Contemporary Mathematics and Science Education
2023, 4(1), ep23010
ISSN 2634-4076 (Online)
https://www.conmaths.com/

Research Article

OPEN ACCESS

Impact of mathematics teachers' self-efficacy belief and professional development on teaching mathematics in inclusive settings in Ghana

Henry Kwami Apoenchir [1], Paul Kobina Annan Bedu-Addo [2], Christopher Saaha Bornaa [3], Kyeremeh Tawiah Dabone [4], Eugene Kwarteng-Nantwi [4], Gladys Attah-Gyamfi [4], Kwesi Amanyi Churcher [3], Margaret Oppon-Wusu [5], Francis Owusu-Sekyere [3], Bernard Kissi-Abrokwah [3]*

[1] SDA College Education, Asokore-Koforidua, GHANA
[2] The University of Education, Winneba, Winneba, GHANA
[3] C. K. Tedam University of Technology and Applied Sciences, Navrongo, GHANA
[4] University of Cape Coast, Cape Coast, GHANA
[5] Antoa Senior High School, Biribiwomang, GHANA
***Corresponding Author:** bkissiabrokwah@cktutas.edu.gh

Citation: Kwami Apoenchir, H., Bedu-Addo, P. K. A., Saaha Bornaa, C., Tawiah Dabone, K., Kwarteng-Nantwi, E., Attah-Gyamfi, G., Amanyi Churcher, K., Oppon-Wusu, M., Owusu-Sekyere, F., & Kissi-Abrokwah, B. (2023). Impact of mathematics teachers' self-efficacy belief and professional development on teaching mathematics in inclusive settings in Ghana. *Contemporary Mathematics and Science Education*, 4(1), ep23010. https://doi.org/10.30935/conmaths/13009

ABSTRACT

The study was based on quantitative assumptions, and investigation was done to check the impact of mathematics teachers' self-efficacy beliefs (MTSEB) and their professional development (PD) in teaching mathematics in inclusive settings. The theoretical foundation of the study was based on self-efficacy beliefs and the concept of system thinking. A purposive sampling technique was used to select all senior high schools practising inclusive education and mathematics teachers teaching in those inclusive settings. The sample used for the study was all 95 mathematics teachers found in all the inclusive settings. The study concluded that MESEB and PD have enhanced the 14 instructional delivery of mathematics and assisted families to help their children do well inmathematics. It was also found that the most difficult parts of teaching in an inclusive setting were not being able to help students understand pictures and diagrams during mathematics lessons and not having enough resources to help students learn. On issues related to teachers managing students in an inclusive setting, it was concluded that the PD of teachers helps them gradually shape students until they can perform the expected behaviour before they are reinforced. However, it was recommended that institutions in charge of issuing certificates for teachers should ensure that the training and development of teachers are done intensively through presentations or practicums to build teachers' self-efficacy for good instructional delivery. Again, the Ministry of Education needs to concentrate on creating more inclusive educational institutions and giving them the tools, they require so that instructors can effectively instruct pupils. The researchers recommend that the inclusive education environment should have a well-established classroom management plan or guideline within which the instructor must function. The national rules should be modified to include a classroom management guideline that is adapted to the unique needs of the students in each inclusive educational environment. During their practicum, teachers should learn about this classroom management rule, which will help them do their jobs in the classroom.

Keywords: professional development, self-efficacy belief, mathematics teachers, inclusive setting, Ghana, senior high schools

Received: 18 Sep. 2022 ◆ Accepted: 22 Feb. 2023

INTRODUCTION

The no child left behind (NCLB, 2001) law, which demands that disabled children are involved in the nation's examinations to fulfil metrics of acceptable annual progress aimed at all student demographics, marked the culmination of accountability movement. Due to the fact that disabled students need to have the same understanding of topics as students in regular education, these rules required that they get the same standards-based curriculum as children who are not disabled. IDEIA (2004) and NCLB (2001) requirements were considered to have a practical solution for the integration of disabled students in general education classes. Because of these changes in the law, disabled children are increasingly placed alongside a variety

of integrated models, which causes many problems for schools (Termini, 2003). General education teachers must be ready to discourse on the different learning requirements of the learners in their classrooms as many disabled students get special education services in inclusive settings. Unfortunately, common education teachers in inclusive classrooms are unwilling to do what is necessary. Feelings of unpreparedness may result from a lack of experience, skills, and knowledge in teaching impaired students, particularly in the areas of behaviour management and substitute or alternative instructional methods (Norman et al., 1997). Arnold (2005) says that it is important to find out how teachers feel about their ability to meet the needs of students in classrooms where there are more and more people from different backgrounds. Countries are adopting restructuring measures to help assure that schools have a constructive influence on student performance for the whole student population, despite the fact that schools are struggling to satisfy the standards outlined in (Ahearn, 2002; Darling-Hammond, 2004; Olson, 2002). In order to address the educational demands of different student groups, teachers are now realising that they must reflect on their present pedagogical knowledge and methods (Darling-Hammond & McLaughlin, 1995). Based on this, it was concluded that "the challenge of establishing learning environments favourable to the development of cognitive competencies is strongly dependent on the abilities and self-efficacy of the instructor" (Bandura, 1977, p. 240). In the classroom, teachers' self-efficacy and personality unswervingly affect students' accomplishments (Darling-Hammond & McLaughlin, 1995). Nevertheless, additional alleviation reasons, together with professional development (PD) activities, are essential for the growth of teachers' self-efficacy (Lewandowski, 2005). Furthermore, when the knowledge and aptitudes gained are relevant to the teacher's classroom environment, PD events have an effect that is beneficial to one's sense of self-efficacy (McLaughlin & Berman, 1977; Scribner, 1998). PD programmes that are suitable for instructors increase teachers' motivation to create lessons, which encourage high levels of participation from the students (Ashton & Webb, 1986; Gibson & Dembo, 1984). Even though it has been established that teachers are the most vital asset in schools, not much is done to encourage their continuous education and advancement (Termini, 2003). Teachers must have the chance to try out new knowledge and skills so that they are more likely to use and remember new strategies and practises when lecturing. This is doable through PD opportunities. The premise that teachers may accomplish anticipated results when they put new information, understanding, and abilities into practise inside the framework of high-quality PD opportunities is continuously supported by research (NCREL, 2006). The presence of constructivist educational theories among many educators and the employment of techniques, such as research, questioning, project-based teaching, and collaborating cluster structures, that are most consistent with these concepts have been connected to high-quality ongoing PD (NCREL, 2006, p. 7). Schools are responding more by offering special education assistance in the regular education classroom as a result of IDEIA (2004) and NCLB (2001). According to the National Council of Teachers of Mathematics (NCTM) Principles and Standards for School Mathematics (SSM) (NCTM, 2000), every child should have exposure to an equitable and high-quality mathematics education. As inclusive policies spread through the education system, teachers in both regular and special education worry more and more about their ability to teach students who are disabled. The recent results of disabled students in the Virginia standards of learning (SOL) exams demonstrate the need for assistance and provision for mathematics teachers in delivering high-quality education for disabled students in an inclusive environment. To a certain degree, mathematics teachers require assistance in obtaining new-fangled professional knowledge and grasping to improve both their instructional strategies and self-efficacy to have a greater impact on the arithmetic accomplishments of children with disabilities. The design, planning, and implementation of PD line-ups that give mathematics teachers the chance to improve their subject-matter knowledge while acquainting themselves with ways to discern training to resolve the learning requirements of the varied student numbers present in our schools these days must be taken into consideration by educational leaders. To achieve that aim, it is imperative to investigate the impact of mathematics teachers' self-efficacy beliefs (MTSEB) and their PD in teaching mathematics in inclusive settings. How does intensive PD enhance the instructional delivery of mathematics in inclusive settings? Challenges mathematics teachers encounter in teaching mathematics in inclusive settings How does PD enhance a teacher's classroom management in inclusive settings? How does PD enhance teachers' competence in the course delivery of mathematics in inclusive settings?

LITERATURE REVIEW

Theoretical Framework

Different theories were reviewed in the empirical studies. These theories include self-efficacy belief and systems thinking. This section provides an overview of these theories within the context of mathematics teachers self-efficacy belief and PD in teaching mathematics in inclusive settings.

Self-efficacy belief

A concept that has arisen from social cognitive theory is teacher self-efficacy (SCT). The theoretical foundation for this study is social cognitive theory, which was developed by Bandura (1977). The perception a teacher has of his ability to impart knowledge effectively and to address student behaviour regardless of the level of motivation displayed by the students is known as teacher self-efficacy (Bandura, 1977; Tschannen-Moran & Hoy, 2001). When teachers engage in PD to advance their skills and knowledge, they believe they can work with their students to attain the results they want. Because they believe they have the potential to be effective in attaining the goals they set for themselves and their students, teachers who have high self-efficacy are receptive to innovation in instructional practise and exhibit strong classroom management (Dibapile, 2012). The basic concept of Bandura's (1977) social cognitive theory of learning is that people learn through their social interactions with others. As a result, instructors' self-efficacy in the classroom can be increased by modelling, imitation, and observation. Therefore, it is thought that through influencing teachers socially through PD, teacher competence could be increased. This social impact can be attributed to the type of motivation teachers experience in their line of work as a result of seeing, copying, or basing their instructional strategies on others in the same line of work. This suggests that instructors' abilities may be improved by the type of inspiration they receive from others as well as the motivation they experience from observing others successfully carry out their teaching duties.

Table 1. Targeted population/sample of the study

List of inclusive SHSs mathematics teachers population/sample	n
Adidome Senior High School	11
Ghana National College	14
Mampong Akuapem Senior High School	9
Okuapeman Senior High School	13
Sirigu Senior High School	11
St. John's Integrated Senior High School	10
WA Senior High School	14
Wenchi Methodist Senior High School	13
Total	**95**

Note. Source: List collated from various SHSs (2022)

Systems thinking

The ability to picture the system and get an understanding of how it operates is facilitated by adopting the perspective that education is the sum total of its component elements, each of which operates independently and in conjunction with the others to realise a shared, idealised societal goal. When seen from this holistic viewpoint, the requirements of the school may be more easily identified, and administrators and instructional leaders can more effectively set goals and objectives within action plans that are geared towards enhancing the teaching and learning process. These "aligned acts of improvement" (Senge, 1990) will make it possible for instructional leaders to design PD programs that cushion instructors while they acquaint themselves with the mode of designing and implementing focused teacher practises on raising the access of students to the regular education curriculum. Those programmes will be implemented by instructional leaders. It is imperative that the members of the institution join in discussions associated with operative instructional practises that will address the wants of all students, as these learning organisations are constantly adjusting their operations in order to comply with a number of different legislative mandates. When they take part in collective dialogues, members of an organisation are able to collaborate in a communal vision of educational accomplishment for all of the pupils enrolled in their school. Associates of student groups not only gain knowledge as a group but also as individuals while simultaneously working together to get an understanding of how their respective schools operate (Senge, 1990). By taking part in these activities, a teacher may feel more in control, which may make him or her feel more confident in his or her skill to teach mathematics in inclusive settings.

METHODS

The underlying philosophical assumptions of the study on how knowledge was gained and constructed were based on the positive paradigm. The study used a quamtitative approach, and the design was a descriptive survey interested in investigating the current situation of MTSEB and their PD in teaching mathematics in inclusive settings in Ghana. The population consists of all eight senior high schools (SHSs) in Ghana running inclusive education. **Table 1** represents the targted population and sample of the study.

To have a fair knowledge and understanding of how MTSEB and their PD in teaching mathematics in inclusive settings in Ghana can be investigated in depth. The researchers purposefully selected all the SHSs in Ghana practising inclusive education and all the mathematics teachers teaching in those schools. Prior to the data collection, the researchers wrote a letter to the authorities of various inclusive schools, informing them about our objectives in conducting this study. When access was granted, the researchers then interviewed the respondents to seek their consent for involving them in this present study. The researchers used field assistants, with each researcher present in a SHS to help with data collection, which took place within three months, that's from May to July 2022.

Table 2. Analysis of respondents background information

S/N	Variables	Frequency (n)	Percentage (%)
	Gender		
1	Male	76	80.00
	Female	19	20.00
	Academic qualifications		
2	First degree	51	53.68
	Master's	44	46.32
	Working experience		
	1-5	19	20.00
3	6-10	42	44.21
	11-15	25	56.32
	16+	9	9.47
	Type of teacher		
4	Professional	79	83.16
	Non-professional	16	16.84

Note. Source: Field Data (2022)

RESULTS

The results of the study were grouped into two phases. The first phase focused on the analysis of the background data of the respondents, while the second highlighted the descriptive analysis of the research questions (**Table 2**).

Descriptive statistics were used to analyse the research questions in the study. The respondents were asked to rate their degrees of agreement or disagreement with statements related to a specific study issue using a four-point Likert-type scale. Any result below 1.99 on the scoring scale denoted a low response, while values between 2.00 and 1.99 denoted a medium response (Kissi-Abrokwah, 2021; Ofori & Dampson, 2012). A significant response rate from respondents was indicated by the score range of 3.00-3.99. The respondent could only get a mean (M) value between 1.00 and 4.00 on the four-point Likert-type scale. According to this claim, a score between 3.00 and 3.99 was considered the highest, and a score of less than 1.99 was considered the lowest. The Likert scale scores were added together to determine the medium score range. In other words, strongly agree received a score of four, agree a score of three, disagree a score of two, and strongly disagree a score of one. The medium test value was calculated by summing up all of the scores (4+3+2+1=10) and dividing that number by the four-point Likert scale (10/4=2.5). A score of 2.00 to 2.99 was considered to be medium. The researchers used this format to check the range of responses. The underlying assumptions were used to explain the results of the study.

The responses on the item "to what extent can you motivate students who show low interest in mathematics based on your instructional delivery?" recorded an M of 3.82 (standard deviation [SD]=0.23), which was within the highest score range. On the question of whether "PD help teachers provide remedial opportunities for acquiring the knowledge and skills, if necessary," an M of 3.79 (SD=0.26) was recorded, indicating that MTSEB and PD do indeed

Table 3. MTSEB and PD on instructional delivery of mathematics in inclusive settins

Statement	n	M	SD	MR
How well does your instructional delivery motivate mathematics averse students?	95	3.82	0.23	1st
How does your professional development help teachers provide remedial opportunities for acquiring the knowledge/skills, if necessary?	95	3.79	0.26	2nd
How does your professional development improve students understanding of mathematics?	95	3.72	0.29	3rd
How much can you use different ways to test your math skills after your institution's delivery?	95	3.69	0.42	4th
How does your professional development improve teachers' procedure of teaching mathematics for students to understand?	95	3.63	0.32	5th
When students are confused, to what extent can you give them a different explanation or example?	95	3.58	0.31	6th
How does your professional development improve teachers self-confident and esteem to teach mathematics?	95	3.52	0.46	7th
How does your professional development help you evaluate students on time and figure out how theylearn?	95	3.52	0.45	8th
To what extent can you get students to believe they can do well in mathematics with your institutional delivery?	95	3.49	0.35	9th
How does your PD enhance your new skills and methods of teaching mathematics such as role play, demonstration group, studies, etc.?	95	3.21	0.46	10th
Does your professional development help teacher evaluate student acquisition?	95	3.11	0.13	11th
How does your professional development enhance your classroom participation and interaction with students during institutional delivery?	95	3.06	1.03	12th
How effectively can you work with families to help their kids succeed in mathematics using your institutional delivery method?	95	2.95	1.09	13th
How does your professional development help teacher demonstrate student's successful use of the knowledge and skills through modelling?	95	2.78	0.99	14th
To what extent can you help your students value learning mathematics based on your instructional delivery?	95	2.68	1.23	15th
How well are you able to create solid mathematical questions for your students?	95	2.45	1.07	16th
To what extent can you get students to follow classroom rule when delivery instructional lesson?	95	2.21	1.28	17th
How successfully can you adapt mathematics teaching methodologies to your institution?	95	2.19	1.28	18th

Note. Source: Field Data (2022)

improve mathematics instructional delivery in inclusive settings. However, it was reported that PD improves students' understanding of mathematics and also helps teachers use a variety of assessment strategies in mathematics after its institutional delivery.

From **Table 3**, it was also recorded that PD improves teachers' procedures of teaching mathematics for students to understand (M=3.63, SD=0.32); while students are puzzled, presenting an alternative explanation for example through the institution's delivery system was also recorded M=3.58 and SD=0.31. In the same vein, respondents asserted that PD improves teachers' self-confidence and self-esteem to teach mathematics, while other respondents commented that PD helps them assess students on time and evaluate learning procedures.

Some scales found in **Table 3** recorded a moderate response rate on how MTSEB and PD enhance the instructional delivery of mathematics in inclusive settings. It was reported that respondents were assisting families to help their children do well in mathematics with your institutional delivery. Other respondents commented that their PD helped them to demonstrate the student's successful use of the knowledge or skills through modelling. Finally, the study shows that respondents can get students to follow classroom rules when delivering instructional lessons, while other respondents said that they can implement alternative teaching strategies for mathematics in their classrooms to fit their institutional delivery. The next section explains the challenges mathematics teachers encounter in teaching mathematics in inclusive settings.

From **Table 4**, respondents confirmed that "they have trouble keeping their place on a page in the textbook or workbook during mathematics instruction" (M=3.81, SD=0.14). The lack of resource rooms to help students do mathematics well in inclusive settings got the second-highest score. Due to a lack of resources to support students' learning in inclusive settings, it has been observed that students with disabilities cause the majority of behavioural issues during mathematics instruction. For example, some respondents said they had trouble understanding pictures and diagrams when teaching mathematics to students, while others said they didn't have enough time to pay attention to each student when teaching mathematics. It was shown that some respondents were complaining of "difficulties they have in oral communication in mathematics during mathematics instructional delivery." This scale also got a moderate number of responses. "Contributions in class are done by a few students while other students disrupt during mathematics instructional delivery." The result further shows a "difficulty in marking students' scripts and providing feedback on time during mathematics instructional delivery" was among the challenges mathematics teachers encounter in teaching mathematics in inclusive settings, which recorded a medium response on MTSEB and PD on mathematics teachers teaching in inclusive settings.

Finally, **Table 4** documented M=2.24 and SD=1.19, illustrating the difficulties mathematics teachers face when interacting with students to understand their problems and provide support becomes difficult throughout the course of mathematical instruction.

Table 5 shows how MTSEB and PD improve classroom management in settings where everyone is welcome. The first common way that teachers' self-efficacy and PD improve classroom management in inclusive settings (M=3.78, SD=0.17) is that teachers say PD has helped them clearly tell students how to do each classroom activity so that they don't bother others. In a similar way, other respondents (M=3.71, SD=0.19) said that PD had helped them deal with disruptive behaviour and improve how well they could set up a classroom management system that kept track of each group of students. But it was seen that PD helped respondents shape students' behaviour gradually over time (M 3.68; SD=0.27). Others, though, said that their self-efficacy and PD helped them change things in the classroom that made them act out, like how the furniture was set up or where people sat. Still others said that their self-efficacy helped them calm down a student who was being loud or disruptive in a mathematics class.

Table 5 gives these two themes' scores of M=3.61, SD=0.25, and M=3.32, SD=1.02. But other respondents gave a moderate response rate when asked how MTSEB and PD improve classroom management in settings where all students are welcome. To prove this, the item recorded M=2.99 and SD=0.18, which shows that "teachers get along well with every student in the class by meeting their needs on time." In

Table 4. Challenges mathematics teacher encounter in teaching mathematics in inclusive settings

Statement	n	M	SD	MR
When learning mathematics, it can be hard to keep track of where you are in a textbook or workbook.	95	3.81	0.14	1st
Lack of resource rooms to make mathematics effective for students in inclusive settings.	95	3.78	0.17	2nd
When math is taught in inclusive settings, students with disabilities are the ones who act up the most.	95	3.76	0.17	3rd
Lack of facilities to aid students' learning in inclusive settings.	95	3.66	0.26	4th
Difficulty interpreting pictures and diagrams during mathematics instructional delivery.	95	3.59	0.62	5th
When teaching mathematics, teachers don't have enough time to focus on each student individually.	95	3.25	1.02	6th
Difficulty with oral communication in mathematics during mathematics instructional delivery.	95	2.87	0.89	7th
A select few students participate in class while other students disrupt the teacher's delivery of the arithmetic lesson.	95	2.76	1.05	8th
Difficulty in marking students' scripts and providing feedback on time during mathematics instructional delivery.	95	2.45	1.16	9th
Interactions with students in order to know their problems and help become difficult during mathematics instructional delivery.	95	2.24	1.19	10th

Note. Source: Field Data (2022)

Table 5. MTSEB and PD enhance classroom management in inclusive settings

Statement	n	M	SD	MR
Professional development has definitely helped me teach kids how to do every activity in the classroom so that they do not cause trouble.	95	3.78	0.17	1st
To what extent can you control disruptive behaviour in the mathematics classroom.	95	3.71	0.27	2nd
How well can you work with every group of learners to set up a system for running the classroom?	95	3.68	0.27	3rd
PD has helped me shape my students in a gradual way, even when they stop doing bad things before they are rewarded.	95	3.59	0.25	4th
PD help me to know that changing negative classroom conditions that make them misbehave such as furniture arrangement, sitting places etc. most of the time.	95	3.32	0.25	5th
In order to deter kids from misbehaving in class, pictures are displayed on the wall.	95	3.09	1.02	6th
How much can you control a student that is obnoxious or disrespectful in mathematics class.	95	2.99	0.18	7th
I keep my students from acting badly by paying attention to them and valuing how they are different.	95	2.71	0.18	8th
I'm able to get along with every student in the class because I respond quickly to their needs.	95	2.71	1.04	9th
By describing the behaviours connected to a behaviour, PD has helped me communicate to students the consequences of that behavior.	95	2.48	1.07	10th
All pupils, in my opinion, should feel like they belong and are accepted.	95	2.48	0.89	11th
I discovered how to model acceptable behavior for the pupils and utilize a range of rewards and penalties to deter misbehavior in the classroom.	95	2.32	1.01	12th
I discovered that encouraging good behaviour in pupils as soon as it occurs helps with classroom instruction.	95	2.11	1.27	13th
My expertise is how to keep track of the students' successes and promptly give comments after assignments are given to me via PD.	95	2.09	1.31	14th

Note. Source: Field Data (2022)

Table 6. MTSEB and PD on competence in the course delivery of mathematics in inclusive settings

Statement	n	M	SD	MR
My self-efficacy belief helps me to manage and maintain discipline in the classroom.	95	3.86	0.04	1st
My understanding of mathematics content knowledge was delivery my self-efficacy.	95	3.84	0.04	2nd
I have the will power to accept all students irrespective of their family background.	95	3.72	0.08	3rd
My self-efficacy helps to inform my students of criteria ahead of the lesson?	95	3.56	0.16	4th
PD have help me with strategies to calm descriptive students down during instructional period.	95	3.29	0.19	5th
My self-efficacy belief helps me to adapt to classroom climate or conditions.	95	3.11	0.21	6th
My self-efficacy belief assists me to provide quality of instructions to students.	95	2.95	1.07	7th
PD program have help me to develop a good classroom management technique.	95	2.93	1.00	8th
PD program have help me to develop a skill to motivate students in class.	95	2.92	1.01	9th
I have the will power to accept all students irrespective of their disability.	95	2.91	1.07	10th
My professional development has helped me understand the dignity and worth of every student in an inclusive setting.	95	2.78	1.11	11th

Note. Source: Field Data (2022)

the same way, respondents agree that PD has helped them show students how their actions affect them by naming the actions that go with them. M value for this theme was 2.78, and SD was 1.04.

Table 5 showed that M and SD for the two themes were the least moderate (M=2.32, SD=1.01 and M=2.11, SD=1.27). These things show how respondents learned that reinforcing good behavior by students right away helps with classroom management, and PD taught them how to keep track of what students have done well and give quick feedback after assignments.

The most frequently cited MTSEB and PD enhance competence in the delivery of mathematics courses in inclusive settings, as found in **Table 6** respondents' statements that "my self-efficacy belief helps me to manage and maintain discipline in the classroom" (M=3.86, SD=0.04).

The study shows that "respondents were able to understand mathematics content knowledge with their self-efficacy," which was frequent with SEB and PD to enhance the competence yielded M=3.84 and SD=0.04. The respondents asserted that "they have the will power to accept all students, irrespective of their family background," which also recorded high efficacy beliefs and PD enhancing competence. In the same vein, respondents reported that their PD has helped them with strategies to calm descriptive students down during instructional periods, while others said that "their self-efficacy belief helps me to adapt to classroom climate or conditions." All recorded an M score

higher than 3.0. On the other hand, the response rate from other respondents was generally moderate. This is supported by the item's data, which shows that "respondents reported that their self-efficacy belief aids them to offer quality instruction to students" (M=2.95, SD=1.07). The moderate response rate on this scale for the statement "I have the willpower to accept all kids regardless of their impairment" was measured as M=2.91 and SD=1.07.

Table 6 shows that "my PD have expanded my knowledge to comprehend the dignity and worth of every kid in an inclusive setting," reported as M=2.78 and SD=1.11, indicates a moderate belief in one's own ability to manage a classroom. In conclusion, the study in **Table 6** made it clear that respondents had high levels of SEB and PD, which made them more competent.

DISCUSSION

The findings revealed that PD assists teachers in providing remedial opportunities for acquiring knowledge and skills. However, the study also shows that PD improves students' understanding of mathematics and helps teachers use a variety of assessment strategies in mathematics after their institutional delivery. It was shown that there is a substantial connection between a teacher's level of mathematical expertise and the views they hold on to the teaching of mathematics (Borko et al., 1992). Other research investigations have shown evidence of correlations between the opinions of instructors and the ways they instruct their students (Mewborn, 2002; Stipek et al., 2001). There is a possibility that even instructors who have a great degree of confidence in their own abilities to select material, develop pedagogy, and teach cannot give an education that is research-based and based on standards. Upper elementary teachers with more traditional attitudes toward content and mode of teaching tended to depend more heavily on traditional methods, which emphasise academic achievement and correct answers rather than the student's conceptualization of the mathematical subject, in order to create fresh comprehension and knowledge of the matter. These old-style methodologies concentrate on the performance of students and accurate feedback (Stipek et al., 2001). In the same vein, the teachers suggested that PD improve the procedure of teaching mathematics for students to understand while providing an alternative explanation for example when students are confused by institutional delivery. Other teachers asserted that PD improved teachers' self-confidence and ability to teach mathematics. Marsh saw that a teacher's sense of self-efficacy has a positive effect on achieving a goal, changing a teacher's teaching practices, and continuing to use techniques and resources that were discussed over the length of their investigation. There is a direct link between an instructor's level of instructional dedication to the students they teach and the level of accomplishment their students attain (Brookover et al., 1978). Higher increases in student performance and accomplishment were achieved by teachers who not only had high expectations for the performance of their students but also had a strong sense of responsibility connected to the achievement of the students they taught (Brophy & Evertson, 1977; Gibson & Dembo, 1984). Because instructors' feelings of competence are affected by PD activities, there is a link between those feelings and student success and performance (McLaughlin & Berman, 1977; Scribner, 1998). It was reported that respondents were assisting families to help their children do well in mathematics with your institutional delivery. Other respondents commented that their PD helped them to demonstrate the student's successful use of the knowledge or skills through modelling. Finally, the study shows that respondents can get students to follow classroom rules when delivering instructional lessons.

The findings from research question two show that teachers were having difficulties keeping place on a page in the text or workbook during mathematics instructional delivery. In support of this, a study by Shamim et al. (2007) found that resources are essential tools for effective teaching in an inclusive setting. For effective teaching and learning in an inclusive setting, there should be things like scribe books, storybooks, and other accessories. For lack of these resources, teachers are limited in their ability to teach and learn, which has a negative effect on the social and academic success of their students (Bamba, 2012). Also, Michaelowa's (2001) study shows that there were no TLMs at the students' homes to help them do better in school, and that inclusive settings have fewer TLMs and fewer facilities to help with teaching and learning. Others who responded claim that because there aren't enough resources to support students learning in inclusive settings, students with disabilities cause the majority of behavioural issues when mathematics is taught. Finn et al. (2003) went into more detail about antisocial behaviours like being loud and bothering other people in an inclusive setting. Finn et al. (2003) also said that when a classroom is run well, students take part in classroom activities and have more time to talk to their teachers and to each other. unlike a classroom that is hard to manage and where students play around and don't talk to teachers much. Also, Torkornyo (2019) found that it was hard for teachers in inclusive settings to handle or keep order in their classrooms. Short (2013) discovered that the number of interactions in the classroom was related to the number of disruptions in the classroom. For instance, respondents reported they frequently had challenges interpreting pictures and diagrams during mathematics instructional delivery to students, while other respondents complain that they do not have enough time to pay attention to each student during mathematics instructional delivery. Few students participate in class while others cause disruptions, and it can be difficult for teachers to mark students' scripts and give feedback on time while delivering mathematics instruction. All of these are problems that mathematics teachers face when they try to teach mathematics in environments where everyone is welcome. According to Blatchford et al. (2002), students participate less actively in teaching and learning in inclusive environments and pay less attention to their teachers' communications. Blatchford et al. (2002) also found that teachers pay less attention to shy pre-schoolers in an inclusive setting. Instead, they pay more attention to students who are active or who take part in classroom activities. Akoto-Baako (2018) said that when students are put in groups, they do more things that aren't related to the task at hand. The findings show that PD clearly helped them to give instructions to every classroom activity to students in order to prevent them from disturbing, whereas other respondents claimed that PD helped them control disruptive behaviour and how well they can establish a classroom management system with each group of students. Evertson and Emmer (2013) said that good feedback from the teacher helps keep the class running smoothly. Also, if feedback is given at the right time, it helps students get better at the activities they are doing and makes them behave better in the classroom (Torkornyo, 2019). But pre-schoolers are more likely to work hard and get along with their classmates if they get good feedback on how they are doing and what is expected of them (Donkor, 2011). Edjah (2018) confirms that feedback on an assignment or quiz

should be given so that pre-schoolers will be encouraged to do more or do well. Again, giving pre-schoolers the right reward when they do or show good behaviour helps or encourages them to do the same thing at the expected time or event (Edjah, 2018). However, other respondents claimed that their self-efficacy beliefs (SEB) and PD have helped them in changing the bad classroom conditions that cause them to misbehave, such as the furniture arrangement and sitting places, while other respondents claimed that their self-efficacy has allowed them to calm a disruptive or noisy student in the mathematics classrooms. Also, Lyons et al. (2013) said that teachers and students need to talk to each other regularly and effectively to understand how students act in the classroom. The assertive approach tries to keep teachers from being left alone in the classroom to deal with bad behaviour from students (Etheridge, 2010).

But Canter and Canter (1976) found that a firm approach to discipline cuts down on the time it takes to deal with student problems and increases attention in the classroom. But other respondents gave a moderate response rate when asked how MTSEB and PD improve classroom management in settings where all students are welcome. In the same way, respondents agree that PD has helped them show students how their actions affect them by naming the actions that go with them. Swinson and Cording (2002) said that an assertive approach can be used in the classroom. They said that

(1) rules should be set up for students to follow in the classroom,

(2) 2) steps should be taken to make sure that students who do what the teacher says get positive feedback, and

(3) 3) pre-schoolers who don't do what the teacher says should be punished.

But the way these traits are described by Swinton and Cording (2002) puts more emphasis on authority in the classroom. Donkor (2011) said that a teacher can't manage classroom activities until he or she sets clear goals for teaching and outlines the steps that need to be taken to reach those goals. Donkor (2011) also said that telling the students what they can learn will keep them from bothering their classmates in class. These things show how respondents learned that reinforcing good behaviour by students right away helps with classroom management, and PD taught them how to keep track of what students have done well and give quick feedback after assignments. Edjah (2018) concludes that positive reinforcement is anything that makes it more likely that a behavior will happen. Positive reinforcement was the thing that was added to the situation to make the behaviour patterns stronger. The teacher can establish and maintain order in the classroom with the help of positive reinforcement. But preschool teachers use applause, free time, food, and special rewards as some of the most important positive incentives to keep young children in line in the classroom (Misiowiec, 2016).

The study shows that self-efficacy belief helps teachers manage and maintain discipline in the classroom. However, "respondents were able to understand mathematics content knowledge with their self-efficacy," according to the findings. When a mathematics teacher has both subject knowledge in mathematics and delivery mode knowledge in the content, they may be better able to facilitate and promote the mathematical learning of a wider range of student groups. "Deep understanding of basic mathematics" is what is meant when we say that "mathematics pedagogical subject knowledge" is present (Ma, 1999, p. 118). A deep grasp of mathematics, the capacity to conceive information, and the skill to appropriately apply mathematical knowledge are the three components that make up mathematical content knowledge (MCK) (Bransford et al., 2000, p. 16; Kahan et al., 2003). This explanation of MCK emphasises both the routine and theoretical parts of content knowledge, which illustrates an instructor must be knowledgeable in both kinds of content knowledge. Ball and Sleep (2007) identified a significant problem with MKT, which is that there are not enough chances available to enhance a teacher's capacity to build MKT, and that is the vital part of it. The current activities and/or programmes developed to assist teachers' learning in relation to mathematics education do not particularly seek to enhance the ability to know and use mathematics when teaching. This is because these events are programmed to cushion the learning of teachers. It was also revealed that PD has helped respondents develop strategies to calm descriptive students down during the instructional period. MKT is something that a lot of teachers pick up in their classrooms or via other forms of PD, while other instructors might not have access to the same possibilities. The lack of resourceful materials, where the pivotal assignment of mathematics teachers is enlightened and helped, is the path of imperfection in mathematics teacher PD programmes. These programmes or courses are intended for mathematics teachers. It is important that mathematics PD (Grossman, 1992; Wagner, 2003) continue to help teachers gain MKT and professional content knowledge that are both more robust and flexible. Again, PD has enriched teachers with knowledge to understand the dignity and worth of every student in an inclusive setting. Mathematics Teachers require not just solid pedagogical subject knowledge but must also acquaint themselves with a solid concept of the mathematical language. When teaching mathematics, it is necessary to be aware of the cognitive capacities of each individual student so that they can simplify the procedure of evaluating the students' knowledge in mathematics and comprehension in relation to the material that is being taught. Teachers need to have a solid grasp of the subject matter they are teaching if they are to correctly understand the mathematical thinking of their students. With this skill (Ball & Bass, 2000), a teacher who knows a lot about pedagogical topic knowledge can help students really understand what they are learning and stop them from getting confused when they do. It has been developed a new concept that they refer to as "mathematical knowledge for teaching (MKT)" to further broaden the concept of MKT (Hill et al., 2005, p. 373). The following are some of the characteristics of mathematical knowledge that are useful for teaching: The ability to unpack and decompress mathematical ideas; the ability to sequence ideas; the ability to choose and use representations and examples; the ability to explain and guide explanations; the ability to use mathematical language and notation; the ability to analyse errors; the ability to interpret and evaluate alternative solutions and ways of thinking; the ability to analyse mathematical treatments in textbooks; the ability to make mathematical practises explicit; and the ability to attend to it.

Policy and Practical Implications

a. Institutions in charge of issuing certificates for teachers should ensure that the training and development of teachers are done intensively through presentations or practicums to build teachers' self-efficacy for good instructional delivery.

b. The Ministry of Education needs to concentrate on creating more inclusive educational institutions and giving them the tools, they require so that instructors can effectively instruct pupils.

c. The researchers advises that the inclusive education environment should have a well-established classroom management plan or guideline within which the instructor must function. The national rules should be modified to include a classroom management guideline that is adapted to the unique needs of the students in each inclusive educational environment. During their practicum, teachers should learn about this classroom management rule, which will help them do their jobs in the classroom.

d. The Ministry of Education should also put in place a rule that says a person can't become a teacher until he or she has worked as a substitute or part-time teacher for at least a year to learn how to deal with students in an inclusive setting. During the lesson or activity or expedition time, the teachers-in-training would also help with social interaction to make sure that the teaching was done well in a setting that was open to everyone. This could help teachers improve their skills in the classroom.

CONCLUSIONS

a. The study concluded that MTSEB and PD have enhanced the instructional delivery of mathematics and assisted families to help their children do well in mathematics.

b. It was found that the most difficult parts of teaching in an inclusive setting were not being able to help students understand pictures and diagrams during mathematics lessons and not having enough resources to help students learn.

c. On issues related to teachers managing students in an inclusive setting, it was concluded that the PD of teachers helps them gradually shape students until they can perform the expected behaviour before they are reinforced.

d. MTSEB and PD improve the skills needed to keep order in the classroom and understand each student's dignity and worth in an inclusive setting.

Author contributions: HKA, PKAB-A, CSB, & BK-A: developed the study's concept & wrote the introduction section; **KTD, EK-N, & GA-G:** drafted the abstract & methodology sections; **HKA, PKAB-A, CSB, GA-G, KAC, FO-S, & BK-A:** assisted in drafting the instrument & contributed to the data collection process; & **HKA, PKAB-A, CSB, GA-G, MO-W, & BK-A:** drafted the discussion, conclusion, & recommendations. All authors approve final version of the article.

Funding: The authors received no financial support for the research and/or authorship of this article.

Acknowledgements: The authors would like to thank the headmasters of all the inclusive SHSs in Ghana for granting us access to their campuses to conduct the study. The authors would also like to thank the field assistants, who helped collecting data from all over the country.

Ethics declaration: Authors declared that the study was approved by the C. K. Tedam University of Technology and Applied Sciences Graduate Review Board on April, 2022 (Protocol ID: CKT-UTAS-20200708174).

Declaration of interest: Authors declare no competing interest.

Data availability: Data generated or analyzed during this study are available from the authors on request.

REFERENCES

Ahearn, E. M. (2002). *Educational accountability: A synthesis of literature and review of a balanced model of accountability*. Final Report. (ERIC Document Reproduction Service No. ED 439573).

Akoto-Baako, H. (2018). *Perceived influence of large class size and psychological classroom environment on students academic performance* [Unpublished PhD thesis]. University of Cape Coast.

Arnold, D. C. (2005). *An examination of teacher self-efficacy in the inclusion classroom* [PhD dissertation, Marywood University].

Ashton, P. T., & Webb, R. B. (1986). *Making a difference: Teachers' sense of efficacy and student achievement*. Longman.

Ball, D. L., & Sleep, L. (2007). *What is knowledge for teaching, and what are features of tasks that can be used to develop MKT?* [paper presentation]. The Annual Meeting of the Association of Mathematics Teacher Educators.

Ball, D., & Bass, H. (2000). Interweaving content and pedagogy in teaching and learning to teach: Knowing and using mathematics. In J. Boaler (Ed.)., *Multiple perspectives on the teaching and learning of mathematics* (pp. 83-105). Ablex.

Bamba, K. (2012). Dark energy cosmology: the equivalent description via different theoretical models and cosmography tests. *Astrophysics and Space Science, 342*, 155-228. https://doi.org/10.1007/s10509-012-1181-8

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioural change. *Psychological Review, 84*(2), 191-215. https://doi.org/10.1037/0033-295X.84.2.191

Blatchford, P., Moriarty, V., Edmonds, S., & Martin, C. (2002). Relationships between class size and teaching: A multimethod analysis of English infant school. *American Educational Research Journal, 39*(1), 101-132. https://doi.org/10.3102/00028312039001101

Borko, H., Eisenhart, M., Brown, C. A., Underhill, R. G., Jones, D., & Agard, P. C. (1992). Learning to teach hard mathematics: Do novice teachers and their instructors give up too easily? *Journal for Research in Mathematics Education, 23*(3), 194-222. https://doi.org/10.5951/jresematheduc.23.3.0194

Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). *How people learn, brain, mind, experience, and school*. National Research Council, National Academy Press.

Brookover, W., Schweitzer, J., Schneider, J., Beady, C., Flood, P., & Wisenbaker, J. (1978). Elementary school social climate and school achievement. *American Educational Research Journal, 15*,301-318. https://doi.org/10.3102/00028312015002301

Brophy, J. E., & Evertson, C. (1977). Teacher behaviors and student learning in second and third grades. In G. D. Borich (Ed.), *The appraisal of teaching: Concepts and process* (pp. 79-95). Addison-Wesley.

Canter, L., & Canter, M. (1976). *Assertive discipline*. Lee Canter Associates.

Darling-Hammond, L. (2004). Standards, accountability, and school reform. *Teachers College Record, 106*(6), 1047-1085. https://doi.org/10.1111/j.1467-9620.2004.00372.x

Darling-Hammond, L., & McLaughlin, M. (1995). Policies that support professional development in an era of reform. *Phi Delta Kappan, 76*(8), 597-604.

Dibapile, W. T. S. (2012). A review of literature on teacher efficacy and classroom teacher efficacy and classroom management. *Journal of College Teaching & Learning 9*(2),79-92.

Donkor, E. (2011). Teacher efficacy in classroom management and discipline. *Educational and Psychological Measurement, 5*, 755-765.

Edjah, K. (2018). *Psychology of learning and instructions.* University of Cape Coast Press.

Etheridge, D. (2010). The changes in experienced teachers' understanding towards classroom management. *Universal Journal of Educational Research, 4*(1), 144-150. https://doi.org/10.13189/ujer.2016.040118

Evertson, C. M., & Emmer, T. E. (2013). *Classroom management for elementary teachers.* Pearson.

Finn, J. D., Pannozzo, G. M., & Achilles, C. M. (2003). The "why's" of class size: Student behavior in small classes. *Review of Educational Research, 73*(3), 321-368. https://doi.org/10.3102/00346543073003321

Gibson, S., & Dembo, M. H. (1984). Teacher efficacy: A construct validation. *Journal of Educational Psychology, 76*, 569-582. https://doi.org/10.1037/0022-0663.76.4.569

Grossman, P. (1992). Teaching and learning with cases: Unanswered questions. In J. Shulman (Ed.), *Case methods in teacher education* (pp. 227-239). Teachers College Press.

Hill, H. C., Rowan, B., & Ball, D. L. (2005). Effects of teachers' mathematical knowledge for teaching on student achievement. *American Educational Research Journal, 42*(2), 371-406. https://doi.org/10.3102/00028312042002371

IDEIA (2004). *What parents of students with disabilities need to know and do.* University of Minnesota, National Center on Educational Outcomes.

Kahan, J. A., Cooper, D. A., & Bethea, K. A. (2003). The role of mathematics teachers' content knowledge in their teaching: A framework for research applied to a study of student teachers. *Journal of Mathematics Teacher Education, 6*, 223-252. https://doi.org/10.1023/A:1025175812582

Kissi-Abrokwah, B. (2021). *Effect of large class size and teacher-learner ratio on classroom management in early childhood educational centres in Ghana* [PhD thesis, University of South Africa]. https://doi.org/10.37500/IJESSR.2022.5521

Lewandowski, K. H. L. (2005). *A study of the relationship of teachers' self-efficacy and the impact of leadership and professional development* [DEd dissertation, Indiana University of Pennsylvania].

Lyons, G., Ford, M., & Arthur-Kelly, M. (2013). Classroom management: Creating positive learning environments. *Indian Psychological Review, 72*(3), 155-160.

Ma, L. (1999). *Knowing and teaching elementary mathematics: Teachers' understanding of fundamental mathematics in China and the United States.* Lawrence Erlbaum Associates. https://doi.org/10.4324/9781410602589

McLaughlin, M., & Berman, P. (1977). Retooling staff development in a period of retrenchment. *Educational Leadership, 35*(3), 191-194.

Mewborn, D. S. (2002). *Examining mathematics teachers' beliefs through multiple lenses* [Paper presentation]. The Annual Meeting of the American Educational Research Association.

Michaelowa, K. (2001). Primary education quality in francophone Sub-Saharan Africa: Determinants of learning achievement and efficiency considerations. *World Development, 29*(10), 16991716. https://doi.org/10.1016/S0305-750X(01)00061-4

Misiowiec, F. (2016). How teaching for understanding changes the rules in the classroom. *Educational Leadership, 51*(5), 19-24.

National Council of Teachers of Mathematics (NCTM). (2000). *Principles and standards for school mathematics.*

No Child Left Behind [NCLB] (2001). Implications for special education students and students with limited English proficiency. *Journal of the American Academy of Special Education Professionals.*

Norman, K. I., Caseau, D., & Stefanich, G. P. (1997). *Science educator perceptions: Inclusion in science classrooms.* http://www.ed.psu.edu/CI/Journals/96papll.htm

North Central Regional Educational Laboratory [NCREL] (2006). *enGauge online assessment profile for Hayward High School* [Unpublished raw data]. http://www.ncre!.org/tech/qkey3/techint.htm

Ofori, E., & Dampson, W. A. (2012). *Doing quantitative research analysis using SSPS.* Empress Press.

Olson, L. (2002). Inadequate yearly gains are predicted. *Education Week.* http://www.edweek.org/ew/articles/2002/04/03/29ayp.h21.html

Scribner, J. P. (1998). *Teacher efficacy and teacher professional learning: What school leaders should know* [Paper presentation]. The Annual Convention of University Council for Educational Administration.

Senge, P. (1990). *The fifth discipline: The art and practice of the learning organization.* Currency Doubleday.

Shamim, F., Negash, N., Chuku, C., & Demewoz, N. (2007). *Maximizing learning in large classes: Issues and options.* British Council.

Short, L. (2013). *Teachers and pupils' views of teacher-pupil relationships through primary and middle school.* New Castle University.

Stipek, D. J., Givvin, K. B., Salmon, J. M., & MacGyners, V. L. (2001). Teachers' beliefs and practices related to mathematics. *Teaching and Teacher Education, 17*(2), 213226. https://doi.org/10.1016/S0742-051X(00)00052-4

Swinson, J., & Cording, M. (2002). Focus on practice: Assertive discipline in a school for pupils with emotional and behavioural difficulties. *British Journal of Special Education, 29*(2), 72-75. https://doi.org/10.1111/1467-8527.00243

Termini, M. (2003). *Bringing inclusion from paper to practice* [Paper presentation]. The 13th Annual American Professional Partnership for Lithuanian Education Summer Seminar.

Torkornyo, M. N. (2019). *Kindergarten teacher's perceptions and uses of classroom management strategies in kindergarten classroom in the Hohoe Municipality, Volta Region* [Unpublished PhD thesis]. University of Education, Winneba.

Tschannen-Moran, M. & Hoy, A. (2001). Teacher efficacy: Capturing an elusive construct. *Teaching and Teacher Education, 17,* 783-805. https://doi.org/10.1016/S0742-051X(01)00036-1

Wagner, L. (2003). *The best laid plans: Preservice teachers' use of lesson study as a model for attending to students' mathematical thinking* [PhD dissertation, University of Wisconsin- Madison].