



CHAPTER 50

DEVELOPING PROBLEM SOLVING SKILLS IN CHILDREN WITH SPECIAL NEEDS THROUGH SCIENCE, TECHNOLOGY AND MATHEMATICS EDUCATION

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Introduction

Education is central and crucial to human development and nation building. Human growth and development have always been the focus and paramount in all the undertakings of educational activities. By and large, Okoro (2013) affirmed unequivocally that human beings irrespective of types are expected through education to have their aptitudes and minds awakened and motivated to acquire life sustaining skills for problems solving and most importantly to live a life of continuous learning. The implication, therefore, is that an individual who has the opportunity to attain functional education at all levels must have developed invariably good supportive problem-solving skills that are strong and employable in life. In view of this any nation which undermines the contribution of her citizens definitely makes slow progress towards her national development. (Ibe-liro& Ukpai, 2013). To put in place a sound education system which grants equal opportunities to all without discrimination is for a nation to involve and harness the potentials of all its citizens including children with special needs.

Invariably children with special needs are children who are physically, mentally, emotionally or socially delayed in their developmental stages. These children are placed behind others in terms of cognitive, affective and psychomotor skills in their learning process. These children have impaired attention, descriptive behaviour, learning disabilities and developmental disorder among other conditions. It is as a result of these special needs that the needs of children with special needs cannot be met within the traditional classroom, but required special teaching methodology and delivery instruction to meet the appropriate needs of each child. This is why there is special needs education for such children. Special needs education is designed to facilitate the learning of individuals who for a wide variety of reasons, need additional support to participate and meet learning needs and objectives in an education programme through adaptive pedagogical process/methods (Buriki, 2018). In addition, UNESCO (2017) stated that special needs education is where special children's needs are met through special schools, classes or instructions to meet specific needs of individual child. These needs include different aspects which could be emotional, intellectual, physical, behavioural and social capacities. Furthermore, UNESCO (2019) stated that special



needs education may follow a similar curriculum as that of regular parallel education system, but have to take particular individual needs into consideration by making available resources like special trained instructor, adequate space and equipment and if possible, a modified educational learning objective or contents to meet individual's needs (Afolaye, 2019).

In the same vein, the national policy on education (FRN, 2013) provided that education must be inclusive and that all children including those with disabilities have the right to qualitative, functional and effective basic education. The purpose and objectives of special needs education according to the national policy on special needs education (FRN, 2013) are to: take care of total service delivery of the physical, mental and emotional disabilities of the Nigerian child, irrespective of setting (school, home and hospital); provide adequate and qualitative education for persons with special needs in all aspects of national developmental endeavours; and ensure that all persons with special needs develop at a pace commensurate with their abilities and to contribute to the nation's socio-economic and technological development.

Since the national policy on education (FRN, 2013) emphasized that education should be given to all citizens including persons with special needs, it is mandatory that children with special needs should be taken into consideration in the aspect of science, technology and mathematics. Science, technology and mathematics (STM) are compulsory subjects for primary and junior secondary schools. At the senior level, students have the choice between science, technology and other subjects but mathematics is compulsory at that level. Science, technology and mathematics (STM) education is important for all citizens. Okoro (2013) stated that human beings irrespective of types are expected through STM to have their aptitudes and minds awakened and motivated to acquire life sustaining skills for problem solving and most importantly to live a life of continuous learning. By this, when children with special needs are given the opportunity to attain functional STM education at all levels must develop invariably good supportive problems solving skills that are strong and employable in life. In view of this any nation which undermines the contributions of her citizens especially children with special needs through STM education definitely makes slow progress towards its national development. Apparently, STM education is a meta discipline considered as one cohesive teaching and learning paradigm based on the integration other disciplinary knowledge into a new whole. The inter-disciplinary building among discrete disciplines is now created as an entity. It offers students with special needs the best opportunities to make sense of the world by developing skills that will help them solve daily life's problems.

Science, Technology and mathematics (STM) is also an integral field of study that takes into consideration subject matter of science disciplines such as physics, chemistry, biology, agriculture, integrated science, mathematics and computer science. It encompasses all education process geared towards providing



opportunities for learners to utilize the skills and attitudes required to function effectively in a scientific and technological society (Nwafor&Umoke, 2014).

It is very important to state here that problem solving skills in the context of this study is where special needs children used their previous experiences, acquired knowledge and skills to respond to situations or challenges through the process of thinking and practical approaches in tackling the problem. Nwosu (2014) also stated that imbibing problem-solving skills in children with special needs through proper teaching and learning prepare them to face the challenges of life adequately and responsively.

Both federal and state governments in Nigeria have recognized the importance of STM education in everyday life. Their positions about STM education is stated clearly in the national policy on science and technology and mathematics education concerning children with special needs individuals as stated above, but the realization or workability is very little especially among children with special needs (Buriki, 2018). Abdulrahman (2016) also pointed out that if Nigeria is to compete favourably with other developed nations, it has to lay emphasis on teachers using appropriate strategy that can help develop problem solving skills in children with special needs. Thus, it has become very important that research efforts be directed towards developing problem solving skills in children with special needs. This paper, therefore, discussed understanding children with special needs in Science, Technology and Mathematics (STM) learning, STM problem solving skills, how to develop STM problem solving skills in children with special needs, and pedagogy for developing problem solving skills in children with special needs in STM education.

Understanding Children with Special Needs in Science, Technology and Mathematics (STM) Learning

The major focus on how children with special needs in education could be included in the classroom is a thing of concern to education Prunti (2011) and United Nations Educational Scientific and cultural organization (UNESCO, 2021) stated that every child has equal right to education irrespective of emotional, physical, social, intellectual linguistic, race or other condition. Also, the Science for All Movement (SAM, 2020) laid emphasis on producing more science, technology and mathematics (STM) students who should also be the consumers. For this to be achieved, there is the need for understanding who these children with special needs are, before developing the problem-solving skills in them through STM.

Children with special needs are always neglected or looked down upon by the society. The feedback they received from schools is often negative and have therefore affected their positive cognitive development within and outside the world. This attitude towards such children is very wrong. It is their basic rights as humans to an equal opportunity of receiving education especially in science, technology and mathematics. It is very important to understand children who are handicapped or gifted with mental, physical or emotional disabilities and to be



given the proper science, technology and mathematics education through special teaching approaches, equipment and care within or outside the regular classroom (Sackel, 2016, Sanda, 2018 &Wajers, 2020). Children with special needs may have mental, physical or emotional and developmental disabilities, so special needs within its range include a number of impairments in which some are: speech and language impairment, multiple disabilities, traumatic brain injury, visual impairment, blindness, hearing impairment, developmental delay, emotion disturbance, specific learning disability, orthopedic impairment, other health impairments, developmental delay, intellectual disability and the gifted. It is therefore not easy for children with special kinds of needs to keep at pace with the learning process of children who do not have such special needs. These children have the right to live a fulfilling life like others and also explaining its fullest potentials. These types of children need to be understood very well. It is very necessary that Science, Technology and Mathematics (STM) should focus on designing a structure that would overpower the disadvantages related to these disabilities, and help children in getting quality STM education that can lead to problem solving in their lives.

Children with special needs require special type of teaching. The STM teacher should understand that these children with special needs vary, depending on individual child. It is very necessary for the teacher to have good knowledge of the different types of special needs in order to have good understanding of the children. There are special needs children who have lost or impaired one of their sensory organs. These children have difficulty in seeing, learning, speaking or smelling. There are those who have problems in dealing with cognitive processes which interferes in learning basic skills such as reading, writing and solving mathematical problems as well as higher level skills like organization, abstract reasoning and long-term memory. The STM teacher should also understand special needs children with medical conditions that experience poor health, resulting in prolonged hospital stays and continuous medication. Even though their conditions differ from one another, the needs of all these children are similar. They need to have the right kind of support, schooling and environment to help them achieve their full potentials in life through developing problem-solving skills in STM education.

Children with special needs have the right to the same STM education privileges as others despite the difficulties they face. A qualitative and well-designed learning in STM education have positive impact on the child's psychological, psychomotor and affective development. With the right approach, the child will not be isolated or excluded, but will have a fulfilling problem solving and social life despite the impairment level. A better understanding of their special needs by the teacher and other children will lead to their acceptance as equal members of the society. They become more independent and happier when they are surrounded by people who understand their needs and support them at every stage of their life. The most important key to understanding and handling of



children with special needs are love, patience and tolerance on the side of the teacher. Positive attitude is essential towards the behaviour of these children and more so each child is different from the other. Proper understanding of these children provides them with development, opportunities and learning process that would develop their problem-solving skills through STM education that would improve the quality of their life. For problem solving skills to be developed among special needs children, there is need to properly understand who they are in the society. Schools for special needs education have established for children with special needs. These schools are into five levels of departments which are Kindergarten, elementary, junior secondary, senior secondary and tertiary. Special needs education is also provided in regular schools. These schools are to take care of and render the necessary education to children with special needs disabilities and these are autism spectrum disorder, deaf-blindness, deafness/hearing impairment developmental delay, speech impairment, learning disabilities, attention deficiency hyper nativity and intellectual disability. There are children with multiple disabilities such as orthopedic impairment, other health impairment, specific learning disability, speech language impairment, traumatic brain injury and visual impairment. In Nigeria, special needs schools were established to take care of special needs person who have visual impairment, hearing impairment, physical and health impairment, intellectual disabilities, emotional and behavioural disorders, speech and language impairment, learning disabilities, multiple disabilities, the gifted and talented, albino and almajri. There are 1,177 full-fledged special needs schools in Nigeria. These special needs schools are part of the education system in Nigeria. The national policy on education (FRN, 2013) categorical special needs persons based on visual impairment, hearing impairment, physical and health impairment, intellectual disabilities, emotional and behavioural disorders as well as speech and language impairment. Others in the category of special needs persons according to the policy document raised in 2013, are those with learning disabilities, multiple disabilities, the gifted and talented, albino and the almajiri were also include (FRN, 2013).

Science, Technology and Mathematics Problem Solving Skills

Problem solving skills for special needs children is more applicable in Science Technology and Mathematics (STM) education than in other fields of study because problem solving which encourages creativity rationally parallels the well agreed processes of science and involves observable activities on the part of the participating individual children. Nwosu (2014) stressed the importance of acquiring problem solving skills in STM education stated that the outcomes of schooling are now more focused on transferable skills than on academic knowledge; hence, there is greater demand for acquisition of problem-solving skills in education than before. Also, Sagone, Decaroli, Indiana, Falanga and Napoli (2020) stated that problem solving skills in STM education is one of the important components of executive functions of special needs children, together with



inhibitory control, working memory, sustain attention, cognitive flexibility, and planning. It is a process directly involved in the solutions of problems with efficient strategies and described as a cycle from recognizing the problem to creating a solution, evaluating the solution, and giving back to recognizing a new problem encountered and finding solutions through the skills acquired.

In the same vein through STM education special needs children develop problem solving skills through the application of creative thinking and critical thinking to generate and evaluate ideas with accurate knowledge. Effective problem-solving skills in STM among special needs children make them to be happier, more confident, and more independent individuals. When they tackle problems on their own, they become resilient. They learn to look at challenges from a fresh perspective and therefore, take more calculated risk. Through practicing problem solving in STM education consistently help develop greater confidence patience and manage time appropriately, and also enhance abilities and interests best (Smith, 2017 & Thomas, 2020). The problem-solving skills of STM are conceptualized as belonging to two distinct groups, basic problem-solving skills and integrated problem-solving skills. Basic problem-solving skills such as observation lays on the foundation of STM learning. The basic problem-solving skills are seen as pre-requisite for the integrated problem-solving skills. Integrated problem-solving skills are directly more related to problem solving and are seen as the highest order intellectual skills that special needs children use in problem solving. These children should understand that problem solving skills in STM are into four steps which are problem orientation. Problem identification, problem solution, data analysis and problem verification.

Furthermore, Schoda and Stephen (2014) explained that problem solving skills in STM helps the special needs children to be active, develop initiative, increase sustainable of learning and development of skills and also provide the basic skills to obtain research ways and methods. The children develop some mental patterns such as proposing relations in observed events in the class discussions, which is called scientific operation ability, determining all alternatives, obtaining mental results, designing tests to examine the proposed hypothesis, collecting the proofs and use them in proving during enquiry processes. Scientific process skills develop in STM help the special needs children to use the information and knowledge gained in problem solving.

How to Develop Science, Technology and Mathematics Problem Solving Skills in Children with Special Needs

Children with special needs in the 21st century science technology and mathematic (STM) education are expected to learn in ways that would develop their problem-solving skills. There are various ways of developing problem-solving skills among special needs children, but for the purpose of this study the focus is on: equipping children with evidence-based learning skills, handling

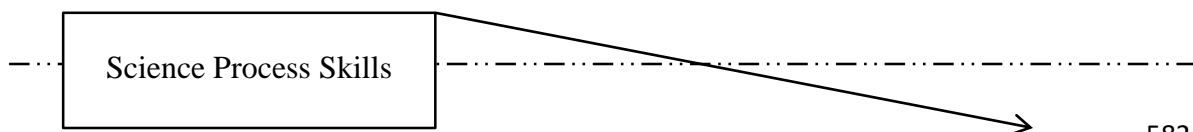


children based on their individual needs and pedagogy that teachers could adopt to develop problem solving skills among children.

Equipping children with adequate content knowledge children with special needs are to be developed and built with the capacity to apply problem solving skills in day today challenges of their lives. Problem solving develops the scientific habits in the minds of the children. The children are given opportunities to ask questions based on prior knowledge, experiences and observations. They are encouraged to investigate through constructing of hypotheses, accurate data keeping and using the scientific investigation to draw conclusion. The STM investigation of children with special needs are of different methods and procedures and these are known as science process skills which are: observation- the application of the five senses to find the characteristics, similarities, features, identification and properties of objects; classification: objects are grouped according to size, shape, colour, types, order and so on; measurement comparing the quantity and quantity through measurement: units of standard and non-standard; communication results of findings are shared through verbal, written, images, graphs, multimedia, signs and any other means of showing; interfering; explaining observations through formation of ideas; and predicting: this is where the expectations of the outcome is being developed to the child.

There are also free integrated science process skills which children with special needs should develop for problem solving. These free integrated science process skills in STM are formulation of hypothesis each child is encouraged to make an education guess or predict based on proofs from previous findings or research; identification of variables-dependent and independent, and controlled; operational description: the observable characteristics of what is happening in an investigation is being described using develop specific terms; experimentation; investigations are being carried out by the children and data interpretation of the results of investigation are being analyzed.

The science process skills and integrated science process skills and integrated science process skills developed in children with special needs are useful in problem solving. Effective development of problem-solving skills is important in STM learning and also encourage the spirit of scientific investigation. Problem is therefore important for STM children. Their existing knowledge structure is challenged which leads to the construction of a new scientific knowledge which results effective STM leaving and problem solving. This is further illustrated in the diagram below.



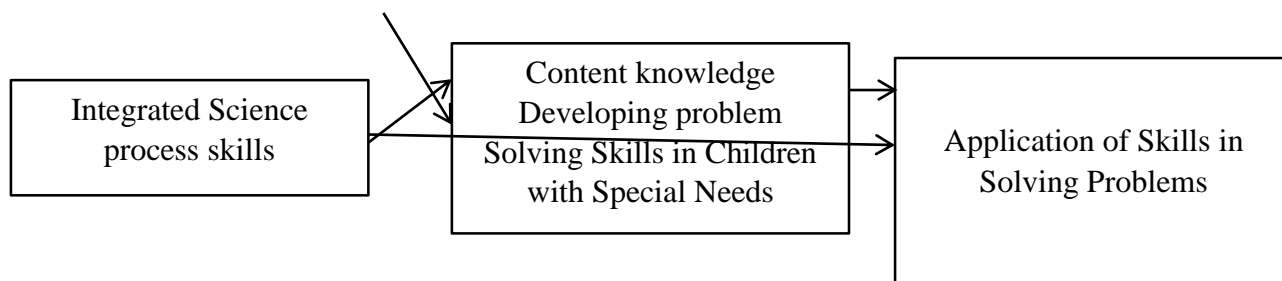


Fig. 1: STM Learning and Problem-Solving Skill

Developing problem solving skills in children with special needs differ from one another. This is because the children have their individual challenges and each child is expected to be patiently treated on individually challenges. It takes a lot of time for children with special needs to develop problem solving skills in STM education.

Pedagogy for Developing Problem-Solving Skills in Children with Special Needs in Stm Education

Children with special needs are to be provided with learning opportunities and processes that would improve the quality of their lives and to overcome challenges and difficulties in life. This can only be achieved through appropriate pedagogy. It is the responsibility of the teacher to help every child benefit from STM education and also properly involved in making sure individual needs of every child is fulfilled. The fundamental success of every child is the appropriate design of the curriculum, skills and knowledge of the teacher and appropriate use of intervention. The pedagogy to be employed by the teacher in teaching STM education should be is the one that can take care of the needs of each individual child. These children would be provided with the most appropriate learning environment and materials. The following approaches could be adopted by teachers to team children with special needs to develop problem solving skills are: incorporate a range of teaching and learning styles such as brainstorming concept mapping, role playing, story boarding questioning activity into the planning, opportunities Hands on, minds-on activities on experimentation, problem solving, collaboration/individual work, and discussion should be provided regularly, children should be given opportunities to participate in the teaching-learning process and also allowed to ask questions, children should be provided with opportunities to choose how they are going to carry out their activities as individuals and group and also share learning knowledge and materials; children should be encouraged to share ideas with others and to discuss on their progress, drama techniques could be employed to create learning opportunities through imagined experiences, seek children's consent by applying democratic principles



in the activities of the classroom, ensure children have a strong belief in their ability to affectively master each word of the STM by developing a high degree of trust for them, divergent thinking should be encouraged in the class rather than convergent, employ variety of activities in the class where within a single instructional period sense organs are put into use. Even though some of the children with special needs might have the problem of losing any of the sight, variety of activities should be provided to take care of the needs and individual child within the same class, children should be allowed to express themselves in various way without fear of molestation, avoid fear inspiring events in the classroom. Children with special needs should be properly taken care of by the teacher and also providing them the ample opportunities to develop their problem-solving skills through STM. It might take longer time, but it pays to do so.

Implications For Children with Special Needs

The implications of developing STM problem solving skills in children with special needs are as follows:

1. Developing problem solving skills in children with special needs is an opportunity for them to grow, broaden their understanding while building confidence.
2. Special needs children learn how to solve problems, appreciate lifelong learning and are curious, motivated and innovative.
3. The children learn how to rely on independent, creative thinking which enhances their sense of independence. They tackle problems on their own as individuals or group and become resilient.
4. The problem-solving skills developed in children with special needs prepare them for life and future careers.
5. Problem solving skills in STM education boost reflective and critical thinking in these children, therefore teachers should often provide regular activities for hands-on, minds-on experimentation, discussion and collaborative or individual work.
6. STM problem solving skills boost reflective and critical thinking in children with special needs, therefore the teacher should encourage them to participate actively in the learning process through various activities

Conclusion

Developing problem solving skills in children with special needs through science, technology and mathematics (STM) education is thus utmost importance for their holistic growth and development in this 21st century society. There is therefore the need to properly understand children with special needs in STM education, STM and problem-solving skills and developing STM problem solving skills in children that would help them solve life challenges, live happily within the society and equally contribute to its development.



Suggestions

The following suggestions are put forward based on the discussion of this study:

1. Teachers should develop problem solving skills in children with special needs by promoting productive thinking skills by allowing them carry out activities that provide opportunity to solve problems and which in turn stimulate productive thinking in them.
2. Education for children with special needs through science, teaching and mathematics should be the top priority in the educational goals of the nation.
3. The learning environment of children with special needs should be properly structured and well equipped to take care of individual needs of every child.
4. The teacher should design instruction with learning activities that will provide opportunities and experiences.
5. Creative and critical thinking skills should be effectively combined with accurate knowledge of ideas in the lives of the children with special needs.
6. STM education for children with special needs should be inclusive and not in isolation with other normal children.
7. Teachers should pay close attention to children with special needs in their learning activities to avoid any mistake or danger.

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