



Effective Teaching and Learning of Mathematics through Constructivism for Employment Creation and National Development

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Abstract

In the past four decades, graduates from Nigerian universities went directly from school into paid employment but now the situation has drastically changed. White collar jobs are fast becoming a thing of the past and the situation appears to have overwhelmed successive governments. However, education can lay a solid foundation for employment creation if necessary inputs are made by way of intervention in instructional strategies. Essentially, mathematics instruction that encourages students to be active and curious to solve problem, is key to employment creation. This study explored constructivism in mathematics education as a means of developing critical thinking skills among students. This paper discussed mathematics and its universality to other areas of life, the theories related to constructivism and how effective teaching and learning mathematics through constructivism could create employment. The way forward was proffered which was on-the-job pedagogical training on the use of constructivist strategies in mathematics education. Taking this step may produce graduates who could create jobs and employment for national development.

Keywords: Mathematics, Education, Constructivist Learning, Pedagogical Training, Employment Creation

Introduction

Employment creation can be viewed as the provision of temporal or stable job for different categories of people who are within the range of working class. Enhancing employment in any nation demands that the citizens of such a nation be informed through education (Odo, Shiaki, Ugwuanyi, Nzeakor & Okeke, 2022). Education forms the basis for developing innovations, science and technology. Education can lay a solid foundation for employment creation if necessary inputs are made. Education can build the human capital and economic development including employment creation. Prioritizing employment creation is needed to reduce the prevailing unemployment and poverty in Nigeria against what was obtained in the past. In the past, graduates from Nigerian Universities went directly from school to paid employment but now, the situation has changed. White collar jobs are fast becoming a thing of the past. Thus, self-actualization can only be achieved through one's creative genius. Achieving this feat demands that education be made functional.

Functional education means that the knowledge acquired should be based on the cognitive, psychomotor and the affective domains. This means that for education to create employment, instruction needs to be focused on the learners' head, heart and hands in line

with the provision of the national policy on education (Federal Republic of Nigeria. Nigerian educational

system has not been able to meet the expectations of the society (Obanya, 2016). If there is a relationship between school activities and industrial field application and experiences, then teaching and learning would be focused and purposeful. But there is a mismatch between what the school teaches and what is expected of the students after school in the labour market for the world of work (Obasan, 2014). There is therefore, the need for collaboration with relevant stakeholders and industries on students' work experience, thus making functionality of education the main of learning. Functional education hinges on effective teaching and learning of curricula contents including those of mathematics.

Mathematics is a very important subject in the school curriculum. In Nigeria, it is a compulsory subject for all pupils and students from pre-nursery through secondary schools (Federal Republic of Nigeria, 2014). It is a pre-requisite for entry into many courses in higher institutions of learning in Nigeria. Mathematics cuts across all disciplines in science, arts and humanities. Mathematics is therefore, the science of the logical study of numbers, shapes, arrangement quantity, measurements and many other related concepts (Highan

2020). It endows people with critical thinking skills and creativity necessary for problem solving. These skills if applied in real-life situation could change people from seeking for employment to creating jobs and wealth. Over the years, our educational system has failed to meet societal expectations because, the contents of the curricula are not being taught with creativity (Obanya, 2016). This is more worrisome when research has shown that different people learn in different ways and respond differently to various teaching methods and types of teacher behaviour (Odo, Ugwuanyi & Otubeje, 2024). In other words, every learner is unique and could approach a learning task with a unique level of learning readiness. This makes it imperative that students should be guided to discover underlying principles in a given context so that they can develop their potential from mathematics teachers. Mathematics teachers should employ a variety of pedagogical approaches that are practical oriented capable of addressing different learning styles within instructional environments, (Odo, Ugwuanyi & Obubeje, 2024). This is in line with the provision in the national policy on education that teaching should be practical, activity based, experiential and information technology supported (Federal Republic of Nigeria, 2014). Hence, there is need to teach mathematics creatively in order to promote employment creation as Nigeria economy requires mathematics education to harness the product of science and technology into wealth creation. The level of mathematics skills acquired determines the level of science and technology that would be used to build economic and national development (Chiakela, 2017). Mathematics education can therefore, prepare students for useful living in different areas of occupation be it tailoring, carpentry, banking, surveying, agriculture and architecture (Yadar, 2019). Functional mathematics education can create employment in that solving mathematics problems requires group work and collaboration among students with teacher as a facilitator. Group work enhances skills acquisition as ideas and information are shared during mathematics instruction. For mathematics education to be a vanguard of employment creation, its curriculum must show whether:

- The content of the curriculum addressed practical skills in mathematics teaching and learning.
- The language structure of mathematics textbook in use, interpreted the curriculum in detail.

- Mathematics curriculum implementation is in tandem with millennium development goals (MDGs).
- There are enough funds and facilities for mathematics curriculum implementation.
- Students' activities encouraged discussion, problem solving, questioning, discovery approach and self-efficacy in mathematics.
- Mathematics curriculum encouraged creativity and critical thinking as well as innovativeness in its implementation (Odo, Shiaki, Ugwuanyi, Nzeakor & Okeke, 2022).

Innovativeness is the ability and capacity of adopting new ideas or new ways in mathematics instructional delivery. Thus, for mathematics education to create employment, mathematics instruction needs to be constructive and focused on the learners' heads, heart and hands to solve problems. This can be done in mathematics classroom instruction through constructivism.

Constructivism as a paradigm posits that learning is an active, constructive process, where the learner is an information constructor. Personal experiences and hypotheses of the environment form the basis for knowledge construction. Learners continuously test these hypotheses through social negotiation. Each individual has a different interpretation and construction of knowledge process. The learner is not a blank slate (tabularasa) but brings experiences and cultural factors to a situation (copper as cited in Dambatta (2018). According to Heinich, Molenda and Smaldino as cited in Dambatta (2018), constructivism considers the engagement of students in meaningful experiences as the essences of learning. This is possible through a shift from passive transfer of information to active problem solving. Constructivism argues that students situate the learning experience within their experience and that the goal of instruction is not to teach information but to create situation so that students can interpret information for their understanding. Providing students with ways to assemble knowledge is the role of instruction. To a constructivist, the focus of learning is based on students' ability to use knowledge to facilitate thinking in real life situation. Environmental factors are critical to the constructivist. This is because the interaction between the learner and the environmental factors creates knowledge (Peggy & Timothy as cited in Dambatta, 2018).

Learning could be aided by real life models, such as the teacher, peers and symbols, such as pictures, posters, radio, drawings, television and computers. Through practical activities, a child constructs meaning which requires deep understanding of the concept being learnt on an interpersonal level. Learners construction of meaning occurs when their ideas are compared, explored and reinforced in social settings with each student having the opportunity to recognize one's ideas through talking and listening. Thus, for meaningful learning to occur and retention facilitated, learners must actively construct knowledge unto existing mental framework in line with this study. This study is anchored on two theories namely Vygotsky (1978) theory of social constructivism and Bruner's (1960) constructivist theory of learning.

Theoretical Framework

Theoretically, this paper is anchored on Vygotsky (1978) theory of social constructivism and Bruner's (1960) constructivist theory of learning. Vygotsky (1978) theory as social constructivism views learning as a collaborative process where knowledge develops from individuals interacting with their culture and society. According to Vygotsky, social interaction is the key in the development of cognition, emphasizing the use of zone of proximal development in learning. Zone of proximal development can be applied in mathematics instruction because it encourages cooperative learning where group members have different levels of ability. The more advanced peers can help the less advanced members operate within the zone of proximal development in mathematics instruction. In this way, knowledge can be shared and acquired through social interaction. In Bruner's (1960) constructivist theory, learning is a process in which individuals develop their own knowledge based on previous experiences and knowledge. The emphasis is on self-discovery and curiosity driven by interest especially, when instruction is student centered. The theory, when applied in mathematics instruction can help students to think deeply and logically in a given problem through experiences that encourage assimilation and accommodation. Assimilation and accommodation require an active learner to discover problem-solving skills. The role of the teacher is to provide rich learning environment for children to explore and construct their own knowledge through interaction with their peers. Assimilation is the integration of new information into the existing

schemas of prior knowledge, while accommodation is the process of changing existing schema (knowledge) in order to deal with new situations. The two theories can therefore promote problem based activities in mathematics instruction where students are active and curious to solve problems by themselves.

Thus, achieving a great, dynamic and vibrant economy that would create employment require the use of constructivism that would instill the global practices in mathematics instructional delivery. Global best practices in mathematics education involve a combination of teaching strategies, technique and tools that cater to different learning needs and promote deep understanding and engagement. Such practices should focus on helping students to grasp the underlying concepts and principles, rather than just memorizing procedures and support technology integration such as mathematics software to enhance students' engagement in mathematics education. Employing global best procedures in mathematics education would also encourage collaborative learning where students work in groups to solve problems, promoting communication, critical thinking and teamwork. A student who passes through these practice, may see challenges as opportunities for growth, thereby fostering a mindset that values effort, perseverance and learning from mistakes. Teaching mathematics through global best practices promotes skills' acquisition in mathematics education and enhances professional development of mathematics teachers (Obasi, Mba, & Unamba, 2015). It therefore, suffices to emphasize that without the knowledge of mathematics, there will be no science and technology and without science and technology, there will be no civilization and modern society and without modern society, no meaningful development can take place and be sustained; hence, the need for effective teaching and learning of mathematics through constructivism to enhance employment creation.

Effective Teaching of mathematics through Constructivism for Employment Creation

It is incumbent on mathematics teachers to create conducive learning environment where learners are active and curious to acquire skills for employment creation. Acquiring these skills implies the need for critical thinking which is developed overtime of consistent practice. Critical thinking is very important in mathematics education because, one cannot effectively learn without thinking well. Learning to think critically could midwife other skills like higher

level of concentration, improved thought processes and higher analytical abilities. Students' critical thinking ability can be brought to the fore where they interpret issues and trends in mathematics education. It would appear that there have not been adequate instructional interventions to develop critical thinking skill necessary for knowledge economy in students. Restricting students to classroom instruction where students are dormant could have negative effect on the learning outcomes. Mathematics classroom instruction that encourages students to be active and curious to solve problem is key to employment creation.

Employment creation requires highly developed critical thinking, creative thinking, creativity and problem solving abilities. These skills are brought to the fore when students interpret and evaluate issues in mathematics education. Thus, employing constructivism in mathematics education is key to acquisition of skills necessary to attain self-reliance and economic prosperity. A constructivist teacher should be able to use such strategies which have been found to engender curiosity and promote achievement among students. Promoting students' achievement through constructivism could be a panacea for employment creation in mathematics. For instance, in teaching shapes whether plane shapes (triangle, rectangle, rhombus, square, trapezium) or solid shapes (cone, circular cylinder, pyramid, frustum) a teacher needs to relate shapes to different types of building like bungalows, upstairs, mosques and churches, among others. In finding the areas, perimeters and volume of these shapes, the teacher must show the application of the area and volume to real life situation. Essentially, when houses are built, they need to be painted. In painting, one needs to know the area of the house to be able to determine the volume of paint sufficient to paint the house. In the same way, finding the perimeter of a rectangle is synonymous with surveying land. It is also synonymous with finding the number of tiles that would be enough for a particular building as well as finding how much is required to build certain structures.

In teaching ratio, rate and proportion, teacher needs to relate them to real life situation like manufacturing or production and prescription of drugs. Medical sciences make use of ratio, rate and proportion in drug production, prescription and administration (Odo, Ugwuanyi, Nwoye & Shiaki, 2021). The quantity of drugs to be administered to a patient is determined based on diagnosis and peculiarities of the patient. Drug prescription uses numerical numbers in the form of ratio,

rate and proportion depending on the concentration of the drugs. Ratio, rate and proportion are offshoot of fractions and refer to the number of times a particular drug is to be taken in a day (Odo et al., 2021). A student who can apply these skills outside the school setting can not only create wealth but create employment. Similarly, during planting season especially, during fertilizer application, farmers are taught to do this in proportionate quantity, which is determined numerically. According to Afolabi (2018), most farm inputs and outputs are not only mathematical in operation but numerical in identification. For mathematics education to be a source of employment creation, teachers need to develop in students those skills, values and knowledge that would help them to succeed (Steven, 2015). Thus, teachers at the secondary school level should be the vehicle for transmitting any innovation and reform (Regan, 2008). Therefore, teaching mathematics with creativity can guarantee employment creation as there is a gap between the knowledge provided by the school and what obtains outside the school for employment creation (Obasan, 2014). Similarly, employability skills are abound in bearing and distances. Knowledge and skills from bearing and distances are used in the production of long range missiles as well as in calculating distances, long range missile could go in order to hit a target. Once the coordinates of the target are picked, long range missile can hit the target with precision. This was used during the gulf war in 1991 when American and her allies invaded and destroyed Iraqi military installation with dexterity and precision. Thus, as a tool for science and technology, mathematics has made a mark in warfare where space vehicles are essential determinant of the superiority of one nation over another (Owunna, Mba & Ewgim, 2019). As bedrock of science and technology, the Nigerian economy, requires mathematics education to harness the product of science and technology into wealth and employment creation for sustainable national transformation.

Conclusion

If mathematics concepts are taught through the indicators of constructivism – critical thinking, creative thinking, creativity, logical reasoning, experiential learning, emotional intelligence, manipulative and computational skills, students could create wealth and employment. Thus, empowering individuals to construct their own knowledge could lead to the creation of personalized employment opportunities.

The constructivist approach promotes collaboration, innovation and community engagement and this has the potential to address employment challenges and enhance economic growth for sustainable national development.

Recommendations

The study made the following recommendations:

1. Teaching of mathematics should be related to real-life situation to enhance employability. Teachers should therefore, design lessons that demonstrate how mathematics is applied in trade, business, agriculture and technology.
2. There should be a paradigm shift from rote-centred examinations to assessments that measure conceptual understanding, problem-solving, collaboration, and critical thinking.
3. Curriculum planners should incorporate constructivist approaches in mathematics curricular across different levels of education. This paper provides important understanding in developing a curriculum which is effective in injecting employability skills into mathematics.
4. Teachers should be trained in constructivist pedagogy through workshops to enhance professional development.

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