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Adopting STEAM Development Strategies in Early Years Education in Nairobi City County, Kenya: Implication For 21st Century Skills

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Abstract

Integration of Science, Technology, Engineering, Art, and Maths (STEAM) ideals in Early Years Education (EYE) builds a strong foundation for learners to discover, explore, play, discuss and experiment with the environment. Given that the goal of EYE is to expand an understanding of the world through observation, experimentation, and exploration, the integration of STEAM activities requires an intentional connection between lesson design and implementation for long life learning. Skills of creativity, collaboration, critical thinking, communication, and inquiry processes embedded in STEAM concepts prepare learners to develop a scientific mindset for solving global challenges. Therefore, the study determined the influence of STEAM strategies on the development of creativity, collaboration, critical thinking, and communication skills among learners in Nairobi City County, Kenya. Based on a descriptive survey design, the study purposively sampled 107 teachers in EYE, 99 head teachers, and 55 parents. The teacher questionnaire, which anchored the study in data collection, was complemented by observation of class activities and documentary analysis. Multiple intelligence theory was adopted to explore the nexus between STEAM and core competencies required for survival in the 21st century. Results illustrated that even though teachers in EYE implemented STEAM activities, which resulted in the development of creativity, collaboration, critical thinking, and collaboration skills, there exist challenges emanating from pedagogy and inadequate support for instructional resources. The study recommends that teachers should be equipped with tools and resources for integrating STEAM activities in EYE, considering the nature of practices to apply and attributes that may promote or deter learning.

Keywords: *STEAM; Creativity; Collaboration; Critical Thinking; Communication*

INTRODUCTION

Early years education (EYE) contributes to basic skills of creativity, collaboration, critical thinking, communication, and problem-solving for survival in the 21st century and beyond (Ganira, 2022). The learner, when provided with opportunities to explore the world around them, tends to ask questions and make interpretations regularly, which allows inquiry processes for observation, prediction, investigation, and drawing conclusions. This is premised on the basis that STEAM lessons involve the integration of Science, Technology, Engineering, Art, and Mathematics activities for inspiring learners to think broadly and solve problems with a hands-on approach for sustained learning. In line with this, the Basic Education Curriculum Framework advocates for the integration of science and technology skills in EYE, given that economic growth and social progress rely on innovation (BECF, 2017). Not only do innovative structures require integrating STEAM in EYE but also nurturing progress from project-based learning through collaborative exploitation to problem-

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solving by focusing on real-world situations. Therefore, exposing learners to STEAM which is an inter-disciplinary approach to learning, develops a strong basis for blending cognitive, interpersonal, and intrapersonal features for knowledge transfer. In support of STEAM activities, Sessional Paper No. 1 of 2019 calls for the integration of skills and competencies with emphasis on the ability to relate knowledge to real-life situations for sustainable development. In addition to encouraging 21st-century skills of literacy, problem-solving, critical thinking, and creativity, the Ministry of education (2018) acknowledges that STEAM encourages the development of social ideals for effective interaction in society.

In the early years of education, STEAM lessons focus on self-directed play and exploration rather than concentrating on teaching concepts. Therefore, teaching-learning strategies employed are directed towards encouraging curiosity and supporting inquisitive, curious perspectives for problem-solving. In support of this position, Arnott and Duncan (2019) argue that when implemented effectively, STEAM stimulates discovery and research as learners mix and sieve water and sand, build projects, sink and float items and determine the height of construction for enhancing innovative mindset. Given that learners in EYE are naturally curious and filled with wonders and fascination with the world, the STEAM disposition is likely to stimulate innovation for sustained learning. In order to stimulate curiosity, learners need opportunities to explore, experiment, manipulate, create and learn from an environment that can nurture STEAM inquiry. Discovery of the world may assist learners in widening their knowledge and acquiring essential skills for making sense of the surrounding. In this regard, Odundo and Ganira (2018) argue that exposing learners to STEAM activities encourages a strong foundation in scientific disciplines identified as vital for economic growth. In cases where STEAM is integrated effectively into EYE, there are high chances of promoting a natural learning process where complicated perceptions will be less threatening to learners who are likely to pick up advanced concepts in life. As such, Yates and Twigg (2017) aver that teachers with a passion for STEAM nurture positive attitudes where learners are enthusiastic about solving real-world issues. On the other hand, Baer (2018) raises concern about whether teachers are equipped with tools for integrating STEAM activities in EYE, considering the nature of practices to apply and attributes that may promote or deter learning. In an effort to address this concern, Dejarnette (2018) points out that in EYE, STEAM is grounded on the conception of experiment and problem-solving through the integration of the following activities:-

1. Science activities entail investigation and answering questions, often involving exploration and experimentation.
2. Technology requires applying scientific knowledge to encourage the use of simple tools, including crayons and rulers, and multifaceted equipment like microscopes and computers.
3. Engineering concept concerns design and building to allow learners to recognize problems and test solutions. Learners identify a problem, design, construct solutions, test the product and work to improve on it.
4. Arts support creativity and process development to allow learners to illustrate learnt concepts.
5. Mathematics includes not only numbers but also the ability to create patterns, shapes, and organizational skills.

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Kelley and Knowles (2016) affirm that learner experiences with STEAM activities in EYE set the stage for future engagement and success in diverse fields for the global market. Therefore, combining diverse components of STEAM activities in EYE is likely to stimulate the asking of inherent questions for determining responses in applying knowledge to problem-solving situations. Achievement in STEAM skills, therefore, requires teachers to be equipped with knowledge, concepts, processes, and activities for inspiring inquiry ideals. However, Ganira and Odundo (2020) posit that despite the recognition of STEAM education, inadequate data exist to support effective instructional practices and issues associated with the implementation of scientific ideals in EYE. This is based on the realization that STEAM implementation requires learners to; identify real-world problems, raise questions to determine challenges, develop solutions and explore hands-on activities. Anchored on this contention, Quigley and Herro (2016) are concerned that teachers in EYE struggle with huge workloads with little energy to plan elaborate STEAM lessons. Similar sentiments were put forward by Ganira (2019), who found out that teachers in EYE demonstrate inadequate awareness of technology and how to relate engineering skills in instructional management. Even though technologies are the product of engineering, inappropriate integration in teaching-learning makes learners miss out on engaging in STEAM activities. This is attributed to inadequate leadership in education, perpetuated by an insufficient motivation to produce skilled STEAM graduates in EYE (Clements & Sarama, 2016: Bekir, 2020). Hence, a competency-based curriculum calls for the integration of core competencies, which include creativity, collaboration, critical thinking, and communication, among others, for learners geared toward long-life learning.

Statement of the problem

There is a global concern for equipping learners with 21st-century skills of creativity, collaboration, critical thinking, and communication for innovation and problem-solving. In order to compete effectively in the global economy, there is a need for the integration of STEAM activities in EYE to encourage learners to take thoughtful risks, engage in experiential learning, persist in problem-solving, embrace collaboration, and work through creative procedures. Does integration of STEAM activities not only develop 21st-century competencies but also nurture learners to work in fields that are anchored in the growth of the economy. For learners to navigate the world as problem solvers, they need creativity: (innovation and personal expression), collaboration: (Working with and leading others to solve problems), Critical Thinking: **(**the ability to gather, analyze, and interpret information and solve problems) and communication: (listening, presenting, public speaking). However, even though technologies are the product of engineering, inappropriate integration in teaching-learning makes learners miss out on engaging in STEAM activities. This raises concern about whether teachers are equipped with tools for integrating STEAM activities in EYE, considering what practices to apply and which aspects may promote or deter learning. Hence, a competency-based curriculum calls for the integration of core competencies which include creativity, collaboration, critical thinking, and communication, among others, for learners geared toward long-life learning.

ISSN 2721-2904 (online)

Purpose and Objectives

The purpose of this study is to explore the impact of the STEAM strategy in the development of 21st-century skills among learners. The specific objective was to determine the influence of STEAM activities in enhancing creativity, collaboration, critical thinking, and community skills in early years education. The determination of the study was anchored on the view that as the world moves towards science and technological standards, educationists tend to ignore what an advantage an early inception of STEAM ideals can be to learners in EYE. The interdisciplinary approach in STEAM implies more connectedness and relatedness of disciplines in EYE for expanding knowledge to real-life situations.

LITERATURE REVIEW

This section has been structured into themes in line with the objectives of the study. Also explored is the theoretical literature showing the nexus between key concepts of the study.

STEAM and creativity Skills

Creativity is the ability to go beyond traditional ways of thinking in order to develop new and original ideas, methods, or objects. In the view of Gardner and Weinstein (2018), creativity is the ability to imagine objects that are not real while forming pictures in the mind of things that one has not seen or experienced and turning pictures into real situations. In cases where creativity is enhanced, learners express and cope with feelings, which in turn foster mental growth by providing opportunities for trying out new ideas and innovative ways of thought processes. Therefore, Yates and Twigg (2017) point out that STEAM integrates creativity and design thinking, and innovation in learners by providing opportunities for trying out new ideas for generating solutions, storytelling, and brainstorming. Further still, Arnott and Duncan (2019) observe that implementing STEAM in EYE encourages creativity for learners to think differently and approach problems in appropriate ways. This is premised on the view that integrating STEAM in EYE encourages participation in craft projects, where learners enthusiastically apply fundamental innovation and engineering procedures while initiating habits for questioning and intuitive creativity. This idea supports the creation of variety in an educational culture where learners in EYE are encouraged to take risks and try out new ideas and innovations for sustained learning.

In the view of Clausen, Parpucu, Gray, and Rule (2018), innovative learners find invention processes as pleasant occurrences, which create a nexus between creativity and science as strongly connected disciplines. Thus, overlooking this connection by teachers may lead to focusing on learning rules in scientific environments with no regard to its prospects for developing creativity. By engaging in STEAM activities that promote creativity, learners may develop accustomed thinking of new possibilities for making meaningful connections and pathways. This is based on the idea that learners in EYE have a natural sense to work with materials, try out things, and solve problems. On the other hand, Baer (2018) found out that teachers in EYE face challenges in integrating STEAM ranging from pedagogy, instructional resources, and professional competence. Thus, when designing learning experiences, teachers should plan and frame curriculum and provide tools that support the learner with options, voice, and choice for developing creative ideals. In order to enhance learning in STEM education, Odundo, Ganira, and Ngaruiya (2018) suggest that teachers should improve not only content knowledge but also motivation, thought processes, and

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creativity skills for learners to develop confidence and improve social development. Consequently, a learner who is used to thinking creatively can more easily problem-solve than one who follows a rigid protocol when searching for a solution to a problem.

STEAM and collaboration skills

Collaboration is the process of two or more people or organizations working mutually to realize shared goals. As noted by Anyiendah and Odundo (2017), collaboration requires activities for teamwork and thoughtful discourse, which necessities the exchange of ideas and concerted problem-solving. This contention supports the perception of Jamil, Linder, and Steglin (2018), who notes that STEAM involves teamwork and the exchange of ideas where learners share views and discuss ways of solving problems. STEAM activities are collaborative in nature for learners to raise questions about class work, identify features observed in the environment and draw conclusions from investigations, and in so doing, learn how to acknowledge criticism from peers and work together with group members. Through collaboration, Sochacka, Guyotte, and Walther (2016) affirm that learners discover how to divide responsibilities, compromise, listen to and encourage each other, and such activities encourage different learning styles and opportunities to celebrate success. As a result, Odundo and Ganira, (2017) study on teacher position in spurring value-based education in early Learning observed that learner who is naturally nervous or anxious about new tasks might be encouraged and supported by those who approach STEAM with curiosity and enthusiasm. Therefore, teachers have the opportunity of placing learners in groups by combining diverse capabilities and personalities for scaffolding each other to realize learning outcomes.

According to Aldermir and Kermani (2016), placing learners in groups is a feature of STEAM, which creates powerful teams of helping each other and figuring out how to apply diverse talents and skills with enthusiasm. Collectively, knowledge skills and enthusiasm could be utilized to help successfully complete projects through networking, sensitivity to viewpoints, and shared decision-making. This contention supports the opinion of Quigley and Herro (2016), who deduced that learners need to be involved in collaborative learning and gain knowledge in ways that can hold attention, just as social media and internet sites do. Since STEAM activities provide hands-on experiences to learners, Aldermir and Kermani (2016) assert that frequent use of different materials and tools to discover how projects work and ways of fixing things in-group work exposes girl children to acquire 21st-century skills. In this regard, Thammaprateep and Chartisathian (2018) disclose that learners exposed to STEAM during EYE tend to be less gender-based stereotypes and experience fewer obstructions in learning. Based on this regard, learners may negotiate and explain their own needs, discern what peers need, and view ideas from others' perspectives in reaching mutually beneficial resolutions as team players.

STEAM and critical thinking skills

Critical thinking is the ability to gather, analyse, interpret and evaluate information to ascertain reliability or genuineness. Fullan and Langworthy (2014) describe critical thinking as the capability to manage projects, solve problems and make effective decisions using a variety of tools. Based on this definition, Klein, Gray, Zhbanova, and Rule (2015) illustrates that critical thinking disposition can be fostered through inclusive STEAM integration by stimulating innovative

ISSN 2721-2904 (online)

exploration for providing dynamic inquiry. Therefore, learners empowered with critical thinking ideals are more likely to avoid being prejudiced and use logic and evidence to reach conclusions. This, according to Waddell (2019), allows learners to systematically think through problems by applying information about technology and engineering to figure out appropriate solutions. Through appropriately integrated STEAM activities, learners are more likely to discover ways of designing solutions to address dilemmas without having to rely on a fixed procedure which sharpens the ability to access information by considering that problem-solving models can be made flexible.

Given that the world is rapidly growing in technology and knowledge, Fazylova and Rusol (2016) aver that the future economy needs learners to move from passive information to active thinkers who can gather, analyse and interpret data to solve problems in society. To achieve this, teachers should promote and encourage critical thinking disposition by allowing learners to explore, manipulate objects, build structures and evaluate evidence for and against various positions. As such, Jacobson, Seavey, and Mueller (2016) acknowledge that teachers who allow learners to pose questions and participate in role-play shift creative skills to boost engagement in critical thinking. However, Ganira, Odundo, Gatumu, and Muasya (2020) are concerned that allowing learners to observe a phenomenon that encourages managing projects, solving problems, and making effective decisions requires a variety of tools and resources for enhanced critical thinking. Therefore, adequate teaching-learning resources coupled with firm and discrete regulations allow learners to build confidence in demonstrating adaptive critical thinking and problem-solving.

STEAM and communication skills

Communication is the act of transferring information from one place to another, whether vocally, visually, or non-verbally. In the view of Odundo and Ganira (2018), effective communication allows learners to work interdependently with interpersonal and group-related skills within and across various contexts, cultures, channels, and media. The rationale for communication is to convey a message concerning occurrences or observations and to express viewpoints. Hence, Jamil, Linder, and Stegelin (2018) content that learners can demonstrate STEAM concepts with crayons, clay, and water and express learning through descriptive language, stories, music, and dance. This is because STEAM learning encourages learners to use all senses in exploring the world around them, which naturally boosts fine motor skills and the development of language to communicate about observed phenomena. Through active participation, Jamil *et al*. (2018) posit that learners are more likely to connect and internalize new knowledge in an inclusive environment for sustained learning. Likewise, safe learning environments permit learners to try innovative ideas and develop the self-assurance required to use new tools to explore different objects.

According to Sochacka, Guyotte, and Walther (2016), teachers develop STEAM skills by talking, reading, singing, playing, or using other devices to communicate whatever works best for learners. A similar view is supported by DeJarnette (2018), who suggests that simple ways to promote learner's communication abilities are by encouraging them to document observations through drawing, painting, or recording voices to describe what they are noticing while constructing objects with blocks or talking about changes in nature – like the weather. To achieve these, teachers should determine STEAM-based challenges by encouraging learners to

ISSN 2721-2904 (online)

communicate ideas, listen to each other and use effective tools like lists and mind maps to generate data as a team. Not only do these expose learners to a wider variety of thinking styles, but they also encourage the development of communication skills for lifelong learning. Jamil, Linder, and Steglin (2018), who expounded that learners exposed to effective STEAM instruction, which provides opportunities for rich vocabulary learning to develop enhanced communication skills and achievement in scientific knowledge for igniting curiosity and problem solving, support this contention.

Theoretical Framework

The theory of multiple intelligences by Gardner (1983) suggests that intelligence is not a single static IQ number but a dynamic collection of skills and talents, which are evident differences in people. The multiple intelligence theory focuses on individual learning needs anchored on different levels of ability while supporting areas of intellectual growth. According to Gardner (1983: 1999), human intelligence accounts for a wide range of potentials which include; Linguistic, Logic-Mathematical, Visual-Spatial, Body-Kinaesthetic, Music-Rhythmic, Intrapersonal, Interpersonal, and Naturalistic. This view suggests that not only do individuals have one intellectual capacity but a range of talents and abilities, including interpersonal, musical, spatial-visual, and linguistic intelligence. For instance, an individual might possess a dominant intelligence – such as musical intelligence – but is also likely to have a blend of additional abilities too. In the same way, learners are likely to have different preferred ways of learning to understand concepts. More still, Tomlinson (2014) suggests that while one learner may favour a verbal explanation, another may choose 'hands-on' (kinaesthetic) learning, while yet another may desire to follow pictures or diagrams.

Integrating the theory of multiple intelligences with STEAM is ideal for enhancing problem-solving skills by identifying definite intelligence, which can assist learners in developing an interest in learning. Gardner (2011) suggests that when learners understand what they are good at (innately good at something), they learn to be engaged and stay out of nuisance, are accommodating and contented to participate in learning. In this regard, Adria and Mao (2017) affirm that understanding learner needs and multiple intelligences authenticates intuitive and spontaneous evaluation of participation in natural talents. This can be achieved by linking instructional objectives to more than two types of intelligence for learners to discover strengths and potential. Given that multiple intelligence theory is connected to multisensory learning, providing diverse instructional strategies through STEAM activities is likely to engage learners' visual, tactile, auditory, and more senses in sustained problem-solving.

Drawing on problem-solving activities focusing on multiple intelligence encourages learners to learn new skills. Therefore, Kallick and Zmuda (2017) encourage hands-on outdoor STEAM activities, allowing learners with diverse learning styles to work in groups and present information in different ways. Such activities allow learners to act out the STEAM concept by presenting a play, doing a speech, or drawing conclusions to research. On the other hand, Jamil, Linder, and Stegelin (2018) indicate that though teachers commonly incline towards math and science facets of STEAM, multiple intelligence theory clarifies that learners have strengths in different types of intelligence, which should be exploited.

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Conceptual Perspective

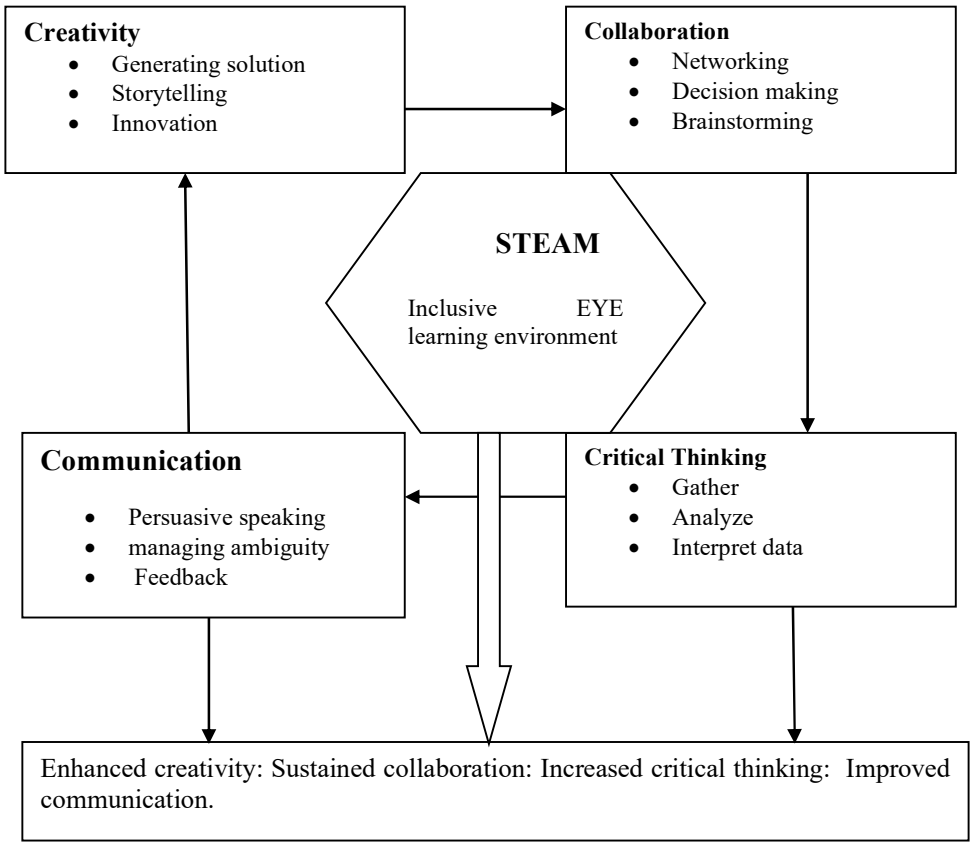

Figure 1. Perceived Framework on STEAM and competency skills

The conceptual framework in Figure 1 shows the nexus between the independent and dependent variables of the study. STEAM activities thrive in an inclusive EYE learning environment that supports the development of competency skills of creativity, collaboration, critical thinking, and communication. When learners engage in activities that combine different elements of STEAM, they experience enhanced creativity, sustained collaboration, increased critical thinking, and improved communication for sustainable development.

RESEARCH METHOD

Research methodology provides guidelines for organizing, planning, designing, and conducting effective studies. This study adopted a descriptive survey design in determining the impact of STEAM activities on the development of creativity, collaboration, critical thinking, and communication in EYE. In descriptive survey designs, Orodho, Nzabalirwa, Odundo, Ndirangu, and Ndayambaji (2016) argue that the focus is on describing characteristics of the population or phenomenon under study through observation method, case studies, and survey research. Thus, a descriptive survey allowed for the observation of a phenomenon in an absolutely natural and unchanged environment. Instruments for data collection included a questionnaire for teachers, an

ISSN 2721-2904 (online)

interview schedule for head teachers and parents, an observation schedule, and a documentary analysis. Data collection was based on the view of Orodho *et al*. (2016) that appropriate methods were used to reduce the likelihood of errors consistent with results. The teacher's questionnaire, which anchored the study, was devised to examine ways in which integration of STEAM activities encourages the development of creativity, collaboration, critical thinking, and communication skills among learners. Qualitatively, data collected using open-ended questions in the respective instruments enabled understanding and interpretation of the implementation of STEAM in EYE.

The sample frame for the qualitative study included 107 teachers of EYE, 99 head teachers, and 55 parents who were purposively sampled from 17 sub-counties. The goal of purposive sampling was to focus on particular characteristics of the population based on knowledge and interest in EYE. As indicated by Guetterman (2015), samples should be as representative of the population as possible, given that illusory samples yield distorted data. For validity, research instruments were subjected to Content Validity Index (CVI). When computed, a CVI greater than 0.7 was considered satisfactory for this study. Hence, Orodho *et al*. (2016) indicate that validity is ascertained through scrutiny and cautious designing of items of the tool with a focus on research objectives. In qualitative research, Creswell (2015) observes that validity is based on dependability, effectiveness, and constancy. Given that research methodology is judged for rigor and based on the strength of reliability and validity of instruments, the teachers' questionnaire, which was the main research tool, was administered to the same pilot sample twice an interval of two weeks. Two sets of scores obtained were used to calculate a reliability coefficient of 0 to +1, and above was acceptable. A coefficient above 0.8 is considered satisfactory in qualitative research. Data analysis involves examining collected data and making deductions and inferences (Creswell, 2015). The study took into consideration the key phenomenon under investigation by bringing order to data, organising it into patterns, and categorising it into descriptive units.

FINDINGS AND DISCUSSION

The findings are anchored on creativity, collaboration, critical thinking, and communication aspects of competency-based learning.

STEAM and enhancement of creativity

Framework for creativity was measured by three intertwined elements interacting with each other based on how learners generated solutions to issues and participated in storytelling and innovative activities. The focus was on whether STEAM lessons assist learners in developing creativity. Out of 107 teachers who participated in the study, an average of 88.81% strongly agreed, whereas 11.90% were uncertain. With STEAM lessons, learners are offered an opportunity to create products in a resourceful environment where they continuously raise questions, wanting to know how things work and why things are the way they are. This is critical for motivating the ability to learn and problem-solve creatively. As noted by Yates and Twigg (2017), STEAM encourages learners to tap into problem-solving tools and approach work with a creative eye, particularly in the EYE school setting. As such, STEAM lessons lean more toward hands-on learning, where learners spend less time in lecture-styled settings and more on their own and working with classmates.

ISSN 2721-2904 (online)

More still, when teachers were asked to comment on how learners generate solutions, tell stories, and participate in innovative activities, one teacher said, " *In my class, I allow learners to explore tools like screwdrivers and hammers used to attach things together (plastic bottles, doors, chairs, etc.) and present them with a problem to solve but without the use of the right tool (e.g., clean up sand table area without a broom or try to cut paper without scissors) or have learners use the "wrong" apparatus for the job (e.g., a fork to eat soup or scissors to paint). As they work through the project, learners also express feelings of sadness, happiness, joy, or excitement in order to find solutions. Teaching children to think 'outside of the box' causes them to approach tasks differently.* Similar results were observed by Arnott and Duncan (2019), who affirms that learners discover creativity by exploiting a broad array of thought processes and skills throughout class activities by rearranging elements of ideas to create innovative facts and products. This helps learners to focus on the function of the appropriate apparatus and about other ways to solve the problem and teaches children about the purposeful structure and function of different tools.

STEAM and Collaboration competency

The second objective focused on how learners demonstrated collaboration competencies such as networking, decision-making, and brain storming through STEAM activities. In response to these, an average of 84.53 % of teachers strongly agreed, and 15.47 % remained uncertain. The argumentation was that STEAM activities are extremely collaborative, with learners operating collectively to grip new information with numerous contact points. Learners distribute responsibility and negotiate by working on group projects which incorporate multiple disciplines. In addition to these findings, Jamil, Linder, and Steglin (2018) noted that working together on collaborative STEM projects aid learners in developing social skills, which allows for working with diverse groups, and to make a distinction of viewpoints for negotiating and coming to a conclusion. This type of collaboration benefits learners not only by inspiring problems solving skills but also by nurturing tools and acting as a team which is vital throughout life and careers. More still, parents who were interviewed indicated that having children participate daily in household chores with siblings is a practical way of encouraging collaboration. Therefore Quigley and Herro (2016) argue that STEAM lessons are not just teaching gaining knowledge on how to discover and be creative but also advocating for learners to develop a range of skills, including turn-taking, teamwork, and cooperation.

With further probing, one teacher remarked…… *"To infuse STEAM in my lessons, I have created an effective collaborative class environment where I encourage learners to practice listening to each other and raise questions in turns, as well as negotiation and accountability ideals, among others. As you can see, learners work in groups of five, and instead of limiting learning to a one-way approach, I allow them to learn from each other. As a result, each learner can develop a unique set of skills and knowledge in an efficient way"* These findings imply that with STEAM activities, learners of varying levels of ability can work together in teams to find solutions to problems, record data, write reports and give presentations. The end result is learners who understand how to collaborate with others and thrive in a team-oriented environment. This analysis is consistent with Aldermir and Kermani (2016), who noted that through collaboration, learners discover each others' strengths, interests, and capabilities which helps in increasing understanding of how others view the world. Learners, therefore, develop new and stimulating viewpoints by learning how to appreciate diverse outlooks.

ISSN 2721-2904 (online)

This is crucial not only to coexist and live side by side in harmony but also to move forward as a civilization.

STEAM and Critical Thinking Competency

The third question was based on the contention that STEAM allows the incorporation of multiple disciplines at the time for promoting experiences where learners can explore, ask questions, discover, and exercise innovative building skills for gathering, analysing, and interpreting data. In this regard, 73.81 % of teachers strongly agreed, yet 26.16 % were uncertain. When requested to provide an explanation of findings, one teacher remarked….. *" since learners are curious by nature, STEAM activities help them to form hypotheses, ask questions and offer observation only when an appropriate environment is provided for analytical thinkers where they actively get involved in directing own education".* These findings are consistent with that of Klein, Gray, Zhbanova, and Rule (2015), who reported that critical thinkers have the ability to evaluate their own thinking using standards of good reasoning such as accuracy, clarity, depth, and breadth of treatment, coherence, significance, and relevance. However, in a departure from these findings, one teacher argued that even though EYE is a period to start learning about scientific content like weather, energy, ecosystems, plants, animals, motion, stability, and life cycles, inadequate resources hinder the development of STEAM activities.

In an interview with parents, which was conducted to examine whether they supported STEAM activities in their families, one participant made the following remarks….. *"When a child presents you with a problem, such as requiring a new video game, ask them why. They may say because it is fashionable and their friends have it. Your second 'why' will have them explaining what makes it popular or famous. They might say what the video is based on, and you should ask 'why' again. The third 'why' will make them expound deeper into the reasons for needing the video. Continuing to pose 'why' in the end may even help them come out with a detailed understanding of the video game.* This argumentation, according to Waddell (2019), is based on the fact that learners in EYE are naturally inquisitive and attempt to make sense of the world, just like scientists. Further still, one teacher said…… *"In EYE, we support STEAM teaching by integrating various activity areas within a significant context. As a result, STEAM integration helps us focus on content (*what *to learn) and processes (*how *to learn). For instance, you may involve learners in recording the weather each day on a chart and creating weekly summaries (e.g., sunny days, two cloudy days) to encourage learning of science and math content and also data gathering and analysis procedures"*. These suggest that learners start practicing basic science skills like observation, prediction, and using evidence to support answers during EYE.

STEAM and Communication competency

In STEM lessons, empathetic communication is essential for success, where learners can ask questions, make connections with prior knowledge, and gather and analyze data. The study focused on how STEAM activities enable learners to persuasive speaking, manage ambiguity, and provide feedback during communication. The analysis revealed that an average of 94.38% strongly agreed, and 5.60% were uncertain. Teachers argued that in EYE, learning is based on hands-on activities where learners communicate as they explore shapes at learning centres while touching and playing

ISSN 2721-2904 (online)

with different shaped objects, thereby describing similarities or differences in shapes. More still, the documentary analysis showed that teachers incorporate systems of communication-based on individual needs by the use of visual aids and pictures to encourage new skills. However, in the view of Quigley and Herro (2016), effective communication requires that teachers provide learners with opportunities to express views and be genuinely listened to in an inclusive environment. This is because when learners actively contribute to learning, they are more likely to be engaged in play that responds to their interests, abilities, and strengths. To achieve this, one teacher made the following remarks……. *"I guide children's activities as I play with them. Children learning how to model a house do ask questions about how it works, try out different techniques to get it fixed, discuss the meaning behind artistic creation, and experience the creative process involved going from a design on paper to a tangible, functional object".* This finding implies that providing daily opportunities for learners to participate in stimulating activities fosters communication.

Further still, when asked to explain whether learners use persuasive speaking and feedback. One teacher said.... *"To infuse STEAM activities throughout the day, I make use of common issues within my class. Issues like how children might share a snack, how to organize materials in the nature corner, or how to recycle materials in class for an art project can be used to create a STEAM experience. As I focus on integrated activities, I find that STEAM initiatives provide complementary perspectives on the world. For instance, I find role play with telephones as an effective way to develop communication skills among children, where even the introverts have something to say when you hand them a telephone"* As noted earlier by Jamil, Linder, and Steglin (2018), when children learn to express ideas in an influential way and respond pleasingly to reactions to viewpoints, they will be able to promote innovation and social change through fields like bioengineering or video game design and the outcomes are transferred to real-world situations. These findings imply that synthesis with STEAM activities requires effective pedagogical approaches which allow learners to apply knowledge to lifelong learning.

CONCLUSION

The study examined the influence of STEAM activities and the enhancement of creativity, collaboration, critical thinking, and community competencies in early years education. Analysis revealed that STEAM activities are developed by extending learners' natural activities, helping them to discover and to understand processes, challenging learners, and projecting targeted educational situations. When learners participate in various STEAM activities, they become part of the process of asking questions, making plans, discovering answers, and applying knowledge to solving problems. Through the integration of STEAM in EYE, learners are offered an opportunity to create products in a resourceful environment where they continuously raise questions, wanting to know how objects work and why things are the way they are. This encourages increased engagement in STEAM projects where learners connect artistic mediums that they enjoy (like visual arts and music) with more technical projects, which seemed overwhelming at first. Parents should also encourage children to pursue STEAM activities at home in order to increase awareness and interest in sustained learning.

Collaborative STEM projects aid learners in developing social skills, which allow working with diverse groups and distinction of viewpoints for negotiating and coming to a conclusion. Given that peer interaction starts in EYE, teachers who encourage teamwork have learners with enhanced

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collaborative skills. More findings indicated through collaboration, learners develop new and stimulating viewpoints by learning to appreciate diverse outlooks. This is crucial not only to coexist and live side by side in harmony but also to move forward as a civilization. Teachers emphasised that STEAM activities are extremely collaborative, with learners operating collectively to grip new information with numerous contact points by asking questions and speaking their minds. Communication is integral to a learner's self-expression, development, and social development. STEAM activities demand that learners communicate with each other about actions, emotions, needs, and ideas. Through such activities, learners become motivated to think critically and consider information across multiple fields to form comprehensive methods of coming up with solutions. When learners engage in activities that combine different elements of STEAM, they experience guided inquiry in which they ask thoughtful questions, discover answers, apply what they learn, and problem-solve creatively.

Recommendations

The study makes recommendations for practice, policy, and further research based on its findings.

For practice: The study recommends that teachers should be equipped with tools and resources for integrating STEAM activities in EYE considering the nature of practices to apply and attributes that may promote or discourage learning.

Recommendations for policy: The Ministry of education, KICD, and Nairobi City County Government should ensure that is a policy framework that supports formal integration of STEAM activities in EYE since teachers lag in technology and engineering skills. This would assist schools in adopting effective instructional strategies that lay a foundation for STEAM concepts in EYE.

LIMITATION & FURTHER RESEARCH

Limitations of the study: The entire core skills advocated by KICD were not addressed due to the vastness of the study.

Recommendations for further research: The gap between strategies used in adopting STEAM ideals in EYE seems to emanate from instructional methods used. In order to address this concern, the study recommends further research on the implementation of STEAM strategies in early years education which formally incorporates engineering activities.

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