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Editor's Note

Welcome to the *Journal of Conflict Management and Sustainable Development,* Volume 11, No.5. The Journal is an interdisciplinary publication that focuses on key and emerging themes in Conflict Management, Sustainable Development and other related fields of knowledge.

Sustainable Development has been embraced at both the global and national levels as the blue print for socio-economic development and governance. The Journal interrogates and offers solutions to some of the current concerns in the Sustainable Development Agenda. It also explores the role of Conflict Management in the attainment of Sustainable Development.

The Journal has witnessed significant growth since its launch and is now a widely cited and authoritative publication in the fields of Conflict Management and Sustainable Development. The Editorial Team welcomes feedback and suggestions from our readers across the globe to enable us to continue improving the Journal.

The Journal is peer reviewed and refereed in order to adhere to the highest quality of academic standards and credibility of information. Papers submitted to the Journal are taken through a rigorous review by our team of internal and external reviewers.

This volume contains papers on various themes including: *Protecting Our Endangered Species for Sustainability; Changing The Narrative on the Right to a Clean and Healthy Environment: Analysing Ecocentrism as a Possible Method of Environmental Governance in Kenya; Integrating Environmental Social & Governance (ESG) Principles into Corporate Governance in Kenya: Trends, Challenges, and Best Practices; Problematic Overlaps and Duplication of Mandates of State and Governmental Agencies in Kenya: Proposals for Legal and Institutional Reform; Lesson Study: Towards an Improved Instruction in Stem Education in Junior Secondary Schools In Kenya; Management of Industrial Waste water in Kenya: Case study of Mavoko; Does the Law Work? A Case of Kenyan Prison Congestion and the Witchcraft Act; Fostering Sustainable Lifestyles for Posterity;*

Legislating to Protect and Compensate Whistleblowers in Kenya: An Appraisal of the Proposed Whistleblower Protection Bill, 2023; The Phenomena of Resource Curse and How to Navigate around it; Primary Teacher Education and Kenya's Vision 2030. The Lacuna in the Transformation Agenda; Mitigating the Environmental Impact of Oil: Strategies for Sustainable Development; and *The Implications of Implementing Kenya's Electronic Travel Authorisation (eTA) System: A Comparative Appraisal*. The Journal also contains a book review of *Towards Human Rights and Prosperity for All* and a review of *Journal of Appropriate Dispute Resolution (ADR) & Sustainability Volume 2 Issue 3.*

We welcome feedback, comments and critique from our readers to enable us to continue improving the Journal.

I wish to thank all those who have made this publication possible including reviewers, editors and contributors.

The Editorial Team also welcomes the submission of articles to be considered for publication in subsequent issues of the Journal. Submissions can be channeled to *admin@kmco.co.ke* and copied to editor@journalofcmsd.net.
Our readers can access the Journal online at https://journalofcmsd.net.

Hon. Prof. Kariuki Muigua Ph.D, FCIArb, Ch.Arb, OGW.
Professor of Environmental Law and Conflict Management
Editor, Nairobi,
November, 2024.

Lesson Study: Towards an Improved Instruction in Stem Education in Junior Secondary Schools in Kenya

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Dr. Winnie Waiyaki‡

Abstract

For a long time, there has been a concern about the poor performance of Science Technology Engineering and Mathematics related subjects in both primary and secondary national examinations in Kenya's schools. Several programs and innovations have been put in place to address this shortcoming. Among the causes cited for poor performance is the poor instructional practices in the classrooms. Lesson Study as an innovation to teaching and learning, calls for teachers to work in collaboration, analysis, planning and continuous improvement of instructional practices through observations, evaluations of students' learning and goal setting and to design instructional practices that can improve the overall performance of STEM education. This paper therefore seeks to establish how Lesson Study as an innovation can be used to improve classroom instructional practices to overcome the poor learning outcomes by learners especially in Junior Secondary schools in the advent of the new Competency Based Curriculum (CBC) introduced in Kenya. The study is significant in that it should impress CBC creators of the need to improve the implementation of the design and how innovative classroom practices can be used to improve learning outcomes, including, overall performance of the national examinations especially the STEM related subjects. The paper is based on available secondary data, current practices and reviews of existing literature on the effectiveness of Lesson Study in enhancing learning outcomes in the classrooms. The study revealed that the use of Lesson Study has had positive results in various classrooms across the globe. By teachers planning and observing the lessons together, they can see their flaws and those of the learners and therefore re-plan the lessons for better learning outcomes. The study concluded that Lesson Study has a positive effect on the quality of

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teaching and learning especially in mathematics and science leading to great improvement in all STEM subjects. With the advent of the Competency Based Curriculum, the study recommended that the new education system fully incorporates this innovation as part of the implementation process to overcome the flaws experienced in the previous curriculum, to improve the overall performance of examination of the STEM subjects and more so enhance classroom interaction in Junior Secondary Schools in Kenya's education system.

Key Words: Lesson Study, STEM subjects, learner-centered pedagogy, teacher collaboration, collaborative teaching, Lesson reflection.

Introduction

The continuous advancement in Science, Technology, Engineering, and Mathematics (STEM) education calls for innovative teaching methods that foster critical thinking, problem-solving, and collaboration among learners. In Kenya, the Junior Secondary School Curriculum is undergoing transformation to enhance these skills, and one promising approach to improving instruction is the Lesson Study. Originating in Japan, Lesson Study is a professional development model that enables teachers to collaboratively plan, observe, and refine lessons. Lesson Study has its roots in the early 19th century in Japan, during the Meiji era (1868-1912). The era marked a time of rapid modernization, and Japanese educators sought ways to improve their teaching practices to meet the growing educational needs of the country (Lewis, 2002). However, it wasn't until the post-World War II period, particularly during the 1960s, that Lesson Study began to take shape in its current form, driven by the need for educational reforms in Japan (Yoshida, 1999).

The background of the study

In the Lesson Study model, teachers work in small groups to plan a single research lesson, observe how the lesson is implemented, and then discuss its outcomes to improve it (Fernandez & Yoshida, 2004). The process is cyclical, with the goal of refining teaching practices to ensure that lessons are more effective

and learner centered. One of the most significant contributions of Lesson Study to global education was through the dissemination of the findings from the Third International Mathematics and Science Study (TIMSS) in the 1990s. This study highlighted the effectiveness of Japanese teaching methods, sparking interest in Lesson Study in the United States and other countries (Stigler & Hiebert, 1999). In Greece, a study on Lesson Study was done and revealed that it contributes to mobilizing pre-service teachers, improving their performance and developing positive attitudes and beliefs of learners and trainers regarding its use in higher education (Kanellopoulou, 2019). There was a significant improvement in students' academic achievements and association with the practice of Lesson Study practice particularly at schools with low levels of academic achievements (Arya and Kostereliogl u, 2021). These authors posited that Lesson Study approach has a noteworthy effect on science learning at elementary level. The two studies also revealed that science teaching through Lesson Study increase comprehension and application skills of elementary students significantly.

Suhaili et al (2014) did a study in Brunei on the impact of Lesson Study on primary mathematics teachers' instructions. The study revealed that Lesson Study had a positive impact on teachers' instructions. Four pathways were identified in which teaching instructions had improved. The lesson plan development had broadened teachers' content and pedagogical knowledge, observation of the students learning helped teachers to be more conscious and sensitive towards students learning needs and difficulties, the development of teacher's self-confidence, teaching skills, questioning skills and classroom management skills and feedback from peers and knowledgeable others had made them more aware of the weakness and strengths on their own teaching. From the study, it can be noted that communication is open and honest in a Lesson Study and that there is a climate of trust. Team members must feel that they are able to share their ideas and opinions without inspiring defensiveness or reprisals. It will be difficult for members to learn from each other if they cannot be honest. Although the ability to share their views openly and honestly is important, members will be unlikely to do so if they fear their contributions will be ignored

or belittled. The balance between honesty and trust may not be easy to establish and maintain at first, but it is crucial to the team's work. Members are encouraged to both challenge and support one another. Team members do this by asking questions, building on each other's ideas, and respectfully disagreeing. They are expected to ask for clarification, explain their reasoning, and provide evidence to back up their assertions. Through reflection of teaching, teachers learn techniques to improve learner centered teaching methods and develop problem solving and critical thinking skills. The method aimed at strengthening teamwork among teachers and improving supervision among school managers (Jung et al., 2015).

STEM education places a strong emphasis on developing learners' ability to think critically, solve real-world problems, and work collaboratively. Traditional teaching methods, characterized by lecture-based instruction, often fall short in nurturing these skills. This is where Lesson Study becomes a critical tool. The collaborative nature of Lesson Study allows teachers to explore new instructional strategies, test them in the classroom, and adjust them based on student feedback and observations. In the context of STEM, teachers can experiment with inquiry-based learning, problem-solving approaches, and other innovative methods that align with STEM learning objectives (Cajkler et al., 2014). By focusing on a research lesson, STEM educators can collaboratively design lessons that integrate technology, engineering practices, and scientific inquiry, ensuring that learners develop not only subject knowledge but also essential skills like collaboration, creativity, and critical thinking (Saito et al., 2014). Group norms provide a set of shared expectations for how the team members will interact and support each other's learning. Group norms are also important because they enable teachers to learn together, adopt a research stance toward their practice, and build a sense of collective efficacy. As team members build their relationships and become accustomed to working together, they will be able to reflect on and deepen their sense of community and strengthen their belief in their capacity to improve student learning (Stepanek, Appel, Leong, Mangan, & Mitchell, 2007). Moreover, Lesson Study fosters a culture of continuous professional development, encouraging teachers to become lifelong learners.

Kenya's education system has undergone significant reforms under the Competency-Based Curriculum (CBC), which was introduced in 2017. The CBC emphasizes skill-based learning, and the development of competencies needed for the 21st century, particularly in areas such as STEM (Republic of Kenya, 2017). However, for these reforms to be successful, teachers need to adopt teaching methods that align with the new curriculum's goals, and Lesson Study offers a pathway for this transition. In Kenya, the need for improved STEM instruction is evident. The government has recognized that the country's economic development is closely tied to advancements in STEM fields. However, challenges such as large class sizes, limited resources, and inadequate teacher training have hindered effective STEM education in many schools. Lesson Study provides a framework for addressing these challenges. By working together, teachers can share resources, experiment with new teaching strategies, and collectively solve problems that arise in the classroom.

A few pilot projects in Kenya have demonstrated the potential of Lesson Study to improve teaching practices. For instance, a project funded by the Japan International Cooperation Agency (JICA) in collaboration with Kenya's Ministry of Education has introduced Lesson Study in select schools, focusing on mathematics and science education (JICA, 2020). Teachers involved in the project reported improvements in student engagement, a better understanding of difficult concepts, and greater confidence in their teaching practices. The collaborative nature of Lesson Study helped teachers overcome the challenges they faced individually. The use of Lesson Study in STEM education encourages the adoption of student-centered teaching methods that promote inquiry and exploration. Teachers can reflect on their practices, identify areas of improvement, and receive constructive feedback from their peers. This reflective practice ensures that lessons are continuously refined to meet the diverse needs of learners.

In Kenyan junior secondary schools, where STEM education is still developing, Lesson Study can significantly enhance the quality of instruction. By allowing

teachers to focus on specific problems, such as how to introduce difficult scientific concepts or how to integrate practical engineering tasks into the curriculum, they can devise solutions that are context-specific and tailored to their students' needs. Additionally, Lesson Study supports the professional development of teachers, enabling them to stay up to date with the latest trends and best practices in STEM education. Moreover, the collaborative nature of Lesson Study promotes a culture of shared responsibility among teachers. Instead of working in isolation, teachers come together to develop strategies that work for their students. This approach not only improves teaching practices but also fosters a sense of community and support among teachers.

Purpose of the study

The purpose for this study was to examine the role of Lesson Study in improving class instruction in STEM subject in Junior Secondary Schools in Kenya.

Objective of the study

The objective of this study was to advance Lesson Study for better lesson delivery towards improved learning outcomes in STEM subjects in Junior Secondary Schools in Kenya.

Literature review

Literature review examines several studies carried out in countries implementing Lesson Studies and the level of success and challenges encountere in the implementation process. STEM (Science, Technology, Engineering, and Mathematics) education in Kenya has gained significant attention in recent years, particularly at the junior secondary school level, where the demand for improved teaching methodologies is high. One innovation increasingly being adopted in STEM instruction is the "Lesson Study." This method, originating in Japan, focuses on teacher collaboration to refine instructional practices and student understanding. The implementation of Lesson Study in Kenya is still at its nascent stage, but it holds great potential for transforming classroom instruction in Junior Secondary Schools.

Adoption of Lesson Study as an innovation in the classroom

To learn from the Lesson Study process, team members must be willing to collectively examine their practice, acknowledge challenges, and seek out areas for improvement. Lesson Study is a cyclical process that involves teachers planning a lesson collaboratively, teaching it, observing the lesson in action, and reflecting on its effectiveness. As Lewis and Tsuchida (1998) describe, this iterative process promotes continuous professional development for teachers, improving their instructional strategies. Its primary goal is to enhance learning outcomes by encouraging teachers to work together to refine their teaching practices. Research suggests that Lesson Study fosters a deeper understanding of content, pedagogy, and students' learning processes (Dudley, 2011).

The adoption of Lesson Study as an innovation in the classroom has been slow but promising in many countries, including Kenya. According to Perry and Lewis (2009), one of the primary reasons for its success is its collaborative nature, which allows teachers to share expertise, critique each other constructively, and develop teaching strategies that align with students' needs. In Kenya, the introduction of Competency-Based Curriculum (CBC) has necessitated a shift from traditional teacher-centered approaches to more student-centered ones, making Lesson Study particularly relevant (Kisaka & Ogada, 2020). One of the key features of Lesson Study is its emphasis on teacher collaboration. Teachers work together to plan, execute, and analyze lessons, which not only enhances their teaching strategies but also fosters a culture of continuous professional development. In the context of Kenyan Junior Secondary Schools, where many STEM teachers lack adequate pedagogical training, Lesson Study can bridge the gap by creating opportunities for peer learning and mentorship (Wangeleja, 2016).

Adopting Lesson Study as a classroom innovation also directly benefits students. The approach encourages teachers to focus on student engagement, assess how students interact with STEM content, and adjust their teaching strategies accordingly. Studies in other contexts, such as those conducted in the United States and Japan, have shown that Lesson Study can improve students' critical

thinking, problem-solving skills, and conceptual understanding in STEM subjects (Fernandez & Yoshida, 2004). For Kenyan students, this would be particularly beneficial, given the national focus on increasing STEM participation and achievement. Despite its potential, there are several challenges associated with the adoption of Lesson Study in Kenya. First, there is a lack of sufficient training for teachers in how to effectively implement this approach (Ouko & Karani, 2021). Second, many schools face resource constraints, including limited access to instructional materials and a high student-to-teacher ratio, which can hinder effective collaboration and lesson observation. Finally, the hierarchical nature of many school systems in Kenya may discourage the open and constructive dialogue that Lesson Study relies upon (Kisaka & Ogada, 2020).

Methodology

This study was purely a paper review from refereed journals in Google scholars, Scopus and Research Gate. The journals selected were mainly on Lesson Study, and education curriculum innovations. The sampling procedure was derived by using research articles containing key word "Lesson Study" where a total of 30 papers from different countries where Lesson Study had been implemented by 2023 formed the greater sample. Ten papers were purposively used in each category of the journals. The journals were selected depending on the year of publication. It was clear that most countries who adopted Lesson Study were being trained by JICA using the education approach borrowed from Japan. Lesson Study adopted different names in different countries, but implementation was similar.

Findings of the study

In Kenya, the Center of Mathematics, Science and Technology Education in Africa CEMASTEA in collaboration with JICA introduced the school-based Lesson Study in its secondary INSET program in 2011. Lesson Study, a teacher-driven model for improving instructional practice through collaboration, has gained momentum as an innovative approach in Kenya's Junior Secondary Schools, particularly in STEM education. Lesson Study provides a structured

platform for teachers to collaboratively plan, observe, and critique their lessons. It enhances professional development by encouraging reflective practice and peer feedback. Studies in Kenya show that teachers who engage in Lesson Study are more likely to improve their teaching methods and increase student engagement in STEM subjects. The collaborative nature of Lesson Study fosters a community of practice among teachers, which is essential for continuous improvement in instructional methods (CEMASTEA, 2017; UNESCO, 2021).

Kenya's shift to the CBC, which emphasizes skills, creativity, and learner-centered teaching, aligns with the goals of Lesson Study. Lesson Study complements the CBC by allowing teachers to adapt their teaching strategies to the needs of learners, focusing on critical thinking and problem-solving. Research highlights that Lesson Study has been particularly effective in STEM education, where the CBC's emphasis on practical skills is paramount (UNESCO, 2021). Lesson Study has proven to be a valuable tool in improving STEM instruction. It encourages teachers to design lessons that are student-centered and inquiry-based, which are key to engaging students in STEM learning. CEMASTEA reports that teachers who participate in Lesson Study are more adept at implementing STEM-focused instructional strategies, improving students' comprehension of complex concepts in subjects like mathematics and science (CEMASTEA, 2017).

Successful implementation of Lesson Study depends significantly on school leadership. Principals who support collaborative professional development initiatives are crucial in fostering an environment conducive to Lesson Study. Their involvement ensures that teachers have the necessary resources and time to engage in meaningful collaboration. In schools where leadership actively supports the Lesson Study process, there is a noticeable improvement in teaching quality and student outcomes (Chiira, 2021). Despite its potential, Lesson Study faces challenges in Kenya's junior secondary schools. Many schools lack sufficient resources, including infrastructure and teaching materials, which are critical for effective STEM instruction. Additionally, teachers need further training to fully

integrate Lesson Study into their practice, particularly in the context of the CBC. The scarcity of well-trained STEM teachers also limits the potential of this innovation in some regions (CEMASTEA, 2017; UNESCO, 2021).

Conclusion

Lesson Study represents a powerful tool for improving STEM education in Kenya's Junior Secondary Schools. As the country continues to implement the CBC and emphasize the importance of STEM skills, Lesson Study provides a structured approach for teachers to collaborate, reflect on their teaching practices, and continuously improve their lessons. While challenges such as limited resources and large class sizes remain, the potential of Lesson Study to transform STEM education is evident. As more schools adopt this approach, Kenya stands to benefit from a generation of learners who are well-equipped with the critical thinking, problem-solving, and collaborative skills needed for the future. The adoption of Lesson Study in Kenyan Junior Secondary Schools holds great promise for improving instruction in STEM education. By fostering teacher collaboration, promoting continuous professional development, and focusing on student-centered learning, this approach can significantly enhance both teaching practices and student outcomes. However, for Lesson Study to be successfully integrated into Kenyan classrooms, there must be adequate teacher training, policy support, and resources. Further research and pilot programs could explore how this innovation can be adapted to meet the unique needs of Kenyan schools.

Recommendations

The study recommended that policy makers develop strategic plans to promote the use of Lesson Study as a school based professional development initiative. With the advent of the competency based curriculum in Kenya, the study also recommended that the new education system fully incorporates this innovation as part of the implementation so as to overcome the flaws experienced in the previous curriculum, to improve the overall performance of examination of the STEM subjects and more so enhance classroom interaction in the Junior Secondary Schools in Kenya's education system. The study recommended the endorsement of Lesson Study approach in teaching of science by inculcating it in teacher training curriculum.

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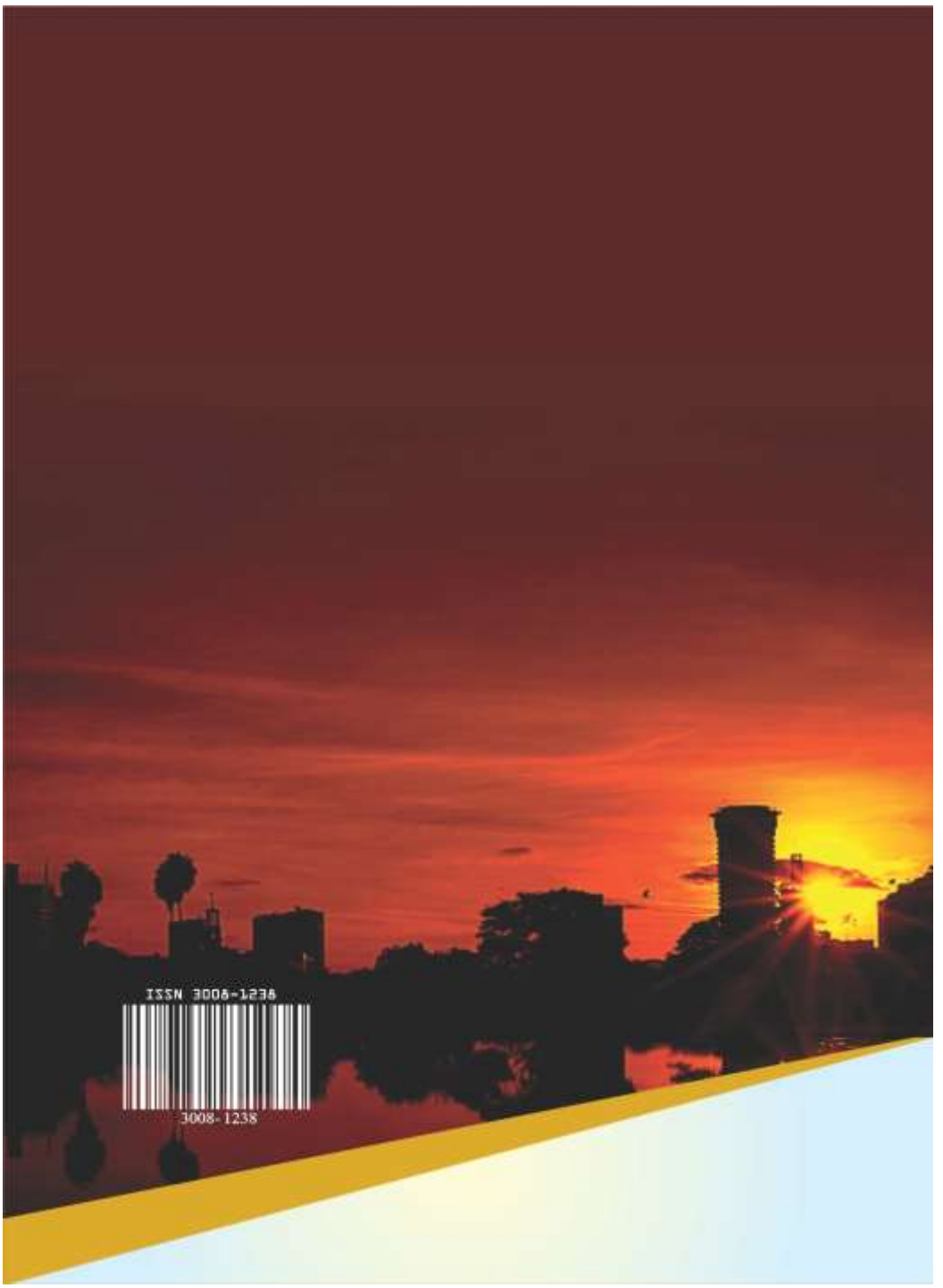
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