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Assessing Mathematics and Science Self-Efficacy Beliefs for Teaching

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Abstract

The study used a questionnaire survey to collect quantitative data from respondents. The independent variables of interest were level of math and science self-efficacy beliefs, as well as self-efficacy for teaching math and science. The questionnaire survey was voluntarily completed by 60 teachers, comprising 45 male and 15 female. The respondents ranged in age from 19 to 38 years. The findings of the study revealed that the mathematics and science teachers at the basic school had high level of self-efficacy beliefs. The study further discovered that though not strong, there is a positive relationship between math and science teachers' self-efficacy and their ability to teach math and science. The findings also found that math and science teachers' scores on the MSSEB scale for mathematics and science self-efficacy beliefs were generally higher than their scores on the SETMS scale for self-efficacy for teaching mathematics and science. The ability to effectively explain math /science concepts to students received the lowest mean rating in comparison to others. Teachers' self-efficacy beliefs and self-efficacy can be important considerations for teacher professional development training as a powerful intervening factor for teacher effectiveness and student performance outcomes.

Keywords: self-efficacy for teaching mathematics and science, personal beliefs, mathematics and science self-efficacy beliefs, self-image

1. Introduction

1.1 Background

The 21st-century math and science teacher faces a slew of challenges in rethinking and reorganizing student learning in the classroom to accommodate today's shifting paradigms. The paradigm shift in math and science instruction brought about by technology creates a "can-do" or "can't-do" impulse in teachers. McCampbell (2015) conducted a study that compared pre-service mathematics and science teachers entering the classroom to soldiers entering a battlefield unprepared. According to McCampbell (2015), many pre-service teachers are concerned that the classroom warfare will be unwinnable based on their self-worth assessment. Corroborating similar defeatist thoughts expressed by teachers, Usher and Pajares (2009) asserted that if teachers believe they are under-trained in their areas of specialization, they will be unmotivated to teach, let alone inspire learners to learn. In the opposite sense, if trainees are confident in their level of readiness to teach, they will be eager not only to teach but also to inspire learning. It is thus reasonable to conclude that the nature of teacher training has a significant impact on their self-efficacy to want to apply acquired knowledge and self-worth to assume responsible professional roles in their areas of specialization.

Meanwhile, one perplexing question is, 'What push factors drive persons to believe they are unworthy of learning and/or teaching mathematics or science?' An examination of teachers' self-efficacy beliefs is one method of investigating this question. Liu et al (2021) conducted a study on self-efficacy sources of Dibromoacetic Acid candidates and concluded that individuals generally have certain personal beliefs about how they perceive their ability to perform the task. This self-image of one's strength is called self-efficacy (Tiyuri et al., 2018). This perspective on self-efficacy is consistent with Gavora (2010), who stated that it is the incredibly heavy thought that a person has about whether or not s/he has what it takes to perform a given task according to some given standards. Thus, self-efficacy is an individual's belief that he or she can competently complete a given task by a set of criteria (Zuya, Kwalat & Attah, 2016).

Usher and Pajares (2009) revealed in their study that a person's belief in his abilities and belief in the likely outcome of his actions are not mirroring images of each other. They admit, however, that, what is expected of a person's abilities to accomplish is heavily dependent on his or her self-efficacy beliefs. Thus, when confronted with new tasks, people's self-efficacy beliefs may serve as filters through which new information is processed. Importantly, a high level of self-efficacy is required because it motivates a person to succeed.

A person's self-efficacy beliefs, according to Lopez-Garrido (2020), influence how he thinks and feels. As a result, how a person thinks and feels can either enable or hinder action. This means that a math and science teacher with a high level of self-efficacy will take on greater challenges, whereas a low level of self-efficacy will lead to inertia and non-performance. Lopez-Garrido (2020) defined self-efficacy as one's beliefs about one's abilities in a specific academic domain. Math and science self-efficacy is thus one's belief in one's ability to solve problems in math and science. According to Ferla et al. (2015), mathematics and science

self-efficacy is an indicator of an individual's self-perceived confidence in completing a mathematics or science task. Their findings are consistent with those of Tiyuri et al. (2018), who discovered that pre-service teachers with high self-efficacy are much more motivated to learn and persevere when faced with a challenge than their peers with low self-efficacy.

Similarly, Han and colleagues discovered that students with high self-efficacy are motivated and approach difficulties as challenges to be conquered, whereas students with low self-efficacy are less committed and approach difficulties as threats and with anxiety (Han et al., 2015, p). This belief aligns with the great Asian philosopher, Mahatma Gandhi, who once said that a person often becomes what he believes himself to be, which means that if he continues to believe that he cannot do something, he will never succeed; conversely, if he continues to believe that he can do something, he will surely acquire the capacity to do it, even if he does not have it at the start (Kundu, 2020).

Another unanswered question is: To what extent does a teacher's math and science self-efficacy reflect his/her competence? In other words, are highly self-efficacious math and science teachers proficient in their respective subjects? According to Gavora (2010), a strong sense of teaching self-efficacy is directly related to positive teaching behaviour. He went on to say that highly self-efficacious teachers are more likely to use effective teaching methods. It follows that students learn more from highly self-confident and highly self-confident teachers who are highly self-confident. Teachers with high self-efficacy in math and science teaching are always open to new ideas and willing to embrace innovations (Zuya et al., 2016).

Again, highly efficacious teachers experience less stress and have a stronger belief in students' freedom (Glazzard & Rose, 2019). They pay equal attention to students who are slow learners (Ross & Bruce, 2007). Furthermore, teachers with high teaching self-efficacy not only show greater interest in teaching but also a sense of self-satisfaction and are more likely to stay in the classroom for the rest of their working lives (Tschannen-Moram & Hoy, 2001).

In this context, math and science teaching self-efficacy is concerned with how teachers positively influence students in achieving success in mathematics or science, as well as reducing anxiety and negative beliefs about math and science (Kahle, 2008). Self-efficacy research is thus critical because it provides avenues for reducing anxiety and having a positive influence on students. Furthermore, self-efficacy studies inform stakeholders about the different types of learning environments in the classroom and how they affect teaching and learning. This is because a teacher's choice of instructional methods is known to be related to the current classroom environment (Hatlevik, 2016; Kahle, 2008).

Knowledge of teachers' self-efficacy beliefs is also important in tailoring professional training to maximize effectiveness (Usher, &Pajares, 2009). According to Unlu and Ertekin (2013), teachers' self-efficacy in mathematics or science is strongly related to their self-efficacy in teaching the same domains.

This study, focused on math and science because, at the basic level in Ghana, most of the teachers who teach mathematics are the same teachers handling science. Apart from that, at

the teacher training institutions in Ghana, math and science teachers always major in one of these specialisms and minor in the other. Bishop claimed in his 2008 study that both math and science are based on rational logic and are centered on universal knowledge statements. He went on to say that the values embedded in mathematics instruction are almost always implicit, whereas some are very explicit in science instruction, and that each is similarly incorporated into the applications of the other, but in an asymmetrical relationship.

Again, in Ghana, there has been little research on basic school teachers' math and science self-efficacy on the one hand, and their self-efficacy for teaching on the other. As a result, the study would help to close this gap

1.2 Statement of the Problem

One of the most important and often overlooked characteristics of an effective math and science teacher is their self-belief and ability to teach. Teachers' beliefs about their abilities provide the information needed to tailor professional development to maximize the quality of teacher performance (Zuya et al., 2016; Usher et al., 2016). As stated by Zuya et al. (2016) and McCampbell (2015), teachers who are highly self-directed in math and science and who demonstrate self-trust and independence through teaching will be more effective at inspiring learning.

Aside from being a facilitator, contributor, or integrator, the 21st-century math and science teacher should be adaptable, a life-long learner, tech-savvy, collaborative, forward-thinking, and an advocate for the profession. The extent to which these 21st-century features are manifested in classroom teaching and learning heavily rest on the individual's teacher self-efficacy beliefs for teaching the subject (Quiño, J., & Corpuz, 2021). This amply calls for new lenses to refocus on the issue of self-efficacy beliefs of math and science teachers.

Glazzard and Rose (2019) and Skaalvik and Skaalvik (2010) found that self-efficacy in teaching predicts stress, burnout, and job satisfaction. However, there appears to be little information available about math and science teachers' self-efficacy in Ghanaian basic schools. Furthermore, knowledge, according to Zuya et al. (2016), is a type of justified belief. Keeping this in mind, it is critical to investigate teachers' self-efficacy beliefs in light of the knowledge they possess for teaching.

Furthermore, we found that, although the teachers had chosen to teach these subjects, not all of the math and science teachers in the study district had received specialized training in these subjects. Curiously, it would be interesting to note the self-efficacy beliefs of these basic school math and science teachers, as well as the extent to which the latter influences their self-efficacy for teaching. Understanding the relationship between math and science self-efficacy and teaching self-efficacy is important because they are both worthwhile constructs.

1.3 Purpose and Objectives of the Study

The overarching concern of this study was to survey the relationship between mathematics and science teachers' self-efficacy and teaching self-efficacy at the basic school level. Precisely, the study attempted to achieve the following objectives:

1. To examine the self-efficacy level of mathematics and science teachers for teaching at the basic school level.

2. To establish the relationship between self-efficacy and teaching self-efficacy of basic school mathematics and science teachers.

1.4 Research Questions

The following research questions were developed to guide the study:

1. What is the self-efficacy level of mathematics and science teachers for teaching at the basic school level?

2. What is the relationship between self-efficacy and teaching self-efficacy at the basic school level?

2. Related Literature Review

2.1 Teachers' Mathematics and Science Self-Efficacy Beliefs (MSEB)

It seems that the common understanding in many classrooms is that students already have personal belief systems about what will be taught, and these beliefs influence learning to a large extent. Based on this, knowledge of teachers' beliefs as well as how their beliefs relate to teaching practice can provide educators with the best opportunity to plan instructions and better support teacher development in lifelong learning (Fives and Steup, 2018). According to Kutakaet al. (2018), educators develop belief systems that are resistant to change. He continued by saying that teachers who continue to use conventional teaching techniques encounter greater resistance to change.

Beliefs influence people's behaviour and guide their actions. A study by De Corte, Verschaffel, and Depaepe (2008) found that students continue to hold "naive, incorrect, and/or negative beliefs about math as an area of learning and education." (p. 3), disproportionate to grade level. In addition, public commentary on mathematics and science is often accompanied by fear and anxiety. These fears and anxieties often lead to the belief that a person may or may not do well in math and science. The term that has been coined to describe this tendency is the self-efficacy of mathematics and science. Teachers and students share certain beliefs about their effectiveness in teaching and learning math and science. The concept of math and science self-efficacy is a measure of how math and science teachers assess their ability to design and successfully achieve math and science instructional goals (Zuya et al., 2016; Bates, Latham, and Kim, 2011). In another context, it is the confidence that teachers have in their ability to perform math or science tasks. There are many ways researchers refer to different types of self-efficacy beliefs, so it's important to clarify the terms. Bandura refers to self-efficacy as "self-perceived efficiency", but then says that in a literary sense, he would use "self-efficacy" (Lopez-Garrido, 2020). Usher et al. (2009) use

the term "self-efficacy" throughout their paper. The term "teacher effectiveness" is used by Klassen et al. (2011) as a term that encompasses beliefs about teacher effectiveness and beliefs about collective effectiveness. Another term that is frequently used in relation to teaching is teacher effectiveness. For this study, all sorts of beliefs about self-efficacy and the effectiveness of actions will be referred to as Math and Science Self-Efficacy Beliefs (MSSEB). MSSEB is here considered self-effectiveness of knowledge of the subject matter. In this case, the teacher trusts his or her knowledge in the field of math or science.

2.2 Self-Efficacy for Teaching Mathematics and Science (SETMS)

According to Bandura's theory of self-efficacy, there are four sources from which self-efficacy beliefs are developed: mastery experiences, social models (indirect experience), persuasion by speech/social, and physiological state (Lopez-Garrido, 2020). Competency experiences include knowledge acquisition, skill development and refinement, practice, performance, and generally formal education and learning experiences. The social model deals with situations in which learning takes place indirectly, not by the learner but by the learner observing the learning. Teachers, especially prospective teachers, learn by watching the teacher teach. A study by Rymanowicz (2015) has shown that the quality of learning is associated with expert knowledge of the mimicry model, the similarity between the model and the learner, as well as the ability to visualize the body of a person.

Verbal or social persuasion includes comments and messages received by learners. Physiological and emotional states record the effects our bodies have on our experiences and memories. Some teachers may have received messages claiming that teaching math and science is a career to pursue and commenting on being a good teacher. On the other hand, teachers who have had unpleasant experiences in math or science may experience anxiety when these memories are triggered. According to Bates et al. (2011), self-efficacy is an important filter of human capacity as well as a dominant mediating factor between beliefs and behaviour. Even though research indicates that simply knowing a subject matter does not automatically make one a good teacher (Ball et al., 2008), a math or science teacher's skills are still the culmination of their professional knowledge and experience, which also includes the beliefs necessary to work in these fields (Ozge, 2015).

Finally, Zuya et al. (2016) agree that highly effective teachers are more likely to successfully apply their professional knowledge and skills than teachers with low self-esteem. Therefore, low performance in math and science can limit the effective application of professional knowledge and practice, and thus hinder student learning. In fact, "teachers' self-efficacy is related to persistence; The stronger the self-efficacy, the greater the persistence, and the greater the persistence, the higher the possibility of successful teaching" (Gavora, 2010, p. 18). This claim shows that highly effective teachers tend to work harder and persist longer to achieve their math and science teaching goals. But does this also mean that teachers who score high on the math or science self-efficacy scales will be better able to implement the right hybrid scaffolding methods in their classrooms? Jacobs and Kane (2020) reported that the self-efficacy of first-year osteopathic medical students was strongly correlated with their academic performance. According to the Khale (2008) study, pupils who excelled in math

and science were more likely to major in math or science in the future. This indicates that kids who succeed in math and science are more likely to pursue a major that demands them.

What is the relationship between one's self-efficacy in math and science and one's ability to teach math and science? The research reports provided by Bates et al. (2011) and Gresham (2008) found that the anxiety of prospective math and science teachers was negatively related to their beliefs about the effectiveness of science or math teaching. Bates et al. (2011) further reported in their literature that half of the 65 preparatory teachers enrolled in the math and science method course felt that they would not be able to teach math effectively (ibid.). In this study, it was noted that students worried about math or science showed high confidence in science and math education, while students worried about math and science had less confidence in math and science. Confident in his ability to teach. math or science. Gresham (2008) surveyed 20 elementary school teachers and found that the participants' responses to their anxiety about math and science reinforced their beliefs about the effectiveness of their teaching. Courses in scientific and mathematical methodology were also found to be strongly associated with student achievement and instructional effectiveness during internships (Bates et al., 2011).

2.3 Connections between MSEB and SETM

A study by Unlu and Ertekin (2013) on the effectiveness of science and mathematics in teaching and their beliefs in their effectiveness found that participants rated scores on both scales as high. The study also found a significant positive relationship between self-efficacy in teaching math and confidence in the self-efficacy of elementary school math and science teachers in early childhood education. Similarly, belief in the effectiveness of math and science, as well as the effectiveness of self-teaching, was found to be strongly associated with conceptual and procedural knowledge in these areas.

Research by Turner et al. (2009) shows that teachers' beliefs about effectiveness affect how they motivate and motivate learning. Turner et al. (ibid) believed it was important to professionally examine a teacher's self-efficacy beliefs because highly effective teachers can have an impact on learning quality in terms of environmental factors. Learning in any setting is positively impacted by Self-efficacy in teaching mathematics is a predictor of self-efficacy in teaching (Erbay, 2021). Study by According to Hatlevik (2017), self-efficacy in teaching is a critical factor in implementing effective teaching practices. He also discovered a positive relationship between teachers' self-efficacy in information and communication technologies (ICTs). In addition, Liu and Koirala (2009) investigated the effects of math and science effectiveness on high school students' math achievement. Their research shows that promoting student effectiveness has the potential to improve math and science achievement.

3. Methodology

3.1 Research Design

The study used a survey, with a quantitative method, to collect data from the participating teachers. The variables studied were beliefs about self-efficacy and self-efficacy in teaching

math and science. Quantitative data is most appropriate for studying relationships because the data can be measured objectively (W. Creswell & D. Creswell, 2018).

3.2 Population, sampling, and sampling techniques

The study population included all primary school math and science teachers in the Pusiga District in the Upper East Region of Ghana. The study began at the beginning of the 2018/2019 academic year. A sample of 60 participants, including 45 male and 15 female, voluntarily completed the survey questionnaire. There is no data from the District Office of Education (DEO) on the number of math and science teachers specifically for the school year in question. This challenge informed our choice of survey design and, therefore, convenience sampling technique. The ages of the respondents ranged from 22 to 56 years old. The 60 respondents all taught math or science or both. Again, not all the respondents majored in math and science.

3.3 Research Tools

Two different questionnaires were used as data collection tools; these are the MSSEB (Mathematics and Science Self-Efficacy Beliefs) and SETMS (Self Efficacy in Teaching Mathematics and Science) questionnaires. The questionnaire consisted of two parts: the self-efficacy level of teaching math and science, parts A and B. The MSSEB and SETMS both consisted of a 10-item questionnaire and are based on an adjusted 5-point scale from Tschannen-Moran et al. (2001) and Zuya et al (2016). Respondents were asked to express their confidence level from “strongly disagree” to “strongly agree”.

3.4 Research Process

The research began with self-administered questionnaires. Respondents had enough time to complete the questionnaires. Sixty (60) respondents completed all items of the questionnaire and returned them.

3.5 Data analysis plan

The obtained data were analysed using correlation and descriptive statistics tools. Research question 1 is answered using descriptive statistics while research question 2 is answered using correlation statistics.

4. Results and Discussion

The study sought to understand respondents’ beliefs about their effectiveness in math and science (MSSEB) and their effectiveness in teaching mathematics and science (SETMS). again, the study went further to seek the relationship that exists between these two variables, MSSEB and SETMS. The analyses are presented according to the research questions.

4.1 Measuring Basic School Math and Science Teachers’ Level of Effectiveness

To answer this question, respondent effectiveness was measured using the MSSEB questionnaire. The responses of the participants were analysed using descriptive statistics and

the results are presented in Table 1. When the average response level of respondents to an item is less than 3, respondents have a lower level of confidence in this factor.

Table 1: Mathematics and science self-efficacy belief (MSSEB)

No.	Items	Mean	SD
A1:	I am confident that I can solve new mathematical/scientific problems related to the level I am teaching	3.90	1.017
A2:	I am confident of solving real-world math and science problems	3.62	1.027
A3:	I am confident solving reasoning problems in math and science with my students at the basic level	3.63	1.089
A4:	I have always felt myself able to learn math and science	4.02	.911
A5:	I find doing math and science interesting and challenging	3.82	.965
A6:	I have less trouble learning math and science than other subjects	3.67	1.311
A7:	I feel confident using math and science outside of school	3.67	1.174
A8:	I am confident about my ability to solve math and science problems	4.03	1.025
A9:	I always feel excited when trying to solve a math and science problem	3.58	1.139
A10:	When I have difficulties with math and science, I know I can handle them	3.93	1.039
N = 60		3.80	1.07

(Source: Field Survey Questionnaire, September 2019)

Table 1 consists of 10 items, five of which test respondents' feelings on the one hand and the other five on their ability to do math and science. It can be seen that respondents' attitudes toward math and science were generally more positive than their ability to do/solve problems. As shown in Table 1, none of the entries recorded mean valuesbelow 3.0. Again, the overall mean response of respondents to all items on the math and science effectiveness questionnaire was 3.80. This shows that math and science teachers have a high level of self-efficacy. High effectiveness means teachers are confident in their knowledge of math and science content. Since possessing content knowledge alone does not necessarily translate into good teaching (Ball et al., 2008), it is necessary to obtain information about teachers' self-teaching effectiveness on content. Teaching Math and Science (SETMS). In doing so, another set of questionnaires measuring SETMS was administered to the respondents. The results are shown in Table 2.

Table 2. Level of Self-Efficacy for Teaching Mathematics and Science (SETMS)

No.	Items	Mean	SD
B1:	I will constantly find better ways to teach math and sciencee	3.87	1.081
B2:	I know how to teach math and science concepts effectively	3.32	1.081
B3:	I understand math and science concepts well enough to be effective at teaching math and science at the Junior High School level	3.13	1.096
B4:	I understand math and science concepts well enough to be effective in teaching math and science in elementary school	3.82	1.033
B5:	When I teach math and science, I often permit questions from my students.	4.15	1.005
B6:	I find it very easy to use concrete manipulatives to explain concepts to students when teaching math/science.	3.38	1.075
B7:	When a student has difficulty understanding math concepts and science	3.57	1.047
B8:	When a student has difficulty understanding math and science concepts, I think I can help students better understand	3.85	.988
B9:	I am confident I can help students master new concepts in math and science	3.70	1.062
B10:	I feel I will be able to improve the performance of students in math and science through a variety of teaching methods	3.85	0.18
N = 60		3.66	0.31

(Source: Field Survey Questionnaire, September 2019)

Table 2 shows that the average response for each item on a 5-point scale is greater than 3.00. This indicates that the majority of respondents have a satisfactory level of confidence in individual items. Across all items, the overall mean response was 3.66 with a standard deviation of 0.31. Again, this shows that respondents have a high degree of confidence in the effectiveness of their math and science teaching.

4.2 Relationship Between Basic School Teachers' Msseb and Setms

To establish the relationship between MSSEB and SETMS of teachers, the Pearson product-moment correlation coefficient was calculated and the result is presented in Table 3.

Table 3. Pearson Product-Moment Correlations Between MSSEB and SETMS

Variables	Correlation Coefficient	Sig (2 tail)	Effect Size
MSSEB SETMS	0.285	0.424	0.20

Table 3 shows that among teachers, there is a positive relationship between self-efficacy beliefs and self-efficacy for teaching math and science. It suffices to say that these teachers have a strong sense of mathematics or science self-efficacy beliefs and self-efficacy for teaching, and thus have a higher potential for promoting productive struggle in students' learning. It also implies that teachers with high self-efficacy are more likely to support

learning in a constructivist manner. Even though the fact that the relationship was not strong, this study suggests that there is a direct relationship between the quality of education obtained in schools and the quality of the teacher's teaching. Effective teachers believe they can make a difference in their student's lives, and they teach in ways that reflect this belief. Teachers' self-perceptions of their abilities are a strong predictor of their effectiveness.

4.3 Findings

Respondents' opinions about math and science, in general, were more favourable than their aptitude for problem-solving. A high level of math and science self-efficacy was demonstrated by the respondents, whose response rate exceeded the average of 3 points on a 5-point scale. Math and science self-efficacy beliefs and math and science teaching self-efficacy have a tenuous positive relationship.

4.4 Discussion of Findings

The findings of this study revealed that math and science teachers have high levels of self-efficacy beliefs and teaching self-efficacy. These findings are consistent with those of Erbay et al (2021), Zuya et al (2016), Unlu and Ertekin (2013), and Khale (2013). (2008). According to Erbay (2021), self-efficacy accounted for math and science teaching self-efficacy. In an era when the government pretended to pay and teachers pretended to work, the fact that math and science teachers with high self-efficacy are consistently open to embracing new concepts and innovations gives stakeholders comfort. A highly effective teacher would teach with little remuneration and motivation. Since self-efficacy beliefs in math and science, as well as self-efficacy in teaching, are linked to conceptual and procedural knowledge (Jacobs, & Kane, 2020), the emphasis should be on recruiting professional teachers who have these traits, a strong sense of self-efficacy beliefs, and self-efficacy in teaching.

Another important finding of this study is the positive relationship that existed between math and science self-efficacy beliefs and self-efficacy for teaching mathematics and science. This finding corroborates Zuya et al (2016) who found a moderately positive correlation between the teachers' MSSEB and SETMS. Earlier research by Jacobs and Kane (2020), and Unlu and Ertekin (2013) found a strong relationship between the two constructs. It can therefore be concluded that, the belief that teachers hold about their capability to do mathematics and science correlated positively with the belief in their capability to teach mathematics and science. This is a restatement of Erbay (2020) who reported that mathematics and science self-efficacy accounted for mathematics and science teaching self-efficacy. The results also indicated that the mathematics and science teachers' scores in MSSEB were generally higher than their scores in SETMS. This trend is evident in the grand mean scores in Tables 1 and 2 (3.80 and 3.66) respectively. This observation runs counter to Zuya et al (2016) who found that pre-service teachers' mathematics teaching self-efficacy was higher than their mathematics self-efficacy. This study's finding suggests that knowledge of doing mathematics and science does not always translate to the knowledge of teaching mathematics and science. As a result, MSSEB cannot be used to predict SETMS among teachers. This explains why the two constructs have a weak positive correlation.

However, the category for effectively explaining math and science concepts to elementary school students had the lowest average score compared to other categories. Therefore, more attention should be paid to mathematical and scientific knowledge to be taught in teacher training programs. As stated by Bandura (1993), teachers' beliefs in their effectiveness to motivate and promote learning to influence different types of learning environments and, therefore, increase learning progress.

4.5 Conclusion and Recommendations

Teacher self-efficacy beliefs and teaching self-efficacy are important variables that account for teacher effectiveness and are consistently related to teacher behaviours and student outcomes. Teachers' professional development should include self-efficacy beliefs with a focus on improving teacher competence and student outcomes in the face of rising teacher dissatisfaction due to low pay.

Amid the increasing teacher uncertainty about their performance, belief in self-efficacy is a viable concept that should be incorporated into professional teacher training as a powerful mediator between learning and later outcomes. As the goal of the country being to produce effective, inspirational, and engaging professional teachers, belief in one's competence and teaching effectiveness should be central to curriculum planning and design. We believe that if teachers' beliefs about their effectiveness are at the heart of the design of in-service activities and career development, it will provide a theoretical basis for understanding more clearly why and how to develop self-motivated teachers who can inspire learning.

It will also provide practical tools that can be used to cultivate beliefs about positive effects, improve teacher skills, and improve student outcomes. Ongoing in-service training is required to improve the self-efficacy of math and science teachers, as well as self-teaching effectiveness and enhance lifelong learning. On-the-job training will not only increase confidence but also knowledge effectiveness, especially for teachers who have not had specialized math and science training. This study shows that some teachers have no specialized training but have high MSSEB and SETMS.

We recommend that observations of how teachers teach are conducted to compare this with their self-perceived effect on teaching. This will allow not only validation but also to detect possible wrong answers to the questionnaire items. It is suggested that interviews be part of data collection methods in future research of this type. This will further reveal teachers' beliefs about their potential and teaching effectiveness.

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