

Self-Efficacy Beliefs in Mathematics Teaching and Learning

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Abstract—According to Bandura (1995), a self-efficacy belief is: “The belief in one’s capabilities to organize and execute the courses of action required to manage prospective situations. These cognitive self-evaluations influence all manner of human experience, including the goals for which people strive, the amount of energy expended toward goal achievement. Unlike traditional psychological constructs, self-efficacy beliefs are hypothesized to vary depending on the domain of functioning and circumstances surrounding the occurrence of behavior. Self-efficacy, the belief in one’s own abilities, is a rising star in the latest research on characteristics that make a teacher most effective in the classroom. The quality of Mathematics teaching depends on the knowledge and self-efficacy beliefs of the teacher. It is important for educators to know how their learners feel, think, and act, about, within, and toward Mathematics. The belief systems of staffs create School cultures that can have vitalizing or demoralizing effects on how well schools function as a social system. In this paper, I address the self-efficacy beliefs in Teaching and Learning Mathematics.

Keywords—Self-efficacy beliefs; mathematics teaching; learning and school.

I. INTRODUCTION

Self-efficacy reflects confidence in the ability to exert control over one's own motivation, behavior, and social environment. The theory of self-efficacy was coined by Albert Bandura, an early cognitive psychologist who has contributed to many fields of psychology. The theory has been, and still is, very influential in modern psychology. Self-efficacy belief refers to an individual's belief in his or her capacity to execute behaviors necessary to produce specific performance attainments. The belief that one can control stressful events is related to emotional well-being, successful coping, health behaviors, better performance on cognitive tasks, and a good health. It has also been linked to a lower risk of mortality (Taylor, 2012). Efficacy belief is an idea with significant implications in education. Teacher efficacy is an important construct to predict their actual efficacious teaching. An individual's sense of efficacy is a judgment of his or her capabilities to accomplish certain levels of performance. A teacher's sense of efficacy is a judgment of his or her capabilities to bring desired outcomes of student engagement and learning, even among those students who may be difficult or unmotivated. Efficacy beliefs are somewhat resistant to change, once they are established. However, the development of self-efficacy beliefs seems to be more influenced by mastery experiences than information formed by social comparisons. People who have a low sense of efficacy in a given domain may withdraw from difficult tasks. They sustain their efforts in the face of failure, and they attribute failure to insufficient effort or deficient knowledge and skills that are achievable. They quickly recover their sense of efficacy after failures or setbacks (Bandura, 1993).

II. FOUR MAJOR SOURCES TO DEVELOP SELF-EFFICACY BELIEFS

There are four major sources that contribute to the development of self-efficacy beliefs. They are:

Performance accomplishments: The experience of mastery influences your perspective on your abilities. Successful experiences lead to greater feelings of self-efficacy. However, failing to deal with a task or challenge can also undermine and weaken self-efficacy

Vicarious experience: Observing someone else perform a task or handle a situation can help you to perform the same task by imitation, and if you succeed in performing a task, you are likely to think that you will succeed as well, if the task is not too difficult. Observing people who are similar to yourself succeed will increase your beliefs that you can master a similar activity

Verbal persuasion: When other people encourage and convince you to perform a task, you tend to believe that you are more capable of performing the task. Constructive feedback is important in maintaining a sense of efficacy as it may help overcome self-doubt.

Physiological states: Moods, emotions, physical reactions, and stress levels may influence how you feel about your personal abilities. If you are extremely nervous, you may begin to doubt and develop a weak sense of self-efficacy. If you are confident and feel no anxiety or nervousness at all, you may experience a sense of excitement that fosters a great sense of self-efficacy. It is the way people interpret and evaluate emotional states that is important for how they develop self-efficacy beliefs. For this reason, being able to diminish or control anxiety may have positive impact on self-efficacy beliefs.

III. SELF-EFFICACY IN MATHEMATICS LEARNING

Self-efficacy has the potential to facilitate or hinder our mathematics learner's motivation, use of knowledge and disposition to learn. Self-efficacy is the judgments we make about our potential to learn successfully and the belief in our own Capabilities. Self-efficacy impacts on a learner are potential to succeed. An insight into the self-efficacy of their learners is a valuable tool for mathematics educators. It is important for educators to know how their learners feel, think, and act, about, within, and toward mathematics. The influence of attitudes, values and personality characteristics on achievement outcomes and later participation in the learning of mathematics are important considerations for mathematics educators. One way to gain insight into how their learners feel, think, and act, about and toward mathematics are to examine their psychological domains of functioning: the affective, the cognitive, and the conative. It is important to examine each domain as a student may feel efficacious within the affective domain but less confident within the cognitive domain. Affect is a student's internal belief system. The affective domain includes students' "beliefs about themselves and their capacity to learn mathematics; their self-esteem and their perceived status as learners; their beliefs about the nature of mathematical understanding; and their potential to succeed in the subject". The cognitive domain considers students' awareness of their own mathematical knowledge: their strengths and weaknesses; their abstraction and reification of processes; and their development of links between aspects of the subject. Cognition refers to the process of coming to know and understand; the process of storing, processing, and retrieving information. The cognitive factor describes thinking processes and the use of knowledge, such as, associating, reasoning, or evaluating. Conation refers to the act of striving, of focusing attention and energy, and purposeful actions. Conation is about staying power, and survival. The conative domain includes students' intentions and dispositions to learn, their approach to monitoring their own learning and to self-assessment. Conation includes students' 'dispositions to strive to learn and the strategies they employ in support of their learning. It includes their inclination to plan, monitor, and evaluate their work and their predilection to mindfulness and reflection on their potential to succeed. Students' self-efficacy for mathematics may be defined as their judgments about their potential to learn the subject successfully.

IV. MATHEMATICS TEACHING EFFICACY

The quality of mathematics teaching depends on the knowledge and beliefs of the teacher. Appropriate level of content knowledge should increase teachers' self-efficacy in mathematics teaching. Socio-cultural aspects of education can possibly influence teachers' outcome expectancy. Teachers themselves should have experienced such early prerequisite learning, and they would also be aware, with a teacher's perspective, soon that there is no new knowledge for their students and that increasing students' achievement would be very difficult because the achievement level has already been increased. This societal mood may lead to decrease teachers'

outcome expectancy in mathematics teaching. Mathematics teaching efficacy is an important construct because such beliefs can predict teachers' future behaviours in mathematics teaching. Teacher education programs should help teachers develop a higher level of mathematics teaching efficacy. Therefore, understanding teachers' efficacy beliefs is an important factor in knowing how or whether new teachers will succeed in their practice. Efficacy beliefs may vary from the region of the world, and culture is the most influential factor to their own teacher efficacy. The contextual and socio-cultural settings surrounding teachers and the teacher education program can influence their personal efficacy and outcome expectancy in mathematics teaching.

V. SCHOOL AS AN AGENCY FOR CULTIVATING COGNITIVE SELF-EFFICACY

During the crucial formative period of children's lives, the school functions as the primary setting for the cultivation and social validation of cognitive competencies. School is the place where children develop the cognitive competencies and acquire the knowledge and problem-solving skills essential for participating effectively in the larger society. Here their knowledge and thinking skills are continually tested, evaluated, and socially compared. As children master cognitive skills, they develop a growing sense of their intellectual efficacy. Many social factors, apart from the formal instruction, such as peer modeling of cognitive skills, social comparison with the performances of other students, motivational enhancement through goals and positive incentives, and teachers' interpretations of children's successes and failures in ways that reflect favorably or unfavorably on their ability also affect children's judgments of their intellectual efficacy. The task of creating learning environments conducive to development of cognitive skills rests heavily on the talents and self-efficacy of teachers. Those who are having a high sense of efficacy about their teaching capabilities can motivate their students and enhance their cognitive development. Teachers who have a low sense of instructional efficacy favor a custodial orientation that relies heavily on negative sanctions to get students to study. Teachers operate collectively within an interactive social system rather than as isolates. The belief systems of staffs create school cultures that can have vitalizing or demoralizing effects on how well schools function as a social system. Schools in which the staff collectively judges themselves as powerless to get students to achieve academic success convey a group sense of academic futility that can pervade the entire life of the school. Schools in which staff members collectively judge themselves capable of promoting academic success imbue their schools with a positive atmosphere for development that promotes academic attainments regardless of whether they serve predominantly advantaged or disadvantaged students. Students' belief in their capabilities to master academic activities affects their aspirations, their level of interest in academic activities, and their academic accomplishments. There are a number of school practices that, for the less talented or ill prepared, tend to convert

instructional experiences into education in inefficacy. Classroom structures affect the development of intellectual self-efficacy, in large part, by the relative emphasis they place on social comparison versus self-comparison appraisal. Self-appraisals of less able students suffer most when the whole group studies the same material and teachers make frequent comparative evaluations. Under such a monolithic structure students rank themselves according to capability with high consensus. Once established, reputations are not easily changed. In a personalized classroom structure, individualized instruction tailored to students' knowledge and skills enables all of them to expand their competencies and provides fewer bases for demoralizing social comparison. As a result, students are more likely to compare their rate of progress to their personal standards than to the performance of others.

VI. CONCLUSION

Self-efficacy is concerned with people's beliefs in their capabilities to exercise control over their own functioning and over events that affect their lives. Succeeding periods of life present new types of competency demands requiring further development of personal efficacy for successful functioning. The nature and scope of perceived self-efficacy undergo changes throughout the course of the lifespan. Mathematics teaching efficacy is an important construct because such

beliefs can predict teachers' future behaviours in mathematics teaching. Teacher education programs should help teachers develop a higher level of mathematics teaching efficacy. Therefore, understanding teachers' Self-efficacy beliefs is an important factor in knowing how or whether new teachers will succeed in their practice. Students with higher levels of self-efficacy set higher goals, apply more effort, persist longer in the face of difficulty and are more likely to use self-regulated learning strategies. School is the key role of nurturing efficacy beliefs of students in order to learn and participate.

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