education sciences

MDPI

Article

South African Teachers' Insights on Improving the Sensory Classroom Teacher Questionnaire (SCTQ) for Inclusive Education and ADHD Support

Hannelie Du Preez

Department of Humanities Education, University of Pretoria, Pretoria 0027, South Africa; hannelie.dupreez@up.ac.za

Abstract: The Sensory Classroom Teacher Questionnaire (SCTQ) is a psycho-educational tool designed to empower teachers in creating sensory-rich, inclusive environments that promote diversity, equity, accessibility, and inclusivity through the application of sensory ergonomics. Unlike other tools that focus on isolated strategies, the SCTQ takes a holistic approach by optimizing the overall classroom environment to meet the sensory and ergonomic needs of learners, particularly those with ADHD and sensory integration/processing challenges. This makes the SCTQ especially vital in diverse and under-resourced quintile schools, where creating sensory-optimized, inclusive environments is essential for fostering equitable learning experiences. By addressing sensory needs through thoughtful classroom design, the SCTQ not only strengthens learners' cognitive development and socio-emotional well-being but also improves behavior regulation, physical comfort, and overall functioning. This manuscript is part of a larger exploratory mixed-methods study that validated the SCTQ using both qualitative and quantitative approaches. Here, the focus is on the qualitative aspect, utilizing thematic analysis to explore data from 23 focus group interviews with 88 Grade 1, 2, and 3 teachers from various Quintile 1–5 schools in Gauteng, South Africa. Guided by the enactivism paradigm, the study emphasizes the crucial role teachers play in creating and adapting sensory environments. Their insights were key to refining the SCTQ, ensuring it is practical, developmentally appropriate, culturally, linguistically, contextually, and socio-economically relevant. Developed through collaboration among researchers, specialists, and teachers, the SCTQ supports sensory ergonomic practices, raises awareness of ADHD and sensory integration/processing challenges, and supports both learners' potential and teachers' well-being, contributing to a more sustainable and positive educational experience.

Keywords: ADHD; behavior regulation; classroom design; early childhood education (ECE); environmental psychology; ergonomics; foundation phase; learners with special educational needs (LSEN); inclusive education; sensory integration/processing; teacher agency; teacher professional development

Citation: Du Preez, H. South African Teachers' Insights on Improving the Sensory Classroom Teacher Questionnaire (SCTQ) for Inclusive Education and ADHD Support. *Educ. Sci.* **2024**, *14*, 989. https://doi.org/10.3390/educsci14090989

Academic Editor: Garry Hornby

Received: 27 June 2024
Revised: 27 August 2024
Accepted: 31 August 2024
Published: 9 September 2024

1. Introduction

1.1. Integrating Sensory Environment Design for Better Classrooms

A physical classroom should be a space where learners with diverse educational needs come together as equal classmates to co-discover their innate yearning for connection and meaning-making. Through thoughtful sensory environment design, the early childhood classroom can embody Loris Malaguzzi's notion of the "environment as the third teacher", where children (co)explore their sense of belonging, being, and becoming [1]. In this way, the classroom becomes both a literal and figurative cornerstone in a child's developmental journey.

To effectively support child development, it is essential to understand how sensory environment design influences children's interactions with their physical surroundings, shaping their behavior and learning. This understanding is rooted in three key concepts: sensory ergonomics, children's ergonomics, and sensory processing/integration.

Sensory ergonomics focuses on designing environments that manage sensory input to promote well-being and optimize performance [2,3]. It involves adjusting classroom settings to regulate sensory stimuli, helping teachers create spaces that meet the diverse needs of their learners. By aligning sensory experiences with individual needs, sensory ergonomics enhances both well-being and academic performance [2,3]. Children's ergonomics builds on this foundation by tailoring environments to support the physical comfort and developmental needs of young learners [4]. It emphasizes the design of classroom resources that accommodate children's unique physical requirements, contributing to a sensory-friendly, accessible, and inclusive learning environment [4]. Sensory integration/processing further refine this approach by examining how children perceive, interpret, and respond to sensory information [5,6]. This field ensures that classroom setups effectively cater to diverse sensory experiences, making the learning environment supportive for all learners.

To design optimal sensory environments, it is essential to integrate insights from multiple disciplines, including early childhood development and education, educational psychology, educational neuroscience, environmental psychology, sensory ergonomics, sensory neurology, sensory sciences, and occupational therapy. These fields collectively support the importance of sensory environment design in education. Sensory sciences and neurology explain how children process sensory information, while sensory ergonomics and environmental psychology focus on creating supportive environments. Educational neuroscience and psychology link these insights to learning processes and strategies, ensuring that environments are conducive to effective teaching. Occupational therapy offers practical approaches to addressing sensory needs. Educational psychology and early childhood development and education focus on how children learn and how teaching methods and environments can be optimized to improve learning outcomes while ensuring that these sensory environments are developmentally appropriate. Together, they contribute to classrooms that enhance well-being, behavior, and learning.

1.2. Optimizing Educational Environments for Children with ADHD

Neurological research, including insights from Michael J. Cohen, reveals that all humans constantly process up to 53 overlapping internal and external senses, such as visual (sight), auditory (hearing), olfactory (smell), gustatory (taste), haptic (touch), and vestibular (movement and coordination) [7].

For children in a classroom, managing this sensory influx is crucial before learning can even begin. Optimizing these sensory inputs is essential because they significantly influence a child's ability to focus, engage, and absorb educational content [2,5]. Furthermore, the successful processing and integration of these sensory experiences are fundamental to a child's behavior, cognitive development, social interactions, and psychological well-being [5,6]. Thus, a child's capacity to regulate behavior and participate in learning is intricately linked to how well they process and integrate sensory information [5,6].

For children with ADHD and other severe educational needs, these sensory integration/processing challenges become even more significant [8,9]. Difficulties in integration/processing sensory information can exacerbate ADHD symptoms like inattentiveness, impulsivity, and hyperactivity [5,8,9]. This can lead to the classroom being perceived as unsafe, excluding, or inaccessible. These sensory integration/processing issues may manifest as behaviors such as over-responsivity, under-responsivity, or sensory-seeking [5,6,10]. Therefore, a deeper understanding of these sensory integration/processing challenges is crucial for designing effective sensory environments that accommodate the unique needs of children, especially those with ADHD and sensory processing/integration challenges.

1.3. Utilizing Psycho-Educational Tools to Improve Sensory Ergonomics in Classrooms

Sensory ergonomics has proven effective in improving educational outcomes for children with special educational needs and neurological disorders [2,3,5]. By tailoring educational environments to meet individual sensory needs, sensory ergonomics enhances

both learning experiences and behavioral outcomes for learners with ADHD and sensory integration/processing challenges. To address these challenges, teachers can leverage psycho-educational tools grounded in interdisciplinary knowledge, as discussed before (see Section 1.1). These disciplines collectively highlight the critical role of sensory environment design in fostering effective learning spaces. In this context, several psycho-educational tools offer valuable approaches to managing sensory needs in the classroom, each with unique contributions to enhancing educational outcomes. While all these tools address aspects of sensory integration/processing and ADHD to support diverse learners, they differ significantly in their scope and methodology. Some focus specifically on behavior management or targeted sensory activities, whereas others emphasize comprehensive environmental design. Notably, the Sensory Classroom Teacher Questionnaire (SCTQ) distinguishes itself with its holistic approach to creating inclusive and sensory-optimized classroom environments, setting it apart from tools that concentrate on individual strategies or specific sensory interventions.

- The *Classroom Self-Regulation Toolbox* [9] is a collaborative program designed specifically for children with ADHD. It aims to provide practical tools and strategies for teachers and occupational therapists to use in the classroom.
- The *Sensory Diet* [10] provides insights into practical strategies for using sensory diets to support learners' emotional and social development, ultimately aiming to improve their quality of life and academic performance in inclusive educational environments.
- *Growing Brains, Nurturing Minds: Neuroscience as an Educational Tool* [11] discusses practical ways to integrate neuroscientific principles into educational practices, aiming to foster better cognitive development, emotional resilience, and adaptive learning skills.
- The *Sensory Classroom Teacher Questionnaire* [12] helps teachers assess how well their classroom environments support learners with ADHD by focusing on various sensory and environmental factors. It aims to identify whether the physical and sensory aspects of the classroom are conducive to learning for these learners, helping to create more supportive and effective learning spaces tailored to their specific needs.
- The *Classroom Sensory Environment Assessment* [13] can be used by teachers and therapists to identify sensory-related issues in the classroom that might affect learners' learning and behavior and make informed adjustments to create a more supportive and effective learning environment for all learners, particularly those with sensory processing difficulties.

By incorporating these tools, educators can create sensory-friendly classrooms that support learning and development while promoting diversity, equity, accessibility, and inclusivity.

1.4. Aligning Psycho-Educational Tools with Policy Goals and Socioeconomic Challenges

Psycho-educational tools are pivotal in translating educational policies, acts, and white papers into actionable strategies for the classroom. These tools offer evidence-based approaches for implementing essential classroom adaptations, supporting the broader education system, and providing specialized teacher training, aligning with government recommendations [14,15]. These tools can help ensure effective resource allocation for improving classroom infrastructure, meeting safety standards, and addressing the needs of children with disabilities and learning barriers. Furthermore, these tools support continuous professional development (CPD) for teachers and the establishment of robust support systems within schools, as emphasized in key policy documents [16–18].

The SCTQ exemplifies this alignment by focusing on designing inclusive and sensory-optimized classroom environments. The SCTQ supports diverse learning needs and enhances teacher effectiveness, complementing policy objectives related to inclusive education and classroom adaptations. While it does not address every aspect of policy implementation or resource distribution directly, the SCTQ provides a practical tool for teachers to adapt their classrooms in ways that align with broader goals outlined in South African educational policies.

Despite these well-intentioned policies, teachers in South Africa face significant challenges related to classroom conditions, especially in schools with socioeconomic disparities [19]. South African schools are categorized based on socioeconomic status, determined by average income, unemployment rates, and literacy levels in the surrounding area [20,21]. Quintile 1 schools are in the most economically disadvantaged areas, while Quintile 5 schools are in the most advantaged areas. Quintiles 1 to 3 are non-fee-paying schools receiving more government funding per learner, whereas Quintiles 4 and 5 are fee-paying, requiring less governmental support. However, the quintile system exacerbates resource allocation disparities, particularly affecting Quintile 1 and 2 schools with overcrowded classrooms and inadequate facilities [20,21]. Additionally, uneven implementation of infrastructure standards leaves many under-resourced schools without the necessary support [20,21]. Teachers in lower-quintile schools face greater challenges due to higher unemployment and lower literacy rates in their communities [19].

Therefore, the demand for sensory environment design solutions [2,3] and psychoeducational tools [12] becomes increasingly crucial in effectively supporting diverse learning needs. These tools empower teachers to design environments that foster enhanced learning and development, which is particularly important in the face of socioeconomic disparities and inadequate training in special educational needs.

1.5. Leveraging Teacher Agency to Implement Psycho-Educational Tools in Policy and Practice

The concept of teacher agency is pivotal in educational reform, as it underscores the significant impact teachers can have on improving educational practices and shaping policy implementation [22]. Teacher agency involves teachers actively engaging in decision-making processes and using their professional knowledge to drive change within educational settings [22]. This proactive involvement is crucial for ensuring that educational tools and practices align with both policy goals and classroom realities.

In the context of validating the Sensory Classroom Teacher Questionnaire (SCTQ), early childhood teachers played a central role in this process. Their active participation was instrumental in refining the SCTQ, demonstrating how teacher agency can lead to effective adaptations that cater to diverse educational needs. By contributing their expertise and practical experiences, these teachers provided essential feedback on the SCTQ's psychometric properties, such as validity, reliability, and responsiveness. This feedback was vital for ensuring that the tool is not only theoretically sound but also practical and effective in real-world classroom settings.

Teacher agency, therefore, is not just a theoretical concept but a driving force behind practical improvements in education. Teachers' active engagement in validating tools like the SCTQ ensures that these resources are relevant and effective, aligning with broader educational policies and addressing the specific needs of learners. This engagement fosters the creation of inclusive learning environments and empowers teachers to drive systemic changes, ultimately enhancing the overall quality of education.

1.6. Advancing Research and Practice through Teacher Collaboration

While this study offers valuable insights into the development and validation of the SCTQ within the South African educational context, its primary scholarly contribution is the demonstration of the benefits of collaborative research. This research fills a critical gap by showcasing how the active involvement of early childhood teachers in focus group interviews significantly enhances both the development of inclusive educational practices and the refinement of the SCTQ.

Teacher-participants provided essential perspectives that addressed developmental, cultural, linguistic, contextual, and socioeconomic factors. Their feedback was instrumental in developing evidence-based strategies to make the SCTQ more effective in meeting the sensory needs of learners, especially those with ADHD or sensory integration/processing challenges. Collaboration not only advances the application of sensory ergonomics in early

childhood education but also builds collective knowledge and agency among teachers and researchers.

By integrating teachers' lived experiences and practical insights, the study ensures that the SCTQ is well-aligned with diverse classroom realities within South Africa. This alignment supports South African educational policies focused on inclusive education and the needs of learners with ADHD or sensory integration/processing challenges, thereby contributing to broader educational goals and fostering a more inclusive learning environment.

2. Methodological Considerations

2.1. Enactivism as Research Paradigm: Enhancing SCTQ through Teacher Agency

Enactivism provides a comprehensive paradigm for understanding how individuals perceive, act, and interact with their environments, making it especially relevant for research on sensory ergonomics and educational practices [23,24]. As illustrated in Figure 1, enactivism is grounded in the idea that reality is co-constructed through dynamic interactions between people and their surroundings, where cognition is deeply embedded in sensory experiences and actions [23,24].

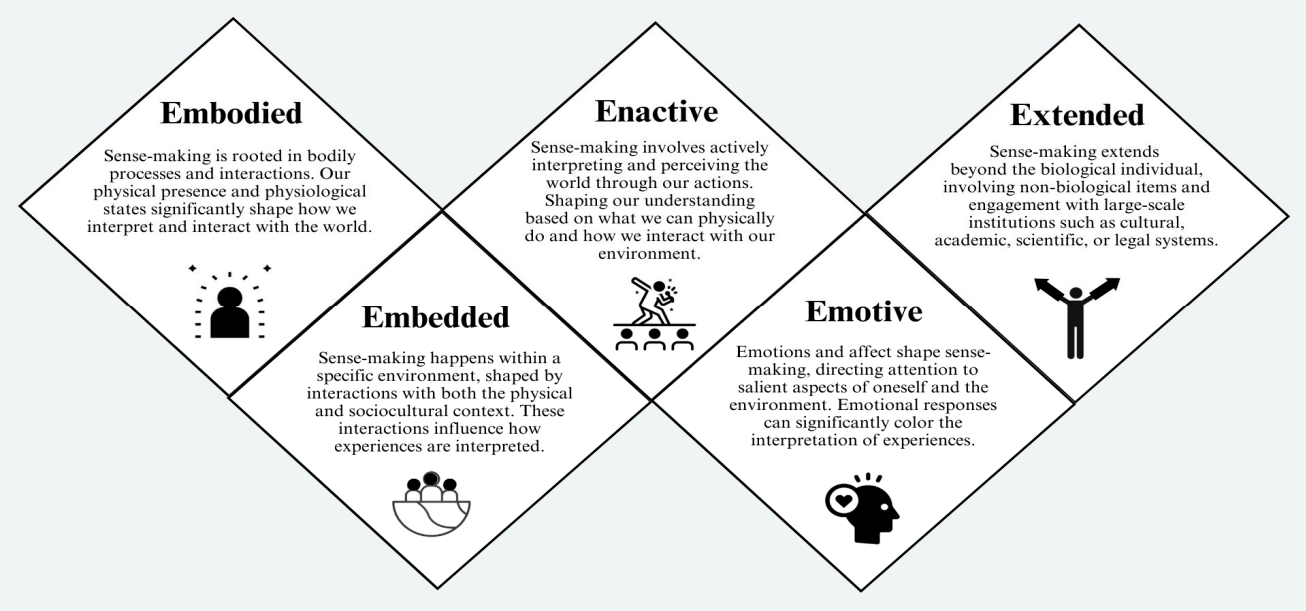

Figure 1. Simplified 5E's cycle of sense-making.

In the context of this study, enactivism is pivotal for validating and refining the SCTQ because its core principles—embodied, enactive, extended, embedded, and emotive cognition—align closely with this psycho-educational tool's goals. The embodied principle refers to how teachers' and learners' sensory experiences shape their interactions within the classroom. The enactive principle highlights the role of teachers' active engagement in designing inclusive sensory environments. The extended and embedded principles emphasize how classroom designs must account for the broader socio-environmental context and sensory inputs that affect learning. Finally, the emotive principle highlights the need to address emotional responses to potential sensory overload in classroom settings, given that humans process up to 53 overlapping internal and external senses [7]. Enactivism supports this by emphasizing that effectively understanding and optimizing these sensory experiences is crucial for creating environments that enhance focus and engagement.

Teachers, therefore, play a central role in shaping sensory environments that accommodate learners' complex sensory inputs. Their active involvement in the SCTQ's development and validation process demonstrates how teacher agency can drive improvements in classroom design. By integrating their insights into the SCTQ, teachers help ensure that the tool is practical and responsive to the real-world needs of diverse learners, ultimately supporting broader educational goals.

2.2. Enactivism as Research Paradigm: Collaborative Teacher Research

This manuscript illustrates how the SCTQ has been enriched through a collaborative approach involving both teachers and researchers, strengthening its relevance and effectiveness.

For teacher-participants, this enactive approach shifts their role from passive recipients to active co-creators of knowledge. Their embodied experiences and practical classroom interactions directly inform the SCTQ's development. This engagement not only enhances the SCTQ's embedded application in real-world educational settings but also fosters teacher agency as they collaborate, share insights, and reflect on their practices. The structured questionnaire process encourages teachers to reflect, evaluate, and adapt their pedagogical strategies, supporting learners with diverse sensory needs. By integrating their emotive responses and lived experiences, teachers refine their approaches to align closely with the realities of their learners.

For researchers, piloting, and validating the SCTQ and conducting focus group interviews with teacher-participants offer significant benefits. Direct engagement with teachers allows researchers to embody practical classroom insights, grounding the tool in real-world contexts. This enactive process of collaborative knowledge creation not only empowers researchers to refine the questionnaire but also fosters a sense of agency as they address teachers' needs. Feedback from teacher-participants helps embed the tool within diverse classroom settings, ensuring its relevance and applicability. This interaction enhances researchers' emotive understanding of classroom challenges, promoting reflection and self-evaluation of the tool's effectiveness. The extended nature of this collaboration further enables researchers to integrate broader educational and institutional perspectives, resulting in a more comprehensive tool that aligns with larger educational goals and frameworks.

2.3. Mode of Inquiry, Research Design, and Research Sample

This manuscript is a segment of a larger study [12] that utilized an exploratory mixed-methods approach. Although the broader study incorporated both qualitative and quantitative methods for validating the SCTQ, this particular manuscript focuses solely on the qualitative aspect, employing thematic analysis as its research design [14,25]. To show how this research fits within the larger study [12], the following infographic highlights the key aspects of mixed-methods research [25,26], such as theory, mixing, timing, and weighting, and explains how the enactivism paradigm [23,24], namely, embodied, embedded, enactive, emotive, and extended, guided the entire research process. This combination of enactivism and mixed-methods enabled a comprehensive understanding of the larger study, the latent constructs, and the refinement of items from a psycho-philosophical viewpoint, ensuring that the instrument was both theoretically grounded and empirically validated [12,25]. Please note, the pin (📌) in the infographic indicates the specific position of this manuscript within the context of the broader research study. Figure 2 is a succinct summary of the entire process to provide contextual insight.

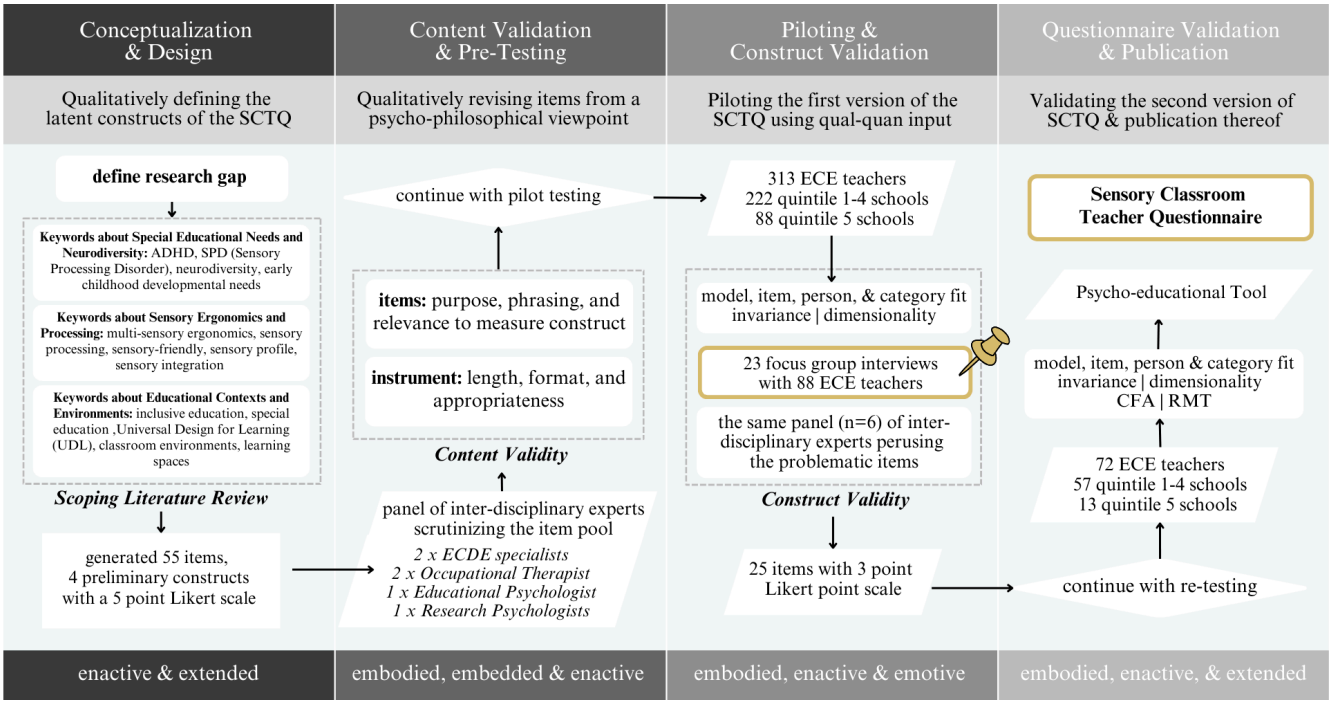

Figure 2. Flowchart of the development phases of the SCTQ.

Phase 1: Conceptualization and Design of the SCTQ: A scoping review was conducted to explore sensory ergonomics and the design of sensory environments using key terms across scientific, academic, and policy contexts (embedded). This review identified research gaps and guided the development of items for the SCTQ. This phase deepened the understanding of sensory experiences in educational settings (enactive) and led to the creation of an initial pool of 72 items, assessed using a 5-point Likert scale.

Phase 2: Content Validation and Pre-testing: A panel of six interdisciplinary experts (embodied, embedded, enactive) reviewed the initial 72-item pool for content validity. Early childhood education (ECE) experts contributed insights into age-appropriate sensory experiences and developmental practices for young learners. An educational psychologist assessed the impact of sensory ergonomics on learning processes and classroom dynamics. Occupational therapists evaluated how sensory and environmental factors affect learners' functional performance and well-being. Meanwhile, a research psychologist provided expertise on research methodologies and psychometric validity. Their combined perspectives ensured a thorough and comprehensive review of the SCTQ, considering the unique South African contextual needs. The refined pool was then piloted in Quintile 1–5 schools to confirm its effectiveness.

Phase 3: Piloting and Construct Validation: The SCTQ was first piloted quantitatively with 313 grade 1–3 teachers from Quintile 1–5 schools in Gauteng. Next, 88 teachers participated in the qualitative focus group interviews at their schools, offering detailed feedback on their experiences with the SCTQ (enactive, emotive). Using enactivism principles, the process underscores teachers' active role in shaping the tool through their real-world experiences and teaching practices (embodied, enactive, emotive). This ensured that the SCTQ was aligned with teachers' realities across quintile schools and effectively addressed sensory ergonomics and design of sensory environments. Purposive sampling gathered insights from teachers with relevant expertise (embodied, enactive), while convenience sampling broadened data collection for practical validation (extended). This exploratory mixed-methods approach thoroughly evaluated the SCTQ across varied classroom settings. Both quantitative and qualitative data, supported by demographic and inferential statistics (enactive), guided the tool's refinement. The interdisciplinary panel from Phase 1, along with a statistical expert, revised the tool based on all the above analyses (embedded, en-

active). Consequently, the item pool was reduced to 25, and a 3-point Likert scale was introduced to enhance accuracy.

Phase 4: Questionnaire Validation and Publication: The revised SCTQ was tested with a different sample of 72 early childhood teachers from Quintile 1–5 schools in Gauteng, using purposive and convenience sampling techniques. Rasch measurement theory and Bayesian confirmatory factor analysis assessed the tool's reliability and validity [12]. The teachers' diverse experiences (embodied) and hands-on use of the tool (enactive) ensured its practical relevance. Their broader educational and institutional insights (extended) were crucial in finalizing the tool, which now includes 24 items on a 3-point Likert scale [12].

Table 1 below provides a detailed biographical profile of the teachers who participated in the SCTQ pilot, focus groups, and validation phases. The focus group sample, highlighted in bold, represents the teacher-participants central to this manuscript, offering valuable insights into the practical application and refinement of the SCTQ tool across diverse educational settings.

Table 1. Biographical profile of teacher participation in SCTQ pilot, focus groups, and validation.

Biographical Components	Category	Pilot		Focus Group		Validation	
		%	*n*	%	*n*	%	*n*
Type of School	Quintile 1–3 (non-fee paying)	28	88	**26**	**6**	19	13
	Quintile 4–5 (fee-paying)	72	222	**74**	**17**	81	57
	Total Number of Schools:	100%	310	**100%**	**23**	100	70
Teaching Experience	>11 years	60	188	**98**	**86**	86	60
	<11 years	40	125	**2**	**2**	14	10
Further Education	Diploma/Certificate	2	6	**2**	**2**	3	2
	B.Ed Early Childhood Education	78	243	**91**	**80**	54	38
	B.Ed (Hons) Learning Support	20	64	**7**	**6**	43	30
Knowledge about ADHD	Solid, functional understanding of ADHD	66	207	**46**	**41**	100	70
	Basic, introductory understanding of ADHD	34	106	**54**	**47**	0	0
	Total Number of Participating Teachers:	100%	313	**100%**	**88**	100	70

This holistic, enactivist research paradigm ensured that the SCTQ was grounded in the lived realities of teachers, interdisciplinary experts, and researchers, making it a more effective and relevant psycho-educational tool for assessing sensory ergonomics in early childhood settings across various socioeconomic contexts.

3. Results and Data Presentation

Thematic analysis can integrate both inductive reasoning (a posteriori) and deductive reasoning (a priori) to describe how we come to know something [26]. A posteriori refers to knowledge gained from real-world observation and experience, thus building themes from the ground up based on generated raw data. A priori refers to knowledge based on reasoning or theory without needing actual experience, thus testing and refining emerging themes using existing theories [26]. This dual approach ensures a well-rounded interpretation of the generated data, making sense of it through both experience and theoretical perspectives [26]. In this study, both inductive and deductive reasoning were applied. Initially, the raw data from the focus group interviews was analyzed to identify recurring words, phrases, and connecting categories from teachers. Subsequently, deductive analysis was employed to align these themes with the predefined constructs of the SCTQ [12], as shown in Figure 3.

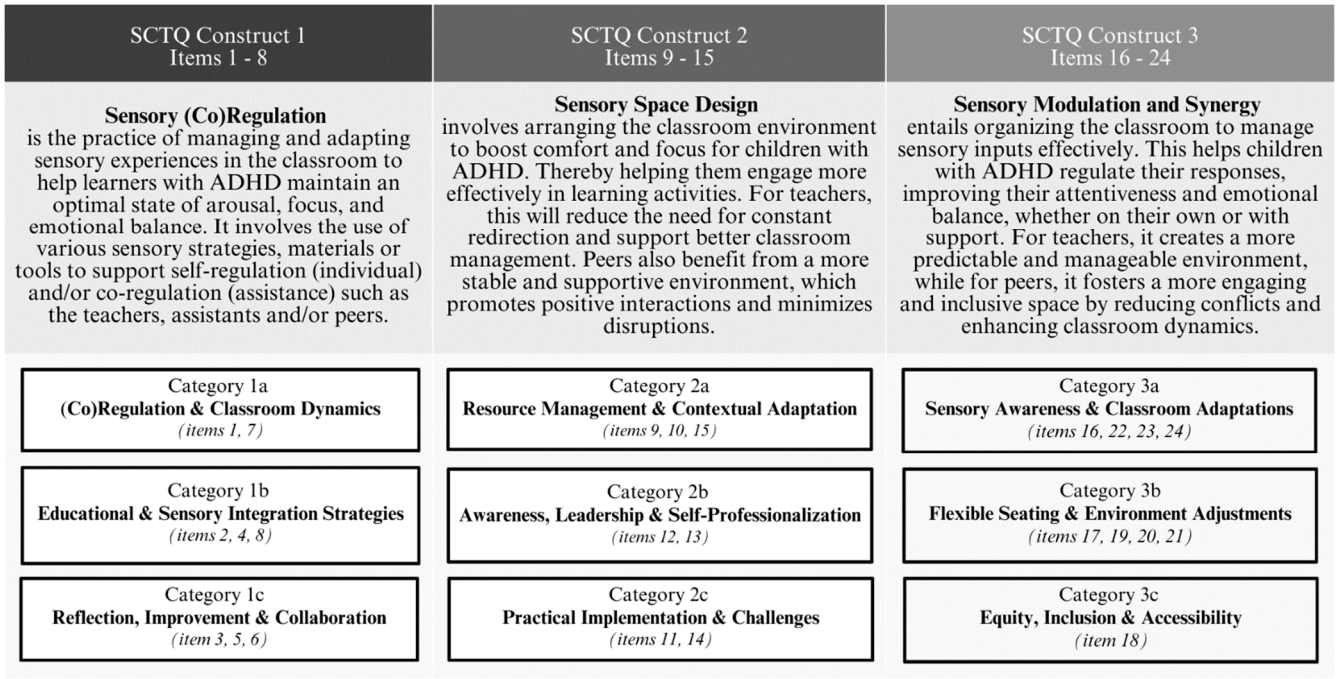

Figure 3. Inductive and deductive analysis of data from focus group interviews.

3.1. SCTQ Construct 1: Sensory (Co)Regulation

3.1.1. Category 1a: (Co)Regulation and Classroom Dynamics

Teachers play a critical role in modeling, coaching, and assisting children with ADHD to manage their attention and impulses. Effective strategies include maintaining focus, staying alert, and directing attention toward task goals while ignoring distractions. The questionnaire significantly enhanced teachers' understanding of ADHD and its impact on classroom dynamics, prompting practical changes in teaching methods. One teacher mentioned, 'Because it is a medical condition that affects a child's ability to focus, pay attention, or control his behavior, this questionnaire puts light [on] these aspects' (School_E; Participant_3). Another teacher noted, 'It made me aware of a few things that I can make use of in my classroom, that can assist in the learning process of the learners' (School_R; Participant_3). Additionally, the questionnaire encouraged self-reflection, with a teacher stating, 'It prompts ME to reflect on MY teaching methods. It encouraged ME to consider how ADHD affects classroom dynamics' (School_R; Participant_3). Recognizing the dependency of younger children, one teacher observed, 'Children in Grade 1 are still very dependent. The checklist won't work for most of my Grade 1′s. They need personal reminders' (School_F; Participant_2). However, the practical implementation of these strategies faces challenges due to limited classroom space and resources. One teacher highlighted, 'There are a lot of great ideas, but in real life the classroom is only so big and there are only four corners and limited options for seating arrangements for children with ADHD' (School_D; Participant_3). Larger classes exacerbate these difficulties, with another teacher finding it 'extremely challenging' to support learners with ADHD while attending to all learners (School_H; Participant_3). While practical challenges such as classroom size and time constraints remain, teachers are inspired to continue exploring effective solutions that foster inclusivity and enhance learning environments for all learners.

3.1.2. Category 1b: Educational and Sensory Integration Strategies

Effective instructional management involves establishing classroom rules, routines, and positive reinforcement techniques. Participants found the questionnaire beneficial in offering innovative ideas for managing ADHD and other behavioral issues. One teacher shared, 'The questionnaire provided me with new ideas to handle ADHD. Things I haven't

tried before' (School_L; Participant_2). Another participant expressed appreciation for the specific suggestions, stating, 'I like the idea of the trampoline, bouncing balls, and different textures. This may also help with our learners that are showing behavioral problems like uncontrollable temper tantrums and crying' (School_L; Participant_1). The questionnaire also encouraged teachers to reassess their classroom environments to minimize distractions and better accommodate learners with ADHD. For instance, one participant noted, 'I will also remove some very bright posters from the wall as it might be distracting some of the learners with ADHD' (School_G; Participant_2). Practical sensory solutions such as 'elastic bands around the seats for them to pick at' (School_H; Participant_2) and 'a sensory cushion with soft spikes for their child to sit on' (School_G; Participant_1) were explored, highlighting the role of sensory integration techniques. However, practical challenges were noted, with one teacher remarking, 'Moving between work stations may be a problem because of our learner's disabilities, but it is a very nice idea' (School_I; Participant_2). Also, one teacher expressed, 'In bigger classes having learners with ADHD is extremely challenging and often feels I run out of time to help them and also attend to all the other learners' (School_H; Participant_3).

3.1.3. Category 1c: Reflection, Improvement, and Collaboration

The theme of reflection, improvement, and collaboration among educators emerged strongly from the questionnaire responses. Teachers expressed a newfound awareness of their teaching practices and the need for adjustments to better accommodate learners with ADHD. One teacher remarked, 'Some questions helped me to think about the support I give to the learners with ADHD. It provided information about what I can do in advance to support my learners' (School_T; Participant_1). Collaboration was highlighted as essential for professional growth, with teachers discussing the importance of sharing ideas and seeking advice from colleagues to enhance teaching strategies. For example, a participant mentioned, 'Oral motor chew tools seem like a good idea. I will discuss it with our speech therapists' (School_T; Participant_2). However, some teachers expressed frustration with the questionnaire's effectiveness in addressing their needs. One teacher lamented, 'This questionnaire did not help me because I still do not know how to accommodate learners with ADHD in my classroom' (School_H; Participant_1). Another suggested, 'It would be helpful if it was accompanied by a recommendation manual. I cannot learn from questions that I don't know if I got right or wrong' (School_D; Participant_2). Despite these challenges, the questionnaire prompted teachers to reflect on their teaching practices and consider new approaches. One teacher noted, 'It helped me to get a better idea and understanding of where I improve in the classroom' (School_R; Participant_1). Another expressed, 'It's also nice to know that the accommodations we do make are on the right track; and it made me more mindful towards other accommodations I should consider' (School_E; Participant_1). Overall, the feedback underscores the complexity of managing ADHD in the classroom and highlights the need for adaptable, context-sensitive approaches that consider the unique dynamics and limitations of each classroom. While the questionnaire provided valuable insights and strategies, practical challenges in implementation remain, emphasizing the importance of continuous reflection, collaboration, and the pursuit of resources to support effective behavior co-regulation and instructional management for learners with ADHD.

3.2. SCTQ Construct 2: Sensory Space Design

3.2.1. Category 2a: Resource Management and Contextual Adaptation

Resource management and contextual adaptation are crucial for implementing effective classroom practices and addressing the diverse needs of learners. Teachers must allocate resources judiciously, considering budgetary constraints and procurement challenges, and tailor educational strategies to fit the specific limitations of their classrooms. This includes accommodating developmental readiness, grade relevance, and technological or space limitations. One teacher pointed out a common challenge in resource allocation: 'You don't always have the correct assistive devices that will make life easier for the child

and the teacher' (School_U; Participant_1). Another teacher emphasized the difficulty of adapting physical spaces: 'It is just not always possible to do some of the things because of the limitation brought about by the classroom structures' (School_P; Participant_3). Despite these challenges, some teachers found the questionnaire motivating for change. One expressed, 'I have definitely become more mindful of certain areas, and even though we do not have dimmer switches, I found a solution on Pinterest where you can use frosted plastic as dimmers' (School_S; Participant_3). Another stated, 'The questionnaire gave me ideas about how I could move the learners around and what management styles I could implement in my teaching strategies' (School_C; Participant_2). Also, one teacher shared her plans: 'I am testing different strategies for teaching and learning and one that I believe will be very effective with the learners is having multiple working areas in the classroom. Where learners can sit or stand while completing work' (School_D; Participant_1). 'It did help me to adjust my classroom by giving me new, different ideas to change my classrooms as well as add resources' (School_Q; Participant_2). In summary, while the questionnaire provided valuable insights and motivated some teachers to make practical changes, it also revealed significant challenges related to resource management and contextual adaptation. The balance between positive insights and practical limitations underscores the need for increased support and resources to implement classroom adaptations effectively.

3.2.2. Category 2b: Awareness, Leadership, and Self-Professionalization

Developing teachers' awareness and understanding of classroom management and learner needs is crucial. This includes recognizing ADHD and other challenges, understanding the classroom environment's impact on learning, and appreciating diverse learner needs. Environmental awareness ensures teachers consider factors like lighting, noise levels, and sensory stimuli, tailoring their approaches accordingly. The questionnaire enhanced teachers' understanding of ADHD and its impact on classroom dynamics. 'I started planning to change my classroom layout and minimize triggers. The questions encouraged me to explore alternative strategies beyond medication' (School_G; Participant_1). This increased awareness led to practical changes in teaching methods, as another teacher observed, 'It made me aware of a few things that I can make use of in my classroom, that can assist in the learning process of the learners' (School_R; Participant_3). 'By completing the questionnaire, I was made aware of things that I was not aware of before' (School_N; Participant_3). The questionnaire also encouraged self-reflection, with a teacher stating, 'The questions foster openness to diverse approaches for supporting children with ADHD' (School_R; Participant_3). Insights gained extended to the physical classroom environment. One teacher noted, 'It's lovely to be reminded how the learners' environment needs to be taken into account for learning' (School_Q; Participant_2). Another added, 'It made me more aware of my classroom and setting as well as the learners in my classroom. I also noticed a general lack of sensory input and tactile tools for these learners' (School_B; Participant_1). However, some participants noted challenges. A teacher expressed concern about the depth of knowledge required, stating, 'Most questions wanted deeper knowledge about ADHD' (School_J; Participant_2). Another highlighted the difficulty of identifying learners with ADHD without formal diagnosis: 'It's so easy to let these learners [those with ADD/ADHD] slip under the radar, especially if they are not formally diagnosed.' (School_D; Participant_2). 'The questionnaire reveals lack of resources for implementing suggested changes. This helped me to suggest the need for resources and funding to address classroom needs' (School_R; Participant_3). 'This questionnaire initiated discussions with my school's leadership about school development' (School_D; Participant_3). Many teachers felt inadequately informed about ADHD. One teacher expressed a need for more resources: 'I would have really appreciated it if the questionnaire recommended ways to accommodate learners with ADHD. I would really like to know more about this condition, I feel like I am not doing this one learner in my class any justice' (School_H; Participant_1). Another echoed this sentiment, noting the lack of sufficient knowledge among educators, 'Some educators do not have sufficient knowledge on ADHD so that might need some time

to read through information' (School_L; Participant_3). The realization of their knowledge gaps was common, with one participant admitting, 'Made me realize that I do not know as much about ADHD as I thought, and I will incorporate the ideas' (School_P; Participant_2). While the questionnaire was insightful, it revealed gaps in understanding, prompting teachers to seek more information and strategies. 'The questionnaire was insightful to see what areas need to be focused on when dealing with a learner diagnosed with ADD/ADHD. It was also helpful to see how I can improve my classroom' (School_K; Participant_3). This lack of knowledge often led to struggles in providing appropriate accommodations. As another teacher reflected, 'It was insightful to gain ideas on how to change the classroom as best as possible and to see how the learners could be handled in different ways' (School_O; Participant_2). One teacher suggested: 'This questionnaire becomes a source of information during our quarterly planning (School_U; Participant_2) and can 'Help expand vocabulary and knowledge among us teachers' (School_E; Participant_3). The need for professional development and better resources to support these learners was evident, highlighting the importance of continuous education and support for teachers dealing with ADHD and sensory needs in their classrooms. Overall, while the questionnaire provided valuable insights and raised awareness about ADHD and classroom management, it also highlighted the need for more resources and support for teachers to address these challenges effectively.

3.2.3. Category 2c: Practical Implementation and Challenges

Implementing sensory classroom design changes to accommodate diverse learners, particularly those with ADHD, presents practical challenges. This category focuses on the practical implementation and challenges associated with sensory space design. Teachers must balance innovative strategies with the realities of their classroom environments, often facing constraints related to space, resources, socioeconomic status (Quintile 1–3), and class size. Seating arrangements, for instance, present significant challenges. Teachers strive to accommodate learners in wheelchairs and with walking frames, which complicates classroom dynamics. 'Seating arrangements can be a bit of a problem as we already try to accommodate learners in wheelchairs and with walking frames' (School_G; Participant_2). One teacher pointed out, 'Some of the questions posed are based on a studio design, focused on learners who need one-on-one attention' (School_H; Participant_2), highlighting the need for more flexible and inclusive design recommendations. Another participant reflected, 'The questionnaire made me realize how important charts are in a Grade 1 classroom, and as a new teacher, I will create a few charts' (School_F; Participant_3). However, limitations due to classroom structures make some suggestions difficult to implement, according to one teacher: 'Overcrowded classrooms and schools with limited resources further complicate the implementation of innovative ideas' (School_R; Participant_2). Some of the questions asked cannot be implemented due to a lack of resources and classroom structure: 'I think some of the questions are unrealistic because some of the things are not practically feasible in an overcrowded classroom' (School_R; Participant_2). Some feedback from a participant included: 'The challenge is financial support in procuring these support materials' (School_C; Participant_2). Despite the insightful nature of the questionnaire, practical challenges remain in adapting classrooms to better support learners with ADHD. In conclusion, while the questionnaire inspired teachers to reflect on and consider changes to their classroom practices, particularly regarding seating arrangements and accommodating ADHD learners, significant practical challenges remain. The feedback underscores the need for adaptable, context-sensitive approaches and increased support to effectively implement these classroom design changes.

3.3. SCTQ Construct 3: Sensory Modulation and Synergy

3.3.1. Category 3a: Sensory Awareness and Classroom Adaptations

Sensory awareness and classroom adaptations are critical for creating an optimal learning environment for learners with ADHD. The participants' feedback highlighted both the benefits and challenges of implementing sensory accommodations. Teachers acknowledged

the importance of sensory tools in supporting learners' needs. One participant emphasized, 'The questionnaire reminded me to focus on aspects that ADHD children may need, for example sensory toys and chairs' (School_E; Participant_2). Also, 'I learned more about the aspects regarding accommodations. I realize how important adjustments are in the classroom and that I will improve the way I accommodate the learner' (School_Q; Participant_1). This indicates an increased awareness of the need for sensory accommodations. Another teacher expressed enthusiasm for implementing alternative seating options: 'I am definitely going to try the alternate seating; I am very keen to introduce Pilates balls for them to sit on' (School_D; Participant_1). However, there are practical challenges to consider. One teacher noted the potential distractions posed: 'I feel that some of these questions or suggestions are a bit tricky to implement in the classroom, because the classroom structure for example the lights and ceiling fans are already built in' (School_C; Participant_1). This underscores the need to balance sensory accommodations with the potential for sensory overload. Another participant highlighted resource limitations: 'This questionnaire did make me realize the areas in which we are lacking, for example, things like air filters and light regulators' (School_D; Participant_3). This feedback illustrates the practical constraints faced by some schools in implementing sensory adaptations. In summary, while the questionnaire raised awareness about the importance of sensory considerations in classroom design and encouraged teachers to enhance their strategies, it also revealed the challenges of implementing these suggestions in resource-limited settings. A balanced approach is necessary to effectively integrate sensory adaptations into educational environments.

3.3.2. Category 3b: Flexible Seating and Environment Adjustments

Flexible seating and environment adjustments are essential for accommodating the unique needs of children with ADHD in the classroom. The feedback from the teachers demonstrated a strong interest in exploring different seating options to enhance learner engagement and comfort. One participant shared her plans, 'Some of my ADHD children were seated at the back of the classroom so they won't bother the other children, but I will move them to the front and see if it will improve their attention' (School_E; Participant_1). Another teacher expressed a similar interest: 'The questionnaire is beneficial as it encouraged me to reassess my own classroom strategies. It is a good reminder to bring my attention to the condition and its implications, as well as it being very informative of the wonderful aids (e.g., kneeling cushions) that would assist in the classroom' (School_O; Participant_2). These comments highlight a proactive approach to creating a more adaptable and responsive classroom environment. Addressing environmental factors such as lighting and airflow was also deemed crucial. One participant noted, 'There was one question about the 'airflow' or the sound of the fan in the classroom and how that could possibly disrupt the kids. I will look into that' (School_C; Participant_3). These adjustments aim to create an optimal learning environment that minimizes distractions and sensory overload. In conclusion, while flexible seating and environmental adjustments are promising strategies for supporting ADHD learners, practical limitations must be addressed to ensure successful implementation. Teachers need support and resources to create adaptable learning spaces that cater to the diverse needs of their learners.

3.3.3. Category 3c: Equity, Inclusion, and Accessibility

Creating an educational environment that promotes equity, inclusion, and accessibility is essential for supporting diverse learners, especially those with ADHD. Feedback from the questionnaire highlighted the need for cultural competence, educational and socioeconomic equity, and tailored special education services. Participants appreciated the questionnaire's role in fostering inclusive practices. One teacher noted, 'The questionnaire provided ideas to think about how to arrange my classroom differently in terms of learners with learning disabilities such as ADHD/ADD' (School_U; Participant_2). Another mentioned, 'It's also nice to know that the accommodations we do make are on the right track; and it made me more mindful towards other accommodations I should consider' (School_E; Participant_1).

A third shared, 'I've experienced every child with ADHD/ADD differently and we just adjust to what works for the whole class at that time, to accommodate everyone' (School_F; Participant_1). These reflections underscore the necessity of differentiated instruction and adaptive teaching strategies. However, several responses pointed to significant challenges. One participant remarked, 'The questionnaire is more suitable for schools that are more financially strong and who have classrooms big enough to make all the necessary changes for ADHD children' (School_F; Participant_1). Another highlighted contextual limitations: 'This cannot be applied to all schools in South Africa due to classroom ratios and the economic status of the school' (School_D; Participant_1). One teacher also stated, 'The school I teach at is a Quintile 1 school which means that there are very limited resources and some of the questions were directed at schools that have efficient resources which means I cannot change my classroom situation' (School_D; Participant_3). Another suggested, 'The SCTQ should differentiate and be adapted to either teachers in mainstream or teachers in special needs schools' (School_O; Participant_2). These comments underscore the socioeconomic disparities that can hinder equitable access to educational resources. Moreover, the questionnaire's applicability to various educational contexts was a concern. One teacher mentioned, 'The odd question is not particularly relevant for a teacher at a mainstream school or a mainstream environment' (School_T; Participant_1). Another pointed out, 'Some questions were based on the technical setting of the school, which some are not applicable to the current school situation' (School_D; Participant_1). These responses reflect the need for more tailored approaches that consider the specific circumstances of different schools and classrooms. Despite these challenges, the feedback also included positive reflections, such as, 'I felt inspired to create a space in my classroom where the children feel safe' (School_I; Participant_1). Overall, while the questionnaire provided valuable insights and raised awareness about ADHD and inclusive classroom management, it also highlighted the need for more resources and tailored support to address these challenges effectively.

4. Results and Discussion

The revision and finalization of the SCTQ [12] were informed by a rigorous quantitative analysis of the dataset, input from an interdisciplinary team, and extensive feedback from focus group interviews with early childhood teachers (see Figure 2). This comprehensive approach led to significant changes in the SCTQ. The revision process was guided by the enactivism paradigm [24], ensuring that the SCTQ not only assessed classroom environments but also promoted an interactive and experiential learning approach. This paradigm emphasizes the active role of teachers and learners in designing and shaping their classroom environment, making the SCTQ a dynamic tool for fostering effective sensory practices for learners with ADHD.

4.1. The Sensory Classroom Teacher Questionnaire (SCTQ) as Psycho-Educational Tool

4.1.1. The Underlying Latent Constructs of the SCTQ

Initially consisting of four latent constructs—communal space, regulated space, individual space, and semantic space—the questionnaire was streamlined to three constructs, namely:

1. *Sensory (Co)Regulation* is the practice of managing and adapting sensory experiences in the classroom to help learners with ADHD maintain an optimal state of arousal, focus, and emotional balance. It involves the use of various sensory strategies, materials, or tools to support self-regulation (individual) and/or co-regulation (assistance), such as the teachers, assistants and/or peers.
2. *Sensory Space Design* involves arranging the classroom environment to boost comfort and focus for children with ADHD, thereby helping them engage more effectively in learning activities. For teachers, this reduces the need for constant redirection and supports better classroom management. Peers also benefit from a more stable and supportive environment, which promotes positive interactions and minimizes disruptions.
3. *Sensory Modulation and Synergy* entails organizing the classroom to manage sensory inputs effectively. This helps children with ADHD regulate their responses, improving

their attentiveness and emotional balance, whether on their own or with support. For teachers, it creates a more predictable and manageable environment, while for peers, it fosters a more engaging and inclusive space by reducing conflicts and enhancing classroom dynamics.

4.1.2. Administration, Interpretation, and Implementation of the SCTQ

Assessment and Reflection: The SCTQ is designed for teachers to independently assess their classroom with a focus on designing for sensory ergonomics. To ensure the most accurate results, it is recommended that teachers complete the questionnaire when no learners are present (embodied). During this self-assessment, teachers should visualize a learner with ADHD in the classroom, considering their specific seating arrangement and interactions (embodied). As teachers fill out the questionnaire, they should reflect on observed behaviors and challenges experienced by these learners, documenting their insights comprehensively (enactive). This reflective process aims to better understand and address the learner's sensory needs and behaviors rather than making judgments. Teachers should complete a separate questionnaire for each learner with ADHD to address their unique sensory requirements effectively (enactive).

Implementation and Collaboration: Teachers are encouraged to take detailed notes on their observations and any potential improvements they identified. If needed, they should collaborate with colleagues to ensure a thorough evaluation (embedded). This process actively engages teachers in refining classroom practices based on their firsthand experiences (enactive). Reflecting on the SCTQ results offers valuable insights into classroom dynamics, aiding in continuous self-evaluation and adjustment (emotive). Teachers are advised to implement one or two strategies at a time rather than trying to do everything at once. Starting with handmade resources before considering purchased ones is also recommended (extended). Collaborating with the school to identify and acquire necessary resources and possibly creating a shared resource library within the school or community can also be beneficial (extended).

Community and Professional Development (CPD): Involving parents and the community by sharing insights and incorporating their feedback can help create a supportive network (extended). Teachers should also seek support from school management and local government resources, such as occupational therapists and educational psychologists, to strengthen their strategies (embedded). Additionally, attending CPD workshops on sensory ergonomics, ADHD, SPD, and sensory classroom design can enhance teachers' knowledge and application of these approaches (enactive). Engaging learners with good self-regulation or low sensory thresholds to assist in implementing changes can further support peers with ADHD (embodied).

Broader Integration: Overall, the tool facilitates integration into the broader educational context and aligns with institutional goals, ensuring that changes are practical, effective, and supported by the wider educational framework (extended).

4.1.3. Practical Strategies for Adapting the Classroom Utilizing the SCTQ

In crafting a learning environment that fosters inclusivity and accessibility while meeting the diverse needs of learners with ADHD and sensory integration/processing challenges, it is essential to consider practical strategies that enhance accessibility and sensory friendliness.

Table 2 provides a detailed overview of innovative approaches derived from the literature and focus group interviews designed to optimize classroom settings despite various challenges, ensuring all learners can thrive [1–4,6,8,9,13,27,28].

Table 2. Final Validated SCTQ with Practical Suggestions for Resource Implementation.

SCTQ Item Statement		Likert Scale			Purchased Resources	Handmade Resources
Examinethe classroom thoroughly and rate each statement using the Likert scale provided. **Can you provide learners with…**		**Not possible at all**	**Possibly, but unsure**	**Entirely possible**	***Bought from suppliers, typically standardized and advanced; generally utilized by Quintile 4–5 schools with more funding.***	***Created by individuals or locally, often using recycled materials; typically found in Quintile 1–3 schools with limited budgets.***
Latent Construct 1: Sensory (Co)Regulation						
1	**a sensory signal to indicate transition or change of activity?**	1	2	3	Gives learners advance notice of changes, which helps reduce anxiety and prevent disruptive behavior. *visual timers, traffic light, bells or chimes, music clip*	*calming song, gentle drumbeat, hand signal, or gesture*
2	**a designated area to use and explore diverse sensory input?**	1	2	3	Provides a safe space with controlled stimuli, allowing learners to meet their sensory needs without becoming overstimulated. *fidget tools, weighted blankets, soft lighting, stress balls, sensory toolbox, sensory wall, sensory umbrella, sensory play mats*	*textured fabric squares, sensory bins filled with sand/water/rice, tactile paths, scented massage rollers, DIY sensory bottles, egg cartons filled with different materials*
3	**alternative or creative seating options or surfaces?**	1	2	3	Offer seating options that help learners manage their energy levels, improve focus, and feel more comfortable during teaching and learning activities. *Pilates balls, BOSU balls, standing desks, sensory cushions, bean bags, balance cushions, wobble stools*	*cushions filled with scrap fabric, old tires covered with fabric, sturdy wooden crates with cushions, elastic bands around chair legs, tennis balls on chair feet*
4	**access to non-distracting sensory tools, material, and/or resources?**	1	2	3	Supports learners' ability to self-regulate by offering sensory tools that help them focus without causing distractions. *noise-canceling headphones, fidget toys, stress-relief items, sensory brushes, chewable jewelry, lava lamp, weighted lap pads, sensory cushions, ASMR audio orvideo clips*	*DIY noise-reducing earmuffs, upcycled earplugs, balloons filled with sand/cornstarch, old toothbrushes, sponges, beaded necklace, calming bottles filled with glitter/bubbles*
5	**a daily or routine schedule placed in a designated area?**	1	2	3	Creates a predictable environment that helps learners feel secure and stay focused by clearly outlining the day's activities. *velcro/magneticsystem to easily change and update the schedule daily, high contrast boards (e.g., bright circle against soft background),commercial daily or routine schedules*	*handwritten labels on recycled paper/cardboard, visual schedule using pegs with pictures and words, color-coded with markers*
6	**labeled resources and designated areas?**	1	2	3	Helps learners easily find and put away materials, reducing chaos and fostering independence. *pre-printed and laminated, color-coded labels using text and images*	*hand-drawn schedules on cardboard, repurposed clothing pegs for task markers*

Table 2. *Cont.*

SCTQ Item Statement		Likert Scale			Purchased Resources	Handmade Resources
7	**a self-management plan, goal planner, behavior chart and/or token chart?**	1	2	3	Encourages positive behavior and self-regulation by setting clear goals and offering rewards for meeting them. *commercial behaviorand goal chart sets with stickers, digital apps, reward boards, whiteboards, bulletin boards, progress trackers*	*tokens made from painted stones or bottle caps, color-coded labels using stickers and markers*
8	**a designated area that caters to their preferred sensory input?**	1	2	3	Providing access to resources that match learners' sensory preferences, helping them stay calm, focused, and comfortable. *'sensory diet' or sensory kits for different sensory systems, tactile wall panels, sensory umbrella, electronic/video of spirals and spinning concentric circles, ASMR audio orvideo clips*	*old blankets/carpets for a soft corner, checkerboards, hanging spirals, homemade tactile boards using textured materials (sandpaper, fabric, etc.)*
Latent Construct 2: Sensory Space Design						
9	**age-appropriate resources and furniture?**	1	2	3	Ensures that classroom materials and furniture are suitable for learners' developmental levels, promoting effective learning and reducing frustration. *adjustable desks and chairs, ergonomic furniture, comfortable and supportive for various age groups*	*repurposed furniture, pallets turned into tables or shelves, cushions on the floor for seating*
10	**functional and adjustable curtains, blinds, or covers?**	1	2	3	Allows control over light levels to prevent sensory overload from bright or inconsistent lighting. *blackout curtains, adjustable blinds, room dividers, movable panels, sound-absorbing panels*	*bed sheets or fabric as makeshift, cardboard window covers painted or decorated by learners, egg containers for sound-absorbing, carpet*
11	**one undecorated wall or a neutral color vertical surface?**	1	2	3	Reduces visual clutter to help learners maintain focus and minimize sensory distractions. *avoid bright colors andthe color white, corkboards, vertical garden walls, artificial plants or grass*	*avoid bright colors and the color white, large sheets of plain or brown paper covering a wall area*
12	**an age-appropriate rule and behavioral chart in a designated area?**	1	2	3	Clearly communicates classroom expectations, helping learners understand and follow the rules. *commercial rule posters, digital behavior tracking apps*	*hand-painted rule posters on cardboard, fabric wall charts with pockets for rewards*
13	**adjustable light devices to regulate light quantity and quality?**	1	2	3	Enables fine-tuning of lighting to suit learners with sensory sensitivities, making the environment more comfortable. *bubble tube lamps, dimmable lights, sensory-friendly LED, natural light filters, light covers, light diffusers, UV light with fluorescent resources*	*homemade lampshades, covers using recycled materials to soften the light, DIY light filters using colored cellophane or plastic*

Table 2. *Cont.*

	SCTQ Item Statement	Likert Scale			Purchased Resources	Handmade Resources
14	**different types of sensory input that they can see, hear, taste, smell, and feel?**	1	2	3	Engages learners' senses in a balanced way, supporting sensory integration and reducing extreme sensory-seeking or avoidance behaviors.	
					multi-sensory tools or panels, textured wall panels, soft music, bubble tubes, lava lamps, sensory paths, tactile boards, commercially produced sensory toys	*DIY sensory boards, sound tubes made from PVC pipes, textured walls using recycled materials, DIY textured panels using different materials*
15	**the opportunity to regulate body temperature, room temperature, and airflow?**	1	2	3	Prevents discomfort from temperature and airflow, which can distract or distress learners with sensory sensitivities.	
					fans, heaters, air purifiers, air-conditioning units, cool-down areas with cold packs, warm-up areas with blankets, water fountain	*Hand fans made from recycled materials, hanging wet sheets for cooling, open windows and doors for natural airflow, DIY cooling packs (e.g., frozen sponges), beanbags, warm water bottles*
	Latent Construct 3: Sensory Modulation and Synergy					
16	**an organized, manageable, and sensible classroom layout?**	1	2	3	Creates a structured and orderly environment that helps reduce sensory overload and keeps learners focused	
					marked pathways, defined zones, tidy, organized, clutter-free, flow and accessibility, storage, transparent containers, modular furniture, stackable storage bins	*DIY shelves from crates or boxes, furniture made from pallets,room dividers made from pallets or old sheets, clear jars for organizing materials, recycled containers, book carts, and rolling storage units*
17	**a specific allocated area for personal belongings and resources?**	1	2	3	Encourages organization skills and reduces clutter, making the classroom environment more manageable for learners.	
					clearly labeled with name and photo, cubbies, lockers, bins, drawers, shelves, chair pockets, chair back organizers	*recycled cardboard boxes or crates, hooks made from wood or plastic for hanging items, tin or plastic boxes, chair back organizers made from material*
18	**non-interfering and functioning electronic devices, appliances, and apparatus?**	1	2	3	Ensures that electronic tools support learning without adding unnecessary sensory distractions.	
					noise-controlled devices, soundproof covers, silent keyboards, noise-canceling headphones, white-noise devices	*maintaining existing equipment, using non-electric alternatives where possible, repairing rather than replacing, DIY noise-reducing earmuffs, egg containers, cloth covers*
19	**seating away from doorways, windows, or transition areas?**	1	2	3	Minimizes distractions and interruptions, helping learners stay focused and avoid sensory overload.	
					movable partitions, room dividers, multi-purpose furniture	*curtains or fabric screens, strategically placed furniture to create separation, DIY room dividers*

Table 2. *Cont.*

	SCTQ Item Statement	Likert Scale			Purchased Resources	Handmade Resources
20	**seating close to self-regulated, focused, and tolerant peers?**	1	2	3	Places learners near peers who can model good behavior and help them stay focused. *adjustable seating arrangements, chair organizers*	*rearranging desks manually, using floor mats or cushions to create defined seating areas*
21	**seating away from communal, disruptive, and exhibition areas?**	1	2	3	Reduces exposure to distracting or overwhelming stimuli, fostering a calmer learning environment. *room dividers, portable soundproof panels, noise-reducing carpets, acoustic panels*	*old rugs or thick curtains to dampen sound, repurposed cardboard dividers*
22	**the removal of unrelated and unnecessary resources or stationery?**	1	2	3	Simplifies the workspace to help learners concentrate on relevant tasks without getting overwhelmed. *chair pockets, chair back organizers, desks with storage space, storage units, labeled bins*	*repurposed containers, chair back organizers*
23	**a designated area to release pent-up energy?**	1	2	3	Provides a space for physical activity, helping learners manage their hyperactivity and meet sensory needs. *therapy swing, trampolines, mini sensory gym, balance board, exercise mat, jump ropes, hula-hoops, resonance board*	*tire swings, repurposed jump ropes, balance board, exercise mat*
24	**a designated space with resources to relax?**	1	2	3	Offers a quiet area where learners can retreat to calm down and manage sensory overload. *noise-canceling headphones, ear plugs, calming jars, calming visuals, weighted blankets, rocking chairs, soft music, lava lamps, electric water features, chimeabout wooden carousel toy, pheromone scents, essential oils, scented candles, scented massage roller, smell noodles, white noise, ASMR, or broadband clips, sensory brushes*	*cushioned area with blankets and pillows, DIY lamps or candle holders from recycled materials, DIY calming jars with glitter and water, rainmaker, mirrors, space blanket, cotton wool as ear plugs, plants (e.g., lavender, rosemary, lemongrass, peppermint), scented massage roller using recycled deodorant roll-on, brushes (e.g., toothbrush, old paintbrush, feathers)*

This table also includes a rationale for each item, further supported by two columns with actionable strategies to help teachers effectively use both handmade and purchased resources, enhancing sensory ergonomics in classrooms across all socioeconomic levels in South Africa, regardless of quintile status.

4.1.4. Utilizing the SCTQ in Socio-Economically Disadvantaged Settings

In adapting the SCTQ for Quintile 1–3 schools, it is crucial to address the unique challenges these settings face, such as limited resources and overcrowded classrooms [20,21]. Despite these constraints, the SCTQ can be a valuable tool in creating diverse, inclusive, and sensory-friendly learning environments. Tailoring the questionnaire to meet the specific needs of these schools allows educators to effectively assess and address sensory regulation, learning space design, and sensory modulation.

Given the socioeconomic constraints often faced by these schools, practical strategies are essential. For instance, investing in multi-functional furniture with built-in storage and desks that support both individual and group work can optimize classroom layouts. Creating adapted learning stations with specific themes and rotating them regularly encourages independent learning while helping manage overcrowding. Mobile resources, like book carts and rolling storage units, enhance material accessibility, making it easier for all learners to access necessary resources.

Community and parent involvement can further enrich classroom environments. Donations, fundraising, and partnerships with local organizations can provide essential supplies, furniture, and technology upgrades. Additionally, involving learners in classroom design decisions and creating designated areas for their projects can foster a sense of ownership and pride in their learning space.

These combined efforts not only support the development of inclusive and sensory-friendly environments but also leverage the SCTQ to address the diverse needs of learners with ADHD in Quintile 1–3 schools, ultimately improving overall learning outcomes.

4.1.5. Utilizing the SCTQ for Continuous Professional Development

The SCTQ not only serves as a psycho-educational tool but also as a means to empower teachers through targeted training programs [12,23,26,27]. By incorporating the SCTQ and input from interdisciplinary experts, such as those in occupational therapy, educational neurology, and educational psychology, into teacher development initiatives, educators gain valuable insights into addressing the unique challenges faced by learners with ADHD [1,3].

Training sessions can enhance teachers' understanding of ADHD and provide effective classroom management strategies tailored to sensory needs. Programs like knowledge-building seminars or community engagement workshops offered by organizations such as the South African Research Association for Early Childhood Education (SARAECE) [29], the South African Council for Educators (SACE) [30], and Takalani Sesame [31], focus on sensory awareness and creating supportive learning environments [1–3].

These training opportunities, combined with reflective practices and practical resources, empower teachers to implement adaptive teaching methods and optimize classroom setups. This approach ultimately helps create more inclusive and supportive educational experiences for all learners.

4.2. Challenges and Future Directions

While the SCTQ offers valuable insights and tools for promoting sensory-friendly environments, several limitations should be acknowledged, and recommendations for improvement should be considered.

4.2.1. Limitations

The effectiveness of the SCTQ can vary significantly across different socioeconomic settings due to factors such as resource availability and school infrastructure. Schools facing challenges like overcrowded classrooms or limited sensory resources may struggle

to address all the sensory needs identified by the questionnaire. Additionally, the reliance on self-reported data from teachers introduces potential biases or inaccuracies, highlighting the need for further validation studies across diverse educational contexts. The variability in teacher readiness, experience, and external factors like changes in school policies or funding can also impact the successful implementation of the SCTQ recommendations. Moreover, the applicability of the questionnaire's insights may vary depending on cultural and contextual differences, affecting how well the recommendations fit different educational environments. There is a need to assess the long-term effects and sustainability of the changes implemented based on the SCTQ to ensure ongoing effectiveness.

To address these limitations, future research should focus on refining the SCTQ to better accommodate practical challenges and ensure its applicability in a broader range of school environments while also examining long-term effects and addressing the sustainability of sensory adaptations.

4.2.2. Recommendations

To effectively address the challenges identified and enhance the utility of the SCTQ, a multifaceted approach is recommended. Schools should focus on strategically allocating resources to meet the sensory needs of learners with ADHD, including investing in flexible seating, sensory tools, and adaptive materials. This effort can be supported through funding from grants, local businesses, and community partnerships, which can help overcome resource constraints. Additionally, developing customized implementation strategies will ensure that the SCTQ's recommendations are adaptable to varying classroom sizes, budgets, and resource levels. Ongoing professional development is crucial, with regular training programs designed to keep educators updated on the latest research and strategies for managing ADHD and sensory needs. Strengthening collaborations with local authorities, occupational therapists, educational psychologists, and sensory integration specialists will provide valuable expertise and support. It is also important to establish mechanisms for incorporating teacher feedback to continuously improve the SCTQ and its application in classrooms. Engaging parents and the community through fundraising and resource collection can further support classroom adaptations. Finally, implementing the SCTQ in selected schools to identify and address potential challenges before a broader implementation will ensure practical and effective adaptation in diverse settings. By adopting these recommendations, schools can better address practical limitations and enhance the SCTQ's effectiveness, creating more supportive and inclusive environments for learners with ADHD.

5. Conclusions

Addressing the diverse sensory needs of learners with ADHD in various socioeconomic settings is essential for fostering inclusive and supportive educational environments. This study has highlighted the pivotal role of the Sensory Classroom Transition Questionnaire (SCTQ) as a psycho-educational tool designed to enhance classroom settings to better cater to these needs. Through an extensive validation process involving 23 focus group interviews with 88 early childhood teachers from a range of South African schools, the SCTQ has proven its practicality and content validity across different classroom contexts. By integrating enactivism and thematic analysis, the research has underscored the significance of teacher agency in developing and refining educational tools that align with South African policies on equity and inclusion.

The SCTQ has enabled teachers to move beyond passive use, engaging them as active co-creators who leverage their own experiences to adapt and improve classroom environments. This collaborative process not only refines the tool but also heightens teachers' awareness of their practices and promotes continuous professional development. By focusing on manageable adaptation strategies and involving the broader educational community, the SCTQ supports the creation of responsive and sensory-friendly learning environments. These strate-

gies are particularly valuable in socio-economically disadvantaged settings, where resource constraints can impact the implementation of effective classroom adaptations.

Ultimately, the SCTQ stands out as a crucial resource for both future research and practical application, reinforcing the importance of ongoing reflection and adaptation in pedagogical application and design of sensory environments. It provides a robust framework for ensuring that educational practices and policies are inclusive, equitable, accessible, and centered on the well-being and success of every learner and educator. This study affirms the SCTQ's potential to transform educational practices, advocating for continued efforts to refine and implement strategies that address the evolving needs of all learners and their teachers.

Funding: The University of Pretoria's Research Development Programme (RDP) offers seed funding to emerging researchers aiming to build their research careers. The author and primary investigator of this manuscript received an internal RDP grant (number RDP-334-2019) to conduct this research at the University of Pretoria.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and was approved by the University of Pretoria, Faculty of Education Ethics Committee (reference number: UP09/04/01).

Informed Consent Statement: Informed consent was obtained from all participants involved in the study. A protocol document was compiled, and the fieldworkers were trained on handling topics such as ethical procedures to obtain informed consent, conduct a focus group interview, and ensure safe and anonymous participation. A qualitative interview schedule was provided to the fieldworkers who verbatim transcribed the raw data in Microsoft Word. All fieldworkers were authorized by the Department of Basic Education to visit any primary school in South Africa and issue a copy of the registered ethics certificate granted by the University of Pretoria, Faculty of Education Ethics Committee (reference number: UP09/04/01).

Data Availability Statement: The data presented in this study are available on reasonable request from the corresponding author due to privacy and ethical reasons.

Acknowledgments: Fieldworkers, qualified in early childhood education, enrolled for their post-graduate studies in learning support at the University of Pretoria, assisted in conducting focus group interviews with early childhood education teachers at schools within the Gauteng district. Please note that all individuals acknowledged in this section have given their consent to be recognized as fieldworkers. Artificial intelligence (AI) and large language models (LLMs) were used to confirm or make suggestions for alternative wording of the already generated codes, categories, and themes of the raw data sets.

Conflicts of Interest: The author declares no conflicts of interest. The funders had no role in the design of the study, in the collection, analyses, or interpretation of data, in the writing of the manuscript, or in the decision to publish the results.

References

1. Australian Children's Education and Care Quality Authority. Quality Area 3: The Environment as the 'Third Teacher'. 2018. Available online: https://www.acecqa.gov.au/resources/supporting-materials/infosheet (accessed on 21 June 2024).
2. Davies, C. (Ed.) *Creating Multi-Sensory Environments: Practical Ideas for Teaching and Learning*, 2nd ed.; Routledge: Oxon, UK, 2020.
3. Lombard, A. *Sensory Intelligence: Why It Matters More Than IQ and EQ*; Metz Press: Cape Town, South Africa, 2015.
4. Heman, E.; Dekel, H. Ergonomics for Children: An Educational Program for Elementary School. *Work* **2009**, *32*, 261–265. [CrossRef] [PubMed]
5. Ayres, A.J. *Sensory Integration and the Child*; Western Psychological Services: Los Angeles, CA, USA, 1979.
6. Dunn, W. *Sensory Profile: User's Manual*; Psychological Corporation: San Antonio, TX, USA, 1999.
7. Cohen, M.J. Counseling and Nature: A Greening of Psychotherapy. 1994. Available online: https://eric.ed.gov/?id=ED374387 (accessed on 12 June 2024).
8. Dellapiazza, F.; Michelon, C.; Vernhet, C.; Muratori, F.; Blanc, N.; Picot, M.C.; Baghdadli, A. Sensory Processing Related to Attention in Children with ASD, ADHD, or Typical Development: Results from the ELENA Cohort. *Eur. Child Adolesc. Psychiatry* **2020**, *30*, 283–291. [CrossRef] [PubMed]

9. Costa, R. A Classroom Self-Regulation Toolbox: A Collaborative Program between Occupational Therapists and Teachers for Children with ADHD. Ph.D. Thesis, Boston University, Boston, MA, USA, 2019. Available online: https://hdl.handle.net/2144/38164 (accessed on 7 August 2024).
10. Wójcik, M. The Role of a Sensory Diet in Improving the Quality of Psychosocial Functioning of Students in Inclusive Education. *Podstawy Edukac.* **2023**, *16*, 39–53. [CrossRef]
11. Goldberg, H. Growing Brains, Nurturing Minds—Neuroscience as an Educational Tool to Support Students' Development as Life-Long Learners. *Brain Sci.* **2022**, *12*, 1622. [CrossRef] [PubMed]
12. Du Preez, H.; Combrinck, C.-M. The Sensory Classroom Teacher Questionnaire: A Tool for Assessing Conducive Classroom Conditions for Children with ADHD. *Afr. J. Psychol. Assess.* **2022**, *4*, a107. [CrossRef]
13. Miller Kuhaneck, H.; Kelleher, J. Development of the Classroom Sensory Environment Assessment (CSEA). *Am. J. Occup. Ther.* **2015**, *69*, 6906180040p1-9. [CrossRef] [PubMed]
14. Department of Basic Education. *The National Policy for an Equitable Provision of an Enabling School Physical Teaching and Learning Environment*; Government Printers: Pretoria, South Africa, 2011.
15. Department of Social Development; UNICEF. *The National Integrated Early Childhood Development Policy*; Government Printers: Pretoria, South Africa, 2015.
16. Department of Education. *Minimum Uniform Norms and Standards for School Infrastructure*; Schools Act 84 of 1996; Government Printers: Pretoria, South Africa, 2009.
17. Department of Education. *Education White Paper 5: Early Childhood Education: Meeting the Challenges of Early Childhood Development in South Africa*; Government Printers: Pretoria, South Africa, 2001.
18. Department of Education. *Education White Paper 6: Special Needs Education: Building an Inclusive Education and Training System*; Government Printers: Pretoria, South Africa, 2001.
19. De Clercq, F.; Phiri, R. The Challenges of School-Based Teacher Development Initiatives in South Africa and the Potential of Cluster Teaching. *Perspect. Educ.* **2013**, *31*, 77–86. Available online: https://journals-co-za.uplib.idm.oclc.org/doi/10.10520/EJC133226 (accessed on 20 June 2024).
20. Van Dyk, H.; White, C.J. Theory and Practice of the Quintile Ranking of Schools in South Africa: A Financial Management Perspective. *South Afr. J. Educ.* **2019**, *39*, s1–s19. [CrossRef]
21. Ogbonnaya, U.I.; Awuah, F.K. Quintile Ranking of Schools in South Africa and Learners' Achievement in Probability. *Stat. Educ. Res. J.* **2019**, *18*, 106–119. [CrossRef]
22. Cong-Lem, N. Teacher Agency: A Systematic Review of International Literature. *Issues Educ. Res.* **2021**, *31*, 718–738. Available online: https://www.iier.org.au/iier31/cong-lem.pdf (accessed on 25 June 2024).
23. Stilwell, P.; Harman, K. Phenomenological Research Needs to be Renewed: Time to Integrate Enactivism as a Flexible Resource. *Int. J. Qual. Methods* **2021**, *20*, pp. 1–15. [CrossRef]
24. Popova, Y.B.; Rączaszek-Leonardi, J. Enactivism and Ecological Psychology: The Role of Bodily Experience in Agency. *Front. Psychol.* **2020**, *11*, 539841. [CrossRef] [PubMed]
25. DeVillis, R.F. *Scale Development: Theory and Application*, 4th ed.; SAGE: Los Angeles, CA, USA, 2017.
26. Babbie, E.; Mouton, J. *The Practice of Social Research*; Oxford University Press: Cape Town, South Africa, 2001.
27. Grace, J. *Sensory-Being for Sensory Beings: Creating Entrancing Sensory Experiences*; Routledge: London, UK, 2018.
28. Moyes, R. *Building Sensory Friendly Classrooms*; Sensory World: Arlington, TX, USA, 2010.
29. South African Research Association for Early Childhood Education (SARAECE). Available online: https://www.saraece.org.za/ (accessed on 14 August 2024).
30. South African Council for Educators (SACE). Available online: https://www.sace.org.za/ (accessed on 14 August 2024).
31. Takalani Sesame. Available online: https://sesameworkshop.org/our-work/shows/south-africa-takalani-sesame/ (accessed on 14 August 2024).