e-ISJN: A4372-3114
p-ISJN: A4372-3115

ISSN: 2321-7782 (Online)
ISSN: 2347-1778 (Print)
Impact Factor: 7.529

Volume 11, Issue 3, March 2023

International Journal of Advance Research in Computer Science and Management Studies

Research Article / Survey Paper / Case Study

Available online at: www.ijarcsms.com

Mathematics Empowerment among Students: A Research Review

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Abstract: ***Empowerment in mathematics is crucial for students to maintain current knowledge and meet the future demands of the modern world. Approximately one-third of the population avoids math, and this can be changed through appropriate remedies that empower maths learners. Beliefs play a crucial role in math empowerment, as they make learning enjoyable, facilitate precise comprehension, and promote autonomy. Math-empowered learners cultivate memory and visualization, experience joy rather than derision, grasp mathematical logic with ease, acquire application skills, and monitor performance. They can make choices for their learning, plan activities for self-engagement, and regulate their own activities, which are typically performed by instructors. Math empowerment never compromises performance standards and presents demanding challenges. Dweck's theory supports this, stating that lowering standards will not provide students with success experiences, enhance self-esteem, and increase achievement. Therefore, mathematics instructors should strive to promote a growth mindset. Leonard and Martin (2013) assert that cultural, spiritual, and historical identities must be taken into account when empowering inferior students in mathematics. Empowering mathematics instruction provides students with opportunities to express themselves and the needs of their communities, promoting social justice in classrooms and communities. Dele, Ogbo, and Omenka (2015) define mathematical empowerment as the development of personal confidence, mathematical self-efficacy, and a sense of personal possession and control over mathematics. Only when these powers are developed will students feel entitled to be confident in applying mathematical reasoning, judging the correctness of their own applications, and critically appreciating the applications and uses of mathematics by others across all types of contexts, including power and energy, in school and society. Ernest (2002) distinguished three domains of mathematical empowerment: mathematical empowerment, social empowerment, and epistemological empowerment. Social empowerment involves using mathematics to improve one's existence, while mathematical empowerment refers to the acquisition of control over language, abilities, and practices of applying and using mathematics.***

Keywords: ***Mathematics, Applications, Maths Empowerment, Challenges, Empowerment, Students.***

Content

Important aspects of the teaching and learning processes include the subject matter, the student, the instructor, and the surrounding environment. Mathematical content, cognitive and affective processes, purposefully designed mathematical tasks and activities, and the development of twenty-first-century competencies can therefore all contribute to the empowerment of mathematics students. Many development organisations now use the term 'empowerment' frequently. In addition to appearing in government-issued policy documents, empowerment goals can also be found in strategy papers addressing poverty reduction over the past three decades. The term 'empowerment' is used in a variety of methods and contexts.

The concept of power lies at the centre of the concept of empowerment. Power is dynamic and multidimensional, altering according to context, circumstance, and interest. The World Bank (2002) defines empowerment as "the process of increasing the capacity of individuals or groups to make choices and transform those choices into desired actions or outcomes." Empowerment can be viewed as both a process and an end result. As a process, it is associated with circumstances in which individuals and groups move from relative powerlessness to increased power, or from a lower to a higher level of empowerment. As a result, it refers to the consequences of the process as the final products through which a measure of power is attained, such as information access or increased resources. Kieffer (1984) defines empowerment as "an interactive process that occurs between an individual and his environment, during which the individual's perception of himself as worthless is transformed into an acceptance of himself as an assertive citizen." According to Parsons (1988), empowerment is "a process of internal and external change." The internal process is the conviction in one's own decision-making and problem-solving abilities. The external transformation is the capacity to act and apply the practical knowledge, information, skills, and other new resources acquired during the process.

Alsop and Heinsohn (2005) define the two components of empowerment as agency and institutional environment. A person's capacity to pursue and attain objectives that he or she values or has reason to value is agency. It is the capacity of individuals to act independently and make their own autonomous decisions, and the environment provides opportunities for people to exercise agency effectively. According to Solava and Alkire (2007), empowerment is "increased agency-gaining potential." They accentuate individuals' commitment to change as well as their capacity to act as change agents in their own lives.

The aforementioned meanings and definitions of empowerment are pertinent to the mathematics curriculum and pedagogy in schools. A pupil who is proficient in mathematics will be able to maintain current knowledge and satisfy the future demands of the modern world. Approximately one-third of today's population avoids math, endures it, or unwittingly transmits math anxiety to the next generation (Manigault S., 1997). This pitiful depiction can be altered through the application of an appropriate remedy that empowers the maths learner. Beliefs play a crucial role in math empowerment, according to Manigauit D. (2016). The thought paths governed by affirmative sentences are beliefs. They make learning mathematics enjoyable, facilitate precise comprehension, and promote autonomy in learning. A math-empowered learner cultivates memory and visualisation, experiences joy rather than derision, grasps mathematical logic with ease, acquires application skills, and monitors performance. Students who are math-empowered are able to make choices for their learning, plan activities for self-engagement, and regulate their own activities, which are typically performed by instructors. As a result, they develop into intellectuals, challenge existing thought, and acquire life skills. Empowered Students attempt real-world, challenging problems while refining their thinking and addressing their misconceptions. Empowerment in mathematics includes class reflection time, an opportunity for students and teachers to connect, communicate understandings and solutions, and support one another. During reflection, students not only share their knowledge, but also generate new ideas that propel them to the next level of learning (Zorzetto, 2017).

Math empowerment never compromises performance standards and presents students with demanding challenges. It is supported by Dweck's theory regarding the two mind sets—fixed and growth—their function in motivation and self-regulation, and the belief that one possesses the power to nurture success. Dweck (2006) asserts, "Many educators believe that lowering standards will provide students with success experiences, enhance their self-esteem, and increase student achievement. Inadequately educated students who feel entitled to simple work and effusive praise result from lowering standards. Raising standards without providing students with the tools to meet them is a prescription for disaster. Therefore, mathematics instructors should strive to promote a growth mindset. To empower inferior students in mathematics, Leonard and Martin (2013) assert that their cultural, spiritual, and historical identities must be taken into account. Providing students with opportunities to express themselves and the needs of their communities as a means of promoting social justice in their

classrooms and communities, empowering mathematics instruction provides students with the means to do so. According to Dele, Ogbo, and Omenka (2015), "mathematical empowerment of learners involves the development of personal confidence, mathematical self-efficacy, and a sense of personal possession and control over mathematics. Only when all of these powers are developed will they feel entitled to be confident in applying mathematical reasoning, judging the correctness of their own applications, and critically appreciating (and in some cases rejecting) the applications and uses of mathematics by others, across all types of contexts (including power and energy), in school and in society.

Ernest (2002) distinguished three domains of mathematical empowerment: mathematical empowerment, social empowerment, and epistemological empowerment. Through critical mathematical citizenship, social empowerment through mathematics is the capacity to use mathematics to improve one's existence. It is acquiring influence over work, leisure, and social matters. Mathematical empowerment refers to the acquisition of control over the language, abilities, and practises of applying and using mathematics. Personal control over the production and validation of knowledge, as well as the formation of one's own identity, comprise epistemological empowerment.

Hassi (2008) considers two levels of mathematical empowerment: personal and social. The first entails the enhancement of students' personality or identity, skills, knowledge, and experiences through mathematical thinking and learning, leading to an increased desire to study mathematics. Focusing on capacity development, the second aspect of social empowerment is to develop the academic and social skills of students to enable them to make better use of their social and economic environment. Kadyamarunga (2004) considers math empowerment opportunities to improve knowledge and vocational skills, which aid in survival and expand access to more entrepreneurial career pathways. According to Jónsdóttir (2010), the six dimensions of mathematical empowerment are critical thinking, logical thinking, creative thinking, concern and empathy, communicational skills, and metacognition. Thus, math empowerment is a concept with the potential to transform the entire math pedagogy, which is based on conventional beliefs about math learning, teaching, methodologies, assessment, curriculum, etc.

From the perspective of cognitive psychology, mathematical empowerment refers to the development of mathematical skills necessary for task completion. The acquisition and application of concepts, facts, procedures, and algorithms for problem-solving is addressed. From a semiotic standpoint, math empowerment consists of four skills: understanding, composing, and evaluating the validity of mathematical texts pertaining to mathematical tasks and questions, as well as their solutions and answers, and posing the questions themselves. Students' math empowerment can be achieved through extended learning with democratic learning experiences and by empowering classroom resources, which includes: forums for student feedback to give students a voice; students' choice in content selection; students' collaboration with the teacher; encouragement of useful technology in the classroom; and realistic learning (Svitak, A., 2012).

Since empowerment is an interactive process between the individual and his environment, it is crucial for math empowerment to create the optimal learning environment for math learners. Tan et al. (2012) argued on a similar premise that educational inequality is exacerbated by a consistent failure to integrate students' history, culture, and social requirements into the core curriculum, leaving students in a wretched state. They proposed that instructors and schools create hybrid third spaces that are neither classrooms nor homes, but in which underserved students can combine their personal and academic worlds. These spaces have the ability to motivate students to engage in not only future livelihood subjects, but also the maths and science literacy required for robust societal engagement; such empowering education goes beyond social justice and the reasons why students participate in learning maths and science. Academic change requires a new paradigm—a belief that says, "I am accountable for my success, and this is the price I must pay: doing what other successful students do, such as 1) having a positive attitude, 2) focusing on my goal, 3) asking questions to clarify what I don't understand, and 4) practising daily to reach my goals by doing my homework and studying for my tests. This requires that academically effective children behave like successful adults.

Kaur and Hoe (2017) said that "math empowerment takes place through i) mathematical content, ii) cognitive and affective processes, iii) purposefully designed mathematical tasks, and iv) while developing 21st century competencies" to describe how students might be given more control over their own learning. It is through the use of exploratory open-ended, real-world tasks, teacher scaffolding, multiple representations to solve process problems, flexible connections among the multiple modes of representation, cognitive and metacognitive strategies in solving mathematical problems, social interactions, and making sense by connecting, adding, and correcting between pieces of knowledge that students are given the opportunity to become independent, capable, and self-assured individuals. Students will develop a more positive outlook on themselves and mathematics if they are given the tools to pinpoint their hatred of and fear of the subject, as well as the causes behind it.

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