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Fostering Executive Functions Using Learning and Teaching Materials in Kindergarten

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Abstract: Executive function is an essential skill needed for learning in a school environment. This is because the skill helps learners be organised and work effectively during tasks. Literature suggests that executive functions should be developed during early years, as they establish the means to work effectively in a learning environment. However, South Africa's policy document does not detail the materials that enhance the skill. Therefore, the following article provides insight into learning and teaching materials that can enhance executive function skills in the kindergarten years. The study applied the qualitative approach, enabling teachers to provide their experience of the phenomenon. Eight South African teachers were selected as a form of purposive sampling from four kindergarten schools in Pretoria, Gauteng. Semi-structured interviews and lesson observations were utilised to obtain the empirical data. Several themes emerged, including visual materials, tactile objects, songs, and oral materials. These materials need to be age-appropriate and fun for kindergartners to engage with. The findings support that developing or facilitating executive functions mostly depends on teachers' willingness to be innovative and utilise different resources. However, for this to occur, teachers need to know children's interests, as it will captivate learners' attention and have them participate in different tasks. The insights of this study can be used to enhance the current Learning and Teaching Support Material policy document, promote learning through play, and enable school readiness.

Keywords: executive functions, kindergarten, learning and teaching materials, cognitive development, school readiness.

Introduction

Executive functions represent a cognitive umbrella as they are the centre point that controls behaviour, memory, and cognitive flexibility when problem-solving (Keenan et al., 2019). The skill embeds obtaining, managing, and processing knowledge, which are the stepping stones to reaching academic success. Without such skills, working effectively in a learning environment would be problematic (Gunzenhauser & Nückles, 2021). Teachers must always ensure the learners behave correctly and effectively amongst peers. This consists of stopping conversations while the lesson is being taught, allowing the opportunity to take turns during activities, guiding learners to perform tasks neatly, and ensuring learners do not forget anything (Sankalaite et al., 2021; Veijalainen et al., 2019). Hence, literature notes why executive functions should be developed before formal schooling, as it helps kindergartners adjust and work effectively in school (Cook et al., 2022; Segooa & Molise, 2023; Van Rensburg, 2015). Kindergartners often face one of the challenges when they commence formal school: getting easily distracted. The children also struggle to retain information, such as following basic instructions. De Carvalho Etokabeka et al. (2023) state that these struggles result from weak executive functions.

Executive functions can be challenging to nurture if kindergarteners lack essential cognitive and behavioural skills (De Carvalho Etokabeka et al., 2023). The cognitive skills surround attention and knowledge processing, whereas behavioural skills include working properly in class, organising work, and developing alternatives (Diamond, 2013). Children with weak cognitive and behavioural skills easily lose interest and engage in other activities. This would result in teachers having to repeat themselves and lose valuable time. Repetition during lessons is sometimes linked to ineffective auditory skills, such as struggling to listen to the teacher and experiencing difficulties understanding or communicating a message. A child's struggle to understand information often leads to further distractions. Being distracted equates to missing vital information, ultimately impeding the ability to learn effectively.

Hence, effective learning requires executive function skills (Diamond, 2013). Executive functions can be applied in various ways, such as mediated learning (Grévisse et al., 2019). Mediated learning occurs when teachers provide the necessary support using learning and teaching materials. On the portal IIEP Learning Portal (2023) UNESCO defines learning and teaching materials as items that improve teaching instructions in schools. The items include textbooks, instructional guides, printed materials, and multimedia resources (IIEP Learning Portal, 2023). In the foundation phase (Grade 1-3), learning and teaching materials include multisensory objects, visual displays, and models that strengthen cognitive operations (Gogoi, 2015). This is because the objects enable learning engagement. Thus, this study explored learning and teaching materials that foster executive function in kindergarten. The kindergarten year was selected as a primary class since it prepares children for formal school, first grade and onwards.

The concept of learning and teaching materials provides the idea of a vehicle that permits the attainment of learning objectives (Onyango, 2014). The exact vehicle sparks imagination and fun while acquiring the necessary knowledge. The materials are vital for learning since they stimulate learning processes (Rotshak et al., 2021). Therefore, the literature highly recommends its use as it cultivates cognitive development in children. Selzing-Musa and Obinna (2022, p. 41) define "cognitive development as mental or intellectual processes that occur in humans. It is the construction of thought processes that involve remembering, decision-making, and problem-solving". The definition is similar to executive functions, as the skill encompasses the same mental operations (Ibbotson, 2023). The operations include remembering, recognising, and comparing information, similar to what working memory and cognitive flexibility do. Without the skill, learners struggle to learn effectively or work

flexibly during tasks (Ibbotson, 2023). Therefore, mental operations consider the steps needed to achieve a goal.

Learning and teaching materials are unique since they aid teachers and learners during lessons (Davis, 2021). For teachers, materials help with knowledge transmission, whereas for learners, they enable knowledge to be acquired using their senses (seeing, touching, and experimenting). According to Bušljeta (2013), materials aid the teaching and learning; clarify and explain information; spark interest and imagination; develop different skills; promote participation; and improve independent learning. In this way, the learners are placed at the forefront of thinking about how the resources can be utilised, making them less dependent on the teacher and initiating their learning (Gogoi, 2015).

Research Problem

Adults should foster learning environments that enable children to discover, operate, and test various objects. This will prompt their ability to question, envision, and form new ideas. However, various families may struggle to provide such services due to socio-economic challenges (Haft & Hoeft, 2017; Matope, 2021). Segooa and Molise (2023) found minimal learning materials were used to prepare kindergartners for formal school. These materials would have enabled cognitive development and taught various skills in school (Haggai & Shwamut, 2016; Matope, 2021). Gogoi (2015) noted that the more experiences a child is exposed to, the richer the learning outcome will be. Children who play and discover are most likely to develop greater neural connections, essential for learning. Therefore, creating a rich and stimulating environment should involve providing versatile materials children can engage with (Isaacs et al., 2019). This study addresses this gap by highlighting various materials used in South African kindergarten years to develop executive function skills.

Research Aim and Research Question

This study investigated the following research question: What resources do kindergarten teachers utilise to foster executive function skills? The contribution of this article is to outline learning and teaching materials that can promote executive function skills in kindergarten.

There is substantial information on the strategies and practices that promote the growth of executive functions (Grammer & Ahmed, 2023; Gunzenhauser & Nuckles, 2021). However, learning and teaching materials that foster executive function skills in kindergarten have not been emphasized enough (Gauteng Department of Education, 2012). This paper seeks to broaden the dialogue of developing executive functions by highlighting the kinds of learning and teaching materials that foster the skill in the early years.

Literature Review

Being that executive function surrounds cognitive operations, the following section outlines the framework of kindergartners' mental operations, as well as how their cognitive skills are enhanced using learning and teaching materials. The literature review ends by noting the implications of poor learning environments and their impact on executive function skills.

Cognitive development in kindergarten

Cognitive development encompasses mental operations that occur in kindergarten. These operations include remembering, thinking, and resolving obstacles (Goswami, 2011). The evident traits of cognitive development include symbolic thought, which is the ability to visualise items that are not physically present. Symbolic thought is exercised through make-believe or pretend play. Furthermore, the children understand the relationship of cause and effect – the result of actions that can transpire.

Kindergartners also premeditate their actions when working towards a goal (Goswami, 2011). This assists them in considering what actions to take to achieve the goal. The probing of events, such as exploring how, when, and why things occur, sparks children's interest in various subjects. The only cognitive battle kindergartners struggle with during this phase is focusing on long tasks (Selzing-Musa & Obinna, 2022). This is why teachers are encouraged to incorporate different learning and teaching materials to keep children engaged in tasks. Cognitive development also transpires through compartmentalisation of ideas; the ability to process different thoughts and information (Doebel & Muller, 2023; Patil et al., 2021). This is attained using cognitive skills such as differentiating, comparing, or analysing objects. Kindergartners can also recall events, primarily through storytelling. The stories are associated with feelings and are recounted in sequences of events (Levine & Munsch, 2016; Selzing-Musa & Obinna, 2022).

Cognitive development often transpires in the prefrontal cortex as it regulates cognitive operations such as decision-making processes (Levine & Munsch, 2016). Studies, however, discovered that neighbouring parts, such as the temporal lobe and Wernicke area, also influence the development of the skill (Fitzpatrick, 2014). These cognitive areas assist thought processes, helping children to/ learn new information. Thus, it enables cognitive development when lessons utilise learning and teaching materials such as cards, charts, and models. Pereira et al. (2021, p. 2) note that "it is therefore necessary to understand which resources or toys enhance children's cognitive development, to offer such toys to children in their daily routines, so as to provide stimulation". Cognitive stimulation transpires when kindergartners can manipulate, engage, and alternate the learning materials (Patil et al., 2021).

The cognitive skills acquired through learning and teaching materials

According to Goswami (2011), cognitive skills surround making sense of information by arranging or directing how information can be stored. The skill is vital for learning because it allows the application and engagement of knowledge. Especially when a topic is deemed complex, materials facilitate knowledge processing, and they can operate differently (Rotshak et al., 2021). Muñoz Oyola (2011) noted various cognitive skills that can be acquired when embedding learning and teaching materials during lessons, including the following:

- Identification: the ability to recognise an item's trait. Children can name and explain the purpose of items. Identification enables other skills, such as comparing or classifying objects.
- Differentiation: includes identifying unique traits and describing how they differ. This requires paying attention and analysing objects to explain how the items are different.
- Classification: grouping or arrangement of materials based on similarity. Classification can also occur by identifying what the object is used for.
- Comparison: analysing two or more materials. Noting their characteristics and determining whether similar ideas exist in others. Notice if there is any sameness.
- Decoding: applying language to explain the traits of an item. Exposure and interaction with different and similar objects enhance a child's vocabulary.
- Analysing: observing objects and information. This includes using sensory senses such as seeing, touching, and hearing to inspect or process information.
- Synthesising: integrating different ideas to form new knowledge; for example, comparing information can lead to item grouping/classification.
- Memorisation: mentally storing information to use at a later stage. Exposure to various items significantly helps children recall details.

Thus, to understand whether an item has achieved its objective, one must consider its purpose (Gogoi, 2015). Learning and teaching materials should enable in-depth understanding of the topic,

broaden thought patterns, and develop further ideas (Gogoi, 2015). These actions lead to cognitive development and mental stimulation. The above-mentioned points outline various cognitive skills that can arrange and direct children's thought processes. Since young learners are susceptible to becoming uninterested or frustrated during lessons (Selzing-Musa & Obinna, 2022; Veijalainen et al., 2019), intentional effort should be placed on exploring the kind of learning and teaching materials that assist with the development of executive function skills.

Learning and Teaching Materials in the South African context

According to the Gauteng Department of Education (2012), materials used in South African classrooms are called Learning and Teaching Support Materials (LTSM). The materials encompass resources that enable effective teaching and learning, facilitating curriculum delivery (Koornhof & Milligan, 2015). Riet (2015) categorises LTSMs into different categories that include:

1. Consumable items: items that can be depleted after their use, for example, pencils or a rubber
2. Non-consumable items: items intended for long-term use, mainly over the years, such as textbooks
3. Library resources: information for research and recreational purposes
4. Other resources: practical tools such as overhead projectors
5. E-learning materials: digital resources and electronic devices

LTSMs play a critical role when teaching as they provide support during lessons. This enables the teacher and learner to reference information and build upon existing knowledge (Riet, 2015). The function enhances comprehension and guides students to complete tasks effectively, improving academic performance (Koornhof & Milligan, 2015). Aligned with 2012's Learning and Teaching Support Material policy, the document outlines different materials used for teaching and learning and explains how learners can use the items effectively (Riet, 2015). Research by Grossman and Thompson (2008) has highlighted that the effective use of materials depends on the teaching approach educators employ. A learner-centred lesson will employ materials learners enjoy, versus a teacher-centred lesson could opt for materials the teacher deems best. LTSMs often complement the teacher's teaching style (Milligan et al., 2019).

It is worth noting that the resources highlighted in the 2012 policy document include textbooks and teacher guides (Gauteng Department of Education, 2012). Unfortunately, the reading materials lack explicit examples of materials that could foster executive function skills. Furthermore, the LTSMs highlighted do not cater for play-based learning, which is essential for promoting cognitive development and learning in kindergarten years. Therefore, this study seeks to address this gap.

Poor learning environment and its implication for executive functions

Duval et al. (2017, p. 39) noted that "poverty-related factors may impact brain function and cognitive development." This is because its force hinders the growth of executive function skills (Haft & Hoeft, 2017). Since executive functions involve assessing and understanding information, limited or deprived environments affect the kind of ideas and knowledge a child holds (Huang et al., 2022). Secondly, cognitive operations determine how people engage and react, thus influencing their self-regulatory skills. Levine and Munsch (2016) stated that the mindset of children from disadvantaged homes gradually grows, affecting how quickly they can master a skill or comprehend a thought. This phenomenon occurs because cognitive stimulation activates working patterns in the brain; therefore, if cognitive operations are inactive, little learning can occur.

Blair and Raver (2016) found that underprivileged homes have poorer vocabulary and executive function skills. Reasons often relate to limited opportunities that could expand or strengthen language and executive function skills. Environments that are exposed to danger, hostility, delinquency, and tension also hinder neurocognitive development. This consequently affects the growth of executive function skills (Doebel & Muller, 2023). Therefore, schooling environments need to include resources that permit language development and interactive games that counter hostility or tension; these would ease the development of executive function skills (Haft & Hoeft, 2017). If a learning environment (particularly in low-income communities) lacks the necessary resources and support, the goal of developing executive functions becomes harder to attain (Van der Merwe, 2010).

Following a literature review of the research topic, it became evident that specific gaps have not been addressed. These include outlining resources that can develop executive functions in poorer areas; vocabulary resources that can enhance executive function skills; play-based learning materials that promote cognitive stimulation; as well as explicit examples of how resources are applied during lessons. This study addresses these gaps (Gauteng Department of Education, 2012; Grossman & Thompson, 2008; Haft & Hoeft, 2017; Van der Merwe, 2010).

Lev Vygotsky introduced the concept of the Zone of Proximal Development (ZPD) as part of his efforts to describe cognitive skills. ZPD embodies a range of tasks children can perform with guidance and support rather than operating independently (Bodrova & Leong, 2015). This belief highlights what children can achieve independently versus what they can accomplish with supervision (Garhart Mooney, 2013).

ZPD is represented through three concentric frames. These frames include the innermost part, which represents the knowledge that children already possess; the middle part encompasses the skills children still need to learn; and the outer part embodies the skills children have not yet attained. The effective use of ZPD is facilitated during interactions with knowledgeable persons; these include parents, teachers, peers, and friends who help attain the intended skill. Yogman et al. (2018, p. 4) noted that “scaffolding is a part of guided play; [where] caregivers are needed to provide the appropriate amount of input and guidance for children to develop optimal skills”. Therefore, scaffolding becomes integral to this study since learners are guided to reach the learning objective by observing and imitating actions (Grévisse et al., 2019).

Understanding the ZPD is crucial for educators, as it informs them how instructional tools can guide children in acquiring the necessary knowledge/skills (Garhart Mooney, 2013). In this study, the ZPD is utilised to examine how learning and teaching materials enabled teachers to develop executive functions in kindergarten. The learners were guided to apply the skills independently. Its focus lies on the interaction between the expert (the teacher) and the child (learners); the theory suggests that knowledge is obtained through engagement, which is noted to be a learning experience. Concerning this study, learning and teaching materials were employed by educators to model how executive function skills could be developed (Grossman & Thompson, 2008).

Materials and Methods

The choice of a qualitative approach was deemed most suitable for this research model, as it allowed the investigation of the phenomenon and allowed the participants to construct their knowledge (Lodico et al., 2010). The researcher also employed a case study to obtain comprehensive knowledge of how learning and teaching materials can foster executive function skills in kindergarten.

Sample and Participants

Purposeful sampling was utilised to identify study participants. Since the researcher included four private schools in Pretoria, eight teachers[YuS1] (two from each school) agreed to participate. The inclusion criteria included being a kindergarten teacher, teaching in the first language, having an education qualification (degree or diploma), and having at least four years of teaching experience. As a result, the study only managed to obtain female participants since male teachers in the foundation phase were hard to find. All participants had a Bachelor of Education, highlighting their pedagogy training. Lastly, the number of teaching years ranges from a minimum of 5 years to a maximum of 21 years of teaching experience, providing valuable information on learning and teaching materials that can foster executive function skills in kindergarten (Patil et al., 2021). The participants taught four-year-olds. The purpose of focusing on this age reveals what literature reveals: executive functions rapidly grow from 3 to 5 years (Diamond, 2013; Fitzpatrick, 2014). These children are preparing for formal school.

Instrument and Procedure

The data gathering techniques comprised semi-structured interviews and classroom observations (Lodico et al., 2010). This was done to share personal experiences and offer insights into how different learning and teaching materials foster executive functions during lessons. Before collecting the empirical data, ethical clearance was obtained from the University's Ethics Committee, Faculty of Early Childhood Education; the Department of Basic Education; and parents, teachers, and principals consenting to conduct the study in primary schools. Semi-structured interviews were conducted once an hour to capture the different perspectives; the researcher used a phone recorder to record the participants' answers. Classroom observations were also done only once, lasting 3-5 hours for each teacher. This aimed to see how learning and teaching support materials enabled executive function skills. The results obtained using both techniques are outlined under the Discussion.*Data Analysis*

After completing the semi-structured interviews and lesson observations, the researcher commenced data analysis by first organising all collected data. This consisted of transcribing the audio recordings and reviewing the field notes. The researcher went on to classify, as well as categorise emerging themes from the data. These themes were systematically arranged in units and stored in digital files. The thematic categories aligned with answering the research question. This enabled the study to obtain relevant findings.

Results

This research contributes knowledge of materials that foster executive function skills in kindergarten. Responses were obtained from teacher interviews and classroom observations.

The participants shared the following:

T1: "we're using sounds [to] listen to songs...we go outside to write with chalk...then we practise [writing these letters]...we have worksheets with just [that] letter". T1's response illustrates how teachers utilise music to reinforce concepts in lessons.

T2: "lot of uhm...tactile [objects]...we're trying to avoid as much bookwork at this stage, so they can actually use everything through their senses". The objects promote cognitive flexibility by exercising the skill.

T3: "counters, big pictures letter, and characters story". Materials that enhance visual learning and memorisation.

T4: “routine chart or timetables, behaviour charts, your school routine charts, my school rules chart, and rewards charts.” The materials helped regulate behaviours and learning activities, and rewarded appropriate class behaviors.

T5: “De Bono’s thinking hats, Kagan strategies, the philosophy for children, games...we have little cards and things”. The resources not only stimulate learning but also allow learners to have fun.

T7: “Kagan quiz card”. The activity allows knowledge to be studied in pairs, developing confidence, learner engagement, and sharing knowledge.

T8: “play stations”. Most participants used these spaces to enhance learners’ cognitive flexibility. The stations contain different tasks based on a single concept. The stations perform different tasks based on a single concept. The space encourages learners to try different techniques and discover alternatives.

The researcher further asked: Do you think a school with fewer resources (poorer context) would hinder your ability to implement the training of these mental skills? Please justify. This question explored whether the learning context affected the form of implementing executive functions.

Thus, T1 mentioned: “I think there are two ways to look at it. I think if I was a teacher who had experienced a way of teaching like this and having been exposed to the learning materials that I can use...uhm...I think it would be completely different if I had to work in a poorer environment when I’ve started here [richer school]”.

T2 agreed that: “it’s very much up to the teacher and what she puts into it; bring it into ideas they know”.

T3 shared that: “[she] taught at all these schools, all the types of schools...you have to be very creative; make toys from scrap materials”.

T8 also said: “it would definitely make it more difficult; I’m not saying that you couldn’t do it, but it would definitely make it more challenging”.

T6 added, “if [teachers] have access to some sort of internet, then they could go and develop themselves. So, if you’re in a school like that [under-resourced], it doesn’t mean that you must not do anything because there are no resources; you could develop yourself... If you have a teacher who’s passionate and wants to build herself, she can do it; you can ask for the community to help you with...objects and scrap things and old boxes and things to make things so [ultimately] you could”.

The observation notes were as follows:

Most of the used learning materials were created by the teachers themselves. Furthermore, the learners were provided with various toys and games to stimulate the learning of concepts (T02, T01). Some items included stationery such as papers and coloured pencils (T05), while others used natural and recycled objects (T04, T06). All schools were richly resourced, providing insights into the context in which schools are located (urban areas). The use of various resources enables teachers to alternate materials, as well as promote cognitive flexibility during lessons.

Interestingly, teachers hardly used technological devices with the learners (T01-T08). Thus, teachers embedded tactile materials, such as toys, to ensure learners remained engaged in lessons. All the classrooms had routine charts, timetables, and reminders which helped regulate daily tasks; these reminders helped learners’ working memory to recall various information (T01-T08). About self-regulation, classroom rules and pictures were displayed on walls. The classrooms also had behaviour

charts that rewarded learners for good or bad behaviour (TO3, TO1). Cognitive flexibility was fostered when TO2 required learners to use their senses (touch, smell, and hearing) to identify what was in a concealed bag. The learners had to depend on their senses to identify items in the bag. TO8 also required her learners to identify words that sounded the same and words that rhymed with each other (based on the pictures the teacher showed). Each picture showed how words were written, but learners had to select the pair that sounded the same.

In every lesson, the participants ensured learners had only what they needed for the task. This was done to ensure learners would not get distracted by materials they did not need. Therefore, the teacher's ensured learners were always organised before completing a task.

Discussion

The study explored learning and teaching materials that foster executive functions in kindergarten. The materials described often relate to incorporating children's senses, such as seeing (using visual materials), touching/feeling (using tactile objects), hearing (listening to songs), and speaking (using oral materials).

Visual materials include pictures, letters, and charts. These large items helped grasp children's attention, agreeing with Selzing-Musa and Obinna's (2022) description of learning materials in kindergarten years. According to Davis et al. (2017), visual materials play a vital role in explaining what a teacher intends to convey and simplifying thought processes. The materials activate cognitive skills such as analysing, identifying, and classifying objects (Muñoz Oyola, 2011). These objects were often introduced through mediated learning, corroborating Grévisse et al.'s (2019) view about using resources to support knowledge acquisition. However, the teacher guides give kindergartners room to reach the learning objectives themselves (Grossman & Thompson, 2008). Other visual materials noted in classrooms included behavioural guides such as conduct rules, which state how learners ought to behave during lessons. These guides were displayed on boards and posters to outline appropriate behaviour and remind children how to respectfully engage with one another (Zondo & Mcube, 2022). With the behavioural guides, examples include raising one's hand to speak; keeping your desk tidy; packing away toys at the end of a task or using kind words when speaking to others. These points were also outlined in the Department of Education conduct rules (Department of Education, 2008). The executive functions developed through visual materials include self-regulation, as it guides engagement and behavior in classroom activities. Secondly, the working memory was also strengthened by reminding kindergartners how to uphold themselves (Koepp et al., 2022). Without memorizing the information, learners would struggle to follow instructions correctly, use the tools provided, or complete a task.

An interesting factor surrounding visual materials is that teachers hardly use technological devices. This finding was expected since Eberhart et al. (2023, p. 3) found that "kindergartners' engagement in exergames or touchscreen games predicted lower cognitive flexibility skills in second grade, but higher engagement in puzzle games predicting higher cognitive flexibility skills in second grade". Teachers preferred using materials children could engage with since electronic games might not constantly improve executive functions in the latter years.

When using tactile objects, kindergartners experience working with objects such as counters, puzzles, and chalk; this develops their knowledge of different kinds of learning material – the characteristics (Mwania & Murithi, 2017; Onyango, 2014). During lessons, one activity had children guessing the objects in a concealed bag; this ultimately promoted discovery learning while working with tactile objects. The teacher then encouraged the children to practise using the objects in outdoor areas. According to Fermin et al. (2024, p. 56), "if children are taken to alternative environments, their

awareness of the material presented to them may become more tangible and easier to understand". Carson and Boyd (2024, p. 47) noted that "active outdoor play and access to green space is associated with ... better attention behaviours, self-regulation, and improved spatial working memory". Both studies highlight the value of working with tactile objects in outdoor spaces, enabling better cognitive operation. Apart from outdoor areas, tactile objects were explored in different play stations. According to Pereira et al. (2021, p. 2), the ability to "play with toys in various ways reflects exploration and discovery of possibilities. This can increase opportunities for the development of creativity and imagination, as well as skill development". Play stations, in this case, promoted the ability to think in different ways, enhancing cognitive flexibility. Therefore, when embedding tactile objects during lessons, teachers should remember to allow the exploration of materials in different ways. Besides developing cognitive flexibility when working in different play stations, kindergartners also obtained problem-solving skills and different learning techniques when engaging in various activities (Grammer & Ahmed, 2023). These skills all speak to exercising executive function skills.

Traditionally, children learned in classroom environments with basic objects such as tables, chairs, boards, paper, and pencils (Fermin et al., 2024). However, materials today need to be fun to prevent boredom and frustration from occurring during lessons (Isaacs et al., 2019; Patil et al., 2021). The materials should also be suitable for practising cognitive and physical skills, enabling learners to utilise the objects needed in a class and complete the tasks accordingly (Gogoi, 2015; Patil et al., 2021). This is why literature notes use toys to promote executive function behaviour. Toys include building blocks, dimensional blocks, tricycles, balls, cards, costumes, and game boards (Gibb et al., 2021; Koepp et al., 2022). Because kindergartners often lose their attention quickly, the teachers selected materials children could engage with (Bušljeta, 2013; Gogoi, 2015). These were often toys that revealed what children were interested in. Then, listening to songs also played a vital role in providing instructions and imparting knowledge during lessons. According to Hargraves (2022), music and movement games help develop children's executive function skills by encouraging them to move in specific ways while coordinating their actions through lyrics. The songs grasped kindergartners' attention and helped them perform activities correctly (Rodriguez-Gomez & Talero-Gutiérrez, 2022). This process engages both inhibitory control and working memory. Music allowed dance and physical activities to transpire, stimulating cognitive development.

Some ways teachers can train young children to think in different ways are by applying oral materials. According to Yogman et al. (2018, p. 3), the materials "encourage the use of more sophisticated language to communicate with playmates and develop common rule-bound scenarios". Language development has been found to improve executive function skills (Shokrkon & Nicoladis, 2022). Therefore, applying oral materials during lessons would enhance executive functions in kindergarten. This study utilized De Bono's thinking hat since it stretched learners' cognitive skills using different thinking strategies. The strategies are represented through six colours: blue (decision-making), white (gathering information), green (developing ideas), yellow (considering the benefits), red (exploring feelings), and black (considering the dangers). Each colour trains learners to work using a different mindset; for example, gathering necessary information or considering possible dangers of a task. De Bono's thinking hat developed problem-solving skills and goal-directed behaviour (Patil et al., 2021). Then, with the Kagan Quiz, this card game entailed answering questions when paired with someone else. The executive function skills developed through the Kagan Quiz game surrounded self-regulation (since learners had to collaborate with peers) and cognitive flexibility (switching roles when working in pairs).

For the participants, executive function does not only develop in affluent spaces; poorer areas can develop the skill too. The statement corroborates Yogman et al.'s (2018, p. 9) finding that "creativity and play are enhanced by many inexpensive toys (eg, wooden spoons, blocks, balls, puzzles, crayons, boxes,

and simple available household objects)". Developing or fostering executive functions mostly depends on teachers' willingness to innovate and utilise different learning items (Kobayashi, 2023). Resources such as the Internet, books, and social media note how executive functions can be developed differently (IIEP Learning Portal, 2023). Teachers only need exposure to these learning and teaching materials. Therefore, knowledge and awareness are required to allow teachers to foster executive function skills using learning and teaching materials (Isaacs et al., 2019; Patil et al., 2021).

Limitations of the Study

This study took place in wealthier areas of Pretoria. This study was to observe how well-equipped classrooms utilised different learning and teaching materials to foster executive function. The study could have benefited from exploring resources in poorer learning areas. The second limitation is that the study occurred in private schools. Exploring this research in public schools could have helped the researcher compare whether learning and teaching materials are similar or different. Lastly, the study applied a qualitative approach, limiting the findings to the participants' experiences.

Conclusions

Developing executive functions is essential for teaching and learning experiences. Although South Africa has an LTSM policy document outlining resources that can be embedded in lessons, it fails to stipulate how its resources foster executive function skills in kindergartners. Therefore, this article outlined learning and teaching materials that can foster executive function skills before formal schooling. The study found that visual materials, tactile objects, songs, and oral materials were employed, allowing kindergartners to recall information, follow classroom rules, and work with items differently. Apart from enabling cognitive stimulation, learners' senses were enhanced. Selected resources are subject to teachers' creativity and innovation; the study also found that the same resources can be applied in poorer learning areas.

Suggestions for future research

Although empirical data found that school resources play a vital role in developing executive functions, what is still unknown is whether resources are supported and utilised at home. Therefore, future research can explore learning materials or toys that develop executive functions at home. The study could also explore how outdoor spaces (like playground areas) promote executive function skills training. This helps note how different spaces utilise different materials to enable executive function skills. In conclusion, the following paper recommends kindergarten teachers to:

- Exposing kindergartners to various materials will strengthen their cognitive abilities.
- Utilise various materials as long as they fall within the constructs of developing executive function using play.
- Avoid store-bought, expensive materials; instead, use natural or recycled objects.
- Guide children to work with specific material to develop their executive function skills.

Assess whether the materials enhance executive functions or not.

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