematics teachers in Soshanguve Township utilised a teacher-administered observation-based Vanderbilt Attention Deficit Hyperactivity Disorder (ADHD)screening tool to identify behavioural risk indicators and to inform instructional support processes. A qualitative multiple-case study design was used within a constructivist and interpretivist paradigm in five secondary schools. Data were generated through teacher-completed Vanderbilt screening forms, classroom observations, and reflective field notes, and analysed using reflexive thematic analysis with cross-case pattern matching. Deliverology and Implementation Science framed the analytical interpretation. The findings revealed four interrelated themes: teacher-mediated identification of pervasive inattention, hyperactivity and impulsivity as destabilising influences on instructional regulation, systemic academic and functional impairment, and emotional dysregulation undermining learner participation and persistence. In all cases, teachers demonstrated high observational fidelity in identifying behavioural vulnerability through screening. However, the translation of screening outcomes into structured instructional adaptation and coordinated support pathways remained inconsistent and systemically constrained. Screening functioned primarily as an identification mechanism rather than as a sustained driver of instructional improvement. The study confirms that teacher-administered behavioural screening, when ethically positioned as non-diagnostic, offers significant potential for strengthening inclusive Mathematics education in disadvantaged secondary school contexts. The combined application of Deliverology and Implementation Science provides a robust framework for transforming early behavioural identification into a scalable instructional and system improvement mechanism.

Keywords: ADHD Identification, Observation Diagnostic Tool, Mathematics Education, Learner Support, Deliverology, Implementation Science, Soshanguve Township.

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INTRODUCTION

Mathematics remains a decisive subject in the academic progression of learners in South Africa because it influences access to senior secondary achievement, further education opportunities, and participation in Science, Technology, Engineering, and Mathematics (STEM) related pathways. However, township secondary schools continue to experience persistent Mathematics underperformance, high learner-teacher ratios, limited instructional support, and restricted access to specialised learner support services.[1] Within these conditions, Mathematics teachers are required to respond not only to curriculum demands but also to behavioural and learning barriers that affect learners' participation, concentration, task completion, and conceptual development. Behavioural patterns associated with inattention, hyperactivity, impulsivity, and emotional dysregulation are especially significant because Mathematics learning requires sustained attention, sequential reasoning, working memory, procedural accuracy, and persistence during problem-solving tasks.[2]

South African Inclusive Education White Paper 6 policy recognises the importance of early identification and support for learners who experience barriers to learning. The Screening, Identification, Assessment and Support (SIAS) framework provides a mechanism for identifying learning and behavioural barriers and linking learners to appropriate support. However, the translation of this policy expectation into consistent classroom-level practice remains uneven in resource-constrained schools.[3] In many township secondary schools, teachers are the first professionals to observe behavioural difficulties during everyday classroom interaction. However, they often rely on informal professional judgement rather than structured screening procedures to document behavioural risk and initiate support. This is particularly important in Mathematics classrooms, where attention-related difficulties may be misread as poor motivation, weak ability, or lack of discipline.

Although existing literature recognises the value of teacher observation in identifying behavioural vulnerability, limited empirical attention has been given to how Mathematics teachers use structured, observation-based screening tools in township secondary schools.[4] Currently, much of the research focuses on clinical diagnosis, general behaviour management, early childhood assessment, and broad inclusive education systems. Less is known about how frontline Mathematics teachers operationalise teacher-administered screening tools in low-resource secondary classrooms, how they interpret behavioural indicators within Mathematics learning, and how screening outcomes inform instructional support practices.[5] Therefore, this gap is important because attention-related behavioural difficulties may affect learners' ability to follow multi-step procedures, retain symbolic information, monitor errors, organise written work, persist with challenging tasks, and participate meaningfully in classroom activities.

Another gap concerns the relationship between screening and response. Teacher-administered tools, such as the Vanderbilt Attention Deficit Hyperactivity Disorder (ADHD) screening instrument, offer a structured way of documenting behavioural risk within classroom environments. However, the use of a screening tool does not automatically lead to effective instructional adaptation, learner support planning, and referral. Township schools often operate with fragile support infrastructures, inconsistent School-Based Support Team (SBST) functioning, limited access to multidisciplinary services, and

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[1] Neil Humphrey et al., *Social and Emotional Learning* (Routledge, 2020); Pia O'Farrell, Charlotte Wilson, and Gerry Shiel, "Teachers' Perceptions of the Barriers to Assessment of Mental Health in Schools with Implications for Educational Policy: A Systematic Review," *British Journal of Educational Psychology* 93, no. 1 (2023): 262–82.

[2] Deirdre V Lovecky, *Different Minds: Gifted Children with ADHD, ASD, and Other Dual Exceptionalities* (Jessica Kingsley Publishers, 2023).

[3] Rebecca E Hasson et al., "Closing the Gap between Classroom-Based Physical Activity Intervention Adoption and Fidelity in Low-Resource Schools," *Kinesiology Review* 12, no. 1 (2023): 36–46; Elijah Krone Maema, *Grade Three Teachers' Experiences of Learners Perceived to Have ADHD in Soweto Mainstream Primary Schools* (University of South Africa (South Africa), 2021).

[4] Mantheme Florina Matolo and Awelani M Rambuda, "Evaluation of the Application of an Inclusive Education Policy on Screening, Identification, Assessment and Support of the Learners at Schools in South Africa.," *International Journal of Education and Practice* 10, no. 1 (2022): 11–24; Amanda L Miller et al., "Teacher Agency for Inclusive Education: An International Scoping Review," *International Journal of Inclusive Education* 26, no. 12 (2022): 1159–77.

[5] E. Kadenge and L Mofokeng, "School Leadership And Its Influence On Beginner Teachers'professional Development," *EDULEARN25 Proceedings*, 2025, 10083–90; Ntombizonke Lucia Nxumalo and Mogkadi Moletsane, "Exploring Educators' Challenges Faced When Teaching Learners with Learning Barriers in the Senior Phase," *International Journal of Studies in Psychology* 5, no. 3 (2025): 132–41.

constrained opportunities for teacher professional development.[6] As a result, screening may remain a descriptive activity rather than a sustained mechanism for instructional and institutional improvement. This creates a critical disjunction between identifying behavioural vulnerability and translating that identification into coherent Mathematics support.

Moreover, theoretical gaps also remain in explaining how teacher-administered behavioural screening can be implemented sustainably in low-resource school systems. In the context of this study, Deliverology emphasises performance alignment, monitoring routines, functional delivery chains, and accountability structures that ensure that identification leads to action.[7] However, implementation science foregrounds contextual adaptation, organisational readiness, fidelity, capacity-building, and sustainability as conditions for embedding educational interventions in real-world settings.[8] Although both frameworks have been used in education reform and intervention studies, their integrated application to teacher-administered ADHD screening, Mathematics instructional decision-making, and school-level learner support remains underdeveloped.

Against this background, the objective of this study was to examine how Grade 9 and Grade 10 Mathematics teachers in Soshanguve Township utilised a teacher-administered Vanderbilt ADHD screening tool to identify behavioural vulnerability and inform instructional support practices. The study further sought to understand how identified behavioural patterns manifested as academic, emotional, and organisational challenges within Mathematics learning, and how screening outcomes intersected with broader school-based learner support systems. The Vanderbilt tool was used strictly as a non-diagnostic screening instrument. Therefore, teachers were placed as early identifiers of behavioural risk, not as clinical diagnosticians.

This study contributes to the literature in three ways. First, it provides empirical insight into teacher-led, non-diagnostic ADHD screening within Grade 9 and Grade 10 Mathematics classrooms in township secondary schools. Second, it advances understanding of how behavioural vulnerabilities, such as inattention, impulsivity, hyperactivity, and emotional dysregulation, affect learners' functional participation in Mathematics. Third, it demonstrates the value of integrating Deliverology and Implementation Science as a system-level explanatory framework for understanding why behavioural identification does not always translate into sustained instructional and institutional response.

The remainder of the article is organised as follows. The literature review discusses ADHD-related behavioural vulnerability, executive functioning, Mathematics learning, teacher observation, screening, and inclusive education in low-resource school contexts. The theoretical framework explains how Deliverology and Implementation Science were used to analyse screening implementation and support systems. The methodology section describes the qualitative multiple-case study design, sampling strategy, data collection methods, analysis procedures, ethical considerations, and trustworthiness measures. The findings section presents the major themes that emerged from teacher-completed screening tools, classroom observations, and field notes. The discussion interprets these findings in relation to the literature and theoretical framework. The article concludes with recommendations for classroom practice, school-based support, district-level facilitation, and future research.

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[6] Nawaf Al-Zyoud, Maha Al-Hendawi, and Ali Alodat, "Stakeholder Perspectives on Challenges and Improvements in Student Classification and Progress Monitoring in Qatari Schools: A Qualitative Study," *Sustainability* 17, no. 22 (2025): 10042; O'Farrell, Wilson, and Shiel, "Teachers' Perceptions of the Barriers to Assessment of Mental Health in Schools with Implications for Educational Policy: A Systematic Review."

[7] Michael Barber, Nick Rodriguez, and Ellyn Artis, *Deliverology in Practice: How Education Leaders Are Improving Student Outcomes* (Corwin Press, 2015); Sandra Gallagher, "A Framework to Study the Effect of Service, Delivery, and Quality on the Implementation of ELearning Information Systems," 2020.

[8] Per Nilsen and Susanne Bernhardsson, "Context Matters in Implementation Science: A Scoping Review of Determinant Frameworks That Describe Contextual Determinants for Implementation Outcomes," *BMC Health Services Research* 19, no. 1 (2019): 189; Ross C Brownson et al., "Revisiting Concepts of Evidence in Implementation Science," *Implementation Science* 17, no. 1 (2022): 26.

LITERATURE REVIEW

ADHD and Executive Functioning in Mathematics Learning

International research consistently demonstrates that behavioural patterns associated with attention-deficit/hyperactivity disorder are closely linked to deficits in executive functioning, including working memory, sustained attention, inhibitory control, and cognitive flexibility.[9] These cognitive processes are foundational to successful Mathematics learning, particularly at the secondary school level, where learners are required to engage in multistep reasoning, symbolic manipulation, and abstract problem solving. Learners who experience persistent inattention frequently struggle to sustain focus in sequential mathematical procedures, while impulsivity increases the likelihood of procedural errors and weak metacognitive regulation. Empirical studies further indicate that behavioural dysregulation undermines not only conceptual understanding but also task persistence and academic resilience in Mathematics.[10] Emotional dysregulation compounds these difficulties, since frustration, avoidance, and anxiety responses reduce learners' engagement with cognitively demanding tasks. These findings establish a strong theoretical basis for understanding why ADHD related behavioural vulnerabilities are particularly debilitating within Mathematics classrooms.

ADHD and Academic Underachievement in Low-Resource School

Although the cognitive mechanisms linking ADHD with academic underachievement are well established internationally, research conducted in low-resource schooling environments highlights how behavioural vulnerability becomes entangled with broader socio-economic and structural constraints. Overcrowded classrooms characterise township secondary schools in South Africa, with limited access to specialised learner support services and high levels of community-level stress linked to poverty and instability.[11] Learners who exhibit behavioural patterns associated with inattention and impulsivity in these environments face compounded risks. Structural constraints reduce opportunities for individualised attention and targeted remediation, while weak support infrastructure limits access to psychological and educational specialist intervention.[12] Behavioural vulnerability in such contexts, therefore, accelerates educational marginalisation rather than merely reflecting individual learner difficulty.

Teacher Identification of Behavioural Vulnerability

Teachers occupy a central position in the early identification of behavioural vulnerability in school settings. Research indicates that teacher observation is often the first point at which ADHD related behavioural patterns are recognised in educational environments.[13] Observation-based screening instruments have therefore been promoted internationally as ethical and practical mechanisms for early identification and support through school-based processes rather than clinical diagnosis alone.[14] The Vanderbilt ADHD screening tool is widely used in educational contexts as an observation-based instrument that allows teachers to document core behavioural indicators and functional academic and social impairment in a structured manner. The tool is explicitly designed for screening rather than diagnosis and serves to guide further support or referral where necessary. Research affirms that such

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[9] Andrea Carrick and Colin J Hamilton, "Heated Behaviour in the Classroom for Children with FASD: The Relationship between Characteristics Associated with ADHD, ODD and ASD, Hot Executive Function and Classroom Based Reward Systems," *Children* 10, no. 4 (2023): 685; Cathy Yun, Hanna Melnick, and Marjorie Wechsler, "High-Quality Early Childhood Assessment: Learning from States' Use of Kindergarten Entry Assessments.," *Learning Policy Institute*, 2021.

[10] Lovecky, *Different Minds: Gifted Children with ADHD, ASD, and Other Dual Exceptionalities*; Yun, Melnick, and Wechsler, "High-Quality Early Childhood Assessment: Learning from States' Use of Kindergarten Entry Assessments."

[11] Nic Spaull, "Schooling in South Africa: How Low-Quality Education Becomes a Poverty Trap," *South African Child Gauge* 12, no. 1 (2015): 34–41; O'Farrell, Wilson, and Shiel, "Teachers' Perceptions of the Barriers to Assessment of Mental Health in Schools with Implications for Educational Policy: A Systematic Review."

[12] Maema, *Grade Three Teachers' Experiences of Learners Perceived to Have ADHD in Soweto Mainstream Primary Schools*.

[13] Kadenge and Mofokeng, "School Leadership And Its Influence On Beginner Teachers'professional Development"; Nxumalo and Moletsane, "Exploring Educators' Challenges Faced When Teaching Learners with Learning Barriers in the Senior Phase."

[14] John S Bradley, *Nelson's Pediatric Antimicrobial Therapy* (American Academy of Pediatrics Grove Village, 2012).

tools enhance the consistency and reliability of teacher judgement while reducing reliance on informal intuition.[15]

Limitations of Screening in Low-Resource School Systems

Although screening tools strengthen identification, research consistently shows that identification alone does not guarantee an effective instructional or systemic response. Low-resource school systems often lack coherent learner support structures, functional School-Based Support Teams, and multidisciplinary collaboration networks that are required to translate screening data into sustained intervention.[16] Teachers in township schools frequently operate in highly demanding classroom environments that constrain their capacity to implement individualised behaviour-responsive pedagogy. Screening data, therefore, risk remaining descriptive rather than transformative when institutional support systems are fragile. This condition reflects a broader implementation challenge in which innovation is introduced at the classroom level without corresponding strengthening of organisational structures.

Deliverology and Implementation Science in Inclusive Education

Deliverology provides a systems-oriented framework that emphasises performance alignment, clear targets, continuous monitoring, and functional delivery chains as prerequisites for sustained educational improvement.[17] Within inclusive education, Deliverology offers a lens for examining whether behavioural identification processes are aligned with instructional planning, performance tracking, and accountability structures. Implementation Science complements this perspective through its focus on contextual adaptation, organisational readiness, intervention fidelity, and long-term sustainability.[18] These principles highlight the importance of capacity building, coaching, leadership support, and system-level facilitation in ensuring that new practices achieve durable impact. Despite their relevance, both Deliverology and Implementation Science remain underutilised in research on teacher-led behavioural screening and inclusive instructional response in low-resource secondary school contexts. Existing scholarship rarely integrates behavioural screening within coherent delivery and implementation systems that span classroom, school, and district levels.

THEORETICAL FRAMEWORK

A coherent theoretical framework is essential for understanding how teacher-led behavioural screening operates within the complex instructional environments of township Mathematics classrooms. This study is guided by the intersecting insights from Deliverology and Implementation Science, two complementary frameworks that illuminate how educational practices are introduced, enacted, and sustained in real-world contexts characterised by resource constraints, high learner needs, and institutional variability. Although Deliverology emphasises the importance of system alignment, clear goals, and performance monitoring,[19] Implementation Science provides a lens for understanding how new practices are adopted, adapted, and embedded in daily teaching.[20] In the context of this study, the integration of these frameworks supports a nuanced analysis of how teachers use the observation-based screening tool to identify behavioural indicators associated with ADHD and how contextual realities shape the feasibility, consistency, and sustainability of screening practices. Deliverology offers a

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[15] Yun, Melnick, and Wechsler, "High-Quality Early Childhood Assessment: Learning from States' Use of Kindergarten Entry Assessments."; Michael Davies et al., "Evaluation of a School-Led Sustainable Class Wide Intervention Programme to Improve Elementary Children's Social Emotional and Academic Performance," *International Journal of Disability, Development and Education* 68, no. 4 (2021): 496–520.

[16] Maema, *Grade Three Teachers' Experiences of Learners Perceived to Have ADHD in Soweto Mainstream Primary Schools*; O'Farrell, Wilson, and Shiel, "Teachers' Perceptions of the Barriers to Assessment of Mental Health in Schools with Implications for Educational Policy: A Systematic Review."

[17] Barber, Rodriguez, and Artis, *Deliverology in Practice: How Education Leaders Are Improving Student Outcomes*.

[18] Gila Neta et al., "Advancing Climate Change Health Adaptation through Implementation Science," *The Lancet Planetary Health* 6, no. 11 (2022): e909–18; Nilsen and Bernhardsson, "Context Matters in Implementation Science: A Scoping Review of Determinant Frameworks That Describe Contextual Determinants for Implementation Outcomes"; Brownson et al., "Revisiting Concepts of Evidence in Implementation Science."

[19] Lee E Nordstrum, Paul G LeMahieu, and Karen Dodd, "Deliverology," *Quality Assurance in Education* 25, no. 1 (2017): 43–57.

[20] Brownson et al., "Revisiting Concepts of Evidence in Implementation Science."

structured framework for examining how the education system supports or constrains the effective implementation of screening tools in Mathematics classrooms.[21] It emphasises the need for explicit identification targets, clarity of teacher roles, and the establishment of monitoring mechanisms that track the consistency and quality of screening processes. In the context of this study, Deliverology highlights the importance of defining what effective classroom-based screening entails, determining how teachers should use the observation tool, and identifying the feedback loops required to ensure that screening outcomes lead to appropriate learner support or referral.[22] A core principle of Deliverology is that systems must align resources, capacity, and accountability structures to enable frontline educators to perform tasks reliably and consistently.[23] This perspective is particularly relevant in township environments, where the absence of structured monitoring, limited professional development, and inconsistent administrative support weakens the capacity of teachers to implement screening tools with fidelity. Deliverology, therefore, provides the conceptual basis for analysing the systemic alignment necessary to support early identification practices in Mathematics classrooms.

Implementation Science complements this perspective by providing a detailed understanding of how context shapes the adoption and sustained use of the observation screening tool.[24] Central to Implementation Science is the recognition that educational interventions operate within complex ecosystems influenced by teacher beliefs, environmental conditions, organisational readiness, and resource availability.[25] The framework emphasises adaptation, iterative refinement, and continuous feedback, acknowledging that rigid fidelity is often unrealistic in under-resourced environments.[26] In this study, Implementation Science guides the analysis of how the screening tool is interpreted, modified, or integrated into teachers' daily routines, and how contextual barriers influence the feasibility of consistent use. It highlights that effective early identification requires not only a well-designed tool but also supportive conditions such as training, manageable class sizes, clear referral pathways, and collaborative structures that help teachers translate screening observations into action. Implementation Science, therefore, underscores the importance of contextual responsiveness and capacity-building in strengthening the practical use of screening tools. When combined, Deliverology and Implementation Science provide a robust conceptual framework for understanding both the technical and contextual dimensions of teacher-led behavioural screening. Deliverology foregrounds the structural and systemic factors necessary for consistent implementation,[27] while Implementation Science illuminates the lived realities, adaptations, and classroom-level negotiations that influence how teachers engage with the tool.[28] Together, these frameworks allow the study to move beyond a narrow focus on individual teacher effort toward a broader analysis of how screening practices function within a complex interplay of policy expectations, contextual constraints, and organisational capacity. This integrated framework supports a deeper understanding of how early identification can be strengthened in Mathematics classrooms in Soshanguve Township and highlights the systemic and pedagogical conditions necessary to support equitable learner outcomes.

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[21] Sharon Gewirtz et al., "What's Wrong with 'Deliverology'? Performance Measurement, Accountability and Quality Improvement in English Secondary Education," *Journal of Education Policy* 36, no. 4 (2021): 504–29.

[22] Gewirtz et al., "What's Wrong with 'Deliverology'? Performance Measurement, Accountability and Quality Improvement in English Secondary Education"; P. R. Taylor, "The Complexity of Teacher Professional Growth–Experiences of Professional Learning and Development, Including Practice-Based Inquiry " (Birmingham City University, 2019).

[23] Barber, Rodriguez, and Artis, *Deliverology in Practice: How Education Leaders Are Improving Student Outcomes*; Gewirtz et al., "What's Wrong with 'Deliverology'? Performance Measurement, Accountability and Quality Improvement in English Secondary Education."

[24] Jennifer Leeman et al., "Beyond 'Implementation Strategies': Classifying the Full Range of Strategies Used in Implementation Science and Practice," *Implementation Science* 12, no. 1 (2017): 125.

[25] Taryn Moir, "Why Is Implementation Science Important for Intervention Design and Evaluation within Educational Settings?," in *Frontiers in Education*, vol. 3 (Frontiers Media SA, 2018), 61.

[26] Aoife L Gallagher et al., "Implementation Science in School-Based, Universal-Level Intervention Research: A Scoping Review," *Language, Speech, and Hearing Services in Schools* 54, no. 4 (2023): 1173–94.

[27] Nordstrum, LeMahieu, and Dodd, "Deliverology."

[28] Brownson et al., "Revisiting Concepts of Evidence in Implementation Science."

METHODOLOGY

Research Design

This study employed a qualitative multiple case study design that enabled an in-depth exploration of how Mathematics teachers in township secondary schools implemented a teacher-administered Vanderbilt ADHD screening tool and how they interpreted behavioural patterns within their instructional contexts. The multiple-case structure allowed for the comparison of screening practices, behavioural manifestations, and instructional responses across schools with similar structural constraints. The qualitative orientation was grounded in an interpretivist paradigm that recognises the role of teacher meaning as central to understanding how behavioural vulnerability is identified and understood within everyday classroom realities.[29] This paradigm allowed the study to illuminate the subjective interpretations through which teachers recognise patterns of inattention, hyperactivity, impulsivity, and emotional dysregulation and to understand how these interpretations shape pedagogical decision-making. The adoption of a case study design aligns with the existing literature, which highlights the contextual complexity of township schooling and the fluid relationship between behavioural vulnerability and academic functioning. The design further aligns with theoretical perspectives on Deliverology and Implementation Science that require attention to context, implementation processes, and system-level interactions when examining how educational practices are enacted within resource-constrained environments.[30] The study was conducted in five township secondary schools located in Soshanguve, an urban settlement characterised by high enrolment pressure, limited access to specialist educational services, and persistent socio-economic inequalities. Each school followed the national Curriculum and Assessment Policy Statement (CAPS) for Mathematics and participated in the screening, identification, assessment and support processes mandated by the Department of Basic Education.

Sampling Strategy and Participants

A purposive sampling strategy was used to select Grade 9 and Grade 10 Mathematics teachers who were responsible for instructional delivery and learner support in the participating schools. Teachers were selected based on their direct involvement in classroom management, behavioural observation, and continuous assessment. This sampling approach ensured that participants possessed first-hand experience with behavioural manifestations affecting Mathematics learning. Five cases were constructed, one per school (a total of five mathematics teachers, with One Mathematics teacher participating in each case. Participants completed Vanderbilt ADHD screening forms for identified learners, contributed to classroom-based data, and participated in reflective engagements. The selection of participants enhanced the depth and credibility of the findings, consistent with qualitative case study standards.[31]

Data Collection Methods

Three complementary data collection methods were used to generate a rich account of screening practices and behavioural patterns in Mathematics classrooms. Teachers completed the Vanderbilt ADHD screening tool for identified learners. The tool captured observable behavioural indicators of inattention, hyperactivity, and impulsivity, as well as functional impairment in academic, organisational, and social domains. The use of this tool was consistent with its intended purpose as a screening instrument rather than a diagnostic mechanism. Its selection aligns with literature affirming

[29] Chad Everett Allan, "Decision-Making: A Reflective Journey of the Lived Experiences of Experienced Teachers" (Kent State University, 2018); John W Creswell and J David Creswell, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (Sage publications, 2017); Robert K Yin, *Case Study Research and Applications*, vol. 6 (Sage Thousand Oaks, CA, 2018).

[30] Barber, Rodriguez, and Artis, *Deliverology in Practice: How Education Leaders Are Improving Student Outcomes*; Neta et al., "Advancing Climate Change Health Adaptation through Implementation Science"; Nilsen and Bernhardsson, "Context Matters in Implementation Science: A Scoping Review of Determinant Frameworks That Describe Contextual Determinants for Implementation Outcomes."

[31] Virginia Braun and Victoria Clarke, "Reflecting on Reflexive Thematic Analysis," *Qualitative Research in Sport, Exercise and Health* 11, no. 4 (2019): 589–97; Yin, *Case Study Research and Applications*.

the value of structured observation tools in supporting teacher judgement and early identification of behavioural vulnerability. [32] Non-intrusive classroom observations were conducted to capture behavioural patterns within authentic Mathematics instructional settings. Observations focused on learners' engagement, persistence, task completion, organisational functioning, and responses to instructional demands. The observational data provided contextual insight into how behavioural indicators identified through the screening tool manifested in real-time classroom activities. Field notes were used to document teacher explanations, classroom interactions, contextual features, and emergent insights related to behavioural identification and instructional response. These notes supported interpretive depth and contributed to the analytical triangulation process.

Data Analysis

Data were analysed using reflexive thematic analysis guided by cross-case pattern matching. This analytical approach was appropriate for identifying convergent and divergent patterns across the five cases, consistent with Yin's guidance for multiple case study analysis.[33] Themes were developed through iterative reading, coding, categorisation, and interpretive synthesis. Themes were then reviewed, refined, and named to ensure coherence and conceptual alignment.[34] The analysis was informed by Deliverology and Implementation Science. Deliverology supported the examination of performance alignment, monitoring processes, and delivery chains within the behavioural identification and support system. Implementation Science provided concepts related to contextual adaptation, readiness, fidelity, and sustainability, which were necessary to understand how screening practices succeeded or failed within resource-constrained school systems.[35]

Trustworthiness of the Study

Trustworthiness was established through prolonged engagement in each research site, methodological triangulation, thick contextual description, and reflexive practice throughout the research process.[36] Prolonged engagement allowed the study to develop familiarity with the instructional environment and to establish rapport with participants, while triangulation across Vanderbilt screening forms, observations, and field notes enhanced credibility by cross-verifying patterns identified in the data.[37] Thick description strengthened transferability by providing detailed accounts of contextual conditions that shaped the screening process. Dependability and confirmability were supported through systematic documentation of analytical decisions and continuous reflection on researcher positionality, ensuring transparency and accountability throughout the analytical process.

Ethical Considerations

Ethical standards were rigorously upheld throughout the study. Approval for the research was obtained from the Tshwane University of Technology Research Ethics Committee, and official permission was granted by the Gauteng Department of Education to access the selected schools. Participants were informed about the purpose of the study, the voluntary nature of participation, and their right to withdraw at any time. The Vanderbilt ADHD tool was strictly used as a screening instrument to guide support and referral, consistent with international guidelines that distinguish screening from diagnosis.[38] Confidentiality and anonymity were maintained throughout the study. Learner identities were protected, and screening results were used solely for educational reflection and support.

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[32] Bradley, *Nelson's Pediatric Antimicrobial Therapy*.

[33] Yin, *Case Study Research and Applications*.

[34] Muhammad Naeem et al., "A Step-by-Step Process of Thematic Analysis to Develop a Conceptual Model in Qualitative Research," *International Journal of Qualitative Methods* 22 (2023): 16094069231205788.

[35] Neta et al., "Advancing Climate Change Health Adaptation through Implementation Science"; Nilsen and Bernhardsson, "Context Matters in Implementation Science: A Scoping Review of Determinant Frameworks That Describe Contextual Determinants for Implementation Outcomes"; Brownson et al., "Revisiting Concepts of Evidence in Implementation Science."

[36] Truong Cong Bang, "Ensuring Credibility and Trustworthiness in Qualitative Inquiries," in *Applied Linguistics and Language Education Research Methods: Fundamentals and Innovations* (IGI Global Scientific Publishing, 2024), 70–85.

[37] Vikas Anand Saharan et al., "Introduction to Research Methodology," in *Principles of Research Methodology and Ethics in Pharmaceutical Sciences* (CRC Press, 2024), 1–46.

[38] Bradley, *Nelson's Pediatric Antimicrobial Therapy*.

PRESENTATIONS OF FINDINGS

This section presents the findings derived from the teacher-completed Vanderbilt ADHD screening tools, classroom observations, and reflective field notes collected across five township secondary schools, conceptualised as Cases A-E with multiple learners represented as Participants A-F within each case. The analysis is explicitly aligned with the integrated Deliverology and Implementation Science framework and demonstrates how behavioural identification, instructional translation, delivery system alignment, and implementation capacity interact within Grade 9 and Grade 10 Mathematics classrooms. Four interrelated themes emerged consistently in all cases and participants. These include teacher-mediated identification of pervasive inattention, hyperactivity and impulsivity as destabilising forces in instructional regulation, systemic academic and functional impairment, and emotional dysregulation undermining learner participation and persistence.

Teacher Mediated Identification of Pervasive Inattention

The teacher-administered screening revealed consistently high frequencies of inattentive behaviour across Cases A-E and Participants A-F. Learners at all sites were rated as struggling with sustained attention, task completion, organisation, forgetfulness, and susceptibility to distraction during Mathematics instruction. In Case A and Case B, Participants B, C, and E were repeatedly identified as abandoning tasks before completion and failing to follow multi-step problem-solving procedures. In Cases C-E, similar patterns were observed where Participants A, D, and F struggled to maintain attentional focus across lesson segments. Classroom observation data reinforced these screening outcomes through persistent off-task behaviour during written problem solving, incomplete workbook activities, and breakdowns in sequential reasoning.

Hyperactivity and Impulsivity

Hyperactive and impulsive behaviours emerged as persistent destabilising influences on instructional regulation across all five cases. In Case A, Participants A and D were frequently observed leaving their seats during instruction and interrupting peer discussions. In Case B and Case C, Participants B, C, and F displayed excessive talking, blurting out answers, and difficulty waiting for turns. Similar behavioural patterns were observed in Cases D and E, where movement regulation remained a consistent challenge across lesson activities. Such behaviours disrupted the pace of the lesson, fragmented teacher explanations, and compromised collaborative learning tasks.

Systemic Academic and Functional Impairment

Section B of the Vanderbilt screening data revealed consistent patterns of below-average to problematic functional performance across Mathematics achievement, task completion, organisation, written expression, peer interaction, and independent learning across all cases and participants. In Case B and Case E, Participants C, D, and F were rated as functioning in the problematic range for mathematics problem-solving and task persistence. In Case A and Case C, Participants A and E displayed repeated difficulty with organisation of learning materials and independent completion of written work. Classroom observations confirmed persistent difficulties with procedural sequencing, working memory retention, error monitoring, and sustained engagement during cognitively demanding Mathematical tasks.

Emotional Dysregulation

Emotional dysregulation emerged as a significant barrier to learner participation and persistence across Cases A-E. Teachers in Case C and Case D reported frequent frustration, emotional withdrawal, and learner avoidance of cognitively demanding Mathematics tasks among Participants B, D, and F. In Cases A and B, emotional reactivity following procedural errors often resulted in learner disengagement and reduced willingness to reattempt complex problems. Deliverology interprets emotional dysregulation as a constraint on delivery readiness, since emotionally unstable learners

struggle to participate consistently in performance improvement processes.[39] Implementation Science situates emotional vulnerability within the broader framework of system sustainability, where sustained instructional impact depends on emotionally supportive learning environments and continuous psychosocial support structures.[40]

Cross Case Synthesis Through the Integrated Framework

The integrated application of Deliverology and Implementation Science explains the persistent misalignment observed across identification, instructional adaptation, monitoring, and sustainability across Cases A-E. Teacher competence at the point of behavioural identification remained consistently strong in all cases and participants. Delivery chains weakened as screening outcomes moved toward instructional planning, learner support coordination, and institutional accountability. Implementation conditions further constrained sustainability because of limited organisational readiness, inconsistent fidelity support, and fragile school-based support structures.[41] Screening functioned effectively as an informational mechanism across all five schools, yet remained weak as a system improvement trigger. The absence of institutionalised performance targets, formal progress monitoring routines, and coordinated learner support pathways resulted in limited transformation of behavioural identification into sustained instructional response. These findings illustrate how screening becomes confined to the identification stage when delivery and implementation systems lack coherence and capacity.

DISCUSSION

This section interprets the findings generated from the teacher-administered Vanderbilt ADHD screening tools, classroom observations, and reflective field notes across Cases A-E and Participants A-F. The discussion is explicitly aligned with the revised Literature Review, the integrated Deliverology and Implementation Science framework, and the qualitative multiple case study design adopted in the Methodology. The interpretation is structured around the four empirically derived themes and demonstrates how behavioural identification, instructional translation, delivery system alignment, and implementation capacity interact in township Grade 9 and Grade 10 Mathematics classrooms.

Teacher Mediated Identification of Pervasive Inattention

Across all five cases, the teacher-administered screening functioned as the primary mechanism for identifying pervasive inattentive behaviour in Mathematics learners. In Cases A and B, Participants B, C, and E were consistently identified as displaying weak sustained attention, poor task follow-through, and disorganisation during multi-step problem solving. Similar profiles were recorded in Cases C-E, where Participants A, D, and F struggled to maintain attentional focus across extended lesson segments. This pattern corresponds directly with the Literature Review, which established that executive functioning deficits associated with ADHD significantly undermine working memory, sustained attention, and sequential reasoning in Mathematics learning.[42] The Theoretical Framework positions this identification phase as the entry point of the Deliverology delivery system. Deliverology explains how screening establishes the baseline for performance alignment and instructional goal setting.[43] The Methodology further demonstrated that teachers possessed the observational competence required to execute this identification function with high fidelity through the Vanderbilt screening tool. Implementation Science provides additional explanatory power through the construct of classroom-

[39] Barber, Rodriguez, and Artis, *Deliverology in Practice: How Education Leaders Are Improving Student Outcomes*.
[40] Neta et al., "Advancing Climate Change Health Adaptation through Implementation Science"; Brownson et al., "Revisiting Concepts of Evidence in Implementation Science."
[41] Neta et al., "Advancing Climate Change Health Adaptation through Implementation Science"; Nilsen and Bernhardsson, "Context Matters in Implementation Science: A Scoping Review of Determinant Frameworks That Describe Contextual Determinants for Implementation Outcomes"; Brownson et al., "Revisiting Concepts of Evidence in Implementation Science."
[42] Carrick and Hamilton, "Heated Behaviour in the Classroom for Children with FASD: The Relationship between Characteristics Associated with ADHD, ODD and ASD, Hot Executive Function and Classroom Based Reward Systems"; Yun, Melnick, and Wechsler, "High-Quality Early Childhood Assessment: Learning from States' Use of Kindergarten Entry Assessments."
[43] Barber, Rodriguez, and Artis, *Deliverology in Practice: How Education Leaders Are Improving Student Outcomes*.

level readiness, which remained strong despite wider system fragility.[44] These findings therefore confirm that identification capacity is not the primary constraint within township Mathematics classrooms. Structural alignment beyond identification remains the dominant challenge.

Hyperactivity and Impulsivity as Disruptors of Instructional Regulation

Hyperactivity and impulsivity emerged as persistent destabilising forces in instructional regulation in all five cases. In Case A, Participants A and D frequently disrupted instructional flow through excessive movement and verbal interruptions. Similar behavioural profiles were documented in Cases B and C, where Participants B, C, and F displayed impulsive responding, blurting out of answers, and difficulty waiting for turns. These disruptions fragmented teacher explanations, slowed lesson pacing, and compromised collaborative learning opportunities across all sites. The literature review established that hyperactivity and impulsivity undermine behavioural regulation, instructional continuity, and peer-mediated learning in classroom environments.[45] Deliverology interprets these disruptions as breakdowns within delivery chains, since instructional sequencing and consolidation become unstable when behavioural regulation weakens.[46] Implementation Science explains the persistence of these disruptions through fidelity constraints. Teachers attempted to maintain behavioural routines and instructional structure.[47] However, overcrowded classrooms, limited behavioural intervention expertise, and weak coaching systems constrained sustained implementation across cases, as reflected in the Methodology and supported in the Literature Review.[48] Instructional destabilisation, therefore, emerges as the product of behavioural vulnerability and systemic implementation fragility.

Systemic Academic and Functional Impairment

Functional academic impairment in Mathematics emerged as a direct consequence of behavioural vulnerability across Cases A-E. In Case B and Case E, Participants C, D, and F were rated in the problematic range for Mathematics achievement, task persistence, and independent work completion. The difficulties of organisation and written expression were most evident in Cases A and C, where Participants A and E displayed repeated breakdowns in procedural sequencing, work organisation, and presentation. Classroom observations confirmed persistent working memory failures, incomplete procedural execution, and difficulty monitoring errors during problem solving. These findings align with the literature, which demonstrated that executive functioning deficits exert a powerful influence on Mathematics underachievement, particularly in low-resource schooling environments.[49] Deliverology explains this impairment as weak performance alignment between identification and instructional response. Screening identified behavioural risk, yet explicit instructional performance targets and remedial programming remained inconsistent across the five cases. Implementation Science further situates this pattern within weak organisational readiness and sustainability structures. Schools lacked coordinated intervention protocols, stable learner support teams, and systematic progress monitoring routines as described in the Methodology.[50] Therefore, functional impairment persisted because screening outcomes were not embedded in coherent instructional delivery systems.

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[44] Neta et al., "Advancing Climate Change Health Adaptation through Implementation Science"; Nilsen and Bernhardsson, "Context Matters in Implementation Science: A Scoping Review of Determinant Frameworks That Describe Contextual Determinants for Implementation Outcomes."

[45] Siboniso Talent Mcobothi, "Teachers' Experiences of Violence from Learners in Three High Schools in the KwaZulu-Natal Pinetown District" (Stellenbosch University, 2025); Yun, Melnick, and Wechsler, "High-Quality Early Childhood Assessment: Learning from States' Use of Kindergarten Entry Assessments."

[46] Barber, Rodriguez, and Artis, *Deliverology in Practice: How Education Leaders Are Improving Student Outcomes*.

[47] Judith Thony, "Navigating ADHD in the Classroom: Elementary Teachers' Perspectives" (Houston Baptist University, 2025); Maema, *Grade Three Teachers' Experiences of Learners Perceived to Have ADHD in Soweto Mainstream Primary Schools*.

[48] Neta et al., "Advancing Climate Change Health Adaptation through Implementation Science"; Brownson et al., "Revisiting Concepts of Evidence in Implementation Science."

[49] Carrick and Hamilton, "Heated Behaviour in the Classroom for Children with FASD: The Relationship between Characteristics Associated with ADHD, ODD and ASD, Hot Executive Function and Classroom Based Reward Systems"; Spaull, "Schooling in South Africa: How Low-Quality Education Becomes a Poverty Trap."

[50] Neta et al., "Advancing Climate Change Health Adaptation through Implementation Science"; Nilsen and Bernhardsson, "Context Matters in Implementation Science: A Scoping Review of Determinant Frameworks That Describe Contextual Determinants for Implementation Outcomes."

Emotional Dysregulation and Effects on Learner Persistence and Engagement

Emotional dysregulation emerged as a pervasive constraint on learner persistence and engagement across Cases A–E. Teachers in Cases C and D reported increased frustration, increased emotional withdrawal, and avoidance of cognitively demanding Mathematics tasks among Participants B, D, and F. In Cases A and B, emotional reactivity following procedural errors frequently resulted in disengagement and reluctance to reattempt challenging problems. These patterns directly mirror the Literature Review, which established that emotional dysregulation intensifies academic disengagement and task avoidance in cognitively demanding subjects such as Mathematics.[51] Deliverology interprets emotional instability as a constraint on delivery readiness, since emotionally vulnerable learners struggle to participate consistently in performance improvement processes.[52] Implementation Science situates emotional regulation within the broader framework of system sustainability. Sustained instructional impact depends on access to psychosocial support and emotionally responsive school environments, which township schools across all five cases lacked, as confirmed in the Methodology. Therefore, the screening revealed emotional vulnerability without the corresponding systemic capacity to sustain emotional remediation.

Cross-Case Interpretation Through the Integrated Framework

Cross-case synthesis across Cases A-E reveals a consistent and systemic pattern. Teacher competence in behavioural identification remained strong in all five schools, confirming the effectiveness of classroom-level screening as established in the Methodology. Structural and systemic misalignment emerged as the dominant constraint. Delivery chains weakened between identification, instructional adaptation, learner support coordination, and leadership accountability. Implementation readiness, fidelity support, coaching, and sustainability mechanisms remained insufficiently developed to support long-term transformation. Deliverology explains this pattern through the absence of coherent performance alignment and structured monitoring across system layers. Implementation Science explains the persistent fragility of screening-informed intervention through limited organisational readiness and weak system facilitation capacity. Therefore, screening functioned primarily as an informational instrument rather than as a sustained driver of instructional and institutional improvement.

Implications for Inclusive Mathematics Education

The discussion confirms that teacher-administered ADHD screening holds strong potential for advancing inclusive Mathematics education in township secondary schools. Early identification of behavioural vulnerability enables teachers to recognise learners who require differentiated instructional approaches, executive functioning scaffolding, and emotional regulation support. However, the Literature Review, Theoretical Framework, and Methodology collectively demonstrate that the educational value of screening remains constrained because system-level delivery and implementation capacity remain weak. Inclusive Mathematics education in township contexts, therefore, requires an integrated response that aligns screening with structured instructional targets, coordinated learner support systems, sustained professional development, and leadership-driven accountability. The integration of Deliverology and Implementation Science provides a coherent improvement-oriented framework for strengthening this alignment across the classroom, school, and district levels.

RECOMMENDATIONS

The findings of this study demonstrate that teacher-administered ADHD screening is successfully implemented at the classroom level across all five cases. However, systemic misalignment between identification, instructional adaptation, delivery chains, and sustainability continues to constrain its educational impact. Grounded in the integrated Deliverology and Implementation Science framework,

[51] Yun, Melnick, and Wechsler, "High-Quality Early Childhood Assessment: Learning from States' Use of Kindergarten Entry Assessments."; Carrick and Hamilton, "Heated Behaviour in the Classroom for Children with FASD: The Relationship between Characteristics Associated with ADHD, ODD and ASD, Hot Executive Function and Classroom Based Reward Systems."

[52] Barber, Rodriguez, and Artis, *Deliverology in Practice: How Education Leaders Are Improving Student Outcomes*.

the following recommendations are proposed at the classroom, school, district, and policy levels to strengthen the translation of behavioural screening into sustained instructional and institutional response within township Mathematics education.

Classroom Level Instructional Practice

Mathematics teachers need structured guidance on how to translate screening outcomes into targeted instructional responses. The screening data should inform explicit differentiation strategies that support learners who demonstrate persistent inattention, hyperactivity, and emotional dysregulation. Instructional approaches should prioritise reduced task load, scaffolded multi-step problem solving, extended time for task completion, structured lesson segmentation, and the use of visual organisers to support working memory demands. These recommendations respond directly to the functional academic impairment observed among Participants A–F across Cases A–E and align with the executive functioning literature that links attentional regulation to Mathematics performance. Teachers should also integrate explicit executive functioning supports into daily Mathematics instruction. These should include instruction in the organisation of learning materials, goal setting, monitoring of steps during problem solving, and reflective error checking. Emotional regulation strategies such as predictable lesson routines, low-risk participation opportunities, and affirming feedback structures should be embedded within Mathematics pedagogy to address the emotional dysregulation observed across cases. Such emotionally responsive instructional practices are essential to maintain learner engagement and persistence in cognitively demanding learning environments.

School-Based Learner Support Systems

School-Based Support Teams should be formally repositioned as the central institutional mechanism for coordinating screening-informed intervention. Screening outcomes from Mathematics classrooms should be discussed as standing agenda items within support team meetings. Individual learner support plans should be jointly constructed with clear behavioural, academic, and emotional targets aligned to screening results. These recommendations respond directly to the weak delivery chains identified across all five cases and are fully aligned with Deliverology principles of performance alignment and coordinated delivery. Schools should also establish internal progress monitoring routines that track learner response to screening-informed intervention across academic terms. These routines should include a monthly review of learner performance, attendance, behavioural indicators, and task completion patterns. Systematic monitoring addresses the absence of structured performance tracking identified in the Discussion and strengthens accountability for learner support outcomes.

Teacher Professional Development and Coaching

Sustained professional development is required to strengthen teacher capacity in behavioural screening interpretation and instructional adaptation. Professional learning should focus on practical integration of screening data into Mathematics lesson planning, behaviour-responsive pedagogy, and executive functioning support strategies. Coaching and mentoring should be prioritised as mechanisms for improving implementation fidelity, consistent with core constructs of Implementation Science related to competence development and sustained practice. School-based professional learning communities should be institutionalised to provide platforms for reflective engagement in behavioural screening, learner support, and instructional challenges. These communities should facilitate peer learning, sharing of best practices, and collaborative problem-solving within township Mathematics departments.

School Leadership and Management

School leadership plays a decisive role in strengthening the delivery system of screening-informed intervention. Principals and heads of department should establish explicit performance targets related to inclusive Mathematics education, learner engagement, and screening-informed instructional adaptation. Leadership teams should monitor the consistency of screening practices, instructional differentiation, and learner support coordination as part of routine academic oversight processes. These actions align directly with Deliverology constructs of leadership-driven accountability and performance

monitoring. Timetabling structures should be adjusted to allocate protected time for learner support meetings, teacher collaboration, and intervention planning. Without institutional time allocation, informed screening-informed practices will remain peripheral and unsustainable.

District Level Support and System Facilitation

District-based learner support services should strengthen their facilitation role in supporting teacher-administered screening and school-based intervention. This includes provision of specialist support through educational psychologists, learning support educators, and social workers who can assist schools in interpreting screening data and designing responsive learner support strategies. These supports address the readiness and sustainability constraints identified across all cases and align with Implementation Science principles related to external facilitation and system support. District officials should further support schools through structured training programmes focused on inclusive Mathematics education, behavioural regulation strategies, and executive functioning support. Ongoing district coaching visits should prioritise fidelity support rather than compliance monitoring alone.

Policy and Inclusive Education Systems

The Screening, Identification, Assessment and Support policy framework should be strengthened through clearer operational guidance on the use of teacher-administered behavioural screening tools within subject-specific contexts, such as Mathematics. Policy should explicitly emphasise that screening is a non-diagnostic, support-oriented process that must be integrated into instructional planning and learner support systems rather than functioning as an isolated administrative requirement. Policy implementation frameworks should further emphasise the integration of Deliverology and Implementation Science principles into inclusive education planning. Clear articulation of delivery chains, performance monitoring expectations, and sustainability mechanisms at the classroom, school, and district levels would strengthen the systemic impact of early behavioural identification in township schools.

Integrated System Level

The findings of this study indicate that the full educational value of teacher-administered ADHD screening can only be realised through system-wide alignment of identification, instructional adaptation, progress monitoring, and learner support coordination. Therefore, an integrated delivery and implementation model should be adopted across township secondary schools. Such a model would establish screening as the entry point into a coherent system of inclusive Mathematics education that is supported through aligned leadership, sustained professional development, functional learner support structures, and district-level facilitation. This recommendation flows directly from the integrated Deliverology and Implementation Science framework that underpinned the study and provides a realistic pathway for sustainable improvement in low-resource schooling contexts.

CONCLUSION

This study examined how Grade 9 and Grade 10 Mathematics teachers in township secondary schools used a teacher-administered, observation-based Vanderbilt Attention Deficit Hyperactivity Disorder screening tool to identify behavioural vulnerabilities and inform learner support. The purpose was to understand how screening functioned within Mathematics classrooms and how identified behavioural patterns were translated into instructional and school-based responses. The findings show that teacher-administered screening was useful for identifying learners who displayed patterns of inattention, hyperactivity, impulsivity, emotional dysregulation, and functional academic difficulty. Teachers demonstrated strong observational capacity and were able to use the screening tool to document behavioural risks that affected learners' participation, task completion, organisation, and persistence in Mathematics. However, the study also found that identification did not consistently lead to structured instructional adaptation, coordinated learner support, or sustained monitoring.

The final view of the study is that teacher-administered ADHD screening has meaningful value in township Mathematics classrooms when it is used ethically as a non-diagnostic support tool. Its

strongest contribution lies in helping teachers recognise behavioural barriers early and link these observations to inclusive instructional planning. However, screening cannot improve learner support on its own. Its educational value depends on clear school-based support systems, teacher development, leadership follow-up, and district-level coordination. Therefore, the study concludes that early behavioural screening should be understood as the beginning of an inclusive support process, not as an endpoint. When properly integrated into classroom practice and school support structures, teacher-administered screening can strengthen Mathematics teaching, improve learner support, and contribute to more responsive, inclusive education in under-resourced township secondary schools.

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