

Junior High School Mathematics Teachers' Practice of Differentiated Instruction and Associated Challenges in Tano South District

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ABSTRACT

Drawing on convergent mixed methods research design, this study examined Junior High School (JHS) mathematics teachers' practice of differentiated instruction and its associated challenges in Tano South district, in the Ahafo Region of Ghana. Simple random sampling technique was used to select 50 JHS mathematics teachers for the quantitative study with the aid of questionnaire, purposive sampling technique was used to solicit qualitative data for the study using interview guide. Inferential statistics and thematic analysis were used to analyse the quantitative and qualitative data respectively. It was generally observed that, there was no significant differences between special and general education teachers practice of differentiated instruction. Therefore, the study recommends that Ghana Education Service (GES) and stakeholders in education should implement professional development and training programmes for both general and special mathematics teachers on differentiated instruction.

Keywords: differentiated instruction, practice, challenges, content, process, and product

INTRODUCTION

Ghana, like many other developing countries has consistently witnessed educational and curriculum reforms since the early 1990s (Chisholm & Leyendecker, 2008). Part of these enormous reforms relates to the idea of inclusive educational opportunities for children and adolescents with special needs. Inclusive Education policy recognizes the varied learning needs of learners and requires all stakeholders in the education sector to address the diverse needs of different groups of students in the Ghanaian education system under the universal design for learning and within a learner friendly environment for all (MoE, 2015). This policy supports the National Development Agenda and the Education Strategic Plan that seeks an enabling environment for addressing the diverse educational needs of Ghanaians. One way to achieve this goal is to emphasize the practice of differentiated instruction in Ghanaian classrooms (Ireh & Ibeneme, 2010).

According to Levy (2008), the focus of differentiated instruction is to ensure that all students reach the same academic goal with the process of arriving there being unique for each student. Differentiated instruction (DI), according to Tomlinson (2004), is a way of ensuring that what a student learns, how he/she learns, and how the student demonstrates what he/she has learned is a match for that student's readiness level, interests, and preferred mode of learning. DI is a flexible way yet an organised form of adjusting teaching and learning to meet students where they are and helping them to maximise learning. Several research work (e.g. American Institute for Research, 2005; Hall, Strangman, & Meyer, 2003; Tomlinson, 1999; Tomlinson & McTighe, 2006) have suggested strategies (such as open and parallel tasks, instructional trajectory/landscape etc.) for differentiating instruction to address the needs of students with varied experiences, learning readiness, learning styles, contextual interests, and learning interaction preferences. However, scientific research has not provided procedural models for differentiating instruction because of the ambiguity surrounding what DI is and the limited research on how to implement it successfully in classrooms (Gibson, n.d.).

There are several key elements that guide differentiation in the education environment. Hall, Strangman and Meyer (2003) and Tomlinson (1999, 2001) identify three elements of the curriculum that can be differentiated: Content, process, and products. Tomlinson (2005a, 2005b) explains that content comprises not only what is taught, but how students access the material taught. Tomlinson suggests that to a large extent, what is taught should remain relatively constant across learners, with teachers varying how students get access to specified content to address learners' needs. For example, if the classroom objective is for all students to subtract using renaming, some of the students may learn to subtract two-digit numbers, while others may learn to subtract larger numbers in the context of word problems. Also, interest centres or groups could be set up to allow students to choose a

mathematical topic which suits their specific interest. Interest centres or groups can focus on specific mathematics skills, such as addition, and provide activities that are high interest, such as counting. According to Algozzine and Anderson (2007), differentiating the process within a lesson refers to “how the learners come to understand and assimilate facts, concepts, or skills” (p. 50). This involves instructional activities to ensure that learning is taking place in the classroom. In other words, it is the way contents of the curriculum are taught to students. When teachers differentiate process, they teach the same concept or skill to each student; however, the manner in which each student makes sense of the topic or skill can vary. For instance, teachers can create open task that is inclusive not only in allowing for different students to approach it by using different processes or strategies but also in allowing for students at different stages of mathematical development to maximize learning. In open number task, pupils have a choice in the numbers they use, choice in the strategies they use and a choice in how they interpret the meaning of the problem. In this way, each student becomes part of the larger number learning conversation, and important member of that learning community. Also, a student may be instructed to explore a learning centre, while another student collects information from the internet. Tomlinson (2001) also defines product as culminating assessments that allow students to demonstrate how much they understand and how well they can apply their knowledge and skills after a significant segment of instruction. This should offer students multiple pathways to show mastery of common learning goals. For example, to demonstrate understanding of a geometric concept, one student may solve problem set, while another builds a model. Also, organizers that contain a variety of mathematical activities for students such as Choice boards can be organized for pupils to choose options that focus on several different skills. Students can choose one or several activities to complete as they learn a skill or develop a product. Choice boards can be organized so that students are required to choose options that focus on several different skills.

The success of differentiated instructional practices as an effective methodology for teachers was established in the literature (Beecher & Sweeny, 2008; Kanevsky, 2011). Teachers sometimes use groupings within collaborate lessons to form a differentiated classroom (Alavinia & Farhady, 2012), but key elements of differentiation discussed by Kanevsky (2011) such as learning environment, content, process, product etc. are ignored, resulting in ineffective differentiated instructional practices. Gardner (1999) posits that the biggest mistake of past centuries in teaching has been to treat all children as if they were variants of the same individual and thus to feel justified in teaching them all the same subjects in the same way. Time factor always poses a threat to differentiated instruction. Due to its time-consuming nature, teachers view differentiated instruction as burdensome and sometimes overwhelming (Joseph & John, 2014). As stated by Scigliano and Hipsky (2010), it can be daunting to differentiate instruction. In their studies, it was reported that, finding activities, trying new ideas, developing the assessments for each lesson and working with so many different learning styles and intelligences among the students. In contemporary education, the academic calendar requires teachers to cover certain amounts of topics at specific times. Teachers are evaluated based on these timelines but not how students learn. Differentiated instruction shifts the focus from teaching to learning hence, requires bridging gaps and re-learning contents that were not mastered by students. It therefore necessitates some amount of flexibility but unfortunately there is no room for such on the academic calendar.

Studies (e.g., Abora, 2015; Owusu, 2016; Robinson, Maldonado & Whaley, 2014) have shown that teachers in basic schools do not differentiate instruction as it is expected. In the study conducted by Owusu (2016) for example, it was revealed that, teachers used only informal pre-assessment strategies to determine students' readiness and interest but no pre-assessment to ascertain individual student's learning profiles was done. Additionally, contents matched readiness but were irresponsive to students' interests and learning profiles. The above-mentioned studies clearly show that there is an extensive scholarly work on teachers practice of differentiated instruction, however, there is limited literature on JHS teachers' practice of differentiated instruction and the challenges that confront them in the mathematics classrooms (Owusu, 2016; Pekeberg, 2012), especially with reference to dichotomy between general and specific teachers in Ghana. Therefore, this paper is set out to investigate JHS mathematics teachers' practice of differentiated instruction and its associated challenges in Tano South District of Ghana.

Specifically, the study attempts to answer following research questions: (1) To what extent do JHS mathematics teachers practice differentiated instruction in Tano South District?; (2) What challenges do JHS mathematics teachers experience in differentiation of instruction in Tano South District? For the purpose of this research, the researcher classified these mathematics teachers as general mathematics teachers [mathematics teacher with BSc Mathematics Education (mathematics Major)] and special mathematics teachers [mathematics teacher with Bsc. Special Education (Mathematics Minor)]. On the basis of nature and purpose of the investigation, the researchers decided to take into account the kind of training JHS mathematics teachers received in the Colleges of Education and Universities of Education. It is believed that teachers who have been trained/prepared specifically to handle children with special needs might have more knowledge on how to adapt instructions to meet the varied needs of these individuals than general education teachers (Kuyini & Abosi, 2014; Whipple, 2012). In view of this, the study also sought to test the null hypothesis “There is no significant difference in the practice of differentiated instruction between general education and special education teachers in Tano South District”.

LITERATURE REVIEW

On the practice of differentiated instruction, Owusu (2016) conducted a case study which employed a mixed method approach to investigate how the different elements of learning experiences are differentiated in the classroom to cater for the varied learning needs in State Experimental Basic One School. A sample size of 182 comprising of 174 students, 2 headmistresses, and 6 teachers were used. Differentiating learning experiences in terms of content in the study considered the extent to which teachers are able to adjust what is to be learnt to meet individual students' readiness, interest and learning profile. From the findings, it was clear that teachers pre-assess students before a unit/topic to identify individual student's readiness. Also, in differentiating process, students agreed that teachers varied pace of instruction to cater for individual learning needs. However, it was discovered that

Table 1. Distribution of Respondents in the Study

Sampling unit	Population	Sample Size
General Mathematics Teachers	45	40
Special Mathematics Teachers	10	10
Total	55	50

teachers do not give different assignments based on individual student's readiness, choice and/or learning profile. This is confirmed by Abora (2015) study which found out that about 93.3% of teachers scarcely differentiate instruction in mixed-ability settings. From Abora's findings, although there were traces of good pedagogical practices in the teachers' instruction, teachers taught to the middle. The primary school teachers scarcely differentiated instruction to address the learning needs of their learners. Contrarily, Whipple (2012) quantitative study revealed that teachers often implement content and process as a component of differentiated instruction. However, product was found to be the least implemented component of differentiated instruction.

Among educators, there is a belief that differentiated instruction is effective in improving academic achievement. The improvements in academic achievement have been documented through use of differentiated instruction (Koeze, 2007; Pardina, 2005; Tomlinson, 1999, 2001). Pardina (2005) states that any increase in the differentiation of instruction in a classroom improves instructional effectiveness. However, despite its effectiveness in enhancing learning, differentiated instruction comes with practical challenges. Joseph, Thomas, Simonette and Ramsook (2013) conducted a study to examine the impact of using a differentiated instructional approach to teaching second year students pursuing an undergraduate course in curriculum studies at a tertiary institution. In this study, the researchers experienced challenges while working with student in a differentiated classroom environment. Among these challenges are that, differentiating instruction is a very time-consuming exercise with long hours of planning, organizing and scheduling individuals and groups in a large class setting. They also encountered difficulty in catering for individual needs and preferences especially those individuals who preferred to work alone. It was again revealed that examination culture which has pervaded teacher education institutions have great impact.

Also, Joseph and John (2014) in their study examined the experiences of prospective teachers in differentiating instruction during a two-week practicum assignment in an inclusive environment. One of the challenges reported is the classroom discipline; limited classroom space. Kobelin (2009) reports that teachers felt overwhelmed by the amount of curriculum they were required to teach, without even considering further differentiating instruction. Another challenge is lack of knowledge on how to address academic diversity. In a review study to explore the construction and composition of a differentiated classroom by researching the variety of strategies available for use in elementary school, Good (2006) observed that teachers in heterogeneous classrooms do not automatically know how to address academic diversity in those setting and often see no need to change their behaviours to do so.

METHODOLOGY

Research Design

In order to achieve the purpose of this research, the study employed convergent mixed method design where both quantitative and qualitative data were collected, analysed separately, and results compared to confirm or disconfirm each other (Creswell, 2012). This method is deemed appropriate as it is used to confirm, cross-validate or corroborate findings.

Sample Size and Sampling Techniques

This study was conducted in the public JHS in Tano South district in the Ahafo Region of Ghana. Since the study was focused on the Junior High School mathematics teachers' practice of differentiated instruction and associated challenges in Tano South District, the targeted population of the study included all the junior high school mathematics teacher in Tano South District. This study classified JHS mathematics teachers into two groups: General mathematics teachers [mathematics teacher with BSc Mathematics Education (Mathematics Major)] and special mathematics teachers [mathematics teacher with Bsc. Special Education (Mathematics Minor)]. Both teachers spend 144 credit hours at the end of 4-year Bsc. Programme; these credit hours include credits hours spent on Mathematics Content courses and other university courses. For teachers who hold BSc. Mathematics Education (mathematics Major) basically spend 111 credit hours on mathematics content courses during the four-year programme at the university while teachers with Bsc. Special Education (Mathematics Minor) spend 24 credit hours on mathematics content courses during the four-year programme at the university. This BSc. Special Education (Mathematics Minor) truncates their mathematical courses at the end of the second year. The BSc. Special Education (Mathematics Minor) are the teachers who offer Special Education but minor in mathematics.

To obtain a representative sample, the researchers employed Krejcie and Morgan (1970) sample size determination table to determine the required minimum sample size using 95% confidence level and 5% margin of error.

The distribution of the sample size is shown in **Table 1**.

To justify unbiasedness, generalization and equal chance for each sample of the sampling units, the researchers employed simple random sampling technique and purposive sampling technique was used to select the precipitants for the qualitative approach. Data on JHS mathematics teachers was taken from the Tano South District Education directorate. This formed the sample frame for the study. The 45 general mathematics teachers were assigned with numbers. The numbers were written on

Table 2. Descriptive Statistics of JHS Mathematics Teachers' Practice of the Main Elements of Differentiated Instruction (n = 50)

Elements of Differentiated Instruction	General Mathematics Teachers			Special Mathematics Teachers		
	Average per Item Rating	M	SD	Average per Item Rating	M	SD
Content (1-4)	1.41	5.63	1.34	1.50	6.00	1.41
Process (5-8)	1.45	5.80	1.10	1.50	6.00	1.23
Product (9-13)	1.39	6.95	1.55	1.38	6.89	1.54

Source: Field data (2018)

Key: *M*–Mean, *SD*–Standard Deviation, *APIR*–Average Per Item Rating

pieces of paper and then folded. The researchers then mixed the folded numbers up and selected randomly from the box without replacement. For the special mathematics teachers, because the population was very small census was applied.

Data Collection

To ensure that the data was obtained from the field, a self-administered close-ended questionnaire with 4-point Likert scale and semi-structured interview guide were used. The main goal of an in-depth interview was to solicit for extensive and detailed information that can be used to explain the junior high school mathematics teachers' practice of differentiated instruction and associated challenges. The interviews were done through face-to-face approach. The interview guide included series of questions, probes and follow-up questions on key themes.

A pilot testing of the research instrument was employed to test 8 JHS mathematics teachers in the Tano South district. This was done to determine the reliability of the questionnaire in achieving the aims of the study. Cronbach Alpha coefficient was calculated on the following variables: Practice ($\alpha = 0.71$); Challenges ($\alpha = 0.70$); and Overall ($\alpha = 0.72$). According to Tayakol and Dennick (2011), the overall alpha value of 0.72 indicates good internal consistency of the items in the scale.

Data Analysis

The quantitative data was analysed using both descriptive statistics (percentage, mean, standard deviations etc.) and inferential statistics (t-test) at .05 level of significance. The t- test was used since the researchers were comparing means of the practice of differentiated instruction between general mathematics and special mathematics teachers. Conversely, qualitative data was analyzed using thematic analysis. The data extracted from the interview were coded by finding common patterns and categorizing them into themes.

RESULTS

Research Question 1: To What Extent do JHS Mathematics Teachers Practice Differentiated Instruction in the Tano South District?

This research question sought to investigate the extent to which JHS mathematics teachers practice differentiated instruction. The teachers' practices of differentiation in the study were sought under three major elements of differentiated instruction namely: content, process and product. The descriptive statistics (frequency, percentage, mean and standard deviation) on how often teachers practice differentiated instruction is presented in **Table 2**. Participants' average per item rating for the three major elements of differentiated instruction that fall below 1.40 were considered to practice rarely, those between the range of 1.40 to 1.60 as sometimes practice and those above 1.60 as always practice.

Among the general mathematics and special mathematics teachers who teach mathematics at the JHS level, process was rated as the highest element of differentiated instruction sometimes practiced. As depicted in **Table 2**, process element yielded a mean of 5.80 and standard deviation of 1.10 with an average item rating of 1.45 for general mathematics teachers while special mathematics teachers' responses yielded a mean of 6.00 and standard deviation of 1.23 with an average per item rating of 1.50. The indication here is that, both general mathematics and special mathematics teachers sometimes practice process differentiation.

The results from the analysis of teachers' response as presented in **Table 2** show that both general mathematics and special mathematics teachers rarely practice the product differentiation. In view of the participants' responses, product element recorded an average per item rating of 1.39 and 1.38 for general mathematics teachers and special mathematics teachers respectively. Details of the items assessing teachers' practice of differentiation based on product are presented in **Table 3**.

A cursory look at **Table 3** indicates the range for the mean from 1.22 to 1.61 and standard deviation scores of 0.42 to 0.50 among general mathematics teachers with an average per item rating of 1.39. This is an indication that general education teachers who teach mathematics at JHS level rarely practice product differentiation. Analysing the special mathematics teachers' responses on product differentiation in **Table 3**, mean range of 1.11 to 1.78 and standard deviation of 0.33 to 0.53 were obtained with an average per item rating of 1.38. This indicates that special mathematics teachers who teach mathematics at JHS level rarely differentiate product.

The results from the analysis of teachers' responses in **Table 3** show that both general mathematics and special mathematics teachers sometimes practice the content differentiation. By way of the participants' responses, the content element recorded an average per item rating of 1.41 and 1.50 for general mathematics teachers and special mathematics teachers respectively.

Table 3. Descriptive Statistics of Teachers' Practice of Product Differentiation (n = 50)

Items	General Mathematics Teachers				Special Mathematics Teachers			
	R	O	M	SD	R	O	M	SD
	f (%)	f (%)			f (%)	f (%)		
PRODUCT								
1. In allowing students to demonstrate mastery of mathematical concept, some of the students are asked to solve problem set while others build model.	32 (77.5)	9 (22.5)	1.22	0.42	8 (80.0)	2 (20.0)	1.22	0.44
2. I specify the necessary skills expected to be learned by the pupils and the required components of the assignment while the student identifies methods for completing the task.	22 (55.0)	18 (45.0)	1.44	0.50	4 (40.0)	6 (60.0)	1.56	0.53
3. Choice boards of mathematical activities are provided for students to choose one or several activities to complete as they learn a skill or develop a product.	24 (60.0)	16 (40.0)	1.41	0.50	7 (70.0)	3 (30.0)	1.22	0.44
4. I provide variety of assessment tasks in mathematics for students.	16 (40.0)	24 (60.0)	1.61	0.49	2 (20.0)	7 (70.0)	1.78	0.44
5. I provide assignment on essential in mathematics at different levels of complexity and open-endedness.	29 (72.5)	11 (27.5)	1.27	0.45	9 (90.0)	1 (10.0)	1.11	0.33

Source: Field data (2018)

Key: R–Rarely Occurs, O–Often Occurs, M–Mean, SD–Standard Deviation

Table 4. Descriptive Statistics of Teachers' Practice on Content Differentiation (n = 50)

Items	General Mathematics Teachers				Special Mathematics Teachers			
	Rarely	Often	M	SD	Rarely	Often	M	SD
	f (%)	f (%)			f (%)	f (%)		
CONTENT								
1. I provide students with mathematical tasks at varied levels of complexity.	29 (72.5)	11 (27.5)	1.29	0.46	6 (60.0)	4 (40.0)	1.33	0.50
2. I decide on a key mathematics concept for learning.	13 (32.5)	27 (67.5)	1.66	0.48	2 (20.0)	8 (80.0)	1.78	0.44
3. I provide students with resource materials on mathematics content of varied interest.	19 (47.5)	21 (52.5)	1.51	0.51	3 (30.0)	7 (70.0)	1.67	0.50

Source: Field data (2018)

Key: f–Frequency, %–Percentage, M–Mean, SD–Standard Deviation

Table 5. Descriptive Statistics of Teachers' Practice on Process Differentiation (n = 50)

Items	General Mathematics Teachers				Special Mathematics Teachers			
	Rarely	Often	M	SD	Rarely	Often	M	SD
	f (%)	f (%)			f (%)	f (%)		
PROCESS								
1. I create open tasks in mathematics for pupils to make choice in the strategies they use and how they interpret the solution of the problem.	25 (62.5)	15 (37.5)	1.39	0.49	4 (40.0)	6 (60.0)	1.56	0.53
2. I focus instruction on key mathematics concepts that are being taught.	14 (35.0)	26 (65.0)	1.61	0.49	3 (30.0)	7 (70.0)	1.67	0.50
3. I map out a sequence of mathematics instruction for pupils.	30 (75.0)	10 (25.0)	1.27	0.45	9 (90.0)	1 (10.0)	1.11	0.33
4. I allow pupils to work as part of many different groups depending on the mathematical task and/or content.	19 (47.5)	21 (52.5)	1.54	0.51	2 (20.0)	8 (80.0)	1.67	0.50

Source: Field data (2018)

Key: f–Frequency, %–Percentage, M–Mean, SD–Standard Deviation

Details of the items assessing teachers' practice of differentiation based on content are presented in **Table 4**.

From **Table 4**, it is clear that the mean scores ranged from 1.17 to 1.66 and standard deviation from 0.38 to 0.51 with an average per item rating of 1.41. This suggests that, general mathematics teachers who teach mathematics at the JHS level sometimes practice content differentiation. On the part of special mathematics teachers, their responses on content differentiation yielded mean of 1.22 to 1.78 and standard deviation of 0.44 to 0.50 as shown in **Table 4** with an average per item rating of 1.50. This means that, special mathematics teachers who teach mathematics at the JHS level sometimes practice content differentiation. The results in **Table 4** show that both general mathematics and special mathematics teachers sometimes practice the process differentiation.

In view of the participants' responses, process element yielded an average per item rating of 1.45 and 1.50 for general mathematics teachers and special mathematics teachers respectively. Details of the items assessing teachers' practice of differentiation based on process are presented in **Table 5**.

As it is evident in **Table 5** under the process, the mean scores ranged from 1.27 to 1.61 and standard deviation scores from 0.49 to 0.51 with an average per item rating of 1.45. The indication here is that, general mathematics teachers who teach mathematics at the JHS level sometimes practice process differentiation. Analysis of special mathematics teachers' responses to the statements

Table 6. Group Statistics of Teachers' Scores in the Practice of Differentiated Instruction (n = 50)

Which category of teacher do you belong to		N	Mean	Std. Deviation	Std. Error Mean
Teachers' Practice	General mathematics teacher	40	18.39	3.24	0.51
	Special mathematics teacher	10	18.89	3.48	1.16

Source: Field data (2018)

Table 7. Independent Samples T-Test of Teachers' Practice of Differentiated Instruction (n = 50)

		Levene's Test for Equality of Variances				t-test for Equality of Means				
		F	Sig.	T	df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	95% Confidence Interval of the Difference	
								Lower	Upper	
T.P	Equal variances assumed	0.06	0.81	-0.41	48	0.68	-0.50	1.21	-2.93	1.93

Source: Field data (2018)

Key: T.P = Teachers' Practice

Table 8. Descriptive Statistics of the Challenges Teachers face in Differentiated Instruction (n = 50)

Items	Agree		Disagree		M	SD
	f (%)	f (%)	f (%)	f (%)		
1. DI is another fad in instructional approaches	31 (62)	19 (38)	1.62	0.49		
2. Time factor always poses a threat to DI	46 (92)	4 (8)	1.92	0.27		
3. Teachers are apprehensive for the concept-based teaching with the pressure of standardized tests in DI	33 (66)	17 (34)	1.66	0.48		
4. DI is another bureaucratic mandate heaped upon teachers	18 (36)	32 (64)	1.36	0.49		
5. Teachers cannot DI if professional development resources are absent	29 (58)	21 (42)	1.58	0.50		
6. Lack of administrative support hinders the practice of DI	45 (90)	5 (10)	1.90	0.30		
7. It is very difficult to assess the readiness level of students	34 (68)	16 (32)	1.68	0.47		
8. How to match appropriate resources with teaching is a challenge to teachers in DI	26 (52)	24 (48)	1.52	0.51		
9. Teachers fear that there are no teacher models to talk to about DI	21 (42)	29 (58)	1.42	0.50		
10. Teachers are not able to practice DI due to limited space for group work.	43 (86)	7 (14)	1.86	0.35		
11. Teachers lack knowledge on how to address academic diversity in DI.	33 (66)	17 (34)	1.66	0.48		
12. As a teacher, adjusting teaching practice as DI is always disorienting and upsetting	27 (54)	23 (46)	1.54	0.50		
13. Large class size is one of the major threats in DI	48 (96)	2 (4)	1.96	0.20		
Average Per Item Rating		= 1.67				

Source: Field data (2018)

Key: f-Frequency, %-Percentage, M-Mean, SD-Standard Deviation,

on process differentiation yielded mean range of 1.11 to 1.67 and standard deviation scores of 0.33 to 0.53 with an average per item rating of 1.50. This means that, special mathematics teachers who teach mathematics at the JHS level sometimes practice process differentiation.

Hypothesis: *There is no significant difference in the practice of differentiated instruction between general mathematics and special mathematics teachers in the Tano South District*

This hypothesis looked for a comparison within two groups: general mathematics teachers' practice as compared to special mathematics teachers' practice. **Tables 6** and **7** represent the variability between general mathematics teachers' practice and special mathematics teachers' practice of differentiated instruction in the questionnaire administered.

Table 6 provides useful descriptive statistics for the two groups (that is general mathematics and special mathematics teachers).

From **Table 6**, the examination of the group means indicates that special mathematics teachers ($M = 18.89$, $SD = 3.48$) practiced more of differentiated instruction than did general mathematics teachers ($M = 18.39$, $SD = 3.24$).

An independent samples t-test was conducted to find out whether the observed difference in mean scores are significant or not in the practice of differentiated instruction between general mathematics and special mathematics teachers using an alpha level of 0.05. **Table 7** illustrates the variability of means between the two groups.

The t-test for the independent samples results in **Table 7** revealed that there is not a significant difference in the scores obtained by general mathematics teachers ($M = 18.39$, $SD = 3.24$, $N = 40$) compared to that of special mathematics teachers ($M = 18.89$, $SD = 3.48$, $N = 10$) in practice, with $t(48) = -0.41$, $p = 0.68$. Hence, the researchers fail to reject the null hypothesis.

Research Question 2: What Challenges Do Jhs Teachers Experience in Differentiation of Mathematics Instruction in the Tano South District?

In addressing the issue of challenges in differentiated instruction, a questionnaire was designed to solicit views from teacher respondents. **Table 8** illustrates frequency, percentage, mean and standard deviation of the responses to each question on the challenges confronting JHS mathematics teachers in differentiation of instruction.

As evident in **Table 8**, the mean scores ranged from 1.36 to 1.96 and standard deviation scores from 0.20 to 0.51 for the 13 items on the challenges teachers face in differentiated instruction with an average per item rating of 1.67. This is an indication that majority of JHS mathematics teachers do encounter the outlined challenges of differentiated instruction in the questionnaire. For instance, in a bid to find out from teachers whether time factor always poses a threat to differentiated instruction ($M=1.92$, $SD=0.27$), only 4 (8%) of the teachers declined. Majority, 46 (92%) of the teachers agreed that time always poses a threat during differentiation of instruction.

Qualitative Results from the Interview

The interviews were conducted to explore issues on JHS mathematics teachers' practice of differentiated instruction and the challenges associated with it. The questions were prepared to explore the common strategies they normally employ in differentiation of instruction and how they know how well students learn in classroom. In the interview report, the narrative accounts of six respondents that is, 4 general mathematics teachers (GT1, GT2, GT3 and GT4) and 2 special mathematics teachers (ST1 and ST2) are presented below.

In gaining insight into how often teachers attend professional events, inside and outside the school, it was revealed that five respondents (GT1, GT2, GT3, GT4, and ST1) rarely attend professional events both inside and outside the school. This is illustrated by the comments made by them:

"The last time I had opportunity to attend a professional development event inside the school was in 2016. As for the one organised outside the school, I have experienced it only once in my entire 7 years of teaching."

However, ST2 responded to the same question that:

"I attend professional events almost every term inside the school and once a year outside this school premises."

In view of these comments, it could be argued that teachers seldom attend professional development programmes which have the propensity to inform practice. The indication here is that, teachers are denied the opportunity to be abreast with 21st century approaches to effective teaching and learning. This therefore strengthens the finding from the quantitative study that general mathematics and special mathematics teachers sometimes differentiate instruction.

For teachers to be able to structure their instruction to meet the varied needs of the individual students, there must necessarily be the need for pre-assessment. In view of this, the researchers asked a question to find out from the teachers whether they pre-assess students before engaging them in classroom instructions. All the teacher respondents (GT1, GT2, GT3, GT4, ST1 and ST2) interviewed stated that, they always pre-assess learners before instruction of a new unit of study.

ST2 noted that:

"Before I begin to teach new topic/unit, I always review pupils' previous knowledge in order to determine their readiness level."

GT3 also stated that:

"I always assess pupils R.P.K related to the new topic I about teach so as to know where to start my lesson from."

Again, the fifth item on the interview guide asked teachers on how well their students learn in classroom and how do they know? The summary of responses to these questions are captured in the excerpts below:

GT4: *"My students learn well when instructions are being given out and also, when students are allowed to manipulate objects. I got to know of these through the way they answer questions."*

ST2: *"The students learn best when I repeat statements and activities. I am able to notice through their facial expressions, and how they ask and respond to questions."*

A further enquiry into whether time poses a threat to differentiation among teachers revealed that all the 6 teachers conceded to the question. They cited some reasons to back their assertion which are captured in the excerpts below:

GT3: *"Yes, because I need to attend to each individual student and give them ample time to finish their work."*

ST1: *"Yes, because in grouping students for class activities and providing immediate feedback through assessment, it takes a lot of time."*

Similarly, concerning the question of whether large class size poses a threat in differentiated instruction, all the respondents conceded 'Yes' to the question. This question was meant to explore more on their response to a similar question provided in the questionnaire where 48 (96%) conceded that large class size poses a threat to the practice of differentiated instruction. They strongly share in the opinion that large class size limits their ability to deliver specific positive feedback to all students with some reasons. GT4 pointed out that,

"If I spend just one minute with each student to check in or give feedback, it would take me 45 minutes - the length of a class period..."

According to ST2:

“Redirecting large number of students to stay on tasks in the classroom can take time away from planned learning opportunities. And it is quite difficult too to prevent accidents with large classes.”

DISCUSSIONS

Studies reveal that the quality of teaching practices have strong effects on children’s experiences of schooling, their attitudes, behaviours and learning outcomes (Musanti & Pence, 2010). This affirms the position of Stover et al. (2011) that instructional methods that do not accommodate the unique learning and curricular needs of diverse learners can expose them to greater risks of school failure. Also, traditional classroom approaches to teaching and learning such as one-size-fits-all have been proven to be ineffective means to instruction. Such highlights have necessitated a call for teachers to vary and adjust curriculum, materials and instructional support so that each learner can access high-quality learning (Kuyini & Abosi, 2014; Tomlinson, 2005a). It is one thing to have knowledge in a concept and it is another thing to practice what you know. This study however seeks to find out from JHS mathematics teachers whether they are able to practice in their classrooms what they understand about differentiated instruction.

Tomlinson and Imbeau (2010) state that learning to differentiate instruction well as teachers requires rethinking one’s classroom practice and results from an ongoing process of trial, reflection, and adjustment in the classroom itself. The findings of this study revealed that JHS mathematics teachers who are general mathematics process, and product differentiation which attracted an average per item rating of 1.41, 1.45, and 1.39 respectively. In the same study, it was also revealed that JHS mathematics teachers who are special mathematics teachers on average sometimes differentiate instruction with content differentiation process differentiation and product differentiation which attracted an average per item rating of 1.50, 1.50, and 1.38 respectively. As it is evident in the data analysis, majority of the participants admitted that they sometimes practice these elements of differentiated instruction. This finding is consistent to Abora’s (2015) study that revealed lower level of teachers’ practices of differentiated instruction despite the fair knowledge they have of it. Whipple (2012) also affirmed this finding when it was revealed that teachers understood more than they implement in her study. Differentiated instruction as a multileveled and complex teaching approach requires a significant change in the way teachers think and act in everyday classroom. Several studies regarding differentiation of teaching in mixed ability classrooms reveal that although teachers acknowledge the diversity of students, mainly in the academic sector, most of them do nothing to respond to this diversity (Kuyini & Desai, 2008; Melesse, 2015; Tomlinson & Edison, 2003).

Though the literature has highlighted the need to employ instructional adaptations including the use of curriculum compacting, flexible grouping, tiered activity, learning centers in classrooms (Boswell & Carlile, 2010; Preszler, 2006; Tomlinson, 2001), the results of this study showed little evidence of the use of such strategies. This is confirmed by the responses received from teachers in an interview when they were asked to enumerate some strategies they employ in differentiating instruction. From the responses, all of them indicated “co-teaching” and “small grouping” as some of the common strategies they employ during lesson. It is important to highlight that, some of the respondents added individualised teaching as one of the common strategies they use to differentiate instruction. Roy et al. (2013) however mention that differentiated instruction is not the same as individualised instruction. This reveals one of the alternative conceptions most teachers have concerning the practice of differentiated instruction. While it is true that differentiated instruction can offer multiple avenues to learning, and although it certainly advocates attending to students as individuals, it does not assume a separate assignment for each learner (Santangelo & Tomlinson, 2012; Tomlinson, 2001). It also focuses on meaningful learning in ensuring that all students engage with powerful ideas. Differentiation is more reminiscent of a one-room-schoolhouse than of individualization. That model of instruction recognized that the teacher needed to work sometimes with the whole class, sometimes with small groups, and sometimes with individuals. These variations were important both to move each student along in his or her particular understandings and skills and to build a sense of community in the group.

Despite its effectiveness in enhancing learning, differentiated instruction comes with practical challenges. One of the biggest challenges in addressing learner differences is large class size and dearth of time needed to differentiate instruction as teachers. Teachers interviewed gave the reason that: “Redirecting large number of students to stay on task can take time away from planned learning opportunities. They also stated that, it takes them a lot of time in grouping students for class activities and providing immediate feedback through assessment. Amadio (2014) confirmed that findings that, extra time on top of already demanding schedules and daily requirements were among the greatest challenges. Lessons often took longer to complete, which interfered with other scheduled activities and responsibilities such as clubs, marking and grading of scripts, and other administrative duties. Joseph et al. (2013) in their study also experienced similar challenges while working with student in a differentiated classroom environment. They labelled differentiated instruction as a very time-consuming exercise with long hours of planning, organizing and scheduling individuals and groups in a large class setting.

In order to address learner differences, teachers need to know what students’ current knowledge at any given time is, and how to address such academic diversity. From the findings of the study, teachers clearly conceded that they lack knowledge on how to address academic diversity which in turn has made it difficult for them to assess the readiness level of students. Differentiated instruction is likely to be effective unless teachers understand students’ mathematical needs and readiness, individually and collectively. Teachers used in the study also agreed to the assertion that ‘lack of administrative support hinders the practice of differentiated.’ In order for differentiation of instruction to be successful, headteachers must fully support this activity through the provision of teaching and learning aids and organisation of professional development programmes to equip them with the

research-based pedagogies needed to implement differentiated instruction. According to Weber, Johnson and Tripp (2013), implementation of differentiated instruction requires three main factors. Among these factors are the support teachers need to enhance their confidence in using the approach, enhance ways in which classroom practices contribute to the carrying out of differentiated strategies and attributes that may improve or impede the development of differentiation. In order to ensure effective implementation of differentiated instruction, collaboration should be emphasised. This however requires experts' guidance and support which are essential to ensure efficiency of the strategy across all curriculums.

Added to this, other challenges included teachers' concerns over limited space for group work teachers in differentiation, unease over the pressure of standardized tests in differentiation of instruction. These are confirmed in the study conducted by Tomlinson (1995) that revealed the among other challenges teachers face in differentiated instruction to include teachers' disquiet over student assessments and preparation for testing. Little (2001) argues that the reform demands are usually fast-paced, while learning takes some time; it goes gradually. In other words, the time needed to implement differentiated instruction is longer than the expectations of the standards-based policy. Emphasizing the principle that each student should be able to experience rigorous education aligned with content and performance standards that promote understanding, Little (2001) still suggests that the understanding by design framework can be a powerful tool to realize that principle.

CONCLUSIONS

According to the responses from general mathematics teachers and special mathematics teachers who teach JHS mathematics, it was established that there was no significant difference in the practice of differentiated instruction between general mathematics and special mathematics teachers. From the findings, it was concluded that JHS mathematics teachers' practice of differentiated instruction was very low. The reason may be that teachers lack the strategies in carrying out differentiated instruction. Hence, it is recommended that Ghana Education Service (GES) and headteachers implement professional development/training programmes for all General Mathematics Education and Special Mathematics Education teachers in each building focusing on the three main elements of differentiated instruction.

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