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Integrating Storytelling and Inquiry-Based Approach as Pedagogies of Developing Scientific Skills in Early Childhood Classrooms

Zukiswa Nhase [1] & Bekithemba Dube [2]

[1] Department of Childhood Education, Faculty of Education, University of the Free State, South Africa.
[2] Department of Curriculum Studies and Higher Education, University of the Free State, South Africa.

ABSTRACT

Early childhood education (ECD) provides a foundation for a child's cognitive and social development. In this context, nurturing scientific skills from an early age is crucial for fostering curiosity, analytical thinking, and problem-solving abilities. This theoretical paper explored the potential of integrating storytelling and inquiry-based approaches as effective pedagogies for developing scientific skills in early childhood classrooms. Storytelling is the use of narratives to convey information, values, and emotions. An inquiry-based approach is the use of questions, investigations, and evidence to explore a topic or problem. Over the years, students have performed poorly in science, igniting the need to reinvent other methods to help improve scientific instruction and learning in early childhood schools. Observing the kind of attitude that most learners have towards this subject, it has been argued that there is a need to consider ways and methods with which science can be made accessible and relevant to all levels of learners across the schooling system. Underpinned by bricolage, this interpretive theoretical paper sought to respond to two questions. What are the challenges and opportunities of learning science in the ECD phase and how can storytelling and inquiry-based approach mediate the learning of science instruction in the ECD phase? Findings revealed that while storytelling is known to create a fun-relaxing environment for young children when integrated with an inquiry-based approach, it has the advantage of developing scientific concepts and skills in a non-threatening environment. Young children learn best through play, games and stories and it is vital to make any learning experience relevant to their context. This study contributes to the body of knowledge by using bricolage as a theoretical foundation to encourage the use of games as a readily available local resource to enhance early childhood teaching and learning.

Keywords: *Early Childhood Education, Storytelling, Inquiry-Based Approach, Science Learning and Decoloniality Theory*

Correspondence
Zukiswa Nhase
Email: NhaseZ@ufs.ac.za

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INTRODUCTION

Early childhood education is referred to as a field that may stimulate learners' natural curiosity and enthusiasm for learning about their surroundings.[1] Additionally, it is imperative to understand that young children as defined by Howitt are capable and inquiry-skilled to view the world through play, which leads them to be successful in science-related disciplines.[2] The integration of play and hands-on activities to assist children's learning of

[1] Todd Milford and Christine Tippett, "The Design and Validation of an Early Childhood STEM Classroom Observational Protocol.," *International Research in Early Childhood Education* 6, no. 1 (2015): 24–37.
[2] Christine Howitt, "Understanding How Children Learn Science," in *The Art of Teaching Primary School Science* (Routledge, 2021), 20–35.

science is a current concern for early-grade education professionals.[3] To accommodate children's capabilities in early childhood years, it is important to consider various pedagogies such as the use of play. For example, the South African Curriculum Framework envisages promoting learning that helps every child develop knowledge, skills, attitudes, and behaviours for a successful life.[4] As a result, the curriculum makes sure that South African Early Childhood Development (ECD) programmes are founded on a comprehensive approach to learners' growth and learning, which can support them to pursue science-related subjects.[5] Further on, at the ECD level of learning, the Life Skills curriculum's initial knowledge study area includes science.[6] Walan emphasises the significance of fictional stories as a possible tool to enhance learning and reinforce memory as well as to evoke and inspire the imagination to promote and develop scientific abilities in the early years of learning.[7] According to Walan, storytelling is a very effective approach to teaching science to young children.[8]

In their research, Piasta et al., also emphasised that early childhood education teachers have been given the responsibility of helping their students develop their creative, scientific and technical abilities.[9] Their research looked at the effects of early childhood educators' professional development in the areas of math and science considering recent initiatives that emphasised the need to better assist preschoolers' learning in those subjects. The scholars found that opportunities for learning supply in science as compared to maths were significantly provided by professional development settings. The beneficial connections between math and science learning opportunities highlighted the fact that early childhood education teachers are tasked with helping their students develop their technical, scientific and creative abilities. Their study looked at the effects of professional development in the fields for early grade educators considering recent initiatives that emphasised the need to improve the early learning of math and science. The findings of their study showed that serious efforts are required to guarantee that learners have the ability to learn math and science from their early years.

Walan and Enochsson, in their study, found that inquiry and context-based teaching methodologies have been shown to promote and encourage learners' interest in studying science.[10] This finding supports the significance of science for young children. Teaching strategies that are inquiry and context-based inspire and engage students to pursue science. The study involved twelve teachers who had used inquiry and context-based teaching strategies in primary schools. Teachers were exposed to a teaching style from a European initiative where inquiry and context-based education (IC-BaSE) methodologies were combined through participation in a continuous professional development (CPD) programme. The study's findings demonstrated that teachers thought the new teaching model was a helpful addition to the one instructional method that existed. However, it was also clear from the instructors' comments that they did not consider how their decision-making in terms of teaching methods or objectives related to students' comprehension of the subject matter at hand. Teachers spoke on the use of inquiry prior to the CPD programme mostly in terms of how much students like doing practical work. Following the session, they identified further justifications for utilising inquiry and spoke about the significance of understanding the justifications for conducting an inquiry.

Drawing from various literature discussions about science teaching strategies in early childhood settings, it was observed that young children need to be actively involved in learning about the world scientifically, by raising questions, collecting data, making observations and communicating their findings.[11] Thus, young children find it interesting to learn and comprehend new ideas, skills and knowledge when the pedagogy of teaching relates to their context and environment. While the literature emphasised the need to use stories to teach science to young children, this research is distinctive in that it provides and explores the potential

[3] Berrin Akman and Sinem Güçhan Özgül, "Role of Play in Teaching Science in the Early Childhood Years," *Research in Early Childhood Science Education*, 2015, 237–58.
[4] Marietjie Oswald and Estelle Swart, "Addressing South African Pre-Service Teachers' Sentiments, Attitudes and Concerns Regarding Inclusive Education," *International Journal of Disability, Development and Education* 58, no. 4 (2011): 389–403.
[5] Michaela Ashley-Cooper, Lauren-Jayne van Niekerk, and Eric Atmore, "Early Childhood Development in South Africa: Inequality and Opportunity," *South African Schooling: The Enigma of Inequality: A Study of the Present Situation and Future Possibilities*, 2019, 87–108.
[6] Department of Basic Education, "Curriculum and Assessment Policy Statement (CAPS): Creative Arts Final," 2011, https://www.education.gov.za/Curriculum/CurriculumAssessmentPolicyStatements(CAPS).aspx.
[7] Susanne Walan, Pernilla Nilsson, and Birgitta Mc Ewen, "Why Inquiry? Primary Teachers' Objectives in Choosing Inquiry-and Context-Based Instructional Strategies to Stimulate Students' Science Learning," *Research in Science Education* 47 (2017): 1055–74.
[8] Walan, Nilsson, and Ewen, "Why Inquiry? Primary Teachers' Objectives in Choosing Inquiry-and Context-Based Instructional Strategies to Stimulate Students' Science Learning."
[9] Shayne B Piasta et al., "Professional Development for Early Childhood Educators: Efforts to Improve Math and Science Learning Opportunities in Early Childhood Classrooms.," *Journal of Educational Psychology* 107, no. 2 (2015): 407.
[10] Susanne Walan and Ann-Britt Enochsson, "The Potential of Using a Combination of Storytelling and Drama, When Teaching Young Children Science," *European Early Childhood Education Research Journal* 27, no. 6 (2019): 821–36.
[11] National Research Council, *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas* (National Academies Press, 2012).

and challenges of introducing science in early grades. The article goes on to describe how to teach science in early-grade settings using pedagogies like storytelling and an inquiry-based approach. Lastly, this paper explores how integrating storytelling and an inquiry-based approach might help early childhood educators foster the development of scientific abilities in young students. The paper is organised as follows, considering the article: the philosophy of the research, problems, and opportunities in blending storytelling with an inquiry-based method. The next section explains bricolage as the study's theoretical foundation.

THEORETICAL FRAMEWORK

Bricolage

Bricolage is used as a theoretical base of this article. Educational settings must use a bricolage approach to address the lived realities in the context of the difficulties in teaching science to young children. A bricoleur is a person who practices bricolage and can make the best use of "at-hand" tools and resources to meet the issue at hand.[12] Bricolage refers to the methods used by individuals to collect items from other social groups to forge new cultural identities to better people's lives, particularly in impoverished areas.[13]

According to Kincheloe, bricolage focuses on processes, linkages, and connections between things.[14] Bricolage becomes the perfect method to elicit resilience since it originates from locally accessible resources and presents an upbeat attitude because resources are an issue in early childhood education and learning.[15] As a result, it "facilitates creative thinking because it encourages seeing new correlations between seemingly dissimilar objects." Thus, according to Blankenship, bricolage may be used for objectives that promote the observing of inventions in the form of new "services" from preexisting materials.[16] The next section explains the research methodology adopted.

METHODOLOGY

This qualitative paper utilised the interpretive theoretical approach. Regarding the current article, the combination of bricolage, story-telling and inquiry-based approach allows young children to creatively explore scientific concepts. Children can use everyday materials to ask questions, design experiments and construct their understanding of the natural world.[17] Integrating these approaches can provide a more holistic learning experience. Children not only gain scientific knowledge but also develop problem-solving, critical thinking and creativity skills.

The bricolage theory, storytelling and the inquiry-based method are all complementing approaches that can significantly improve the way that young children are taught science. For their young students, educators may foster a love of science and encourage the growth of critical thinking abilities by promoting active inquiry, creativity and hands-on discovery. These strategies place a high value on child-centred learning, in which children actively participate in their education. This may result in learners who are more motivated and engaged. The next section focuses on the first research question which addresses the challenges and opportunities of teaching and learning science at ECD.

FINDINGS AND DISCUSSION

Challenges and Opportunities of Learning Science in ECD

a. Lack of trained science teachers at the early childhood level

It is not a hidden fact that teachers at the ECD level are not trained as science teachers, however, they are trained as generalists, as everything taught in their classrooms solely depends on them.[18] Subsequently, early childhood teachers are trained to teach literacy, mathematics and life skills and they are equipped to teach these subjects in their undergraduate degrees or qualifications.

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[12] C. Lévi-Strauss, *The Savage Mind* (Chicago, IL: University of Chicago Press, 1966).
[13] Jenny Phillimore et al., "Bricolage: Potential as a Conceptual Tool for Understanding Access to Welfare in Superdiverse Neighbourhoods," *IRiS Working Paper Series* 14 (2016), 8.
[14] Joe L Kincheloe, "Describing the Bricolage: Conceptualizing a New Rigor in Qualitative Research," in *Key Works in Critical Pedagogy* (Brill, 2011), 177–89.
[15] Ann S Masten, "Ordinary Magic: Resilience Processes in Development.," *American Psychologist* 56, no. 3 (2001): 227.
[16] Brian Blankenship, "Promises under Pressure: Statements of Reassurance in US Alliances," *International Studies Quarterly* 64, no. 4 (2020): 1017–30; Raffi Duymedjian and Charles-Clemens Rüling, "Towards a Foundation of Bricolage in Organization and Management Theory," *Organization Studies* 31, no. 2 (2010): 142.
[17] Z Kuhlane, "An Investigation into the Benefits of Integrating Learners' Prior Everyday Knowledge and Experiences during Teaching and Learning of Acids and Bases in Grade 7: A Case Study." (Rhodes University, 2011).
[18] Angela James, Michele Stears, and Saritha Beni, "Foundation Phase Teachers' Interpretation of the Life Skills Programme with Regard to the Teaching of Natural Science," *South African Journal of Childhood Education* 7, no. 1 (2017): 1–14.

b. Inadequate coverage of science content in early childhood

In the South African curriculum, grouping different components into a single topic has been a major source of criticism. For instance, the science curriculum is merged with the life skills curriculum rather than being taught separately.[19] Thus, many early childhood educators may feel unprepared to teach science because of their lack of science expertise. They may also lack access to up-to-date and reliable sources of information on science topics and recent developments. In early childhood education, teachers hold a pivotal position as they are essential for imparting fundamental knowledge and creating chances for young learners to cultivate the necessary skills associated with mathematics, literacy and life skills, as noted by Appleton and Tytler.[20]

According to Appleton and Fleer, teaching a wide range of courses, which includes the extra complexity of covering all scientific categories, to this age group, is a substantial challenge for most ECD educators.[21] Additionally, according to Davis and Smithey (2009), science instruction in ECD classrooms must follow the proper scientific methodologies. Additionally, a teacher's level of subject matter experience may affect their capacity to pose pertinent and insightful questions. Overall, studies conducted in schools have shown that teaching science is difficult, with teachers either relying on "specialist" teachers to teach scientific subjects or avoiding teaching science because they feel inadequate to do so.[22] These characteristics together make it problematic for early-grade schools to support young learners in engaging in scientific activities. The basis for children's understanding and enthusiasm for science is laid by high-quality scientific education.[23]

c. Inadequate science apparatus to cater for early learners' cognitive development.

In most South African schools, a key difficulty is the absence of apparatus which makes it necessary for instructors to use bricolage to teach successfully. According to a study, which looked at variables influencing how scientific curriculum is implemented in preschools, by James, Beni, and Stears, the suitability of science equipment and materials has a great impact on how well science curriculum is taught in early grades.[24] The study's other goals included determining the activities preschool instructors engaged students in during science classes and evaluating the suitability of scientific tools and resources in preschools.

Inadequate student participation in some of the child-centred activities associated with the scientific method of learning, the inadequacy of science teaching materials and apparatus, inadequate storage facilities for keeping teaching and learning resources, and a dearth of science textbooks were found to be the main factors affecting the implementation of science curricula. This is a reference to the reality that scientific instruction frequently calls for practical activities, experiments, and investigations that need meticulous organisation, preparation and supervision. They might not have the time or materials to carry out these activities in their classrooms efficiently and securely given all the additional demands placed on ECD instructors (Stears, James, and Beni, 2019). The following section focuses on the opportunities which also link with the use of storytelling and inquiry-based approaches in mediating the learning of science in ECD.

Storytelling and inquiry-based approach in mediating the learning of science in the ECD

Notwithstanding the above challenges, teaching science in the early years has some benefits for both learners and teachers.

a. Teaching science stimulates interest among early childhood learners.

Even though teaching science to young children presents numerous challenges, there is still an opportunity to use or introduce science activities in ECD to grab students' attention. Early exposure to science may serve as a foundation for the growth of learners' interest in science if the activities are well-planned and delivered by instructors. Students may have the opportunity to satiate their intrinsic curiosity about the natural world by learning about science (Worth, 2010).

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[19] Department of Basic Education, "Curriculum and Assessment Policy Statement (CAPS): Creative Arts Final."

[20] Ken Appleton, "Developing Science Pedagogical Content Knowledge through Mentoring Elementary Teachers," *Journal of Science Teacher Education* 19, no. 6 (2008): 523–45; Russell Tytler, "School Innovation in Science: Improving Science Teaching and Learning in Australian Schools," *International Journal of Science Education* 31, no. 13 (2009): 1777–1809.

[21] Appleton, "Developing Science Pedagogical Content Knowledge through Mentoring Elementary Teachers"; Marilyn Fleer, "Understanding the Dialectical Relations between Everyday Concepts and Scientific Concepts within Play-Based Programs," *Research in Science Education* 39 (2009): 281–306.

[22] Tytler, "School Innovation in Science: Improving Science Teaching and Learning in Australian Schools."

[23] Hope K Gerde, Rachel E Schachter, and Barbara A Wasik, "Using the Scientific Method to Guide Learning: An Integrated Approach to Early Childhood Curriculum," *Early Childhood Education Journal* 41 (2013): 315–23.

[24] Michele Stears, Angela A James, and Saritha Beni, "Teaching Science in the Foundation Phase: Where Are the Gaps and How Are They Accounted For?," *South African Journal of Childhood Education* 9, no. 1 (2019): 1–9.

Furthermore, according to Trundle, scientific education is a crucial component of national and state standards for early childhood schools and includes process skills, creativity, experimentation and problem-solving in addition to content-based learning.[25] Trundle further asserts that scientific education incorporates procedural skills, creativity, experimentation, and problem-solving in addition to content-based learning and is a vital part of national and state requirements for early childhood institutions. According to the literature, high-quality science learning opportunities in early childhood development (ECD) lay a strong foundation for the eventual development of scientific concepts that children will encounter throughout their academic careers.[26] The fundamental knowledge and abilities help kids develop a comprehension of important scientific ideas and prepare them for later learning more challenging concepts.[27] The teachers' ability to bricolage and use locally accessible resources to spark interest in science, particularly in the context of underprivileged schools, is key to the success of this.

b. Development of thinking skills

Continuing from the preceding argument, science inherently supports the development of thinking abilities vital for human existence since it permits students to discover. Therefore, including learners in the early phases of their development of scientific thinking can encourage them to easily apply their thinking skills to other academic areas, thereby increasing their performance in school and sense of self-efficacy.[28] To eliminate accomplishment gaps in science performance, early scientific education is essential. Inequalities in racial/ethnic, socioeconomic class (SES), and gender achievement in science remain despite steady reductions across grade levels and time.[29] This study suggests the use of story-telling and inquiry-based approaches as a way to improve scientific education for young children in the absence of resources and adequately qualified science educators.

c. Storytelling and Science Learning

Since the beginning of time, telling stories has been used as a teaching and learning tool. Gürsoy defines storytelling as the art of narrating events, customs, or cultural heritage of ancestors while simulating the scenes of an event using language, vocalisation, and gestures.[30] Additionally, according to Yürük, storytelling depicts numerous people, activities, interactions, and reactions (such as emotions), as well as ideas, wants and intents from multiple points of view.[31] Additionally, storytelling is a fundamental human quality and one of the earliest forms of social interaction, communication and education.[32] The ability of storytelling to avoid racial, religious, and linguistic prejudice is also mentioned as a reason why it is an effective educational technique. Additionally, storytelling's instructional character enables the sharing of information and understanding among people from various cultural backgrounds. [33] Storytelling engages children's creativity, improves their language development, and builds their emotional relationships. It has long been an essential component of human communication. Teachers may develop a greater awareness of the natural world and make abstract things approachable by incorporating scientific themes into storytelling. Storytelling is an excellent teaching approach and learning tool that may be applied in various areas of higher education, not just ECD.[34] For example, several storytelling activities can be integrated into the teaching of science.

[25] K. Cabe Trundle, "The Inclusion of Science in Early Childhood Classrooms," in *Research in Early Childhood Science Education* (Springer, Netherlands: Dordrecht, 2015), 1–6.
[26] Haim Eshach and Michael N Fried, "Should Science Be Taught in Early Childhood?," *Journal of Science Education and Technology* 14 (2005): 315–36.
[27] Arthur J Reynolds and Herbert J Walberg, "A Structural Model of Science Achievement.," *Journal of Educational Psychology* 83, no. 1 (1991): 97.
[28] Deanna Kuhn and Susan Pearsall, "Developmental Origins of Scientific Thinking," *Journal of Cognition and Development* 1, no. 1 (2000): 113–29.
[29] Jean Lee, "Effects of Leadership and Leader-member Exchange on Commitment," *Leadership & Organization Development Journal* 26, no. 8 (2005): 655–72.
[30] Gülden Gürsoy, "Digital Storytelling: Developing 21st Century Skills in Science Education.," *European Journal of Educational Research* 10, no. 1 (2021): 97–113.
[31] S. E. Yürük, "Dijital Öykülemeye Dayalı Değerler Eğitiminin Öğrencilerin Değer Kazanımı ve Tutumlarına Etkisi [The Effect of Digital Storybased Values Education on Students' Attitudes and Value Acquisiton]" (Fırat University, 2015).
[32] Tharrenos Bratitsis and Petros Ziannas, "From Early Childhood to Special Education: Interactive Digital Storytelling as a Coaching Approach for Fostering Social Empathy," *Procedia Computer Science* 67 (2015): 231–40, https://doi.org/10.1016/j.procs.2015.09.267.
[33] Shuyan Wang and Hong Zhan, "Enhancing Teaching and Learning with Digital Storytelling," *International Journal of Information and Communication Technology Education (IJICTE)* 6, no. 2 (2010): 76–87.
[34] Wang and Zhan, "Enhancing Teaching and Learning with Digital Storytelling."

The Adventures of Curious Carl

Storyline: "Curious Carl" is a young boy who loves exploring his surroundings and asking questions. In each story, Carl encounters a new mystery or problem to solve, prompting him to use his observation and critical thinking skills. Through his adventures, children learn about concepts such as cause and effect, patterns, and basic scientific principles.[35] In the highlighted story, the scientific skills can be developed from the observation. Children can be encouraged to pay attention to details in Carl's environment and to gain questioning skills from Carl's curiosity that sparks questions. This can inspire children to inquire about the world around them. Lastly, problem-solving can be developed when children engage in critical thinking as they help Carl to solve the mysteries he encounters. In their article, Engel et al.explain that anybody who spends time with a young child would probably be able to identify being requested to read the same tale over and having the same reaction such as fascinated attention, surprise, and excitement each time as if the story were being told for the first time.[36] While the immersive ability of a good story to capture a child's heart and mind has long been used as an effective tool to support learning in the domains of language arts and social studies, it is not always an approach that comes to mind as quickly in the context of science learning, as Engel et al., continue to point out.[37]

The fundamental nature of learning via narrative, however, makes it the perfect method for fostering early learners' comprehension of science. As a result, they provide a framework for writing engaging scientific narratives in their article. Nhase described how teachers in the foundation phase utilised storytelling as an instructional strategy to get their students interested in science investigations in her research on the implementation of the inquiry-based approach (IBA) in the teaching of science in the foundation phase classrooms.[38] How these foundation phase instructors used storytelling to provide their students a place to ask questions, design investigations, and analyse current facts. Nhase also underlined the need for foundation phase instructors to have further support in using storytelling as an educational strategy to help students improve their scientific and mathematical ideas in her results.[39] Finally, she found that students were able to participate, got completely involved in experiments and studies and were at ease during the courses.

d. Inquiry-Based Approach and Science Learning

Inquiry-based education is described by Kidman and Casinader as a teaching approach that necessitates a deep understanding of pedagogy.[40] Additionally, they contend that it necessitates the formation of knowledge inside and inter-disciplines, the growth of learners' conceptual and conceptual capacities and the incentive of autonomy. Kidman and Casinader also highlight the fact that inquiry education necessitates an approach with strong communal qualities and contradicts culturally ingrained ideas of educational achievement as an individual accomplishment in their defence of the concept.[41] The domain question has then been considered concerning classroom objectives, instructional strategy and the level of teacher direction.

For the diversification of discipline-specific inquiry as well as the development of inquiry literacy in both instructors and students, it is thought that these three notions must be in alignment.[42] Similarly, Mkimbili, Tiplic, and Hedegaard define inquiry-based learning as a process that involves students in formulating research questions, creating investigational methods, gathering and evaluating data, drawing inferences from the data and conveying results.[43] According to these researchers, inquiry-based learning must be adjusted to fit the learners' context so that the instructor is aware of their educational context.[44] Despite this, Alfieri et al. note that students require support to do inquiry and that without this support they frequently struggle to maintain

[35] https://www.goodreads.com/book/show/180128104-the-adventures-of-curious-carl

[36] Alison Engel, Kathryn Lucido, and Kyla Cook, "Rethinking Narrative: Leveraging Storytelling for Science Learning," *Childhood Education* 94, no. 6 (November 2, 2018): 4–12, https://doi.org/10.1080/00094056.2018.1540189.

[37] Engel, Lucido, and Cook, "Rethinking Narrative: Leveraging Storytelling for Science Learning."

[38] Z. Nhase, "An Exploration of How Grade 3 Foundation Phase Teachers Develop Basic Scientific Process Skills Using an Inquiry-Based Approach in Their Classrooms" (Rhodes University, 2020).

[39] Nhase, "An Exploration of How Grade 3 Foundation Phase Teachers Develop Basic Scientific Process Skills Using an Inquiry-Based Approach in Their Classrooms."

[40] Gillian Kidman and Niranjan Casinader, "Inquiry-Based Teaching and Learning across Disciplines," *London: Palgrave Pivot* 10 (2017): 971–78.

[41] Kidman and Casinader, "Inquiry-Based Teaching and Learning across Disciplines."

[42] Kidman and Casinader, "Inquiry-Based Teaching and Learning across Disciplines," 4.

[43] Selina Thomas Mkimbili, Dijana Tiplic, and Marianne Ødegaard, "The Role Played by Contextual Challenges in Practising Inquiry-Based Science Teaching in Tanzania Secondary Schools," *African Journal of Research in Mathematics, Science and Technology Education* 21, no. 2 (2017): 211–21.

[44] Mkimbili, Tiplic, and Ødegaard, "The Role Played by Contextual Challenges in Practising Inquiry-Based Science Teaching in Tanzania Secondary Schools."

control over their own learning processes.[45] Inquiry-based learning, as defined by Pedaste et al. is a type of instruction where students gain information by using methods and approaches like those employed by skilled scientists.[46]

They also view inquiry-based learning as an approach to forming hypotheses and testing them through experiments and or observations with learners to uncover new casual relationships. Regarding the concept of inquiry-based learning, some scholars concur.[47] In addition to this explanation, Pedaste et al. semphasise that this type of instructional technique promotes active engagement and learner responsibility for uncovering knowledge that is novel to the learner.[48] Pedaste et al. (2015) created a new framework for inquiry-based learning that includes five inquiry stages after studying the descriptions and definitions of inquiry phases provided in several publications they examined. They are Orientation, Conceptualization, Investigation, Conclusion, and Discussion, according to Pedaste et al.[49] These academics claim that this framework covers most of the inquiry stages they have examined, and the key core phrases were taken directly from the literature they consulted for their assessment. Table 1 shows the definitions of the five components of the synthesised inquiry-based learning framework.

Table 1: Definitions of the five phases of the synthesized inquiry-based learning framework

General phases	**Definitions**
Orientation	The process of stimulating curiosity about a topic and addressing a learning challenge through a problem statement.
Conceptualization	The process of stating theory-based questions and/or hypotheses.
Investigation	The process of planning exploration or experimentation, collecting and analyzing data based on the experimental design or exploration.
Conclusion	The process of drawing conclusions from the data. Comparing inferences made based on data with hypotheses or research questions.
Discussion	The process of presenting findings of particular phases or the whole inquiry cycle by communicating with others and/or controlling the whole learning process or its phases by engaging in reflective activities.

According to Worth, teachers' explicit comprehension of the key underlying scientific principles associated with the emphasis they have selected serves as a guide for children's scientific inquiry.[50] Researchers and educators have perpetuated myths about inquiry-based learning dating back to its inception, claiming that it only emphasises the roles and participation of the learners and ignores the importance of the teachers in successfully putting this approach into practice. The duties and responsibilities of educators during this educational process as was previously noted are crucial.[51] Mkimbili et al. discovered via their research that despite contextual constraints, the practice of scientific inquiry-based learning in schools may be successful.[52] According to this perspective, encouraging the use of resources that are readily available locally can help

[45] Louis Alfieri et al., "Does Discovery-Based Instruction Enhance Learning?," *Journal of Educational Psychology* 103, no.1(2011): 1.
[46] Margus Pedaste et al., "Phases of Inquiry-Based Learning: Definitions and the Inquiry Cycle," *Educational Research Review* 14 (2015): 47–61.
[47] Bosman L. et al., *Teaching Life Skills in the Foundation Phase* (Pretoria: Van Schaik Publishers, 2016); Kidman and Casinader, "Inquiry-Based Teaching and Learning across Disciplines"; Margus Pedaste et al., "Improving Students' Inquiry Skills through Reflection and Self-Regulation Scaffolds," *Technology, Instruction, Cognition and Learning* 9, no. 1–2 (2012): 81–95.
[48] Pedaste et al., "Phases of Inquiry-Based Learning: Definitions and the Inquiry Cycle"; Martin Sedlacek and Klara Sedova, "How Many Are Talking? The Role of Collectivity in Dialogic Teaching," *International Journal of Educational Research* 85 (2017): 99–108.
[49] Pedaste et al., "Phases of Inquiry-Based Learning: Definitions and the Inquiry Cycle," 55.
[50] K. Worth, "Science in Early Childhood Classrooms: Content and Process," Early Childhood Research and Practice, Collected Papers from the SEED (STEM in Early Education and Development), 2010, http://www.predskolci.rs/HTML/Literatura/Science in Early Childhood Classrooms.pdf.
[51] Bosman L. et al., *Teaching Life Skills in the Foundation Phase*; Kidman and Casinader, "Inquiry-Based Teaching and Learning across Disciplines."
[52] Mkimbili, Tiplic, and Ødegaard, "The Role Played by Contextual Challenges in Practising Inquiry-Based Science Teaching in Tanzania Secondary Schools."

students develop their investigations and specific questioning strategies, making science relevant to the students' daily life.[53] The scientific skills that might be referred to as inquiry skills are promoted through scientific inquiry-based learning.[54] The inquiry-based methodology also places a strong emphasis on active discovery, questioning and problem-solving. It is consistent with the constructivist theory of learning, which holds that knowledge is created by individuals via their own experiences. This strategy encourages experimentation, critical thinking and the formation of hypotheses.

In summary, inquiry-based learning and storytelling are effective pedagogies for fostering scientific literacy in early childhood settings. When applied properly, they can help students remember the material by making it relevant to their past knowledge, experiences and interests. Additionally, by fostering a feeling of surprise, suspense and challenge, the two pedagogies of learning can encourage students' curiosity, motivation and enthusiasm for learning. Inquiry-based learning and storytelling are used by educators to provide a lively learning environment. Stories act as a catalyst to pique interest, and the inquiry-based approach gives kids the power to look for solutions, test theories and make judgments. This interaction not only improves scientific abilities but also fosters creativity and a love of discovery.

RECOMMENDATIONS

James et al., emphasise the necessity of enhancing science instruction in ECD through student participation in science-related activities, the creation and use of science teaching resources and the use of instructional techniques that promote scientific inquiry.[55] Additionally, it is advised that the ECD sector begins thinking about engaging in the development of science-related activities which is the focus of this study, based on the literature research findings of these studies as provided. Therefore, it is suggested that ECD teachers should adopt the habit of improvisation and create their own science teaching and learning resources using materials that are readily available locally. It is also suggested that the government must consider increasing the amount of funds allocated to ECD schools so that they can buy science textbooks and other science-related learning materials.[56] This gap between the necessity for ECD to be the starting point for instruction and introducing science-related activities by employing approachable techniques and tactics is once more highlighted by these recommendations from diverse sources. The researchers propose the use of stories and an inquiry-based approach as a starting point for this endeavour, even if there are many chances to improve science in the early years.

CONCLUSION

This article sought to answer two questions. What are the potential obstacles to learning science in the ECD phase, and how do storytelling and an inquiry-based approach mediate the learning of science in the ECD? Literature and theory were utilised in the discussion and the development of the argument based on the questions to provide support for the claim that ECD may employ storytelling and an inquiry-based approach to educate and promote scientific abilities. The results of several research works have demonstrated the potential of using storytelling as an instructional strategy to teach science in the early years. On the other hand, research has demonstrated the superiority of the inquiry approach as a support mechanism for instructors on how they can teach science. From the literature, it is evident that young learners have the potential to learn science at a young age.

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[53] E. N. Asheela, "An Intervention on How Using Easily Accessible Resources to Carry out Hands-on Practical Activities in Science Influences Science Teachers' Conceptual Development and Dispositions" (Rhodes University, 2017); Kuhlane, "An Investigation into the Benefits of Integrating Learners' Prior Everyday Knowledge and Experiences during Teaching and Learning of Acids and Bases in Grade 7: A Case Study."; Z. Kuhlane and K. M. Ngcoza, "Elicitation and Integration of Prior-Everyday Knowledge on Teaching and Learning of Acids and Bases: From Context to Content," in *Proceedings of the African Association for the Study of Indigenous Knowledge Systems, 'The Relevance of Indigenous Knowledge to African Socioeconomic Development in the 21st Century'* (Windhoek, Namibia: University of Namibia, 2015), 257–67.

[54] Bosman L. et al., *Teaching Life Skills in the Foundation Phase*; Kidman and Casinader, "Inquiry-Based Teaching and Learning across Disciplines."

[55] Stears, James, and Beni, "Teaching Science in the Foundation Phase: Where Are the Gaps and How Are They Accounted For?"

[56] Kuhlane, "An Investigation into the Benefits of Integrating Learners' Prior Everyday Knowledge and Experiences during Teaching and Learning of Acids and Bases in Grade 7: A Case Study."; Kuhlane and K. M. Ngcoza, "Elicitation and Integration of Prior-Everyday Knowledge on Teaching and Learning of Acids and Bases: From Context to Content"; Stears, James, and Beni, "Teaching Science in the Foundation Phase: Where Are the Gaps and How Are They Accounted For?"; Nhase, "An Exploration of How Grade 3 Foundation Phase Teachers Develop Basic Scientific Process Skills Using an Inquiry-Based Approach in Their Classrooms."

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ABOUT AUTHORS

Dr Zukiswa Nhase is a Lecturer and Childhood Education Department Program Director at the University of the Free State, Faculty of Education. She is involved in the teaching of both undergraduate and postgraduate students. Her research focus is on Science Education focusing on Early Childhood and Primary education. Her research has been on exploring of opportunities and barriers to learning of science concepts, knowledge and skills in Early Childhood and Primary Education. Her research focus emanates from the home languages used for teaching and learning, the lack of resources in various schools and the opportunity of using scientific inquiry-based approach in teaching of science in early years of learning.

Prof. Bekithemba Dube holds a PhD in curriculum studies and is currently an Associate Professor and Acting Head of the Educational Foundation Department, Faculty of Education at the University of the Free State. He has published more than 100 journal articles, and book chapters and edited a volume of curriculum, religion and politics in the global south in the past 3 and half years. He has guest edited the following journals, alternation, Journal of Cultures and Values, Journal of Curriculum Studies Research, and Journal of Cultures and Values in Education. He serves on the editorial board of various journals as well. He has received various excellence awards such Master's University Book Prize. Best Academic Student, Great Zimbabwe University, 2014, and Best Emerging Researcher in the Faculty of Education University of the Free State, 2018. The Extra Miler Exceeding Expectations Award: In recognition and appreciation of an exceptional contribution to the Unit for Language Development, 2018. Exceptional Contribution as a consultant at the Write Site Award, 2018. USDP Scholar Supervisor Award, 2019 with Colorado State University. He was awarded the Outstanding Service award, community and Excellence in the field of community engagement in the category of engaged research by the Vice-Rector, University of the Free State, 2019. Most Prolific Researcher in the Faculty of Education 2019 and 2020. Recognition for Research Excellence award UFS, 2020 for being the third highest productive scholar in the entire university. He was also awarded the Khothatsa Award for being the most inspirational lecturer, in 2021 and the best departmental award in 2021. He was awarded a supervision grant for UK-SA for a period of 3 years with the University of Highland and Islands (UK). His research focuses on African studies, decoloniality, religion and rural education in post-colonial Africa.