UNIVERSITY OF EDUCATION, WINNEBA

JUNIOR HIGH SCHOOL MATHEMATICS TEACHERS' KNOWLEDGE AND PRACTICE OF DIFFERENTIATED INSTRUCTION IN TANO SOUTH DISTRICT

PATRICK KYEREMEH

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PATRICK KYEREMEH

(8160030019)

A THESIS IN THE DEPARTMENT OF BASIC EDUCATION, FACULTY OF EDUCATIONAL STUDIES, SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES, UNIVERSITY OF EDUCATION, WINNEBA IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF PHILOSOPHY (BASIC EDUCATION) DEGREE

JULY, 2018

DECLARATION

STUDENT'S DECLARATION

I, PATRICK KYEREMEH, declare that this thesis, with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my own original work, and that it has not been submitted, either in part or whole, for another degree elsewhere.

SIGNATURE: ……

DATE: ……

SUPERVISOR'S DECLARATION

We hereby declare that the preparation and presentation of this work were supervised in accordance with the guidelines for supervision of thesis as laid down by the University of Education, Winneba.

DR. JOSEPH ISSAH NYALA (Principal Supervisor)

SIGNATURE: ……

DATE …….

MR. NIXON SABA ADZIFOME (Co-Supervisor)

SIGNATURE ……

DATE ……

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DEDICATION

This research work is dedicated to my Late Uncle, Daniel Desseh Donkor (Canada). I dedicate this research work also to my lovely family.

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LIST OF ABBREVIATION

ASCD	Association of Supervision and Curriculum Development
DI	Differentiated Instruction
EA	Education for All
IE	Inclusive Education
MoE	Ministry of Education
PBL	Project-Based Learning
RPK	Relevant Previous Knowledge
ZPD	Zone of Proximal Development

ABSTRACT

Differentiated Instruction is an approach to teaching that meets the diverse academic needs of students by considering learner readiness, interest and learning styles. The approach is grounded in the socio-cultural, multiple intelligence and constructivist theories. The study sought to explore Junior High School (JHS) mathematics teachers‟ knowledge and practice of differentiated instruction in Tano South district of Ghana. In order to achieve the purpose of the study, an explanatory sequential mixed method design was employed. A sample size of 50 JHS mathematics teachers comprising 41 general teachers and 9 special teachers was used in the quantitative study whereas 6 JHS mathematics teachers comprising 4 general teachers and 2 special teachers was employed in qualitative phase. A proportionate stratified sampling technique was employed by the researcher to select the sample of teachers for the study. In this mixed method study, the researcher followed up the quantitative results garnered through questionnaire with qualitative data using semi-structured interviews. Descriptive statistics involving frequency, percentages, mean and standard deviation was used to provide counts of the factors underpinning the analysis of the questionnaire data and the demographic responses. Data from the teachers‟ questionnaires were analysed using descriptive statistical methods involving frequency, percentages, mean, standard deviation and average per item rating. Also, inferential statistics such as t-test with a 0.05 level of significance was used to test the hypotheses. The qualitative data collected through the interview were analysed using cross-case approach. The findings of the study revealed that majority of JHS mathematics teachers sometimes practice differentiated instruction even though they were found to possess high knowledge of differentiated instruction. Hypothetically, it was revealed that there is no significant difference in the knowledge and practice of differentiated instruction between general education and special education teachers. The study recommends Ghana Education Service (GES) and headteachers to implement professional development/training programmes for all general education and special education teachers with the focus on the three main elements of differentiated instruction. It is directed that, future studies might look at how school administration supports teachers with the implementation of differentiated instruction in the classrooms.

CHAPTER ONE

INTRODUCTION

1.0 Overview

The chapter details the background to the study, statement of the problem, purpose of the study, objectives of the study, research questions, hypotheses, significance of the study, delimitations and limitations of the study, organisation of the study and operational definition of terms.

1.1 Background to the Study

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. The Government of Ghana has over the years emphasized the „all inclusive" approach to education by using various policies such as Inclusive Education Policy; Accelerated Development Plan in 1951; Education Act of 1961 and many more to facilitate discussions on strategies for including all learners who have varied abilities (MoE, 2015). 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 citizens in the Ghanaian education system under the universal design for learning and within a learner friendly environment for all. The overarching goal of the Inclusive Education (IE) policy according to MoE (2015) is to "redefine and recast the delivery and management of educational services to respond to the diverse needs of all learners within the framework of Universal Design for Learning and Child Friendly School Concept" (p. 3). The policy defines the strategic path of the government for the

education of all children with special educational needs. It also builds upon sections in the 1992 Constitution, the National Development Agenda, the Education Strategic Plan and International Commitments to achieve national as well as international goals for creating an environment for addressing the diverse educational needs of Ghanaians.

According to Ireh and Ibeneme (2010), one way to accomplish this goal is to emphasize differentiated instruction not merely as an instructional strategy, but rather as a critical teaching and learning philosophy that all prospective teachers should be exposed to, in teacher education programmes. In recent times, differentiated instruction in education has gained much attention due to the Universal Declaration of „Education for All" adopted in 1990 of which Ghana is a signatory. However, the definition of differentiated instruction varies between and among users with essentially the same goal. 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. Tomlinson (2004) defines differentiated instruction as 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. Tomlinson and Murphy (2015) also explain differentiated instruction to mean a process of adapting instruction and assessment in response to differing student interests, learning preferences, and readiness in order to promote growth in learning. In view of these definitions, the most significant similarity is the belief that students differ from each other in diverse ways and that these differences should be reflected in the learning experiences they are offered in classroom.

Differentiated instruction, according to Tomlinson and Imbeau (2010), is based on a set of beliefs: (a) that students who are the same age differ in their readiness to learn, their interests, their styles of learning, their experiences, and their life circumstances; (b) the differences in students are significant enough to make a major impact on what they need to learn; (c) students will learn best when they can make connections between the curriculum and their interests and life experiences; and (d) the central job of schools is to maximize the capacity of each child. Contemporary teachers therefore need to develop classroom routines that attend to, rather than ignore learner variance in readiness, interest and learning profiles. To achieve this ideal, teacher education institutions must put in place systems that support effective teaching and modelling of differentiated instruction. Although the notion of differentiation has appeared in educational literature since the 1950s (Good, 2006), it has gained greater significance and attention as the diversity of students in today‟s classrooms has increased. According to Tomlinson and Moon (2013), the strongest argument for differentiation is the everyday classroom where the diversity of the students is clearly evident. Tomlinson and Imbeau (2010) note that though differentiation is multifaceted, it can be boiled down to three student needs: student readiness, student interest, and student learning profile.

In the traditional mathematics classroom, instruction is usually seen as “one size fits all” approach. However, not all students are alike. Based on this knowledge, differentiated instruction applies to an approach of teaching and learning that gives students multiple options for taking in information and making sense of ideas. Differentiated instruction is a teaching theory based on the premise that instructional approaches should vary and be adapted in relation to individuals and diverse students in classrooms (Tomlinson, 2001). It also excites the brilliant learners to uncover

deeper layers of learning, while simultaneously structuring early childhood mathematics curriculum to support weak learners with a peer instruction with learning disabilities – both identified and unidentified. Clark (2010) supports that, "individuals find for themselves the most desirable method of learning strategies; therefore, teaching methodologies need to be varied" (p. 37). Clark further suggests that it is impossible to explore content in isolation but instead, teachers learn differentiated instructional strategies within multiple contexts of core disciplines, for instance, mathematics. The model of differentiated instruction, however, requires teachers to be flexible in their approach to teaching and adjust the curriculum and presentation of information to learners rather than expecting students to modify themselves for the curriculum. This model also requires teachers to involve and improve student contributions within the classroom; it requires students to participate in specifically designed lessons that recognize their learning preferences within their zones of proximal development (Goddard, Neumerski, Goddard, Sallous & Berebitsky, 2010; Vygotsky, 1978). Initially, differentiated instruction was considered to be an effective strategy to accommodate only talented and gifted students, but Tomlinson and Santangelo (2012) suggested that these strategies are effective for all learners, regardless of student aptitude. Many teachers and teacher educators have recently identified differentiated instruction as a method of assisting more students to succeed in diverse classrooms.

In response to this view, the Association for Supervision and Curriculum Development (2003) has described best practices evident in an effectively differentiated learning environment for all students: (i) teachers and students accept and respect one another"s similarities and differences; (ii) assessment is an on-going diagnostic activity, and learning tasks are planned and adjusted based on assessment

data; (iii) all students participate in work that is challenging, meaningful, interesting, and engaging; (iv) students and teachers collaborate in setting class and individual goals; (v) students work in a variety of flexible group configurations, as well as independently; (vi) students often have choices about topics, activities, and assessment; (vii) teachers use various instructional strategies to target instruction to student needs; and (viii) students are assessed in multiple ways, and each student‟s progress is measured at least in part from where that student began.

In order to differentiate teaching, changes must occur in lesson content and selection of curricula and activities to ensure instruction and practice are aligned to student skills and needs. Simply grouping students for instruction is not necessarily differentiating instruction either. Grouping itself is only a procedural change. Teachers must select materials that are academically profitable, not just busy work or time fillers. Changing delivery involves grouping for instruction so that opportunities for explicit, skills-focused teaching in small-groups increase. Teaching in small groups is not differentiated when all students receive the same instruction or use the same content, materials, and activities. Specifically, teachers need to know how to: Change instructional delivery, manage whole-class and small-group instruction; collect and use data to align content, or what is taught, to student needs; and improve instructional effectiveness, enhancing the quality of the instruction. However, the problem teachers face is how to get everything done and differentiate instruction to increase student achievement. Where is their guide for scaling that mountain?

The success of differentiated instructional practices as an effective methodology for teachers was established in the literature (Beecher & Sweeney, 2008; Kanevsky, 2011; Subotnikl, Olszewski-Kubilius & Worrell, 2011; Welsh, 2011). These studies

provide evidence of how students encouraged the use of differentiated instructional practices in the classroom. In Kanevsky"s (2011) study, over 70% of students who participated in the study wanted to be able to choose topics of interest and work in collaborative groups at individual paces, all key elements of differentiated instruction. These studies further discussed how students process information by thinking about it before attempting the task. In addition, it was noted that students wanted teachers to provide sufficient time to complete a task. Both of these are key elements of differentiated instruction. Gavin, Casa, Firmender, and Carroll (2013) and Subotnikl et al. (2011) suggested that differentiated instruction affects gifted education programs and how these students are educated. Watson (2011) and Welsh (2011) emphasized that if differentiated instructional methods are effective for gifted and talented students, then they should be effective and used for general education students as well. Berkeley, Bender, Peaster and Saunders (2009) and Dunn et al. (2009) inferred that appropriately implemented differentiated instructional strategies may assist academically, struggling students too.

Scholars have demonstrated that differentiated instructional strategies work for all students; yet despite this information, little direction is found in the literature to provide evidence of how teachers perceive differentiation or when they receive training on how to implement differentiated instructional strategies; furthermore, teachers may consider differentiated instruction as ineffective or challenging to implement on a day-to-day basis. So instead, teachers use grouping or integrate multiple intelligences within collaborate lessons to form a differentiated classroom (Alavinia & Farhady, 2012; Hamdan & Mattarima, 2012), but key elements of differentiation discussed by Kanevsky (2011), Subotnikl et al. (2011) and Worrell

(2011) such as learning environment, content, process, product etc. are ignored, resulting in ineffective differentiated instructional practices.

According to Gibson (n.d.), scientific research has not provided procedural models for differentiating instruction partially because of the ambiguity surrounding what it is and the limited research on how to implement it successfully in classrooms. In order to initiate the implementation of differentiated instruction, Gibson outlines an instructional management system that involves four steps: (i) Prepare the physical environment to create learning centers or workstations where students can complete assignments or projects either working in small-groups, with a partner, or independently; (ii) Divide students into smaller groups using either homogeneous (by similar skill) or heterogeneous (mixed skill) groupings. Memberships change flexibly according to student progress and achievement, type of activity, or resources (time, equipment, personnel); (iii) Manage resources such as instructional time, pacing, and student work. Teachers adjust their daily schedules to alternate time periods for whole-class and small-group instruction. Assigned curricula and activities are based on needs identified by assessments. Students participate in practice activities using Learning Contracts to help organize their work, monitor their progress, and complete assignments; and (iv) Create a rotation chart that identifies small-group memberships and communicates how the groups will participate at the workstations, worktable, or teaching table.

Rock, Gregg, Ellis and Gable (2008) also have designed a blueprint for differentiating instruction called REACH. The first activity requires teachers to reflect on what it will take to change to differentiated instruction. The second activity requires teachers to evaluate the curriculum with a survey including what students should know, what

most know, and what standards they must be held accountable for. The next activity involves analyzing groups and individual students to determine readiness, interests, preferences, strengths, and needs. The teacher should then craft research-based lessons that include graphic organizers, opportunities for students to work in small groups, whole-class, or individualized instruction units. The teacher would allow for student‟s response through dry boards, choral responses, cooperative learning groups, class-wide peer tutoring and assistive technology such as, books on tape, talking calculators, and manipulatives. Teachers are therefore encouraged to collect data on student interests, thinking styles, and readiness for teaching content and skills by using pre-assessments or diagnostic assessments such as checklists, interviews, surveys, observations at the outset.

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. The fact still remains that, teachers in heterogeneous classrooms have students who are below average level, on average level, and above average level. It is therefore imperative for teachers to provide differentiated learning environment that does not preclude any child in a classroom. Lauria (2010) concluded in her findings that by using differentiated instruction, educators have the greatest potential to alter the lives of struggling students to become successful students. The educational system fills classrooms with children of the same age and has the expectation that children have the tools to comprehend the presented information in the same way as their peers.

A study by Butler and Van Lowe (2010) compared students who received differentiated instruction in their mathematics class compared to students who did not receive the differentiated instruction section. Students who received differentiated instruction outperformed students in the non-differentiated instruction section on the final culminating assessment. Also, Stanford and Reeves (2009) discussed a research study conducted by Tomlinson, Callahan, and Lelli (1997), which addressed a 4-year period in a low socioeconomic area and reported positive achievement gains when these teachers addressed student learning preferences through identification, teaching strategies, and nurturing. According to Bailey and Williams-Black (2008), employing differentiated instruction provides teachers with a "way for all students to fit within-the-cracks instead of falling-through-the-cracks in order to become successful individuals in today"s society" (p. 134). Al-Lawati and Hunsaker (2007) contended research also supports that differentiated instruction has a positive bearing on student achievement. Finally, Andradre, Huff and Brooke (2012) in their research agree that differentiated instruction can promote learning and even motivation. They further add that when students are included in the creation of the learning process, they set personal goals for learning, participate in self-monitoring of progress, and actively pursue ways to fill in their gaps in learning.

Academic diversity is soaring in today"s schools. This increasing diversity has placed students with a variety of cultural differences and varying ability levels in a teacher"s classroom (Moon, 2005). Students enter school replete with differences in personality, background, and capabilities. Instead of expecting such categories of students to change themselves to fit the schools" agenda, teachers are expected to modify curricula and presentation to meet the students" needs. In the classroom, a teacher may be responsible for students with vastly differing home support systems and

stressors; gifted students; students with physical disabilities; and children with dissimilar learning styles and interests in school. Teachers also increasingly encounter students with diagnoses of learning disability as well as students from disparate cultures (Tomlinson, 2001). Differentiated instruction is one encompassing methodology that is considered effective to address these issues (Hawkins, 2009; Tomlinson & Santangelo, 2012). Reis, McCoach, Little, Muller, and Burcu-Kaniskan (2011) in their study also found that classrooms are increasingly heterogeneous, and teachers often operate within difficult and unpredictable environments. These diverse populations pose unique challenges for teachers: as the diversity among students increases, so may the differentiation of teaching methods and strategies. Tomlinson (2013) asserts that teachers often struggle when teaching large numbers of diverse students within one classroom. However, Tomlinson and Santangelo (2012) asserted that public schools typically want educators to provide a consistent and prescribed curriculum that functions within specific boundaries and standards without individualization thus making heterogeneous classrooms composed of students with diverse learning styles a challenge for public schools.

There is a gap in understanding how teachers know what they know about differentiated instruction and what they do with this knowledge. Tomlinson (1999) contends, “teachers in the differentiated classroom do not reach for standardized, mass-produced instruction assumed to be a good fit for all students because they recognize that all students are individuals” (p. 2). Robinson, Maldonado and Whaley (2014) in their study on perceptions about implementation of differentiated instruction highlighted that many teachers in a southeast school district are not implementing differentiated instruction. According to them, the absence of participation is due to many factors such as lack of professional development, lack of time, or considering

differentiated instruction to be another fad in educational approaches. The study also conducted by Joseph (2013) among pre-service and in-service trained teachers in Trinidad revealed similar findings. In this study, it was revealed that 58% of the respondents understood the concept of differentiated instruction. However, the majority of teachers did not differentiate content and product in their classrooms.

In Ghana, the situation might not be different as some studies have revealed that teachers in our 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 study also suggested that in differentiating process, teachers focused on only less able students and were merely preoccupied with getting students interested in their lessons rather than making them pursue their individual interests in specific content areas. Abora (2015) also conducted a mixed method study to investigate Ghanaian primary school teachers‟ knowledge and practices of Differentiated Instruction among 100 primary school teachers. His study found out that majority of teachers had at least a fair knowledge on the major concept and practices of differentiation (even though they were not aware that those were concepts and practices of Differentiated Instruction). However, 93.3% of these teachers scarcely differentiated classroom instruction and taught to address the learning needs of their learners despite the knowledge they appeared to possess of Differentiated Instruction.

These findings means that, Ghanaian basic school teachers lack a general understanding on how to define differentiation and uniformly address erroneous and tireless beliefs about instruction to create positive social change within the public school system. Consequently, this gap in understanding allows teachers to continually provide curriculum choices without the complete benefits of differentiated instruction. Researching this problem may provide evidence of teachers‟ knowledge on differentiated and how they intent to use it in mathematics classrooms in Tano South District.

1.2 Statement of the Problem

Research has shown that teachers have a significant effect on academic achievement of students (Heacox, 2002; Hendricks, 2008). In Ghana, the competence of regular primary and JHS teachers is widely criticised for the poor performance of students in the Basic Education Certificate Examination [BECE] (Ministry of Education [MoE], 2010; Kuyini, 2013; Kuyini & Abosi, 2011). Several studies point to the fact that, among school-related factors, teachers are the most critical to students‟ academic achievement and learning satisfaction (Koeze, 2007; Stake, 2002). For this reason, the method they employ in teaching is of essence.

Today‟s schools comprise greater diversity of students in the classrooms. Therefore, meeting the needs of these diverse students has become one of the most persistent and daunting challenges facing educators (teachers) in schools (Melesse, 2015; Owusu, 2016). Teachers are always beset with the problems of how to accommodate differences of individual learners, and also to help them achieve maximum success. Alhassan and Abosi (2014) assert that the Ghana education system has failed to effectively address the needs of pupils with learning difficulties in regular classrooms.

They attribute this anomaly to teachers‟ lack of adequate competence in adaptive instruction. This is confirmed by Pekeberg (2012) and Owusu (2016) in their studies that state that, pedagogy has become „one-size-fits-all‟ with a delivery of not addressing the complexity of the learner‟s needs in Ghanaian basic schools.

However, many researches support the use of differentiation as a way of meeting the needs of academically diverse learners in today‟s classrooms (Alhassan & Abosi, 2014; Good, 2006; Owusu, 2016; Tomlinson, 2005a). According to Konstantopoulos (2009), effective teachers can benefit all students regardless of gender, race, or socioeconomic status with quality instruction in primary schools through applying differentiated instruction. Because teachers are often besieged by the challenge of maintaining the status quo in heterogeneous classrooms, differentiation approaches are vital to meet the needs of all students to allow students access to the curriculum.

Even though there is research relating to the concept of differentiated instruction and its use among educators (e.g., Kuyini & Desai, 2008; Owusu, 2016), there are few studies discussing JHS teachers‟ knowledge and practice of differentiated instruction in the mathematics classrooms. Also, significant part of these studies documented the effects of differentiation on students‟ achievement, but do not state the nuances of teachers‟ knowledge and practice of the strategy. As a result, there exists a decided gap in the literature concerning the knowledge of JHS mathematics teachers regarding differentiated instruction and how their experiences with the approach influence instructional practice. It is against this backdrop that the study sought to investigate JHS mathematics teachers‟ knowledge and practice of differentiated instruction in Tano South District of Ghana.

1.3 Purpose of the Study

The purpose of this study was to investigate Junior High School (JHS) mathematics teachers‟ knowledge and practice of differentiated instruction in Tano South District.

1.4 Research Objectives

The following specific objectives guided the study:

1. To explore JHS mathematics teachers‟ knowledge of differentiated instruction in Tano South District.
2. To investigate the extent to which JHS mathematics teachers practice differentiated instruction in Tano South District.
3. To investigate the challenges confronting JHS mathematics teachers in differentiation of instruction in Tano South District.

1.5 Research Questions

The study was guided by the following questions:

1. What knowledge do JHS mathematics teachers have about differentiation of instruction in Tano South District?
2. To what extent do JHS mathematics teachers practice differentiated instruction in Tano South District?
3. What challenges do JHS mathematics teachers experience in differentiation of instruction in Tano South District?

1.6 Hypotheses

This study tested the following hypotheses:

H_O1: There is no significant difference in the knowledge of differentiated instruction between general education and special education teachers in Tano South District.

H_a1: There is a significant difference in the knowledge of differentiated instruction between general education and special education teachers in Tano South District.

H_O2: There is no significant difference in the practice of differentiated instruction between general education and special education teachers in Tano South District.

H_a2: There is a significant difference in the practice of differentiated instruction between general education and special education teachers in Tano South District.

1.7 Significance of the Study

This study can contribute to mathematics education in Ghana in a number of ways. Firstly, it adds significantly to the advancement of instructional practice in basic mathematics. It provides teachers and headteachers with strategies and tools to help facilitate instructional practices so as to ensure students success in the field of academic. As schools evolve their instructional practices used in preparing students for a 21st century global society also ought to be changed. Headteachers might use this study as a professional development tool to assist instructors in providing instructional practices that promote 21st century learning. Specific observations about the perceptions of instructors might provide headteachers with ideas on specific structures to implement within their institution to assist in coaching instructors to be effective in promoting 21st century learning at basic level and beyond. The perception that every authentic education comes about through experience does not mean that all experiences are genuinely or equally educative (Dewey, 1997). Differentiated instruction however requires a professional teaching force empowered with the skills necessary for designing learning experiences that maximize student potential. Therefore, effective differentiated instruction requires teachers to experience high

quality professional development to learn how to design high quality experiential learning activities.

Many schools are searching for instructional strategies to meet the needs of all learners while adhering to the standards of the frameworks. Differentiated instruction is however a way for teachers to provide instruction and track progress at each student‟s instructional level in order to meet these standards. Since each child enters school with individual needs, abilities and skills, it is pertinent for teachers to screen each student and provide individualized instruction based on the data received from the screening. Hence, findings from this study will help teachers assess and identify the level of instruction each student needs in order to maximize learning.

Also, many countries are in the midst of educational reform with the heart of this reform revolving around changes in the curriculum and teacher instructional behaviour (through teacher preparation). Therefore, findings in this research could help inform Colleges of Education and Universities on the need to restructure their mathematics curricula by giving peculiar attention to its pedagogical content (such as Differentiated Instruction) so as to be able to produce mathematics teachers who are capable of employing multi-directional approaches to effect the desired change/goal.

The utmost beneficiary of every classroom instruction is the learner. Differentiation however allows students to achieve learning objectives at their perspective level. It enables students to show interest and enjoy learning more (Delaney & Shafer, 2007; Lopez & Schroeder, 2008) as studies show that students‟ academic achievement improve when taught using differentiated instruction (Anderson, 2007; Lopez & Schroeder, 2008).

1.8 Limitation

The study, like other research works falls short of the ideal despite the achievement of its purposes. First, due to limited time and scarcity of resources the study was only conducted in Tano South District of Ghana. In effect, the study focused on only 1 district out of 22 districts in the region and one field of study. Hence, the findings may not be similar to that from other districts and other fields. Another limitation to consider was the inadequate number of special education teachers teaching at the junior high school level. Due to the fact that there are more general education teachers than special education teachers in schools, special education teachers were underrepresented. This study was also limited by the level of detail provided by the participants in their responses to the items posed by the researcher especially in the interview. Some teachers may have been hesitant to reveal they had limited knowledge of differentiated instruction and limited ability to practice differentiated instruction in the classroom. This to some extent could threaten the internal validity.

1.9 Delimitation

There are specific delimitations to this study. The primary delimitation is that this study focuses on only differentiated instruction of basic mathematics and does not examine any other intervention. Thus, it purposefully excluded other subjects as well as the perspective of students. Additionally, this study only examine differentiation through the perspective of JHS mathematics teachers in Tano South District and does not look at whether there is a difference in students learning due to teacher‟s practice.

1.10 Organisation of the Study

For successful research work, the study was organised into six chapters. Chapter One presents the background to the study, statement of the problem, purpose of the study,

objectives of the study, research questions, hypotheses, significance of the study, limitations and delimitations of the study, organisation of the study and operational definition of terms. Chapter Two deals with literature review, that is, the review of relevant literature on topics related to subject under study. Chapter Three presents the methodology employed in the study. This details research design, researchers‟ methodological position, research setting, population, sample and sampling techniques, research instruments, issues of validity and reliability, pre-testing, data collection procedures, data analysis procedures, and ethical consideration**.**. Chapter Four focuses on the results and findings of the study while Chapter Five captures the discussion of the findings. Chapter Six also presents a summary of findings, conclusion and recommendations based on the findings of the study.

1.11 Operational Definition of Terms

Content: The knowledge, understanding, and skills we want learners to learn and how they access the material taught (Tomlinson, 2005a, 2005b; Tomlinson & Imbeau, 2010).

Process: How students come to understand and assimilate content (Anderson, 2007; Tomlinson & Imbeau, 2010).

Products: How students demonstrate how much they have come to understand, and how well they can apply their knowledge and skills after a significant segment of instruction (Tomlinson, 2005a, 2005b; Tomlinson & Imbeau, 2010).

Differentiated Instruction: A way of teaching to all children to help them reach a common goal, regardless of the path they take to get there.

Learning Profile: Learners‟ differing rates of learning (Good, 2006).

Interests: Refers to that which engages the attention, curiosity and/or involvement of a student.

Readiness: A student‟s current proximity to specified knowledge, understanding, and skills.

Learning Disability: This refers to a variety of disorders that affect the acquisition, retention, understanding, organization or use of verbal and/or non-verbal information.

Inclusive Education: This is a process of educating learners with special education needs, regardless of age and disability, are provided with appropriate education within regular schools (Farrell & Ainscow, 2002).

General Education Teacher: An individual trained and prepared to teach in regular schools.

Special Education Teacher: An individual trained and prepared to teach in inclusive and/or special schools.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 Overview

This chapter reviews related literature under theoretical and empirical evidences. This includes the theoretical and conceptual frameworks. It also review the empirical evidences of teachers‟ knowledge and practice of differentiated instruction in schools and challenges facing teachers in differentiated instruction. Finally, the chapter summarises the related literature reviewed.

2.1 Theoretical Framework Underpinning Differentiated Instruction

Differentiation was formed on the foundational belief that every learner is different and he/she learns differently from others. According to Gregory and Chapman (2002), they differ in many ways, such as appearance, learning styles, multiple intelligence, previous experience, individual preference and social/emotional development. The goal of the differentiated classroom is to meet student needs in each of these areas. And this has resulted in a variety of learning theories which are applicable within differentiated instruction. Differentiated instruction is grounded in the Vygotsky‟s socio-cultural theory, Gardner‟s theory of multiple intelligences theory and Piaget‟s constructivist theory.

2.1.1 Socio-cultural Theory

The approach of differentiated instruction is held by the socio-cultural learning theory which is based on the work of Russian Psychologist Lev Vygotsky in 1962 (Burkett, 2013). The socio-cultural learning theory holds that the previous experiences and culture of the learner are critical because, these influence the learning process for each individual. It is the background and culture of the learner that frames how he

interprets the world, and what he discovers and attains in the process of learning (Wertsch, 1997). Turuk (2008) opines that the overarching focus of this theory is the interdependence of social and individual processes in the co-construction of knowledge. Kozulin (2002) claims that Vygotsky considers the learning process as not a solitary exploration of the environment by the child on his own, but as a process of the child"s appropriation of the methods of actions that exist in a given culture. Consequently, the individual learner must be studied within a particular social and cultural context, as it is within the context of social relations with others that learning takes place. Shayer (2002) characterized this process as guided participation. Thus, learners participate in wide variety of joint activities that provide the opportunity for synthesizing several influences into the learner"s novel modes of understanding and participation. By internalizing the effects of working together, the novice acquires useful strategies and crucial knowledge. Kozulin (2002) is also of the view that sociocultural learning approaches are based on the concept that human activities take place in cultural contexts, are mediated by language and other symbol systems, and can be best understood when investigated in their historical development. This principle according to Kozulin describes a process situated in, but not limited to, social interaction. When beginning an activity, learners depend on others with more experience. Over time they take on increasing responsibility for their own learning and participation in joint activity. Therefore, social interaction is essential to the development of cognition (Vygotsky, 1978; Wertsch, 1997).

The Zone of Proximal Development (ZPD) is a central proposition of the sociocultural learning theory. Shayer (2002) asserts that the crucial feature of learning according to Vygotsky is the creation of ZPD. That is to say, learning awakens a variety of internal developmental processes that are able to operate only when the

child is interacting and cooperating with people in his environment. And once these processes are internalised, they become part of the child‟s independent developmental achievement.

Vygotsky (1962) posits that the ZPD must be acknowledged in order to gain an understanding of the true relationship between learning and development. According to Vygotsky (1978) ZPD is the "distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (p. 38). In other words, it is the distance between what the child knows and what he is capable of knowing through interaction with his environment. That is, the level of development where a learner is capable of solving problems on his own, versus the level where the learner can only solve a problem with assistance from a more knowing other, usually an adult. Social and cultural interactions therefore play a critical role in a child‟s cognitive development. Vygotsky (1978) observes that the child acquires knowledge through contacts and interactions with people as the first step (interpsychological plane), then later assimilates and internalises this knowledge adding his personal value to it (intrapsychological plane). This transition from social to personal property according to Vygotsky is not a mere copy, but a transformation of what had been learnt through interaction, into personal values. In view of the above proposition, fundamental to any meaningful learning is collaboration through social and cultural interaction. A child would have to first interact with his environment (peers, teachers, parents) in order to mentally acquire concepts for later internalization of same.

Vygotsky claims that this is what also happens in schools. Students do not merely copy teachers‟ capabilities; rather they transform what teachers offer them during the processes of appropriation. During instruction a teacher considers the learners‟ previous development and nudges the student forward, taking care not to go too far. If the learner is pushed out of his/her comfort level without an appropriate amount of guidance and support, the student will not be able to move forward to the ZPD. Vygotsky recommends that the teacher remain slightly ahead of the students‟ actual level of development in order to remain within the ZPD. It is in this range that the learner is able to work independently and where new learning takes place. Consequently, the learning process leads the developmental process and learning occurs. Vygotsky asserts that pre-testing is essential in order to place students in their proper ZPD range. The readiness element of differentiated instruction is linked to this developmental component (Hall, Strangeman & Meyer, 2003). With an awareness of a students‟ ZPD, the teacher can assess student readiness levels and differentiate instruction according to student need. Also, teachers in differentiated classrooms target instruction in response to individual student‟s ZPD (what they already know) and act as experienced facilitators gradually releasing new skills and concepts.

2.1.2 Gardner's Theory of Multiple Intelligence

Gardner‟s multiple intelligence theory is one of the major tools for learning and problem solving (Campbell, Campbell & Dickenson, 2004). It is a departure from the view that intelligence is a single, measurable unit. Gardner‟s multiple intelligence theory is based on the belief that all of the human intelligences should be recognized and nurtured as well as all combinations of these (Armstrong, 2009). According to Gardner (1999), each intelligence must be thought of as its own system with its own rules, each operating according to its own procedures and has its own biological

bases. In his work, intelligence was defined as the existence of one or more basic information processing operations or mechanisms which can deal with specific kinds of input.

Within the approach there are eight intelligence categories: verbal-linguistic, logical-mathematical, visual-spatial, bodily-kinesthetic, musical-rhythmic, interpersonal, intrapersonal, and naturalist (Gardner, 1983 as cited in Burkett, 2013). Gardner (2006) as cited in Koeze (2007) summarized these intelligences as follows:

- *Linguistic Intelligence*: The understanding of the phonology, syntax, and semantics of language, and its pragmatic uses to convince others of a course of action, help one to remember information, explain or communicate knowledge, or reflect upon language itself.
- *Logical-Mathematical Intelligence:* The understanding and use of logical structures, including patterns and relationships, and statements and propositions, through experimentation, quantification, conceptualization, and classification.
- *Bodily-Kinesthetic Intelligence*: The ability to control one‟s bodily motions and the capacity to handle objects skilfully.
- *Spatial-Intelligence:* The ability to perceive the visual world accurately, to perform transformations and modifications upon one‟s initial perceptions, and to be able to re-create aspects of one‟s visual experience (even in the absence of the relevant physical stimuli).
- *Musical Intelligence*. The ability to understand and express components of music, including melodic and rhythmic patterns through figural or intuitive

means (the natural musician) or through formal analytic means (the professional musician).

- *Intrapersonal Intelligence*: The ability to access one‟s emotional life through awareness of inner moods, intentions, motivations, potentials, temperaments, and desires, and the capacity to symbolize these inner experiences, and to apply these understandings to help one‟s own life.
- *Interpersonal Intelligence*: The ability to notice and make distinctions among other individuals with respect to moods, temperaments, motivations, intentions, and to use this information in pragmatic ways, such as to persuade, influence, manipulate, mediate, or counsel individuals or groups of individuals towards some purpose.
- *Naturalist Intelligence*: The capacity to observe patterns in nature, identifying and classifying objects, and understanding natural and human made systems. It also involves the ability to care for, tame, or interact subtly with living creatures, or with whole ecosystems.

It is therefore important to note that these intelligences do not work in isolation but together in ways unique to an individual. Some students may possess almost or all of the eight intelligences in extreme forms. Others may lack all but the elementary aspects of the intelligences. A number of them may also be extremely advanced in some intelligences, average in others, and exhibit basic skills in the rest. Differentiated instruction appreciates the varying degrees of these intelligences present in individuals and offers multiple pathways to learning. Virtually every student has the capacity to develop all eight intelligences to a reasonably high level of performance if given the appropriate encouragement, enrichment and instruction (Gardner 1999 as cited in Armstrong, 2009). An instructional approach that is heavily

reliant on only an aspect of the intelligences, minimises opportunities for students who may not possess a propensity to learn in this way (Gardner, 1999 as cited in Subban, 2006). Creating opportunities for all students, by enriching the classroom through multiple techniques and assessment forms, develops students and brings out their strengths (Campbell et al., 2004; Gardner, 1999; Suban, 2006).

Differentiated instruction aligns well with Gardner‟s proposition that intelligence is the foundation on which individuals acquire new knowledge (Gardner, 1999; 2004). At the core of true differentiated instruction is the creation of multiple paths to learning for students so that they all have equal and, more importantly, appropriate access to the curriculum (King-Shaver & Hunter, 2003). The approach to this process of learning is a child-centered, as teachers start by examining how students learn then work to create curriculum, instruction and assessment accordingly (Hoerr, 2002). Gardner contends that when individuals solve problems, work through crises, and make things which are valued in their culture, they are being intelligent (Gregory & Kuzmich, 2004). The multiple-intelligence perspective conceptualizes enhanced learning in terms of engaging as many of students‟ multiple intelligences as possible in learning. Given that each student has a unique profile of strengths or multiple intelligences, teachers should consider using different pedagogical approaches through multiple intelligences to provide students with more opportunities to learn thorough their strengths so that more students can be reached in more effective ways. This however suggests that teachers need to expand their repertoire of techniques, tools, and strategies beyond the traditional mode of teaching in classroom. Hoerr (2002) however asserts that teachers who implement the multiple intelligence approach are transformed by the experience as they utilize their talents as professional teachers.

2.1.3 Piaget's Constructivist Theory

Constructivism has emerged as one of the greatest influences on the practice of education in the last twenty-five years. Teachers have embraced constructivist-based pedagogy with an enthusiasm that is rare in these days of traditional instruction approach (Jones & Brader-Araje, 2002). For many teachers, the focus on constructing meaning in the teaching-learning process resonates with prior knowledge because constructivist-based instruction firmly places educational priorities on students" learning. It is therefore believed that each learner has a tool kit of concepts and skills with which he or she must construct knowledge to solve problems presented by the environment. The role of the community – other learners and teacher is to provide the setting, pose the challenges, and offer the support that will encourage mathematical construction (Davis, Maher & Noddings, 1990).

Constructivism according to Jones and Brader-Araje (2002) is mainly attributed to the work of Jean Piaget which can be applied to both learning theory and to epistemology. The central principles of this approach are that learners can only make sense of new situations in terms of their existing understanding. Learning involves an active process in which learners construct meaning by linking new ideas with their existing knowledge. Piaget however holds the view that all knowledge, involves an organization, and the kind of organization he has in mind concerns directed actions. All knowledge is tied to action and knowing an object or an event is to use it by assimilating it to an action scheme. This is true on the most elementary sensory-motor level and all the way up to the highest logical-mathematical operations (Glaserfeld, 1995; Jones & Brader-Araje, 2002).

Tobin and Tippins (1993) define constructivism as a form of realism where reality can only be known in a personal and subjective way. Glasersfeld (1989; 1995) notes that constructivist theory acknowledges reality and that, it only exist within the realm of our experiential world and not ontologically. While constructivism takes on different philosophical meanings with different theorists and contexts, the overarching concept hinges itself upon the nature of knowing and the active role of the learner. One of the common threads of constructivism that runs across these definitions is the idea that development of understanding requires the learner actively engage in meaning-making. In contrast to behaviorism, constructivists argue that knowledge is not passively received but built up by the cognizing subject (Glasersfeld, 1995). Thus, constructivists shift the focus from knowledge as a product to knowing as a process. Underlying constructivism is the notion that the world is not just perceived but in some way constructed. According to Piaget‟s theory, "the learner interacts with objects and events available in the physical and social environment and thereby comprehends the features held by such objects or events using the process of assimilation, accommodation and equilibration" (Thakur, 2014, p. 11). The learners therefore construct their own conceptualizations and use those conceptualizations to generate solutions to problems. This theory suggests that humans create and construct knowledge as they try to bring meaning to their experiences.

Although Piaget‟s theories tended to focus primarily on the development of the individual while ignoring the greater socio-cultural context, the roots of constructivism are clearly present in Piaget‟s focus on the active role of the individual in learning: "all knowledge is tied to action, and knowing an object or an event is to use it by assimilating it to an action scheme" (Piaget, 1967, pp. 14-15). Knowledge according to Nonaka (2006) is a dynamic human process of justifying personal beliefs

towards the truth which is normally gained through experience or education. For Piaget, knowledge construction takes place when new knowledge is actively assimilated and accommodated into existing knowledge. Furthermore, Piaget's constructivist stances are seen in his belief that our understandings of reality are constantly being revised and re-constructed through time and with respect to exposure to new experiences.

Glasersfeld (1989) also emphasized that, learners construct their own understanding and that they do not simply mirror and reflect what they read. Learners look for meaning and will try to find regularity and order in the events of the world even in the absence of full or complete information. Hence, the responsibility of learning should reside increasingly with the learner. In the differentiated classroom, teachers should facilitate the learning process by organizing learning activities and using variety of aid material according to the level of functioning of student‟s cognitive structure to enable him to construct knowledge through his experiences.

2.2 The Concept of Differentiated Instruction

Today‟s classrooms are now defined by diversity. Therefore, teachers are required to meet the needs of all students by employing appropriate practices such as differentiated instruction. Differentiated instruction is a pedagogical approach to effectively manage classroom diversity by adapting teaching to maximize learning for all students. Though differentiated instruction seems to be a broad term, it mainly refers to those classroom practices embodying student learning styles, interest, and prior knowledge (Benjamin, 2002). To differentiate instruction is to recognize students‟ varying background knowledge, readiness, language, preferences in learning and interests, and to react responsively. Differentiated instruction is a process to

teaching and learning for students of differing abilities in the same class. The intent of differentiating instruction is to maximize each student‟s growth and individual success by meeting each student where he or she is, and assisting in the learning process. According to Tomlinson (2004a), differentiated instruction can be defined as "a learned way of thinking about „being‟ that honours and contributes to the uniqueness and possibilities of each person in the group, as it honours and contributes to the success of the whole" (p. 189). It is a way of effectively responding to the diversity of learners in the classroom. Therefore, differentiated instruction values student diversity and promotes student learning by building on difference (Gregory & Kuzmich, 2004; Tomlinson, 1999).

Differentiated instruction can also be defined as a philosophy of teaching that is based on the premise that students learn best when their teachers accommodate the difference in readiness levels, interests and learning profiles (Tomlinson, 2001, 2004). In differentiated classrooms, teachers begin where students are, not the start of a curriculum guide. Learning to differentiate instruction therefore requires teachers to rethink their classroom practice through an ongoing process of trial, reflection, and adjustment. They accept and build upon the premise that learners differ in important ways. Tomlinson and Imbeau (2010) describe differentiation as classroom practice with a balanced emphasis on individual students and course content. They posit that at the core of the classroom practice of differentiation is the modification of curriculum-related elements such as content, process and product, based on student readiness, interest, and learning profiles.

Hall, Strangman and Meyer (2003) also define differentiated instruction as a process to teaching and learning for students of differing abilities in the same class. The intent

of differentiating instruction is to maximize each student‟s growth and individual success by meeting each student where he or she is and assisting in the learning process. Differentiated instruction seeks to move away from teaching to the whole class in the same manner and addresses the needs of all learners, including those who are at risk and the gifted, through various forms of well-planned, well-organized, flexible curriculum and instructional strategies.

In order to understand differentiated instruction, the principles for practicing must be articulated. Good (2006) in his study enumerated these as major principles of differentiated instruction: i) instruction is driven by assessment that‟s assessment and instruction are inseparable; ii) goals of differentiated classroom are maximum growth and individual success; iii) students and teachers are collaborators in learning. Other principles that are paramount to understanding differentiated instruction can be found in a research conducted by Owusu (2016). He asserts that teachers should allow students to participate in respectful work while maintaining a flexible working relationship. Also, differentiated instruction is proactive rather than reactive. In differentiated classrooms, teachers adjust content, process and product in response to student readiness, interest and learning profiles (Andersen, 2009). This will enable all learners to have the opportunity to succeed in their learning, from students who struggle to gifted learners, since all students are supported and challenged in their work.

Figure 2.1 presents conceptual framework regarding the understanding and implementation of differentiated instruction among educators especially teachers.

2.3 Conceptual Framework of Differentiated Instruction

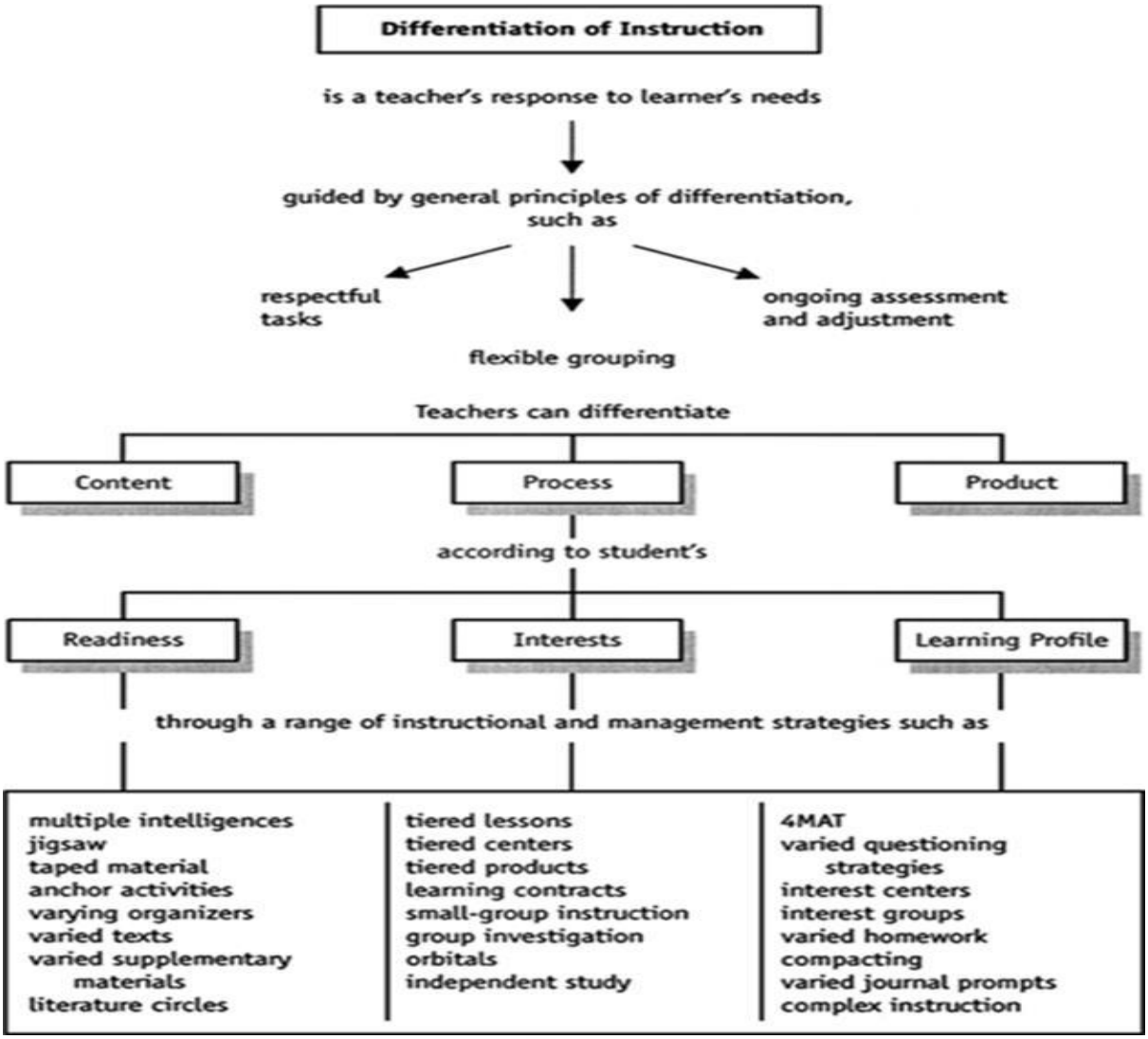

Figure 2.1: A conceptual framework for understanding and planning effective differentiation in the classroom

Source: Ashley (2016, p.41)

Many instructional strategies comprise a differentiated classroom. Differentiated instruction is therefore a compilation of the best practices in teaching and student learning theories and practices that support student achievement. Figure 2.1 shows the conceptual framework for differentiated instruction. Tomlinson (2005a, 2005b)

framework for differentiated instruction however features differentiating three facets of instruction (content, process, and products) based on three characteristics of students: cognitive readiness, interests, and learning profile which define the ways students learn best. Assessment is essential to effective teaching and learning and is a common theme found when researching differentiated instruction (Heritage, Kim, Vendlinski & Herman, 2009). Assessments which include pre-assessment are used throughout the implementation of differentiated instruction and are the driving force behind the specific instruction provided. Whipple (2012) postulates that pre-assessments can range from KWL (what the students know, what they want to learn and what they have learned) charts to teacher-generated tests.

Pre-assessment is an important tool to assess students‟ readiness. Pre-assessment data allows the teacher to create lessons and activities that are appropriate for the students, no matter what level they are performing. According to Sternberg and Zhang (2005), it is important for every teacher to keep in mind students learning styles because, for students to benefit most from instruction and assessment, part of the instruction and assessment should match their learning style. Differentiated instruction aligns tasks and objectives to learning goals. Designers of differentiated instruction view the alignment of tasks with instructional goals and objectives as essential. Goals are most frequently assessed by many state-level, high-stakes tests and frequently administered standardized measures. According to Hall, Strangman and Meyer (2003), objectives are frequently written in incremental steps resulting in a continuum of skills-building tasks. As depicted in Figure 2.1, the curriculum can be differentiated by content, process, and product to adapt to the readiness level of the student.

In differentiation of instruction, several elements and materials are used to support instructional content. The content is what the teacher plans on teaching, what the students need to learn about the topic. These include acts, concepts, generalizations or principles, attitudes, and skills. The variation seen in a differentiated classroom is most frequently in the manner in which students gain access to important learning. Therefore, access to the content is seen as key. The process is the "how" the teacher decides to design the lesson. Student background data are taken into consideration when planning. Teachers need to understand that the prior knowledge with which students enter their classroom is based on many factors such as cultural background and family opportunities. The "how" must be based on best practices in instruction and student learning such as readiness, interest, learning profile, choice, and learning styles of the students. The product, which is some form of assessment of the content, also revolves around the readiness, interests, and learning profile of the student.

2.4 Elements of Differentiated Instruction

According to the authors of differentiated instruction, several key elements guide differentiation in the education environment. Tomlinson (2001) identifies three elements of the curriculum that can be differentiated: Content, Process, and Products. These elements are described in detailed under the following headings:

2.4.1 Content Differentiation

It is reasonable to assume that once teachers have a good understanding of students" level of readiness, interests and learning profiles, that they will be more likely to engage in effective and appropriate content, process, and product differentiation (Santangelo & Tomlinson, 2009). 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. Some strategies for content differentiation include: providing text materials at varied reading levels of complexity; curriculum compacting; using small group instruction to re-teach or reinforce content; providing text on audiotape; supplementing oral presentations with videotapes and visual demonstrations; providing note-taking organizers; highlighting or summarizing key portions of text; and using manipulatives (Tomlinson, 2005a, 2005b).

Clearly, differentiating content requires teachers to either modify or adapt how they give students access to the material they want the students to learn. Heacox (2002) concurs that one way teachers can differentiate the content or curriculum they teach is by providing students with the opportunity to choose a subtopic within a main topic or unit. As each student presents the information on their sub-topic, the whole class learns more about the topic in general. Anderson (2007) suggests that teachers may choose to differentiate content by using flexible grouping where students can work in pairs, small groups or alone, using books or tapes or internet as a means of developing understanding and knowledge of the topic or concept. It is important to note that while all students should be encouraged to work at their own pace, each student has the responsibility for meeting specified deadlines for class projects.

2.4.2 Process Differentiation

Like content differentiation, process can also be differentiated in response to readiness, interest and learning profile (Tomlinson, 2005a, 2005b). According to 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. Therefore, teachers should vary the activities students use to master the concepts or skills.

Strategies for effective process differentiation include: tiering activities to various levels of complexity to optimize every student‟s classroom experience; providing directions at varied levels of specificity; varying the pace of work; offering multiple options of expression; giving students alternative topics on which to focus; creating activities that are harmonious with students‟ preferred modalities of learning (Sylwester, 2003; Tomlinson 2005a, 2005b). These activities are referred to as "sense-making" activities that allow students to increase their understanding of the topic being taught (Tomlinson, 2005a). It is important to note that the process is differentiated not only by how the teacher decides to teach (lecture for auditory learners; centres for tactile learners; small group and whole group), but by the strategies the teachers encourage students to use to facilitate thorough exploration of the content taught. This can be done by way of higher-order thinking, open-ended thinking, discovery, reasoning and research (Bailey & Williams-Black, 2008).

2.4.3 Product Differentiation

Tomlinson (2005a, 2005b) suggests that products are 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. Product differentiation should offer students multiple pathways to show mastery of common

learning goals. Effective product differentiation assignments should offer students clear and appropriate criteria for success; focus on real-world relevance and application; promote creative and critical thinking; allow for varied modes of expression. Santangelo & Tomlinson (2009) also believe that it is important for teachers to provide students with adequate scaffolding and support, as well as opportunities for peer and self-evaluation. Bailey & Williams-Black (2008) suggest that differentiating the product allows students to self-select a way to show they have learned the material that was taught. They argue that when students self-select their product, they normally choose a method that will provide them success which most likely will coincide with their own learning profiles.

2.5 Differentiation by Student Differences

The previous examples of differentiation deal with ways that teachers can differentiate the learning process by varying physical, curricular activities. Curriculum can also be differentiated according to students‟ readiness, interests, and learning profiles.

2.5.1 Readiness

In differentiating instruction by readiness, teachers give more challenging assignments to advanced learners and more basic ones to struggling learners. A student‟s readiness should not be based on actual intellectual ability but on that student‟s attitudes, experiences and schooling (Santangelo & Tomlinson, 2009). The goal for establishing readiness allows teachers an entry point to begin instruction. Tomlinson (2005a) asserts that, “a task that best match student‟s readiness extends that student‟s knowledge, understanding, and skills a bit beyond what the student can do independently. A good readiness match pushes the student a little beyond his or

her comfort zone and then provides support in bridge the gap between the known and the unknown" (Whipple, 2012, p. 32). Good (2006) cautions that teachers must be careful to adjust the actual nature of the assignment rather than merely giving more work to a student with mastery and less to a struggling student. Hence, teachers are required to engage students in respectful work and not having higher-performing students doing interesting work and lower-performing students doing dull drills.

2.5.2 Interest

Sustaining students‟ motivation is often a challenge for teachers but when teachers utilize student interests, motivation increases. Interests according to Tomlinson and Imbeau (2010) can include personal experiences and strengths, cultural background, and areas of need. Differentiating by interest is very validating for students. It makes school lessons relevant to their lives and supports them in making connections between concepts, both of which increase student performance and retention of concepts (Association for Supervision and Curriculum Development, 1997 as cited in Good, 2006). In effect, teachers are required not be sole partners in the choice of teaching and learning materials but rather involve students. It is believed that, when students have the opportunity to choose for themselves, they tend to enjoy work more and develop positive attitude towards learning. Allowing students to read and respond to self-selected materials is one of the simplest ways teachers can differentiate by interest. Other strategies include expert groups; author studies; individual learning goals; working alone or in groups; and allowing students choices in where to sit, in which order to complete tasks, roles in cooperative learning, and different content for writing prompts (Tomlinson, 1999, 2001).

2.5.3 Learning Profile

Understanding learning profile of students is an integral aspect to teaching. Learning profile describes an individual‟s characteristics and preferred way of acquiring, retaining and processing information (Fleming, 2001). Differentiating according to learning profile often means that teachers need to base assignments on students‟ differing rates of learning. Tomlinson and Imbeau (2010) suggest learning profiles be considered greatly when implementing differentiated instruction. There are four elements according to Tomlinson (2001) that define learning profile: learning style, intelligence preference, gender, and culture.

2.6 Strategies of Differentiation in Mixed-Ability Classroom

It can be beneficial to know about certain types of disabilities before teaching students with labels, often teachers are effective when they are accepting, look for strengths in their students, provide personal attention when necessary, and allow for differences in the ways students approach tasks and complete classroom work (Anderson, 2007). Some of the easy strategies are as:

2.6.1 Flexible Grouping

Whether accommodating differing levels of readiness, interests, or learning profiles, flexible grouping is a hallmark of differentiated instruction. Flexible grouping differs dramatically from the old educational concept of homogenous, tracked groups. Rather, this approach uses different configurations to accommodate student strengths and provide support in the areas of student weakness (Tomlinson, 2001). It is the “purposeful reordering of students into working groups to ensure that all students work with a wide variety of classmates in a wide range of contexts during a relatively short span of classroom time” (Mitchell & Hobson, 2005, p. 8). The teacher regularly

groups and regroups students to give them opportunities to meaningfully interact with their peers. This may include some time spent working in a whole-class setting, sometime in heterogeneous and homogeneous small groups, and some in individual work. In order to be successful in this varied environment, all students need clear directions and good training and support to work well in a group setting (Mitchell & Hobson, 2005). Once they have this training, however, students working in group settings can be challenged to move far beyond traditional, rote learning.

2.6.2 Tiered Activities

Tiered activities are one way to provide tasks at various levels. Students work on tasks with differing degrees of difficulty, but all work with the main ideas and at higher levels of thought. According to Preszler (2006), teachers use tiered activities so that all students can focus on essential understandings and skills but at different levels of complexity, abstractness, and open-endedness. In order words, it allows several pathways for students to reach understanding of key concepts. Here, learning tasks are designed at different levels according to students‟ readiness levels, learning preferences, learning styles or Gardner‟s multiple. By keeping the focus of the activity the same but providing routes of access at varying degrees of difficulty, the teacher maximizes the likelihood that: each student comes away with pivotal skills and understandings; each student is appropriately challenged (Preszler, 2006, p. 8). Tomlinson (1999, 2001) asserts that when teachers tier assignments, they make slight adjustments within the same lesson to meet the needs of students. All students learn the same fundamental skills and concepts but through varying modes and activities. The tiers appropriately challenge students at their ability levels. The teacher‟s challenge is to make sure all tasks, regardless of the tier level, are interesting, engaging, and challenging. Preszler (2006) postulates that activities and assignments

can be adjusted in any of the following ways: level of complexity, pacing of the assignment, amount of structure, number of steps required for completion, materials provided, form of expression (letter, essay, report, research, time allowed paper, short story, speech), level of independence required. Since most teachers are under time constraints, they can work with students in small groups as well as individual students (Lewis & Batts, 2005).

2.6.3 Layer Curriculum

Layered Curriculum is a strategy developed by Nunley (2006) as a response to classroom experiences with high school students. The approach features a three-layer model that requires students to use higher level thinking skills as they work through the layers (Preszler, 2006). Nunley (2006) connects the three layers to grades. The *C layer* is the basic layer of competency and reflects what all students must do. If students successfully complete the tasks required in the *C layer,* they earn a C grade. *C layer* activities asks students to collect factual information. The *B layer* provides students with the opportunity to apply, manipulate, and play with the information they gathered while completing *C layer* activities. Typically, the *B layer* requires students to apply, manipulate, discover, hypothesize and prove, demonstrate, or problem solve. Students who successfully complete the *C* and *B layers* earn a B grade. Finally, the *A layer* or top layer asks students to think critically about an issue. Nunley (2006) says the purpose of the *A layer* is to teach students critical thinking skills and to apply their classroom learning into their daily lives. The *A layer* consists of questions that ask students to analyze a topic. Frequently, no right or wrong answer exists. Students who successfully complete *C, B,* and *A layer* activities earn an A grade. According Preszler (2006), Nunley (2006) emphasizes that all layers should provide students with some control over their learning" (p. 19). However, she suggests a menu-like approach to

the tasks in each layer which allows students to choose from the available task options provided by the instructor.

2.6.4 Big Question Teaching

The easiest way to differentiate for all learners is to frame lessons and units as questions, issues, or problems especially in mathematics (Bigelow, 2007). Questions or problems based on critical issues stimulates the students to think innovatively and the best way of getting different responses from different students and also encouraging some of them for further learning and investigation. Some learners will provide answers that are more concrete while others will be able to answer in ways that are more complex and abstract. For example: What does it mean to do mathematics? Using problems, questions, or critical issues as the base of a lesson or unit helps the teacher to narrow the topic delimiting content coverage and reducing the likelihood of fragmented and superficial treatment of subject matter.

2.6.5 Learning Centres or Stations

Centres or stations involve setting up different spots in the classroom where students work on various tasks simultaneously on their pace and abilities. Tomlinson & Edison (2003) define learning centre as an area of the classroom that holds learning materials and activities designed to teach, reinforce, or extend students understandings of specific concepts and skills (Burkett, 2013). This involves flexible grouping because not all students need to utilize all stations. Centres or station teaching is ideal for use in the inclusive classroom since it allows teachers to work with individual students or small groups of learners without the need to push them to achieve the desired objectives. Stations or centres might be teacher-led if new knowledge is to be given or student-led if mastery is to be obtained on the information given by the teacher. For

example in a basic school mathematics classroom, learners might rotate through four stations according to their potentials: (1) Working with the teacher to learn about surface areas and volumes, (2) Solving problems of surface areas and volumes from the textbook, (3) To generate a list of applications related to surface areas and volumes from the real world, (4) Completing a review worksheet from the last unit if last unit not mastered. However, Tomlinson (1999, 2001) argues that regardless of the type of learning centre designed, it should contain materials and activities that address a broad range of reading level, learning profiles and student interests.

2.6.6 Project-Based Instruction

Project-Based Learning (PBL) is a teaching method that is significantly different from the conventional classroom teaching. In this teaching approach, students are challenged to provide solutions to critical questions and problems in the real world. Barell (2010) defines PBL as an instructional approach in which students are confronted real-world issues and problems that they find meaningful, determine how to address them, and then act in a collaborative fashion to create problem solutions. The belief that "all genuine education comes about through experience does not mean that all experiences are genuinely or equally educative" (Dewey, 1938, p. 25). Project-Based Learning (PBL) however requires a professional teaching force empowered with the skills necessary for designing learning experiences that maximize student potential. Students in PBL classrooms work in small groups to complete the projects, and they work independently from their teachers as possible. Research indicates that, PBL with its "hands-on, minds-on" help link problem-solving approach to learning, enhances student"s ability to apply knowledge in real world scenarios and retain the knowledge learned (Gijbels, Dochy, Van den Bossche & Segers, 2005).

The focus of learning is on individual and groups to (a) clearly identify what information they need to solve the problem and (b) identify suitable resources and sources of information. Kilpatrick is apt to his ideas when he defined the project to mean any unit of purposeful experience, any instance of purposeful activity where the dominating purpose, as an inner urge, (i) fixes the aim of the action, (ii) guides its process, and (iii) furnishes its drive, its inner motivation. The project thus, may refer to any kind or variety of life experience which is in fact actuated by a dominating purpose (Capraro, Capraro & Morgan, 2013). This broad definition however became the justification for most educational activity that, project gives learners practice in devising ways and means and in selecting and rejecting method of achieving some definite practical end.

2.6.7 Curriculum Compacting

Curriculum compacting is a technique for differentiating instruction that allows teachers to make adjustments to curriculum for students who have already mastered the material to be learned, replacing content students know with new content, enrichment options, or other activities (Boswell & Carlile, 2010; Reis & Renzulli, 2005; Winebrenner, 2001). However, Reis and Renzulli (2005) and Winebrenner (2001) assert that curriculum compacting can also be effective for those students that may not have already mastered the majority of content and skills. They can benefit from instruction, but will require fewer repetitions for mastery. They recommend that teachers first determine the expected goals of the unit or lesson in terms of the content, skills, or standards students must learn before assessing students to determine which ones have already mastered most or all of the specified learning outcomes. Boswell and Carlile (2010) argue that prior to instruction, teachers determine what students already know and can do using pre-assessment. For those who‟ve already

mastered most of the material, replace and extend the core curriculum using more challenging learning opportunities. Curriculum compacting is therefore a useful tool for modifying the core curriculum. It appropriately challenges students and increases their motivation (Boswell & Carlile, 2010).

2.7 Professional Development

According to the literature in the field of education, the professional development of teachers/heads is one of the most effective methods of improving teacher quality, teacher practice and student learning (Desimone, 2011). The National Staff Development Council (NSDC) defines the term professional staff development as "a comprehensive, sustained, and intensive approach to improving teachers‟ and principals‟ effectiveness in raising student achievement" (Hirsh, 2009, p. 12). In order words, they are activities designed to enhance the professional knowledge, skills and attitudes of teachers so that they might, in turn, improve the learning of their students (Guskey, 2000). The quality of teaching which involves the things teachers do to improve students‟ learning has more bearing on student achievement than any other factor. As Guskey (2000, p.4) states, "one constant finding in the research literature is that notable improvements in education almost never take place in the absence of professional development". Professional development is therefore considered as one of the major keys to meeting today‟s educational demands of which differentiated instruction is no exemption. According to studies, quality professional development has the propensity to change teachers‟ practices and positively affect student learning (Leko & Brownell, 2009; Musanti & Pence, 2010).

Teaching demands a complex set of skills and knowledge and teachers need support as they execute lesson plans, managed classrooms and evaluate students while

meeting state standards. And at professional development sessions, teachers benefit from having individually tailored tools and techniques to choose from as they make instructional decisions. Stover, Kissel, Haag and Shoniker (2011) assert that professional development honours differentiated approach to meet the diverse needs of teachers. 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. Although teacher preparation programs seem to be a natural fit for learning how to differentiate instruction for mixed abilities, often they provide only an introduction to the theory, which is presented in a survey course along with other theories of curriculum and instruction (Leko & Brownell, 2009). These cursory glimpses at differentiation may not provide enough depth for actually putting it into practice. In an effort to address this need for more information on strategies used in differentiation in response to learner diversity, school managements should offer professional development opportunities for their teachers.

EMPIRICAL REVIEW

2.8 Teachers' Knowledge of Differentiation of Mathematics Instruction in Schools

Whipple (2012) conducted a quantitative study to explore teachers‟ understanding of differentiated instruction and their ability to implement differentiated instruction in grades kindergarten through sixth. This quantitative study utilized a survey study methodology that was sent to over 100 participants electronically. In the study, the first component that was analysed is content and there were four items that the participants were to respond to. Teachers were asked to rate their level of understanding regarding what the curriculum is based on, if they are to articulate what they want students to know, use a variety of materials and if they provide a variety of support materials. These items were rated on a one-to-four scale for a possible total score of 4 to 16. Given the 81 teachers who participated in this section, there was a mean score of 14.64, a standard deviation of 1.55 and a median score of 15.00. An average item rating for content was 3.66 out of 4.00. This means that participants on average chose 3 or higher, which put content in first place for understanding. Tomlinson and McTighe (2006) make a strong statement about the importance of content, which underscores the fact it was rated as the most understood component important, "*Clarity about content reveals our awareness that human beings seek to make sense of their world and that the big ideas of the disciplines reveal the big ideas of life. Inevitably, to grasp the key concepts and principles of any subject also help us better understand ourselves, our lives, and our world*" (p. 38).

Process as a component was also analysed and there were four items the participants were questioned about. Teachers were asked to rate their level of understanding regarding whether they structure their classroom environment to support a variety of

activities including group work/or individual work; group students for learning activities based on readiness, interests and/or learning preferences; vary the pace of instruction based on individual learner needs; and use learner preference groups and/or learning preference centres. When teachers rated their level of understanding for process it came in fourth with a mean score of 13.64 out of 16.00, a standard deviation of 1.98 and a median score of 14.00. Teachers had an average item rating for process of 3.41 out of 4.00. Process addresses the rate of instruction, using learner preference groups, grouping students based on readiness and setting up a structured classroom environment. This area is imperative because in order to effectively implement differentiated instruction, a classroom must be structured. It is argued that, teachers who established enabling learning environments are most likely to teach for meaning and understanding (Knapp, Shields & Turnbull, 1992). Hence, teachers are required to create classroom activities that can actively engage students in learning and improve their understanding rather than memorization.

In the study, last category on the survey asked teachers to rate their level of understanding was product. This category had four items for teachers to rate, which asked if they provide multiple modes of expression; provide students with the choice to work along, in groups or pairs; if the product connects to student interest; and if a variety of assessments are used. These four items rated on a one to four scale for a possible total score of 4 to 16. Of the 84 responses, product had a total mean score of 12.95 out of 16.00, a standard deviation 2.45, and a median score of 13.00. There was an average per item rating of 3.24 out of 4.00.

The category of product placed last, for teachers‟ ability to understand. This is concerning because if teachers allow students to use a variety of tools throughout the

lesson but then fail to vary the product, there may not be a high level of understanding for the students. Overall, teachers who participated in the survey had a high level of understanding of differentiated instruction, but there are components teachers understand more thoroughly based on the categorical statistics.

In contrast to the findings, the research findings of Melesse (2015) indicated that there was majority of primary teachers have low perception/knowledge of differentiated instruction. Melesse conducted a descriptive survey which focused on assessing the perceptions, practices and challenges of differentiated instruction by primary school teachers. In that study, data were gathered from randomly selected 232 primary school teachers via questionnaire and focus discussion. This is confirmed by the result of the one-sample t-test analysis that depicted that the perception of differentiated instruction by primary school teachers is low. In that statistical analysis, the obtained mean (2.44) was less than the expected mean (2.5). Differentiated instruction being a new concept, about 96.55% of primary school teachers portrayed that they did not have training on differentiated instruction and as a result they have low perceptions (Melesse, 2015).

Contrary to the findings of this study, a mixed study conducted by James (2009) to investigate teachers‟ perceptions of differentiated instruction and its implementation in day-to-day teaching within the classroom confirms the opposite. According to James (2009), his findings support the premise that teachers share adequate knowledge about differentiated instruction, but the area of implementation needs further investigation. In the interviews, all four participants responded “No” to the question that if differentiated instruction was a fad. As stated by Rock, Gregg, Ellis and Gable (2008), “Differentiating instruction is not a passing fad: it is a revolution – a

fundamentally different way to teach students with diverse learning and behavioral needs" (p. 39). The participants who answered the questionnaires also consented to the statement that „assessment and instruction are inseparable". Again, they emphasized the need for different methods that were needed for optimum learning, giving students the best opportunity for success.

Consistent to James (2009) findings is that of Abora (2015) which revealed primary school teachers to have possessed adequate knowledge in differentiated instruction. Abora (2015) also conducted a mixed method survey research design to investigate Ghanaian primary school teachers" knowledge and practice of differentiated instruction. The findings of Abora indicated that, primary school teachers possessed a higher level of knowledge on the aspects of differentiation in general. However, there were variability in terms of their level of knowledge. Process was rated the highest element followed by product with content been among the least.

2.9 Practice of Differentiated Instruction in Schools

Owusu (2016) conducted a case study that 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 was used. Differentiating learning experiences in terms of content in this 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 results of the study, it was clear with regards to teachers" ability to identify and adjust content to meet individual students" readiness that on the average, students agreed to the questionnaires with a mean of 3.649 and co-efficient of variation of 39.6 percent. It is

also obvious that with a mean of 3.5 and co-efficient of variation of 45.7%, on the average students agreed that their teachers knew their individual interests and related content accordingly.

However, with regards to whether teachers know how individual students learn best (learning profiles) and adjust content to meet their individual learning needs, the analysis of responses provided gives a mean of 3.345 and co-efficient of variation of 38.4% , meaning the average student scored neutral on that statement. The results from the analysis of students‟ response show a mean of 4.24 and a co-efficient of variation of 29.7% for the statement „teacher pre-assesses students before a unit/topic to identify individual students‟ readiness. The results mean that on the average respondents agreed that teachers pre-assessed them to find out how ready they were before teaching any unit/topic. In the researcher‟s observation, it was highlighted that content materials remained same for every student without recourse to individual student‟s readiness, interest or learning profiles. However, triangulation of data from the study indicates that content matched individual student‟s readiness.

Also in differentiating process, students agreed that teachers varied pace of instruction to cater for individual learning needs with a mean value of 3.879 and co-efficient of variation 35.1%, With regards to whether teachers give individual learner‟s role in designing/selecting learning activities, the students‟ response was average. Students observed that their teachers‟ efforts with regards to use of varied teaching materials in a lesson to respond to individual student's readiness, interest and/or learning profile was average. An important aspect of differentiating learning experiences is how individual students express what has been learnt. To examine how differentiated learning is practiced in the school, students were asked to indicate the extent to which

they agreed to statements on how teachers give assignments or how assessments are conducted to give room for differentiated learning experience in their classrooms. The results from analysis of students‟ responses reveal that teachers do not give different assignments based on individual student‟s readiness, choice and/or learning profile. In view of these, one can reason that teachers used „one-size-fits-all‟ in measuring what individual students are able to do to show evidence of achievement of essential intended learning outcomes.

Consistent to this finding is the Melesse (2015) descriptive survey study which employed a sequential explanatory design to assess the perceptions, practices and challenges of differentiated instruction among primary school teachers. The result of this study however revealed that the majority of the primary school teachers were not familiar with various strategies of differentiated instruction. Consequently, this had an adverse effect on how to practice those strategies. This finding may be as a result of teachers being novice about this kind of approach to instruction. This is confirmed by Abora (2015) who found out in his study 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. The teachers employed the traditional forms of assessment instead of alternative assessment strategies that addressed different learner needs.

James (2009) also conducted a mixed study to investigate teachers‟ perceptions of differentiated instruction and its implementation in day-to-day teaching within the classroom. The study adopted a sample size of 37 middle school teachers for

participation. The survey examined the teachers as to whether they individualize instruction as much as possible; teach to the middle; teaching practices match the needs of the student; and use cooperative learning. The mean scores reveal a lower average for teaching to the middle, 2.21, and individualised instruction, 2.55. However, the mean scores for the statements: teaching practices match the needs of the student; and use cooperative learning received higher average scores of 3.00 and 2.94 with similar standard deviations 0.71 and 0.79 respectively. Again, the findings revealed that 97% of the teachers marked that they sometimes, often, or very frequently use individualized instruction. However, Tomlinson (2001) argues that differentiated instruction is not individualized instruction. She is of the view that, teachers would be exhausted if they are to provide different assignments for thirty students in a classroom. This is because, the purpose of differentiating instruction is to maximize the capabilities of the students, and not to exhaust the teachers. It was also reported that 85% of the teachers sometimes, often, or very frequently teach to the middle. According to Rock et al. (2008), this kind of approach to teaching increases students‟ frustration about learning which consequently leads to students‟ low academic achievement.

Whipple (2012) in a quantitative study explored teachers‟ understanding and implementation of differentiated instruction in elementary schools in Southeast Massachusetts. The findings that emanated from the study were contrary to the earlier studies. In the implementation of content, four survey items were assessed by 79 teachers. This category contained four survey items rated on a one to four scale for a possible total score of 4 to 16. There was a total mean score of 14.47 (SD = 1.67). Teachers had an average per item rating of 3.62 out of 4.00, which indicates that teacher most often implement this component of differentiated instruction. In the area

of process, 81 teachers were asked about how often they practice items such as pace of instruction, learning preference groups, grouping students based on readiness and if they have a structured classroom environment to support a variety of activities. These four survey items were rated on a one to four scale for a possible total score of 4 to 16. The mean score across the four items was 13.27 (SD = 2.19). The average per item rating was 3.32 out of 4.00, meaning teachers often implement process as a component of differentiated instruction. Similarly, product also had four items to rate on a one to four scale for a possible total score of 4 to 16. There were 80 teacher responses with a total mean score of 12.13 (SD = 2.53). Teachers had an average per item rating of 3.03 out of 4.00 making product the least implemented component of differentiated instruction.

2.10 Challenges Associated with Differentiated Instruction

There is a belief that differentiated instruction is effective in improving academic achievement. The improvement in academic achievement have been documented through use of differentiated instruction (Koeze, 2007; Pardini, 2005; Tomlinson, 1999, 2001). Pardini (2005) stated 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.

Some students questioned the fairness of the process when assessments were differentiated. 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.

Owusu (2016) in his study observed that, large class size poses a challenge to teachers in differentiation of instruction. Since there is strong evidence of positive effects on academic achievement of students in small class sizes in elementary schools (Uhrain, 2016; Shin & Raudenbush, 2011), class size in differentiated instruction matters. This poses a great challenge if students learning needs are to be effectively addressed. He further added that inadequate professional development (such as in-service training) and limited administrative support systems as some of the challenges confronting teachers in differentiating instructions. Similar findings were found in the study conducted by Melesse (2015) that focused on assessing the perceptions, practices and challenges of differentiated instruction by primary school teachers. In that study, data were gathered from randomly selected 232 primary school teachers via questionnaire and focus discussion. While implementing differentiated instruction a number of hampering factors were identified. The first hindering factor identified by 225

(96.96%) teachers is lack of knowledge and experience on how to differentiate instruction. The second and third key factors identified were large class size by 189 (81.46%) teachers and lack of interest and commitment as 155 (66.81%) teachers rated respectively. Also, lack of parental support, lack of school administrative support were those hampering factors listed in descending order.

Another challenge is lack of knowledge on how to address academic diversity. In a review study to explores 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. According to Good (2006), teachers are normally overwhelmed on an individual level, because they are unsure as to how best they should begin this extensive process. Preparing to present multiple pathways and activities for a single class is also time-consuming for teachers as it requires more elaborate planning. In the experiment of teachers‟ perceptions about the effectiveness of differentiated instruction, Amadio (2014) confirmed that finding that extra time on top of already demanding schedules and daily requirements was 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.

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.

Added to these is the reluctance to adjust teaching practice as differentiated instruction is perceived as disorienting and upsetting. Joseph (2013) conducted a study among 379 pre-service and in-service trained teachers who were randomly drawn from selected primary and secondary schools in Trinidad. This study was meant to investigate what pre-service and in-service trained teachers understand by differentiated instruction, and the extent to which they practised differentiating instruction in their classrooms. The findings of study highlighted various challenges related to implementation of differentiated instruction among these is teacher resistance to change. Human by nature is resistant to change and therefore most teachers are willingly to teach the way they were been taught. This is revealed in the response put out by a teacher with 4 years‟ experience: *"There is only one challenge that I face which is, the traditional teachers believe that the old form of teaching is right and any new method is wrong"* (Joseph, 2013; p. 44). Teachers are more conversant with controlling single-focused activities vis-a-vis coordinating multiple activities. In other words, they are most comfortable using teaching materials and strategies that they were exposed to and hence, rarely re-invent the wheel. Differentiated instruction is therefore perceived as discomforting as it mandates

teachers to ensure more of these: planning, preparation; creativity; adaptive classroom management and organisation; collecting, analysing and evaluating students‟ records; and coordinating multiple tasks. However, there is the temptation to focus most attention on struggling students.

2.11 Summary of the Literature Review

Literature advocates that teachers must respond to students‟ varied needs, by teaching students at their particular readiness levels. In today‟s classroom, students show a range of abilities and learning needs. It is the responsibility of the teacher to be prepared for these differences and tailor their curriculum and instruction to meet each student‟s needs, ensuring every chance of academic success for all students. According to the authors of differentiated instruction, several key elements guide differentiation in the education environment. These elements were identified as content, process and product. Teachers differentiate instruction based on the students‟ readiness, interests, and learning profile which define the ways students learn best. Differentiated instruction therefore is philosophy that offers teachers a means to meet students‟ varying needs, as it recognizes the spectrum of differences among students, and enables teachers to attend to the specific learning styles of each student, by adjusting what they teach, and how they teach it. At its crux, differentiated instruction is a responsive instructional approach that facilitates students‟ learning, according not only to their individual abilities, but just as importantly to their interests. In the differentiated classrooms, all learners have the opportunity to be successful, from students who struggle to gifted learners, since all students are supported and challenged in their work.

Differentiated instruction is a philosophical approach grounded in the socio-cultural and constructivist and multiple intelligence perspectives, and adheres to the belief that optimal learning occurs when students are enabled to create their own meaning, through collaborative learning and sharing their ideas with others. In response to the increasing diversity in classrooms, differentiated instruction is considered an essential form of instruction for teaching students from a wide array of backgrounds and ability levels. Though, some teachers have been found to possess some knowledge in differentiated instruction and therefore recognise its benefits to students, they rarely implement this type of instruction in their classrooms. From the literature, there are enormous factors that challenge the successful implementation of differentiated instruction in classrooms. Among the challenges that emerged from literature about differentiation of instruction are limited time, unsupportive administration and a paucity of necessary materials and pressure to the demands of standardised curriculum.

CHAPTER THREE

METHODOLOGY

3.0 Overview

This chapter covers the research design, researchers‟ methodological position, research setting, population, sample and sampling techniques, research instruments, issues of validity and reliability, pre-testing, data collection procedures, data analysis procedures, and ethical consideration**.**

3.1 Research Design

Research design is an overall plan for gathering and analyzing data including steps taken to enhance both internal and external validity (Gall, Gall & Borg, 2007). According to Creswell (2009), research design is described as the plan and procedures for research that span the decisions from broad assumptions to detailed methods of data collection and analysis. Research design enables the researcher to meet the purpose of the study. It involves a detailed description of the procedures the researcher will use to find answers to the research questions. This study sought to investigate JHS teachers‟ knowledge and practice of differentiated instruction in mathematics in Tano South District. In order to achieve the purpose of this research, the study employed explanatory sequential mixed method design. According to Creswell (2014), explanatory sequential mixed methods approach is a design in mixed methodology that involves a two-phase project in which the researcher collects quantitative data in the first phase, analyzes the results, and then uses the results to plan (or build onto) the second, qualitative phase. Creswell further states that the overall intent of this design is to have the qualitative data help explain in more detail the initial quantitative results. This design enables the researcher to follow up the quantitative results and explore the results in more depth. The idea of explaining the

mechanism – how the variables interact – in more depth through the qualitative follow-up is a key strength of this design (Creswell, 2014). It is also perhaps easier to accomplish (than the convergent design) because one database builds on the other and the data collection can be spaced out over time.

3.2 Researcher's Methodological Position

The researcher"s choice of methods is said to be chiefly driven by the philosophical assumptions (ontological and epistemological) that frame the research. These philosophical positions influence decisions regarding the research approach, choice of method and frame for analysis, and guide to research design (Terrell, 2011). The pragmatist paradigm was adopted for the study. Studies that are products of the pragmatist paradigm combine the qualitative and quantitative approaches within different phases of the research process. First, the researchers believe in paradigm relativism where quantitative and qualitative research methodologies are said to be compatible. According to Teddlie and Tashakkori (2009), the use of whatever philosophical and/or methodological approach works for the particular research problem under study. In view of this, the researcher is in support of the universalistic discourse concerning the advantages of mixed methods because, mixed methods research produces better outcomes than single method research. Again, it is argued that the choice of research methods should follow research questions in a way that offers the best chance to obtain useful answers (Leedy & Ormrod, 2013). Hence, the study employed mixed methods approach due to the nature of the research questions and advantages derived from applying two different approaches in garnering the required data. This design according to Creswell (2014) involves combining or integration of qualitative and quantitative research data in a research study.

These two approaches allowed the researcher to study teachers‟ knowledge and practice of differentiated instruction in basic mathematics, both quantitatively and qualitatively. Basically, no single approach either qualitative or quantitative methods can perfectly be effective and so, each method can be improved significantly through triangulation of data from various sources (Yin, 2014). Creswell (2014) also postulates that a mixed methods design is useful when the quantitative or qualitative approach, each by itself, is inadequate to best understand a research problem and the strengths of both quantitative and qualitative research (and its data) can provide the best understanding. Hence, the design helps to triangulate and corroborate findings from teachers in the study.

3.3 Settings

The study was conducted in JHSs in Tano South District, Brong Ahafo Region of Ghana. Tano South District is one of the 22 districts in the Brong Ahafo Region of Ghana. It lies between lattitudes $7^0$00‟N and $7^0$25‟N and $1^0$45‟W and $2^0$15‟W. It covers an area of 489 square kilometres. The district lies in the moist semi-deciduous forest zone and this has necessitated people‟s engagement in farming. Farming has engaged about 60% of the people‟s population in the district. The District has a total of 85 public schools, of which 55 are Primary School, 29 Junior High Schools, and 4 Second Cycle Institutions including a School for the Deaf. In addition to these, the District also has one tertiary institution as a College of Education. The District has 505 trained teachers and 348 untrained teachers in the public schools. The number of private schools in the District is 18 (Ghana Education Service, 2013).

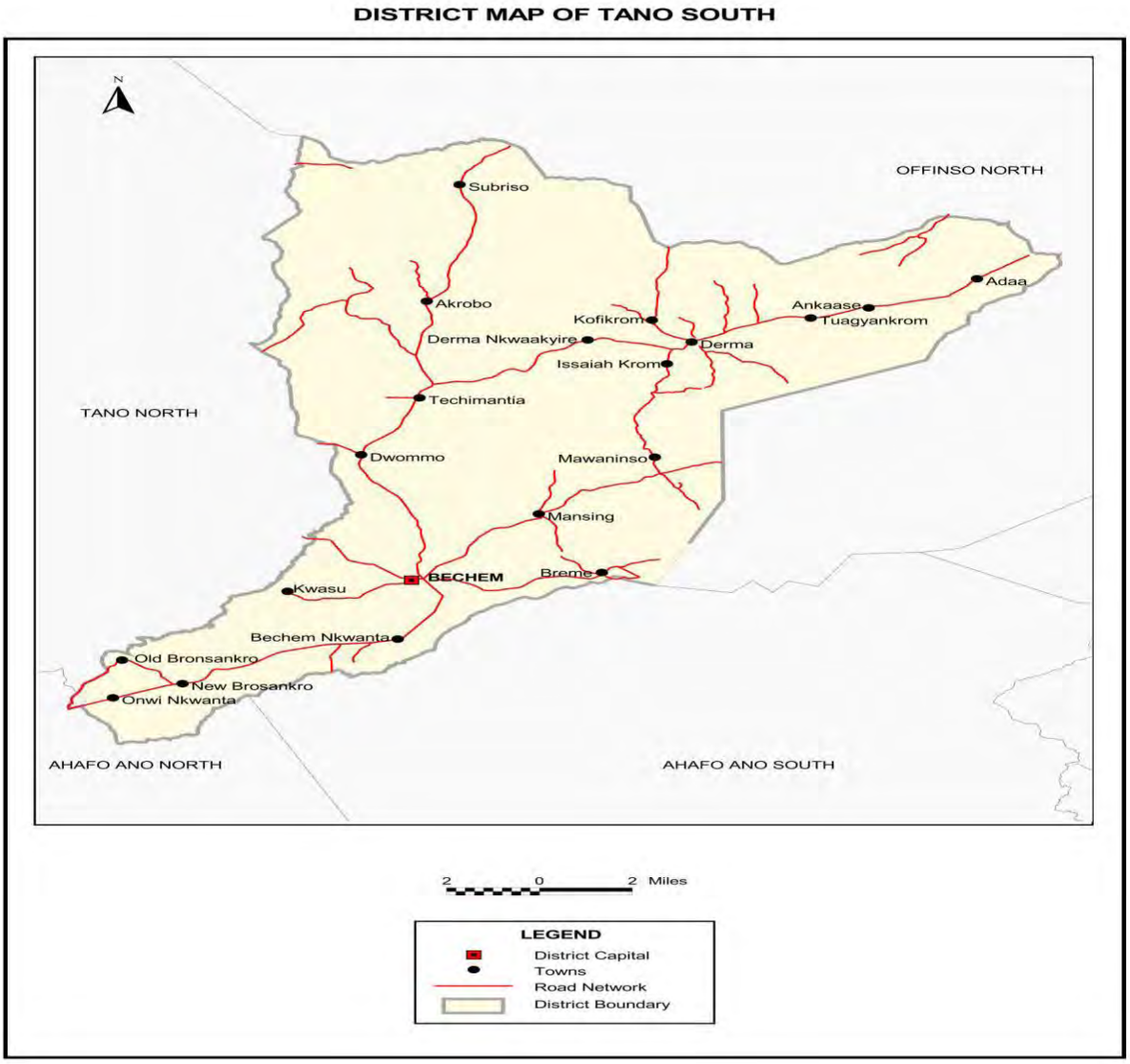

Figure 3.1: District Map of Tano South District

Source: Ghana Statistical Service, GIS (2014)

3.4 Population

A target population is the group of participants which one aspires to apply findings. According to Asiamah, Mensah and Oteng-Abayie (2017), it is the refined part of the general population with the specific attributes of interest and relevance. The target population for the study was all basic school mathematics teachers in Brong Ahafo Region, Ghana.

Accessible population, according to Asiamah et al. (2017) is the final group of participants from which data is collected by surveying either all its members or a sample drawn from it. Bartlett, Kotrlik and Higgins (2001) explains that, accessible population represents the sampling frame if the intention is to draw a sample from it. This however enables researchers apply their conclusions. The accessible population for this study was JHS mathematics teachers in Tano South district. There are 58 JHS mathematics teachers comprising general education and special education teachers with population size of 48 and 10 respectively.

3.5 Sample

A sample is a small portion of a target population. Sampling means selecting a given number of subjects from a defined population as a representative of that population (Kothari, 2004). In other words, sampling is a means of selecting a sample from the population by reducing it to a more manageable size. Kothari however adds that the size of the sample should neither be excessively too large nor too small and generally it must be optimum. Sampling is necessary in research because it is usually not practical to study an entire population. Study therefore employed a sample size of 50 JHS mathematics teachers comprising 41 general teachers and 9 special teachers in the Tano South District. According to Asamoah-Gyimah and Duodu (2007), a sample of 10% to 30% to the accessible size is desirous in quantitative study. Hence, 86% (n = 50) of the accessible population is deemed appropriate for the study.

In the qualitative phase, a sample size of 6 JHS mathematics teachers that comprised 4 general teachers and 2 special teachers was employed. Yin (2009, 2014) recommends at least six sources of evidence in qualitative study.

3.6 Sampling Technique

In the study, proportionate stratified sampling was employed by the researcher to select the sample of teachers for the study. Proportionate stratified sampling is a type of probability sampling technique that uses a sampling fraction in each of the strata that is proportional to that of the total population (Alvi, 2016). Proportionate stratified sampling method according to Alvi (2016) is used when population is heterogeneous (that is, when elements of population differ from one another on a characteristic of a predefined criterion). Homogenous sub-groups (strata) are then formed from the finite population. This technique is considered advantageous as the sample was more representative of the population than if taken from the population as a whole. On the basis of nature and purpose of investigation, the researcher decided to take into account the kind of training JHS mathematics teachers received in the Colleges of Education and Universities of Education.

The researcher believes 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. In view of this, the researcher grouped the JHS mathematics teachers within Tano South district into general education and special education teachers with population size of 48 and 10 respectively. These general education and special education teachers were derived from 27 general schools and 2 special schools respectively. Using proportional allocation technique the sample size of 50 is made proportional to the number of elements present in each of the two strata. Proportional representation technique which is meant to allocate sample from the strata brought the sample size of JHS mathematics teachers which comprises of general educators and special educators to 41 and 9 respectively. Following that, teacher participants with

sample sizes of 41 and 9 were selected from general education and special education teachers respectively through simple random sampling.

3.7 Research Instruments

The research instruments used for data collection in the study include questionnaire and interview protocol.

3.7.1 Questionnaire

The purpose of every questionnaire is to elicit information about the characteristics or opinions of the respondents. A close-ended questionnaire was used for the data collection from teachers. The questionnaire consisted of four sections: A, B, C and D. Section A comprised demographic items such as current class taught, category of teacher (general or special education), age range, gender, education level, and years of teaching experience. Section B was 13 items that used a 4-point Likert scale (labeled strongly disagree, disagree, agree, strongly agree) with items related to teachers‟ level of knowledge about the three elements of differentiated instruction (content, process and product) identified by Tomlinson (2001). Section C also used a 4-point Likert scale (labeled 1=never occurs, 2=rarely occurs, 3=often occurs, 4=always occurs) with 13 items related to teachers‟ level of practice of differentiated instruction in regards to the three elements (content, process and product) identified by Tomlinson (2001). The final section D also used questions that used a 4-point Likert scale (labeled strongly agree, agree, disagree, strongly disagree) with 13 questions related to the challenges teachers encounter in differentiated instruction (See Appendix A).

Oppenheim (2000) indicates that questionnaires in quantitative research give more precise, explicit, and predetermined measure and identification of relevant

variables in advance. Lokan, Hollingsworth and Hackling (2006) further claim that questionnaires are economical and very simple to administer to sample large groups of respondents; give better potential to generalize findings because samples are larger; ensure efficient gathering of large quantities of baseline data; and also the responses gathered can usually be transformed easily by coding into data files that are ready for statistical analysis. However, questionnaires are very complex to construct and the success of using questionnaires depends on the honesty of the respondents.

3.7.2 Interview Protocol

Interviews are methods of gathering information through oral quiz using a set of pre-planned core questions (Patton, 2002). Interview is however an extremely important and notable aspect of data collection in phenomenology (Pitney & Parker, 2009). Patton (2002) argues that, interviews provide a means to "find out from people those things we cannot directly observe" (p. 339). To gain insight into JHS mathematics teachers" knowledge and practice of differentiated instruction, this phenomenological study utilized semi-structured interviews (Denzin & Lincoln, 2005). The interview guide was divided into two main parts. Part I of the items were prepared to find out the background of the respondents. It was comprised of demographic questions such as current class taught, category of teacher (general or special education), age range, gender, education level, and years of teaching experience. Part II of the items consisting of seven questions were prepared to quiz participants to express their view on the meaning of differentiated instruction, how often they attend professional training discussing differentiated instruction, why they feel threatened by time and large class size. It also explored common strategies they normally employ in differentiation of instruction and how they know how well students learn in classroom

(See Appendix B). Semi-structured interview according to Kvale and Brinkman (2009) refers to interviews that are planned and set, but at the same time flexible. It can also help researchers to gather information about peoples‟ perceptions and opinions in one session and for the participants to provide checks and balances on each other‟s views, which can curb extreme views.

3.8 Validity and Reliability of the Quantitative Instrument

3.8.1 Issues of Validity

An instrument is considered valid when there is confidence that it measures what it is intended to measure in a given situation (Heale & Twycross, 2015). In determining the face and content validity of the questionnaires, the researcher presented the drafts to the research supervisor from the Department of Mathematics Education, University of Education, Winneba to assess the questions for face and content validity. Also, questionnaires and interview guides were pilot tested on mathematics teachers in basic schools in the district who were not part of the sample. This is done in order to determine the clarity and relevance of the questions in eliciting information about JHS teachers‟ knowledge and practice of differentiated instruction in basic mathematics in Tano South District. This activity was aimed at ensuring reliability of the instrument.

3.8.2 Issue of Reliability

Reliability however according to Weiner (2007) is the degree to which a measurement instrument can be depended upon to secure consistent results upon repeated application. This can be estimated in one of the following four ways; inter-rater reliability, split-half reliability, test-retest reliability, and internal consistency (Cohen, Manion & Morrison, 2007). In this study, internal consistency was measured on the questionnaire by calculating Cronbach Alpha coefficient of the various sections.

Tayakol and Dennick (2011) suggest Cronbach Alpha to be the best means of testing internal consistency of a research questionnaire instrument. In effect, Cronbach"s Alpha measures how closely related a set of items are as a group. Cronbach"s Alphas for each sub-scale under sections two and three of the questionnaire were as follows: Knowledge ($\alpha = 0.82$), Practice ($\alpha = 0.87$), and Challenges ($\alpha = 0.83$). However, an overall Cronbach"s Alpha reliability co-efficient of 0.91 was obtained for the internal consistency of the questionnaire instrument (See Appendix "E"). According to Tayakol and Dennick (2011), this value indicates excellent internal consistency of the items in the scale. As a rule of thumb for interpreting alpha, Tayakol and Dennick explain the values to mean: $\alpha < 0.50$ (unacceptable), $0.50 \leq \alpha < 0.60$ (poor), $0.60 \leq \alpha < 0.70$ (questionable), $0.70 \leq \alpha < 0.80$ (acceptable), $0.80 \leq \alpha < 0.90$ (good), $\alpha \geq 0.90$ (excellent).

3.9 Data Trustworthiness of the Qualitative Data

Trustworthiness in a qualitative study aims to support the argument that the study"s findings are worthy of receiving attention (Sinkovic, Penz & Ghauri (2008). In order to establish trustworthiness, credibility, dependability, transferability and confirmability were established.

3.9.1 Credibility

Credibility focuses on establishing a match between the constructed realities of the participants and those represented by the researcher (Patton, 2002). To ensure credibility in this study, the interviews conducted were video-taped to enable the researcher to re-visit the interview for calrifification. The researcher ensured that there was accurate reflection on the interview by cross-checking with the participants regarding what had been experienced during the interview. Field notes reflected what

transpired during the interview. Peer debriefing was used to ensure that the items in the interview guide did indeed relate to aspects of teachers" knowledge and practice of differentiated instruction.

3.9.2 Dependability

Dependability deals with the consistency of research results obtained over time. Dependability, according to Bryman (2008) and Sinkovic et.al. (2008) can be established by using different methods of data collection and different times of collecting the data on the same research problem. In this study, dependability was established by having prolonged and concentrated engagement with the participants about the study, two to three weeks in this case.

3.9.3 Confirmability

According to Merriam (2009), confirmability can be established if the results can be linked to the data itself. It speaks to data management and the analysis of the data itself. In this study, confirmability was established by keeping the collected data that was used for interpretation safely, so that any interested researcher could access the data for inspection. In addition, an audit trail was done by independent critical readers whom the researcher had asked to evaluate the methods used for the gathering of the data.

3.9.4 Transferability

Transferability refers to the applicability of the findings to another setting (Shenton, 2004). As this is a qualitative study and no substantive generalisations could be made, the researcher gave thick description with enough detail of the findings so that readers could decide on their own whether the results of the study would be transferable to their own research contexts or not.

3.10 Data Collection Procedure

In the first place, a clear written brief (Appendix C) from University of Education, Winneba which explains the intended research and its purpose was used to seek permission from the District Director of Tano South of the Ghana Education Service. The letter of introduction (Appendix D) obtained from the directorate was circulated to seek permission from the selected schools heads and the district to select JHS mathematics teachers as respondents for the study. The data were collected in two phases. The first phase was used to administer the questionnaire for the quantitative data which lasted for two weeks. Each school was visited at least twice. The first visit was used to seek participants‟ consent, and acquaint them with the study in order to fix the date for the administration of the questionnaire. The other visit was used for the administration and collection of the questionnaire. The respondents who have been selected were contacted to seek their consent as participants. Participants were assured of their privacy and confidentiality. This is necessary for research ethics because, permission and assurance of security raise respondents‟ cooperation to provide data (Creswell, 2014). The researcher created a good rapport so as to have the confidence of the respondents to respond to the questionnaire and interview guides without any fear. The questionnaires were personally administered by the researcher. This gave the researcher the opportunity to clarify any uncertainty that arose from the questionnaire. It also enhanced a faster completion of the items and aided 100% retention of the questionnaires distributed.

The second phase of the study involved the collection of qualitative data through a semi-structured interview with a sub-sample of 6 JHS mathematics teachers. This interview was guided by 8 items which was based on the results of the questionnaire in an attempt to explain in more detail some of the initial quantitative results on JHS

mathematics teachers‟ knowledge and practice of differentiated. During this phase, two visits were made. The first visit was done for purposes of seeking participants‟ consent to take part in the study and acquainting them with the study in face-to-face manner. At that point, the researcher explained to teacher participants the purpose of the study. The interviews were conducted a week after the quantitative study and were used to clarify some claims and issues in the study. The interview span with teachers lasted more than 35 minutes in each case and the questions related to the research were interspersed with a lot of other information sharing. The responses from the interviews were audio-taped and transcribed. Many researchers have subscribed to audio-taping of interviews in order to avoid bias (Gall, Gall & Borg, 2007). The transcripts were read over and over again to identify the unique themes that best correspond to research questions for further analyses. The telephone numbers of respondents were collected and a day after each of the questionnaire and interview sections, fair returns were communicated to them to show appreciation. This falls in line with Law, Carlone and Marcus (2003) assertion that researchers should ethically make fair returns to avoid respondents being exploited.

3.11 Data Analysis Plan

The research data collected was analysed using both quantitative and qualitative methods. In quantitative description, statistics summarise the quantitative observations of the topic under investigation (Groves, Fowler, Couper, Lepkowski, Singer & Tourengeau, 2009). Data from the teacher questionnaire was analysed using both descriptive and inferential statistical methods. These analyses was done using SPSS version 20 to find the extent to which teachers strongly agree, agree, disagree, and strongly disagree on their knowledge and practice of differentiated instruction. The questionnaires on this 4 point Likert scale was sorted and analysed using different

coding and pseudonyms. Descriptive statistics involving frequency, percentages, mean and standard deviation was used to provide counts of the factors underpinning the analysis of the questionnaire data and the demographic responses. Also, inferential statistics such as t-test with a 0.05 level of significance was used to test the hypothesis. The t-test is considered appropriate in testing the hypothesis since it is comparing means of two groups – general teachers and special teachers. And this will enable the researcher to make some statistical generalisations about these hypotheses (Gayle, 2000).

In order to analyse the transcripts from the interviews, the researcher adapted cross-case analysis procedure to analyse the interview data. This method is chosen because the purpose is to make comparisons between each interviewee responds (Khan & VanWynsberghe, 2008). This is expected to help get deep understanding of the data gathered in order to find answers to the research questions. In the cross-case analysis approach, responses to a common question from all interviewees in each category are analysed together. Thus, each question was analysed separately for all interviewees. Merriam (2009) and Patton (2002) posit that it is easy to perform a cross-case analysis for each question in the interview when a standardised semi-structured interview approach is used. In a cross-case analysis, the participants‟ responses to a particular question/item are combined. Common themes across participants (cases) are then identified, analysed and interpreted item by item.

3.12 Ethical consideration

In conducting research, it is important that ethical considerations be given due attention. The researcher took a due cognizance of ethical responsibility in the collection and analysis of data, and the reporting of the information. Permission to

conduct the study among JHS mathematics teachers in Tano South District was obtained from the District Director, Ghana Education Service. Informed verbal consent was obtained from all participants in the study. Participation was voluntary. The purpose of the study was explained and the participants were assured of the confidentiality and anonymity of the responses. In reporting the findings, the researcher used pseudonyms in place of the actual names of research participants. Participants were also assured that the information obtained from the study was solely for academic purposes and would be held confidentially. All the participants were assured of their rights to participate, to decline or to withdraw from the study at any time should they feel uncomfortable. This means that participants were well-informed about what the participation entailed, and were reassured that declining would not affect any services they received. However, all the participants were acknowledged and given a summary of the report so that goodwill could be maintained in future research.

CHAPTER FOUR

RESULTS AND FINDINGS

4.0 Overview

This chapter presents the results and findings of the study. The chapter comprised three major sections which include a presentation of the demographic descriptive statistics, the descriptive and inferential data analyses for each of the three research questions and the two hypotheses, and summary of the research findings.

4.1 Introduction

The purpose of this study was to investigate JHS mathematics teachers‟ knowledge and practice of differentiated instruction in Tano South district. The study was also guided by the following research questions:

1. What knowledge do JHS mathematics teachers have about differentiation of instruction in Tano South District?
2. To what extent do JHS mathematics teachers practice differentiated instruction in Tano South District?
3. What challenges do JHS mathematics teachers experience in differentiation of instruction in Tano South District?

Additionally, the study tested the following hypotheses:

H_O1: There is no significant difference in the knowledge of differentiated instruction between general education and special education teachers in Tano South District.

H_a1: There is a significant difference in the knowledge of differentiated instruction between general education and special education teachers in Tano South District.

H_O2: There is no significant difference in the practice of differentiated instruction between general education and special education teachers in Tano South District.

H_a2: There is a significant difference in the practice of differentiated instruction between general education and special education teachers in Tano South District.

4.2 Quantitative Results from Questionnaire

Results to the research questions and hypotheses are presented in the study as follows. The scales for the research questions were collapsed during the data preparation using SPSS version 20.0. In the analysis, the researcher dichotomised the original 4-point scale of the questionnaire responses on knowledge and challenges (1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree) by collapsing responses for 1 and 2 into a disagree category, and 3 and 4 into an agree category, yielding a 2-point scale: 1=disagree and 2=agree. Also, dichotomized scale responses on practice were generated by collapsing responses for 1 and 2 from the original scale (1=never occurs, 2=rarely occurs, 3=often occurs, 4=always occurs) to 1=rarely occurs and 3 and 4 to 2=often occurs. The rationale behind this dichotomisation is for the study to gain more interpretability or simplicity in terms of capturing the trends in the data (Beamish, 2004).

4.3 Demographic Characteristics of Teacher Participants

The demographic characteristics of 50 participants (teachers) involving general education teachers and special education teachers that were considered in the study included class level taught, type of teacher, gender, highest educational qualification and range of years for teaching. Details of these are depicted in Table 4.1.

Table 4.1: Summary of Demographic Characteristics of Teacher Participants (n = 50)

		General Education Teacher		Special Education Teacher	
Variable	**Category**	**f**	**%**	**f**	**%**
Class Level Taught	JHS 1	14	34.1	4	44.4
	JHS 2	12	29.3	3	33.3
	JHS 3	15	36.6	2	22.2
Gender	Male	35	85.4	8	88.9
	Female	6	14.6	1	11.1
Highest Educational	Diploma	22	53.7	0	0
Qualification	Bachelor"s Degree	19	46.3	8	88.9
	Master"s Degree	0	0	1	11.1
Range of years	1-10 years	23	56.1	5	55.6
for teaching	11-20 years	15	36.6	4	44.4
	21-30 years	3	7.3	0	0
	Total	**41**	**82**	**9**	**18**

Source: Field data (2018) **Key: f**=Frequency, **%**=Percentage

The results from analysis of data in Table 4.1 show that out of 50 teacher participants selected across all the levels of JHS, 41 (82%) were general education teachers. It was also revealed that 14 (34.1%) of the general education teachers taught in JHS 1, 12 (29.3%) taught in JHS 2, while 15 (36.6%) of the remaining participants taught in JHS 3. This shows that, there were more general education teachers teaching at the final level of JHS than at the other levels. Again, the results presented in Table 4.1 show that 35 (85.4%) general education teachers who were males and 6 (14.6%) who were females participated in the study. This an indication that there were few female general education teachers teaching mathematics at the various levels of JHS than were males. In regards to the highest educational qualification, it was observed that 22

(53.7%) of the general education teachers had Diploma in Education while the remaining 19 (46.3%) had Bachelor‟s Degree. Inferably, no one holds Master‟s Degree at that level. Moreover, the data results revealed varieties in the number of years of teaching among the general education teachers. Twenty-three (56.1%) of the teachers had taught for a period between 1-10years, 15 (36.6%) had taught for a period between 11-20 years whiles the remaining 3 (7.3%) taught for a period between 21-30years. It could therefore be seen that, more of the general education teachers were found to have had some years of teaching experience that spans from 1 to 10 years.

On the demographic account of special education teachers who participated in the study, Table 4.1 shows that 9 (18%) of them were participants from all the levels of JHS. It is also evident in that 4 (4.4.4%) of the special education teachers taught in JHS 1, 3 (33.3%) taught in JHS 2, while 2 (22.2%) of the remaining participants taught in JHS 3. This shows that, there were more special education teachers teaching at the initial level of JHS than at the other levels. Moreover, the results presented in Table 4.1 show that 8 (88.9%) special education teachers who were males and 1 (11.1%) who was female participated in the study. This is an indication that there were more males special education teachers who are teaching mathematics at the various levels of JHS than females. In regards to the highest educational qualification, it was discovered that 8 (88.9%) of the special education teachers had Bachelor‟s Degree while the remaining one (11.1%) had Master‟s Degree. Inferably, no one holds Diploma in Education at these levels. The reason however may be that, colleges of education who are primarily mandated to supply basic schools with professional teachers are not offering special education programmes as it is been done at the universities. Furthermore, the data results revealed varieties in the number of years of

teaching among the special education teachers. Five (55.6%) of the teachers had taught for a period between 1-10years, 4 (44.4%) had also taught for a period between 11-20 years with no one teaching for a period between 21-30years. Here, more of the special education teachers were found to have had teaching experiences that spanned 1 to 10 years.

4.4 Research Question 1: What Knowledge do JHS Mathematics Teachers have about Differentiation of Instruction in Tano South District?

This research question sought to ascertain JHS mathematics teachers‟ knowledge of differentiated instruction. Knowledge of teacher participants in the study was sought under three major elements of differentiated instruction namely, content, process and product. In exploring JHS teachers‟ knowledge of differentiated instruction in mathematics, the researcher used descriptive statistics to determine the frequencies, percentages, mean and standard deviation scores for each response from a 13-item questionnaire. Participants‟ average per item rating scores for the three major elements of differentiated instruction that fall below 1.40 were considered to have low knowledge, those between the range of 1.40 to 1.60 as having average knowledge and those above 1.60 as having high knowledge. Table 4.2 shows the results from the field.

Table 4.2: Descriptive Statistics of Mathematics Teachers' Knowledge of Differentiated Instruction Based on the Three Major Elements (n =50)

Elements of Differentiated Instruction	General Education Teachers			Special Education Teachers		
	APIR	*M*	*SD*	APIR	*M*	*SD*
Content (1-4)	1.50	5.98	0.99	1.56	6.22	0.67
Process (5-8)	1.86	7.44	0.78	1.89	7.56	0.73
Product (9-13)	1.49	7.44	1.72	1.58	7.89	1.90

Source: Field data (2018) **Key:** ***M***=Mean, ***SD***=Standard Deviation, **APIR**=Average Per Item Rating

Overall, process was rated the highest understood element of differentiated instruction among the general education teachers. The process category was the second element to be analysed and there were four items the participants were questioned about. As depicted in Table 4.2, this category yielded a mean of 7.44 and standard deviation of 0.78 with an average item rating of 1.86 which placed process as the highest understood element of differentiated instruction among general education teachers who teach mathematics at JHS level. With an average item rating of 1.86 for process category means that participants on average chose agree or strongly agree, which put process in first place for knowledge. This indicates that the participants (general education teachers) had high knowledge in process differentiation. It is also apparent from Table 4.2 under the content differentiation that, the four items which were analysed attracted a mean score of 5.98 and a standard deviation of 0.99 with an average per item rating of 1.50 and that put content in second place for knowledge. With an average item rating of 1.50 for content category, the participants (general education teachers) had average knowledge in content differentiation. Also, the third category (product) analysed in the study yielded a mean of 7.44 and standard deviation of 1.72 with an average per item rating of 1.49. This is a clear evidence that, product category obtained the lowest average per item rating which placed product as the least understood element of differentiated instruction among general education teachers. This however indicates that the participants (general education teachers) had an average knowledge in content differentiation.

Among the special education teachers who were participants, process was also rated the highest understood element of differentiated instruction. In the process category, there were four items that the participants were made to respond to. As depicted in Table 4.2, this category yielded a mean of 7.56 and standard deviation of 0.73 with an

average item rating of 1.89 which placed process as the highest understood element of differentiated instruction among special education teachers who teach mathematics at JHS levels. With an average item rating of 1.89 for process category means that participants on average chose agree or strongly agree, which put process in first place for knowledge. This is an indication that the participants (special education teachers) had high knowledge in process differentiation. It is evident from Table 4.2 under the product differentiation that, the five items which were analysed attracted a mean score of 7.89 and a standard deviation of 1.90 with an average per item rating of 1.58 and that placed product as second for knowledge. With an average item rating of 1.58 for product category indicates that, the participants (special education teachers) had average knowledge in content differentiation. On the aspect of content differentiation, the data analysis in Table 4.2 yielded a mean of 6.22 and standard deviation of .67 with an average per item rating of 1.56 which placed content as third for knowledge of differentiated instruction. For the content category to attain an average per item rating of 1.56 means that, the participants (special education teachers) had an average knowledge in content differentiation.

From Table 4.2, both general education and special education teachers seemed to possess high knowledge on process differentiation. Per the study population, the process element recorded an average per item rating of 1.86 and 1.89 for general education teachers and special education teachers respectively. Details of the items assessing teachers‟ knowledge of differentiation based on process are presented in Table 4.2.1.

Table 4.2.1: Descriptive Statistics of Teachers' Knowledge on Process Differentiation (n = 50)

Items	General Education Teachers						Special Education Teachers					
	Agree		Disagree		*M*	*SD*	Agree		Disagree		*M*	*SD*
	f (%)		f (%)				f (%)		f (%)			
PROCESS												
5. Teachers must collaborate with students about their learning in classroom	40	(97.6)	1	(2.4)	1.98	0.16	9	(100)	0	(0)	2.00	0.00
6. Teachers must assess each student"s readiness level, interest level, and learning profile/style in DI	28	(68.3)	13	(31.7)	1.68	0.47	6	(66.7)	3	(33.3)	1.67	0.50
7. Contents, processes and products must constantly be modified in classroom	33	(80.5)	8	(19.5)	1.80	0.40	8	(88.9)	1	(11.1)	1.89	0.33
8. In DI, teachers must show respect for their learners" commonalities and differences	40	(97.6)	1	(2.4)	1.98	0.16	9	(100)	0	(0)	2.00	0.00

Source: Field data (2018) **Key: f**–Frequency, **%**–Percentage, ***M***–Mean, ***SD***–Standard Deviation

A cursory look at Table 4.2.1 indicates the range for the mean of 1.68 to 1.98 and standard deviation scores of 0.16 to 0.47 among general education teachers with an average per item rating of 1.86. This is an indication that, general education teachers who teach mathematics at JHS level have high knowledge in the process differentiation. In a bid to find out from teachers on two questions of whether teacher must collaborate with students about their learning and show respect for their learners" commonalities and differences, Table 4.2.1 revealed that 40 (97.6%) respondents subscribed to both statements with only one (2.4%) in disagreement. They both had a mean of 1.98 and a standard deviation of 0.16 respectively which formed the highest items in the distribution under the process differentiation that the

teacher participants agreed to. On whether teacher should assess each student‟s readiness level, interest level, and learning profile/style, a mean score of 1.68 and a standard deviation score of .47 were obtained with 28 (68.3%) teachers responding in favour and 13 (31.7%) stating otherwise. The results from the teachers‟ responses as presented in Table 4.2.1 again show a mean of 1.80 and a standard deviation of .40 for the statement „Contents, processes and products must constantly be modified in the differentiated classroom‟. In relation to this question, 33 (80.5%) of the teachers responded in favour whiles 8 (19.5%) teachers responded otherwise.

It is apparent from Table 4.2.1 that, the range of responses for special education teachers attracted the mean of 1.67 to 2.00 and standard deviation of 0.00 to 0.50 with an average per item rating of 1.89. This reveals that special education teachers who taught mathematics at JHS level had high knowledge in the differentiation of process. When these teachers were asked the questions of whether teacher must collaborate with students about their learning and show respect for their learners‟ commonalities and differences, all 9 participants representing 100% subscribed to both statements with no one being in disagreement. They each registered a mean of 2.00 and a standard deviation of 0.00 respectively which forms the highest items in the distribution under the process differentiation that the teacher participants understood. On whether special education teachers should assess each student‟s readiness level, interest level, and learning profile/style, a mean score of 1.67 and a standard deviation score of 0.50 were obtained with 6 (66.7%) teachers responding in favour and 3 (33.3%) stating otherwise. The results from the analysis of teachers‟ responses as presented in Table 4.2.1 again show a mean of 1.89 and a standard deviation of 0.33 for the statement „Contents, processes and products must constantly be modified in

the differentiated classroom". In relation to this question, 8 (88.9%) teachers forming the majority agreed with the remaining one (11.1%) teacher in disagreement.

From the results in Table 4.2, both general education and special education teachers seemed to have average knowledge on content differentiation. From the analysis, the content element recorded an average per item rating of 1.50 and 1.56 for general education teachers and special education teachers respectively. Details of the items assessing teachers" knowledge of differentiation based on content are presented in Table 4.2.2.

Table 4.2.2: Descriptive Statistics of Teachers' Knowledge on Content Differentiation (n = 50)

Items	General Education Teachers						Special Education Teachers					
	Agree		Disagree		*M*	*SD*	Agree		Disagree		*M*	*SD*
	f (%)		f (%)				f (%)		f (%)			
CONTENT												
1. The curriculum is based on major concepts and generalizations.	36	(87.8)	5	(12.2)	1.88	0.33	7	(77.8)	2	(22.2)	1.78	0.44
2. Teachers must use a variety of materials other than the standard text.	7	(17.1)	34	(82.9)	1.17	0.38	2	(22.2)	7	(77.8)	1.22	0.44
3. In DI, it is mandatory for teachers to clearly articulate what they want students to know, understand and be able to do.	15	(36.6)	26	(63.4)	1.37	0.49	4	(44.4)	5	(55.6)	1.44	0.53
4. Teachers must provide a variety of support mechanisms (e.g., organizers, study guides, study buddies) in DI.	23	(56.1)	18	(43.9)	1.56	0.50	7	(77.8)	2	(22.2)	1.78	0.44

Source: Field data (2018) **Key: f**–Frequency, **%**–Percentage, ***M***–Mean, ***SD***–Standard Deviation

As it is evident in Table 4.2.2 under the content category, the general education teachers" mean scores ranged from 1.17 to 1.88 and standard deviation from 0.33 to 0.50 with an average per item rating of 1.50. This suggests that, general education teachers who teach mathematics at JHS level have average knowledge in content

differentiation. From Table 4.2.2, thirty-six (87.8%) teachers agreed to the statement that the curriculum is based on major concepts and generalizations whiles 5 (12.2%) disagree to this statement with a mean of 1.88 and standard deviation of 0.33. The indication here is that majority of the teachers are of the view that, the curriculum is based on major concepts and generalizations. Concerning the question that teachers must use a variety of materials other than the standard text in differentiated instruction (M = 1.17, SD = 0.38), only 7 (17.1%) teachers agreed to this assertion with 34 (82.9%) declining. The indication is that majority of the teachers are of the view that, teachers must not use a variety of materials other than the standard text during instruction. Moreover, 23 (56.1%) teachers asserted that teachers must provide a variety of support mechanisms (e.g., organizers, study guides, study buddies) in differentiated instruction whereas the remaining 18 (43.9%) hold contrary view with mean of 1.56 and standard deviation of 0.50.

From the same Table 4.2.2, special education teachers‟ responses attracted a mean score of 1.22 to 1.78 and standard deviation of 0.44 to 0.53 with an average per item rating of 1.56. This implies that, special education teachers who teach mathematics at JHS level have average knowledge in the differentiation of content. It is clear from Table 4.2.2 that, 7 (77.8%) special education teachers agreed to the statement that the curriculum is based on major concepts and generalizations whereas 2 (22.2%) disagreed to this statement with a mean of 1.78 and standard deviation of 0.44. The indication here is that majority of the teachers are of the knowledge that the curriculum is based on major concepts and generalizations. Similarly, 7 (77.8%) teachers also asserted that teachers must provide a variety of support mechanisms (e.g., organizers, study guides, study buddies) in differentiated instruction whereas the remaining 2 (22.2%) hold contrary view with mean of 1.78 and standard deviation of

0.44. This means that, majority of special education teachers agreed that they must provide a variety of support mechanisms to enhance students‟ learning. Furthermore, on the question that teachers must use a variety of materials other than the standard text in differentiated instruction (M = 1.22, SD = 0.44), only 2 (22.2%) teachers agreed to this assertion with 7 (77.8%) declining. The indication is that majority of the teachers are of the knowledge that teachers must not use a variety of materials other than the standard text during instruction.

As it is evident in Table 4.2, both general education and special education teachers seemed to possess average knowledge on product differentiation. From the analysis, the product element yielded an average per item rating of 1.49 and 1.58 for general education teachers and special education teachers respectively. Details of the items assessing teachers‟ knowledge of differentiation based on content are presented in Table 4.2.3.

Table 4.2.3: Descriptive Statistics of Teachers' Knowledge on Product Differentiation (n = 50)

	General Education Teachers						Special Education Teachers					
Items	**Agree**		**Disagree**		***M***	***SD***	**Agree**		**Disagree**		***M***	***SD***
	f	**(%)**	**f**	**(%)**			**f**	**(%)**	**f**	**(%)**		
PRODUCT												
9. Every assignment must offer students clear and appropriate criteria for success; focus on real-world relevance and application.	23	(56.1)	18	(43.9)	1.56	0.50	5	(55.6)	4	(44.4)	1.56	0.53
10. Using DI in the classroom prepares students to take standardized tests	22	(53.7)	19	(46.3)	1.39	0.51	5	(55.6)	4	(44.4)	1.56	0.53
11. When teachers differentiate instruction, they don‟t create unfair workloads among students	16	(39.0)	25	(61.0)	1.39	0.49	4	(44.4)	5	(55.6)	1.44	0.53
12. DI prepares students to compete in the real world	23	(56.1)	18	(43.9)	1.56	0.50	6	(66.7)	3	(33.3)	1.67	0.50
13. Teachers use whole group instruction in differentiation	16	(39.0)	25	(61.0)	1.39	0.49	6	(66.7)	3	(33.3)	1.67	0.50

Source: Field data (2018)

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

As can be seen in Table 4.2.3, the general education teachers‟ responses to product differentiation yielded mean of 1.39 to 1.56 and standard deviation of 0.49 to 0.51 with an average per item rating of 1.49. It therefore indicates that, general education teachers who teach mathematics at JHS level have average knowledge in product differentiation. From Table 4.2.3, the statement „Every assignment must offer students clear and appropriate criteria for success; focus on real-world relevance and application‟ attracted a mean score of 1.56 and a standard deviation of 0.50. By questionnaire responses, 23 (56.1%) teachers inclined to the assertion with the rest of the 18 (43.9%) teachers in disagreement. The indication is that, majority of the respondents are of the knowledge that every assignment must provide students appropriate criteria for success. Also, 18 (43.9%) of the teachers are of the view that, using differentiated instruction in the classroom will not prepare students to compete in the real world. Contrarily, 23 (56.1%) teachers forming the majority know that differentiated instruction employed in classrooms prepares students to compete in the real world with a mean of 1.56 and standard deviation, 0.50. The results from the analysis of teachers‟ response as presented in Table 4.2.3 show a common mean of 1.39 and standard deviation of 0.49 for both statements: „When teachers differentiate instruction, they do not create unfair workloads among students‟ and „Teachers use whole group instruction in differentiation‟. Among the general education teachers who responded to these statements, 16 (39%) of them agreed whereas 25 (61%) teachers declined making up the majority.

Among special education teachers‟ responses to product differentiation in Table 4.2.3, mean that ranged from 1.44 to 1.67 and standard deviation scores from 0.50 to 0.53 were obtained with an average per item rating of 1.58. This indicates that, special education teachers who teach mathematics at JHS level have average knowledge in

product differentiation. From Table 4.2.3, both statements „teachers use whole group instruction in differentiation" and „differentiated instruction in the classroom prepares students to compete in the real world" yielded a common mean score of 1.67 and standard deviation of 0.50. By way of the teachers" responses to both questions, 6 (66.7%) of them inclined to the assertions whiles the remaining 3 (33.3%) of the teachers declined. The indication is that, majority of the participants are of the knowledge that, the teachers in their quest to employ differentiated instruction use whole group instruction which prepares students to compete in the real world. Again, 5 (55.6%) of the teachers agreed that every assignment must offer students clear and appropriate criteria for success; focus on real-world relevance and application, representing a majority. Contrarily, 4 (44.4%) remaining teachers did not agree that every assignment must offer students clear and appropriate criteria for success; focus on real-world relevance and application with an obtained mean of 1.56 and a standard deviation of 0.53. Furthermore, the eleventh item which was: „When teachers differentiate instruction, they do not create unfair workloads among students" had majority, 5 (55.6%) of the teacher participants who disagreed to the statement whiles 4 (44.4%) of them agreed. The item attracted a mean of 1.44 and a standard deviation of 0.53. This is an evidence that, most of the special education teachers hold the position that differentiated instruction does create unfair workloads among students.

Generally, it could be concluded that JHS mathematics teachers who are general educators possess average knowledge in content differentiation. Those who are special educators were also revealed to possess average knowledge in content differentiation. Though both general education and special education teachers were found to possess average knowledge, special educators recorded higher average per item rating than general educators. This indicates that JHS mathematics teachers who

are special educators have more knowledge in content differentiation than their general education counterparts. Again, JHS mathematics teachers who are general educators were found to possess high level of knowledge in process differentiation. Similarly, special educators were revealed to possess high level of knowledge in process differentiation. Despite the fact that the two groups of JHS mathematics teachers possess high level of knowledge in process differentiation, special educators recorded higher average per item rating than general educators. This is an indication that JHS mathematics teachers who are special educators have more knowledge in process differentiation than their general education counterparts. Finally, it was revealed that JHS mathematics teachers who are general educators possess average knowledge in product differentiation. Those who are special educators were also revealed to possess average knowledge in product differentiation. Though both general education and special education teachers were found to possess average knowledge in product differentiation, special educators recorded higher average per item rating than general educators. This means that JHS mathematics teachers who are special educators have more knowledge in product differentiation than general educators.

4.5 Hypothesis 1: There is no significant difference in the knowledge of differentiated instruction between general education and special education teachers in Tano South District.

This hypothesis looked for a difference between two groups: general education teachers‟ knowledge and special education teachers‟ knowledge. Tables 4.2.5 and 4.2.6 illustrate variability between the general education teachers‟ knowledge and special education teachers‟ knowledge in differentiated instruction in the questionnaire administered. In choosing to analyse the data using an independent t-

test, part of the process involves checking to make sure that the data can actually be analysed using an independent t-test. Among the assumptions that need to be satisfied is the normality of the distribution aside the data been of interval level of measurement. Table 4.2.4 shows the normal distribution of the dependent variable.

Table 4.2.4: Tests of Normality of Teachers' Scores in the Knowledge of Differentiated Instruction (n = 50)

	Which category of teacher do you belong to	Kolmogorov-Smirnov[a] Statistic	df	Sig.	Shapiro-Wilk Statistic	df	Sig.
Teachers‟ Knowledge	General education teacher	0.12	41	0.17	0.95	41	0.08
	Special education teacher	0.20	9	0.20*	0.91	9	0.34

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Source: Field data (2018)

From Table 4.2.4, scores are approximately normally distributed for both general education teachers and special education teachers. Using Kolmogorov-Smirnov test, it can be seen that p = 0.17 for general education teachers and p = 0.20 for special education teachers. Also in the Shapiro-Wilks test, p = 0.08 for general education teachers and p = 0.34 for special education teachers. Where p >0.05, we statistically presuppose an acceptance of the null hypothesis that the data comes from a normally distributed population. Thus, the levels are considered to be statistically normal. Therefore, the assumption of normality has been met for this sample.

In analysing data using independent t-test, it is considered appropriate to highlight information on its mean and standard deviation. Table 4.2.5 provides useful descriptive statistics for the two groups (that is general education and special education teachers).

Table 4.2.5: Group Statistics for Teachers' scores in the Knowledge of Differentiated Instruction (n = 50)

	Which category of teacher do you belong to	N	Mean	Std. Deviation	Std. Error Mean
Teachers" Knowledge	General education teacher	41	20.85	2.83	0.44
	Special education teacher	9	21.45	2.45	0.82

Source: Field data (2018)

As depicted in Table 4.2.5, the examination of the group means indicates that special education teachers (M = 21.45, SD = 2.45) showed higher knowledge of differentiated instruction than did general education teachers (M = 20.85, SD = 2.83).

An independent samples t-test was conducted to ascertain whether the observed differences in mean scores are significant or not in the knowledge of differentiated instruction between general education and special education teachers using an alpha level of 0.05. Table 4.2.6 illustrates the variability of means between the two groups.

Table 4.2.6: Independent Samples T-Test of Teachers' Scores in the Knowledge 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. K	Equal variances assumed	0.38	0.54	-0.80	48	0.43	-0.81	1.02	-2.87	1.24
	Equal variances not assumed			-0.88	13.16	0.40	-0.81	0.93	-2.82	1.19

Source: Field data (2018) **Key: T.K** = Teachers" Knowledge

The *t*-test for the independent samples results in Table 4.2.6 revealed that there is not a significant difference in the scores obtained by general education teachers (M = 20.85, SD = 2.83, N = 41) compared to that of special education teachers (M = 21.45, SD = 2.45, N = 9) in knowledge, with $t(48) = -0.80$, $p = 0.43$. The mean difference in practice of differentiated instruction between general education teachers and special education teachers was -0.81. Therefore, the researcher retains the null hypothesis. The 95% confidence interval for the mean difference between the general education and special education teachers‟ knowledge was also relatively precise (-2.87 to 1.24). Moreover, the assumption of homogeneity of variances was tested and satisfied via Levene‟s test for equality of variances with $p > 0.05$.

4.6 Research question 2: To what extent do JHS mathematics teachers practice differentiated instruction in 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 was 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 4.2, using questionnaire. Participants‟ average per item rating scores 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.

Table 4.3: Descriptive Statistics of JHS Mathematics Teachers' Practice of the Main Elements of Differentiated Instruction (n = 50)

Elements of Differentiated Instruction	General Education Teachers			Special Education 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

From Table 4.3, among the general education teachers who teach mathematics at JHS level, process was rated as the highest element of differentiated instruction sometimes practiced. The process element was the second element to be analysed and there were four items the participants were questioned about. As depicted in Table 4.3, this element yielded a mean of 5.80 and standard deviation of 1.10 with an average item rating of 1.45 which placed process as the highest practiced element of differentiated instruction among JHS mathematics teachers. The indication here is that, general education teachers who were participants sometimes practice product differentiation. It is also apparent from Table 4.3 that the content differentiation which comprised of four items attracted a mean score of 5.63 and a standard deviation of 1.34 with an average per item rating of 1.41 which put content in second place for practice. This is an indication that, general education teachers who were participants sometimes practice content differentiation. Again, Table 4.3 revealed a mean of 6.95 and standard deviation of 1.55 with an average per item rating of 1.39 for product differentiation, and that placed product as the least practiced element of differentiated instruction. This indicates that general education teachers who were participants in the study rarely practiced product differentiation.

Among the participants (special education teachers), product was also rated the least practiced element of differentiated instruction. In product differentiation, there were five items that the participants were made to respond to. As depicted in Table 4.3, this element yielded a mean of 6.89 and standard deviation of 1.54 with an average item rating of 1.38 which placed product as the least practiced element of differentiated instruction among JHS mathematics teachers. This an indication that, special education teachers who were participants rarely practiced product differentiation. As evident in Table 4.3, content differentiation which comprised of four items yielded a mean score of 6.00 and a standard deviation of 1.41 with an average per item rating of 1.50. The process element which also comprised of four items yielded a mean of 6.00 and standard deviation of 1.23 with an average per item rating of 1.50 which put both content and process as the highest elements of differentiated instruction. For both content and process elements to attain common average per item rating of 1.50 means that, special education teachers (participants) on average sometimes practiced these two elements.

The results from the analysis of teachers‟ response as presented in Table 4.3 show that both general education and special education 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 education teachers and special education teachers respectively. Details of the items assessing teachers‟ practice of differentiation based on product are presented in Table 4.3.1.

Table 4.3.1: Descriptive Statistics of Teachers' Practice of Product Differentiation (n = 50)

Items	General Education Teachers				Special Education Teachers			
	R	O	*M*	*SD*	R	O	*M*	*SD*
	f (%)	f (%)			f (%)	f (%)		
PRODUCT								
9. The product form of my instruction connects with student interest.	32 (78.0)	9 (22.0)	1.22	0.42	7 (77.8)	2 (22.2)	1.22	0.44
10. My group composition changes based on the activity for the lesson.	23 (56.1)	18 (43.9)	1.44	0.50	4 (44.4)	5 (55.6)	1.56	0.53
11. I provide multiple modes of expression in the final product.	24 (58.5)	17 (41.5)	1.41	0.50	7 (77.8)	2 (22.2)	1.22	0.44
12. I provide variety of assessment tasks.	16 (39.0)	25 (61.0)	1.61	0.49	2 (22.2)	7 (77.8)	1.78	0.44
13. I provide students with the choice to work alone, in pairs or small group.	30 (73.2)	11 (26.8)	1.27	0.45	8 (88.9)	1 (11.1)	1.11	0.33

Source: Field data (2018) **Key: R**–Rarely Occurs, **O**–Often Occurs, ***M***–Mean, ***SD***–Standard Deviation

A cursory look at Table 4.3.1 indicates the range for the mean from 1.22 to 1.61 and standard deviation scores from 0.42 to 0.50 among general education 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. In Table 4.3.1, thirty-two (78%) of the teachers stated that the product form of their instruction rarely connects with student interest with mean of 1.22 and standard deviation of 0.42. However, only 9 (22%) of the teachers often have their product form of instruction connecting with student interest. The results from the analysis of teachers‟ responses as presented in Table 4.3.1 show a mean of 1.27 and standard deviation of 0.45 for the statement „I provide students with the choice to work alone, in pairs or small group‟. Among the general education teachers who responded to this statement, 30 (73.2%) conceded that they rarely provide students with the choice to work alone, in pairs or small group. On the other hand, the 11 (26.8%) remaining teachers noted that they often give students the opportunity to choose whether to work

alone, in pairs or small group. Contrarily, 25 (61%) of the teachers often provide variety of assessment tasks in the final product whereas 16 (39%) of them rarely practice. In the analysis of this statement, a mean score of 1.61 and standard deviation of 0.49 were obtained.

Analysing the special education teachers‟ responses on product differentiation in Table 4.3.1, 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 education teachers who teach mathematics at JHS level rarely differentiate product. From Table 4.3.1, seven (77.8%) of the teachers stated that the product form of their instruction rarely connects with student interest with mean of 1.22 and standard deviation of 0.44. However, only 2 (22%) of the teachers often have their product form of instruction connecting with student interest. The results from the analysis of teachers‟ response as presented in Table 4.3.1 show a mean of 1.11 and standard deviation of 0.33 for the statement „I provide students with the choice to work alone, in pairs or small group‟. Among the special education teachers who responded to this statement, 8 (88.9%) conceded that they rarely provide students with the choice to work alone, in pairs or small group. On the other hand, the one (1.11%) remaining teachers noted that they often give students the opportunity to choose whether to work alone, in pairs or small group. Contrarily, 7 (77.8%) of the teachers often provide variety of assessment tasks in the final product whereas 2 (22.2%) of them rarely practice. In an attempt to analyse this statement, a mean score of 1.78 and standard deviation of 0.44 were obtained.

The results from the analysis of teachers‟ responses in Table 4.3 show that both general education and special education 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 education teachers and special education teachers respectively. Details of the items assessing teachers‟ practice of differentiation based on content are presented in Table 4.3.2.

Table 4.3.2: Descriptive Statistics of Teachers' Practice on Content Differentiation (n = 50)

Items	General Education Teachers				Special Education Teachers			
	Rarely	Often	*M*	*SD*	Rarely	Often	*M*	*SD*
	f (%)	f (%)			f (%)	f (%)		
CONTENT								
1. I use materials of varied readability and/or interest.	34 (82.9)	7 (17.1)	1.17	0.38	7 (77.8)	2 (22.2)	1.22	0.44
2. I provide a variety of support mechanisms (e.g., organizers, study guides, study buddies).	29 (70.7)	12 (29.3)	1.29	0.46	6 (66.7)	3 (33.3)	1.33	0.50
3. My lesson involves major concepts of the subject.	14 (34.1)	27 (65.9)	1.66	0.48	2 (22.2)	7 (77.8)	1.78	0.44
4. My lessons encourage students to seek and value alternative modes of investigation or problem solving.	20 (48.8)	21 (51.2)	1.51	0.51	3 (33.3)	6 (66.7)	1.67	0.50

Source: Field data (2018) **Key: f**–Frequency, **%**–Percentage, ***M***–Mean, ***SD***–Standard Deviation

From Table 4.3.2, 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 education teachers who teach mathematics at JHS level sometimes practice content differentiation. It is evident in Table 4.3.2 under content that, 34 (82.9%) of the teachers rarely use materials of varied readability and/or interest, whereas 7 (17.1%) often use materials of varied readability and/or interest in their mathematics classrooms with a mean score of 1.17 and standard deviation of 0.38. On whether teachers provide a variety of support mechanisms (e.g., organizers, study guides, study buddies), a mean score of 1.29 and a standard deviation score of 0.46 were obtained. It was revealed that 29 (70.7%) of teachers representing majority rarely provide a variety of support mechanisms with the remaining 12 (29.3%) of the

teachers often practicing this activity. Also, concerning the question on whether their lessons encourage students to seek and value alternative modes of investigation or problem solving (M = 1.51, SD = 0.51), 20 (48.8%) teachers conceded that they rarely structure their lessons to encourage student to seek and value alternative modes of investigation or problem solving. However, 21 (51.2%) of the teachers forming majority indicated that they often structure lessons to encourage students to seek and value alternative modes of investigation or problem solving.

On the part of special education 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 4.3.2 with an average per item rating of 1.50. This means that, special education teachers who teach mathematics at JHS level sometimes practice content differentiation. It is also evident that, 7 (77.8%) of the teachers rarely use materials of varied readability and/or interest whereas 2 (22.2%) often use materials of varied readability and/or interest in their mathematics classrooms with a mean score of 1.22 and standard deviation of 0.44. On whether teachers provide a variety of support mechanisms (e.g., organizers, study guides, study buddies), a mean score of 1.33 and a standard deviation score of 0.50 were obtained. It was revealed that 6 (66.7%) teachers representing majority rarely provide a variety of support mechanisms with the remaining 3 (33.3%) teachers often practicing this activity. Concerning the question on whether their lessons encourage students to seek and value alternative modes of investigation or problem solving (M = 1.67, SD = 0.50), only 3 (33.3%) teachers conceded that they rarely structure their lessons to encourage students to seek and value alternative modes of investigation or problem solving sometimes. Contrarily, 6 (66.7%) of the teachers forming majority indicated that they often

structure lessons to encourage students to seek and value alternative modes of investigation or problem solving.

The results in Table 4.3 show that both general education and special education 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 education teachers and special education teachers respectively. Details of the items assessing teachers‟ practice of differentiation based on process are presented in Table 4.3.3.

Table 4.3.3: Descriptive Statistics of Teachers' Practice on Process Differentiation (n = 50)

Items	General Education Teachers				Special Education Teachers			
	Rarely	Often	*M*	*SD*	Rarely	Often	*M*	*SD*
	f (%)	f (%)			f (%)	f (%)		
PROCESS								
5. I "teach to the middle" to reach the majority of students.	25 (61.0)	16 (39.0)	1.39	0.49	4 (44.4)	5 (55.6)	1.56	0.53
6. The pace of my instruction varies based on individual learner needs.	16 (39.0)	25 (61.0)	1.61	0.49	3 (33.3)	6 (66.7)	1.67	0.50
7. I group students for learning activities based on readiness, interests, and/or learning preferences.	30 (73.2)	11 (26.8)	1.27	0.45	8 (88.9)	1 (11.1)	1.11	0.33
8. I structure classroom environment to support a variety of activities including group and/or individual work.	19 (46.3)	22 (53.7)	1.54	0.51	3 (3.33)	6 (66.7)	1.67	0.50

Source: Field data (2018) **Key: f**–Frequency, **%**–Percentage, ***M***–Mean, ***SD***–Standard Deviation

As it is evident in Table 4.3.3 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 education teachers who teach mathematics at JHS level sometimes practice process differentiation. The results from the analysis of teachers‟ responses show a mean of 1.39 and standard deviation of .49 for the

statement „I "teach to the middle" to reach the majority of students. Twenty-five (61%) of the teachers admitted that they rarely "teach to the middle" in order to reach the majority of students in the class whiles 16 (39%) of them often teach to the middle. It is also apparent from Table 4.3.3 that, 30 (73.2%) of the general education teachers forming the majority rarely group their students for learning activities based on readiness, interests, and/or learning preferences during instruction, whiles eleven (26.8%) of the teachers often practice this. The statement: „I group students for learning activities based on readiness, interests, and/or learning preferences" attracted a mean score of 1.27 and a standard deviation of 0.45. This however indicates that, majority of the general education teachers rarely practice this statement regarding process differentiation. Moreover, in finding out how frequent general education teachers structure classroom environment to support a variety of activities including group and/or individual work, 19 (46.3%) teachers asserted that they rarely practice this kind of activity with the majority of 22 (53.7%) teachers practicing often. Item 13 which addresses this question attracted a mean value of 1.54 with a standard deviation of 0.51.

Analysis of special education teachers" responses to the statements 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 education teachers who teach mathematics at JHS level sometimes practice process differentiation. The results from the analysis of special education teachers" responses show a mean of 1.56 and standard deviation of 0.53 for the statement „I "teach to the middle" to reach the majority of students. Five (55.6%) of the teachers forming the majority admitted that they often "teach to the middle" in order to reach the majority of students in the class, whiles the remaining 4 (44.4%) of them rarely teach to the

middle. From Table 4.3.3 it was revealed that, 8 (88.9%) of the special education teachers forming the majority rarely group their students for learning activities based on readiness, interests, and/or learning preferences during instruction whereas one (11.1%) of the special education teachers often practice this. The statement: „I group students for learning activities based on readiness, interests, and/or learning preferences" attracted a mean score of 1.11 and a standard deviation of 0.33. This however indicates that, majority of the special education teachers rarely practice this statement regarding process differentiation. Furthermore, in finding out how frequent general education teachers structure classroom environment to support a variety of activities including group and/or individual work, 3 (33.3%) teachers asserted that they rarely practice this kind of activity with the majority of 6 (66.7%) teachers practicing often. Item 13 which addresses this question attracted a mean value of 1.67 with a standard deviation of 0.50.

In general, it could be concluded that JHS mathematics teachers who are general educators sometimes practice content differentiation. Those who are special educators were also revealed to practice content differentiation sometimes. Though both general education and special education teachers were found to sometimes practice content differentiation, special educators recorded higher average per item rating than general educators. This indicates that JHS mathematics teachers who are special educators practice more of content differentiation than their general education counterparts. Also, JHS mathematics teachers who are general educators were found to practice process differentiation sometimes. Similarly, special educators were revealed to practice process differentiation sometimes. Despite the fact that the two groups of JHS mathematics teachers sometimes practice process differentiation, special educators obtained higher average per item rating than general educators. This is an

indication that JHS mathematics teachers who are special educators practice more of the process differentiation than their general education counterparts. Finally, it was revealed that JHS mathematics teachers who are general educators to rarely practice product differentiation. Those who are special educators were also revealed to rarely practice product differentiation. Though both general education and special education teachers were found to rarely practice product differentiation, general educators recorded higher average per item rating than special educators. This means that JHS mathematics teachers who are general educators practice more of product differentiation than special educators.

4.7 Hypothesis 2: There is no significant difference in the practice of differentiated instruction between general education and special education teachers in Tano South District.

This hypothesis is quite similar to the first hypothesis, however it refers to practice rather than knowledge of differentiated instruction. This hypothesis looked for a comparison within two groups: general education teachers‟ practice as compared to special education teachers‟ practice. Tables 4.3.5 and 4.3.6 represents the variability between general education teachers‟ practice and special education teachers‟ practice of differentiated instruction in the questionnaire administered. In choosing to analyse the data using an independent t-test, the assumption of normality of the distribution was tested aside the data been of interval level of measurement. Table 4.3.4 shows the normal distribution of the dependent variable (scores).

Table 4.3.4: Tests of Normality for Teachers' Scores in the Practice of Differentiated Instruction (n = 50)

	Which category of teacher do you belong to	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Teachers" Practice	General education teacher	0.15	41	0.02	0.95	41	0.09
	Special education teacher	0.16	9	0.20*	0.91	9	0.34

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction
Source: Field data (2018)

From Table 4.3.4, scores are approximately normally distributed for both general education teachers and special education teachers. Using Shapiro-Wilks test, it can be seen that p = 0.09 for general education teachers and p = 0.34 for special education teachers. However, in using Kolmogorov-Smirnov test, p = 0.02 for general education teachers and p = 0.20 for special education teachers. Where p > 0.05, we statistically presuppose an acceptance of the null hypothesis that the data comes from a normally-distributed population based on Shapiro-Wilks test results. Thus, the levels are considered to be statistically normal. Hence, the assumption of normality has been met for this variable.

In analysing data using independent *t*-test, it is considered appropriate to highlight information on its mean and standard deviation. Table 4.3.5 provides useful descriptive statistics for the two groups (that is general education and special education teachers).

Table 4.3.5: 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 education teacher	41	18.39	3.24	0.51
	Special education teacher	9	18.89	3.48	1.16

Source: Field data (2018)

From Table 4.3.5, the examination of the group means indicates that special education teachers (M = 18.89, SD = 3.48) practiced more of differentiated instruction than did general education 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 education and special education teachers using an alpha level of 0.05. Table 4.3.6 illustrates the variability of means between the two groups.

Table 4.3.6: 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
	Equal variances not assumed			-.39	11.25	0.70	-0.50	1.27	-3.28	2.28

Source: Field data (2018) **Key: T.P** = Teachers" Practice

The *t*-test for the independent samples results in Table 4.3.6 revealed that there is not a significant difference in the scores obtained by general education teachers (M = 18.39, SD = 3.24, N = 41) compared to that of special education teachers (M = 18.89, SD = 3.48, N = 9) in practice, with $t(48)$ = -0.41, p = 0.68. The mean difference in practice of differentiated instruction between general education teachers and special education teachers was -0.50. Hence, the researcher retains the null hypothesis. Also, the 95% confidence interval for the mean difference between the general education and special education teachers" knowledge was -2.93 to 1.93. Moreover, the

assumption of homogeneity of variances was tested and satisfied via Levene"s test for equality of variances with $p > 0.05$ as can be seen in Table 4.3.6.

4.8 Research Question 3: What challenges do JHS teachers experience in differentiation of mathematics instruction in Tano South District?

In addressing the issue of challenges in differentiated instruction, a questionnaire was designed to solicit views from teacher respondents. Table 4.4 illustrates the descriptive statistics (frequency, percentage, mean and standard deviation) of the responses to each question on the challenges confronting JHS mathematics teachers in differentiation of instruction.

Table 4.4: Descriptive Statistics of the Challenges Teachers face in Differentiated Instruction (n = 50)

Items	Agree f (%)		Disagree f (%)		*M*	*SD*
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,

As evident in Table 4.4, 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. In a bid to find out whether teachers see differentiated instruction as another fad in instructional approaches, the mean score of 1.62 and standard deviation of 0.49 were obtained. In view of this, 31 (62%) of the teachers were discovered to be in agreement to that assertion with only 19 (38%) holding contrary views. Concerning the statement that 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.

It is also apparent from Table 4.4 that, 33 (66%) of the teachers are apprehensive for the concept-based teaching with the pressure of standardized tests in differentiation of instruction with a mean of 1.66 and a standard deviation of 0.48. However, the remaining 17 (34%) teachers registered their disagreement. The indication is that majority of JHS mathematics teachers are apprehensive for the concept-based teaching with the pressure of standardized tests in differentiation of instruction. Moreover, the results from the analysis of teachers‟ responses as presented in Table 4.4 show a mean of 1.90 and standard deviation of 0.30 for the statement, „lack of administrative support hinders the practice of differentiated instruction‟. Among the teachers who responded to this statement, 45 (90%) of them agreed, whereas 5 (10%) teachers declined indicating minority. This however means that, majority of teachers hold the belief that lack of administrative support hinders the practice of differentiated instruction. On whether it is difficult to assess the readiness level of students, a mean

score of 1.68 and a standard deviation score of 0.47 were obtained with 34 (68%) teachers responding in favour while 16 (32%) stated otherwise. The implication here is that, most of the JHS mathematics teachers find it difficult to assess the readiness level of students before instruction.

Results obtained from the participants‟ views revealed that, only 7 (14%) teachers are able to practice differentiated instruction despite the limited space for group work. Majority, 43 (86%) teachers conceded that they are not able to practice differentiated instruction due to limited space for group work with mean of 1.86 and standard deviation of 0.35. It therefore implies that majority of JHS mathematics teachers find it more challenging to differentiate instruction in a class with limited space. Again, teachers responded to the statement: „Teachers lack knowledge on how to address academic diversity in differentiation of instruction‟ with a mean of 1.66 and a standard deviation of 0.48. On the views expressed by the teachers, it was noted that 33 (66%) of the teachers indicated that they lack knowledge on how to address academic diversity whereas 17 (34%) indicated that they had knowledge. Finally from Table 4.4, forty-eight (96%) teachers identified large class size as one of the major threats in differentiated instruction with only 2 (4%) of them declining. This statement however attracted the highest mean and standard deviation of 1.96 and 0.20 respectively. This indicates that, among the enormous challenges confronting JHS mathematics teachers in differentiated instruction, large class size was registered as the most pressing issue.

4.9 Qualitative Results from the Interview

In the interview report, the narrative accounts of six respondents that is, 4 general education teachers (GT1, GT2, GT3 and GT4) and 2 special education teachers (ST1 and ST2) are presented after the questionnaire exercise was completed. These interviews explored issues in the first phase of the study with 8 items which were based on the results of the questionnaire on JHS mathematics teachers‟ knowledge and practice of differentiated. These questions were prepared to quiz participants to express their views on meaning of differentiated instruction, how often they attend professional training that discusses differentiated instruction, why they feel threatened by time and large class size. It also explored common strategies they normally employ in differentiation of instruction and how they know how well students learn in classroom.

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 GT3:

> “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 education and special education teachers sometimes differentiate instruction.

On a question of whether any of the professional events provide instructional strategies discussing differentiation? All the teachers interviewed (GT1, GT2, GT3, GT4, ST1 and ST2) responded "No" to the statement.

To the question „what is differentiated instruction?" teachers exhibited fair knowledge of the meaning of differentiated instruction. For example, GT2 defined differentiated instruction as:

> "A kind of instruction that helps students to have a fair share in the learning process."

ST2 also commented that:

> "Differentiated instruction is a way of structuring instruction to suit the individual student needs."

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 researcher 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. Teachers" responses indicated that they pre-assess students before the introduction 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."

Although, there are many common strategies that can be used to differentiate instruction, respondents were able to enumerate few in response to the question „What are some of the common strategies you use to differentiate a lesson?" GT1, GT2, GT3 and GT4 stated co-teaching and small grouping as some of the common strategies they employ during lesson. Aside ST1 and ST2 sharing in the strategies outlined by general education teachers, they further added individualised teaching as one of the common strategies they use to differentiate instruction. This reveals one of the alternative conceptions some teachers have concerning differentiated instruction.

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 this question 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 responded „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 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."

In summary, the results from the interview revealed that most of the JHS mathematics do not often attend professional development programmes which can help build their capacities in teaching. And even few of the teachers who had some opportunities to attend these programmes were not provided instructional strategies that discussed differentiated instruction. Nevertheless, teachers who were interviewed exhibited fair knowledge of the meaning of differentiated instruction. Again, it was revealed that JHS mathematics teachers pre-assess students by reviewing their relevant previous knowledge (R.P.K) before the introduction of new topic. Among the challenges JHS mathematics teachers face in differentiated instruction are large class size and limited time for implementation of differentiated instruction.

CHAPTER FIVE

DISCUSSION OF FINDINGS

5.0 Overview

In this chapter, significant findings on JHS mathematics teachers‟ knowledge and practice of differentiated instruction are interpreted and discussed. The discussions highlight the major study findings based on the research questions/hypotheses, and the inferences made from them in view of findings from related previous studies. These are:

1. JHS mathematics teachers‟ knowledge of differentiated instruction.
2. JHS mathematics teachers‟ practice of differentiated instruction.
3. Challenges JHS teachers experience in differentiated instruction.
4. There is no significant difference in the knowledge of differentiated instruction between general education and special education teachers.
5. There is no significant difference in the practice of differentiated instruction between general education and special education teachers.

5.1 JHS Mathematics Teachers' Knowledge of Differentiated Instruction Based on the Three Major Elements

Knowledge according to Nonaka (2006) is a dynamic human process of justifying personal beliefs towards the truth which is normally gained through experience or education. In our contemporary world today, the knowledge teachers possess still proves to be the most critical factor in their effectiveness or otherwise in their professional endeavours. This is because, teaching has historically been a profession in search of knowledge that could inform classroom practice. This affirms the assertion that the extent of teachers‟ knowledge of differentiated instruction is consequential to its practice by them (Whipple, 2012). In effect, teachers who are in

the best position to differentiate instruction in their classrooms operate from strong and growing knowledge base (Tomlinson & Imbeau, 2010). However, the practice of differentiated instruction requires deep knowledge of its process, theoretical framework and ways through which the theory is translated into action. It is based on these underpinnings that the JHS mathematics teachers‟ knowledge and practice of differentiated instruction was deemed necessary and explored.

Tomlinson (2001) identifies three areas as elements of differentiated instruction: content, process and product. The JHS mathematics teachers including general education and special education teachers participated in a study exploring their knowledge regarding the 3 components. The findings of this study (see Table 4.2) revealed that JHS mathematics teachers who are general educators had a high level of knowledge of the concepts of differentiated instruction with *content* differentiation (M = 5.98, SD = 0.99), *process* differentiation (M = 7.44, SD = 0.78), and *product* differentiation (M = 7.44, SD = 1.72) which attracted an average per item rating of 1.50, 1.86 and 1.49 respectively. From the 41 general education teachers‟ responses, it could be concluded that the participants on average have high knowledge in differentiated instruction. The indication is that, the general education teachers who teach mathematics at JHS level in Tano South District are more knowledgeable in the differentiation of instruction.

The findings Table 4.2 also revealed that JHS mathematics teachers who are special educators had a high level of knowledge in differentiated instruction with content differentiation (M = 6.22, SD = 0.67), process differentiation (M = 7.56, SD = 0.73), and product differentiation (M = 7.89, SD = 1.90) which attracted an average per item rating of 1.56, 1.89 and 1.58 respectively. From the data analysis on 9 special

education teachers‟ responses, it could be concluded that the participants on average have high knowledge in differentiated instruction. The indication is that, the general education teachers who teach mathematics at JHS level in Tano South District are more knowledgeable in the differentiation of instruction. This is affirmed by the definitions some of the respondents gave to differentiated instruction when they were asked in an interview that: "Differentiated instruction is a way of structuring instruction to suit the individual student needs." Tomlinson and Moon (2013) similarly noted differentiated instruction to be an approach to instruction that systematically takes student differences into account in designing opportunities for each student to maximise learning.

In comparison, it could be mentioned that special education teachers have higher than general education teachers. This is consistent with the findings of Whipple (2012) which revealed special education teachers to possess high knowledge of differentiated instruction than general education teachers. This disparity may be as result of the kind of training special educators received from universities which may provide them knowledge on how to adapt instruction to meet diversity of students‟ needs in classroom as compared to that of general education teachers. In addition, special education teachers typically have students with varied abilities and disabilities forcing them to differentiate often. As a result, their hands-on experience could be a factor in the results of the data.

5.1.1 Teachers' Knowledge on Process Differentiation

The varying level of JHS mathematics teachers‟ knowledge of the three major elements is consistent with the findings of Abora (2015) that revealed teachers‟ knowledge on process to be the highest differentiated element among the six sub-

concepts outlined. As painted in Tables 4.2 and 4.2.1, both general education and special education teachers had the highest knowledge in process differentiation among the three major elements. Tomlinson and Imbeau (2010) define process as the "sense-making activities" students engage in order to "retain, apply, and transfer content" (p. 15). They further explain that, process suggests the way contents of the curriculum should be taught to students. It addresses the rate of instruction, using learner preference groups, grouping students based on readiness and setting up a structured classroom environment. Vygotsky (1978) however believes that process is more important than product. This is because, process looked directly at a child"s series of actions and thoughts as he/she tries to solve a problem and, in the process, advance his/her own thinking.

5.1.2 Teachers' Knowledge on Content Differentiation

Among the three major elements of differentiated instruction, Table 4.2.2 revealed that both general education and special education teachers who teach JHS mathematics are highly knowledgeable in content differentiation. However, content differentiation was rated least among the tree elements in this study. This finding is confirmed by Abora (2015) study findings when it was revealed that teachers" knowledge of differentiation on content was among the least. Inconsistently, while teachers" knowledge on content differentiation was reported the highest in the findings of Whipple"s (2012) study, it appeared to be the least element teacher participants. Whipple (2012) study showed dissimilar findings on the content differentiation which reported the element to be the highest understood concept among the six categories she outlined Content according to Tomlinson (2005a, 2005b) comprises not only what is taught, but how students access the material taught. Tomlinson and McTighe (2006) however make a strong statement about the

importance of content, which underscores the fact it was rated as the second most understood component important, "*Clarity about content reveals our awareness that human beings seek to make sense of their world and that the big ideas of the disciplines reveal the big ideas of life. Inevitably, to grasp the key concepts and principles of any subject also help us better understand ourselves, our lives, and our world*" (p. 38).

5.1.3 Teachers' Knowledge on Product Differentiation

In view of the findings on teachers‟ knowledge of differentiated instruction in Table 4.2.3, product was rated the second after process differentiation. This is however consistent with the findings of Abora (2015) which revealed teachers‟ knowledge on product to be second highest differentiated element among the six sub-concepts outlined. Contrarily, Whipple (2012) study placed product at last, sixth, for teachers‟ ability to understand. The product is the way our students demonstrate what they have learned. It helps to determine whether the student has successfully learned what was taught. These assessments can look as different from one another as our students do. Traditionally, teachers use a summative assessment to determine students‟ level of understanding. Tomlinson and Imbeau (2010) suggests an approach that is more encompassing. They argue that, product is not something students generate in a single lesson or as a result of an activity or two. Rather, it is a rich culminating assessment that calls on students to apply and extend what they have learned over a period of time.

Undoubtedly, quality of teachers plays an important factor in influencing students‟ academic achievement. According to Musanti and Pence (2010), quality professional development has the propensity to change teachers‟ practices and positively affect

student learning. An issue Leko and Brownell (2009) notice is the necessity to provide professional development to address instructional strategies, specific school curriculum and the role of the special and general educators in the classroom. Teachers therefore need a sustained support while they are implementing any new instructional strategy specifically differentiated instruction, so as to ensure effective monitoring and instruction of students. Several studies have also agreed that professional development is needed in order to implement differentiated instruction successfully (Stover et al., 2011; Whipple, 2012). In view of this assertion, the study sought to gain insight into how often teachers attend professional events, inside and outside the school. The findings however revealed that almost all the teachers rarely attend professional events in both inside and outside the school. This is affirmed by the comments that were captured in an interview that, "The last time I had opportunity to attend a professional development event inside the school was in 2016. And on that of the one organised outside the school, I have experienced once in my entire 7 years of teaching." Only one of the respondents indicated contrary that, "I attend professional events almost every term inside the school and once a year outside the school premises." It worth to note that, even in the rare professional development events they attended none of them provided instructional strategies discussing differentiation.

5.1.4 Hypothesis 1: There is no significant difference in the knowledge of differentiated instruction between general education and special education teachers.

This study sought to ascertain whether there is significant difference in the knowledge of differentiated instruction between general education and special education teachers using an alpha level of 0.05. Results from the independent samples *t*-test analysis in

Table 4.2.6 revealed that there was no significant difference in the scores obtained by general education teachers (M = 20.85, SD = 2.83, N = 41) compared to that of special education teachers (M = 21.45, SD = 2.45, N = 9) in knowledge, with $t(48)$ = -0.80, p = 0.43. However, the examination of the group means indicates that special education teachers (M = 21.45, SD = 2.45) possess higher knowledge of differentiated instruction than did general education teachers (M = 20.85, SD = 2.83). For p-value to be greater than alpha level, the researcher therefore retains the null hypothesis and conclude that there is no significant difference in the scores obtained on knowledge by general education teachers and special education teachers.

However, the examination of the group mean ranks indicate that special education teachers had higher knowledge of differentiated instruction than did general education teachers. Consistent to this findings, Whipple (2012) study also revealed that special education teachers had a high knowledge in differentiated instruction than general education teachers. Whipple attributed this variation to the type of training that special education teachers received in college/university as compared to general education teachers. Whipple believed that special education teachers may be provided with classes that focus more on differentiated instruction. However, special education teachers in the study conceded that among the few professional programmes they have attended none of them discussed instructional strategies which featured differentiated instruction. Similar is the case of general education teachers.

5.2 JHS Mathematics Teachers' Practice of Differentiated Instruction

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, 2004a, 2004b). 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 of 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 (see Table 4.3) revealed that JHS mathematics teachers who are general educators on average sometimes differentiate instruction with content differentiation (M = 5.63, SD =1.34), process differentiation (M = 5.80, SD = 1.10), and product differentiation (M = 6.95, SD = 1.55) 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 educators on average sometimes differentiate instruction with content differentiation (M = 6.00, SD = 1.41), process differentiation (M = 6.00, SD = 1.23), and product differentiation (M = 6.89, SD = 1.54) 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 findings when she 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 et al., 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; Gijbels et al., 2005; 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 respondents added individualised teaching as one of the common strategies they use to differentiate instruction. Roy et al. (2013) and Tomlinson et al. (2003) 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 (Tomlinson, 2001). It also focuses on meaningful learning – on 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.

5.2.1 Teachers' Practice of Process Differentiation

In regards to the varying level of JHS mathematics teachers‟ practice of the three elements of differentiated instruction, the findings were inconsistent with Whipple (2012) findings that revealed the process to be the least practiced after product among the components she studied. This is concerning because, teacher participants who were found to possess high knowledge in process differentiation are the same group of people who have been revealed to barely practice this element. The reason may be that, teachers probably lack adequate strategies in carrying out differentiated instruction which is evident in their responses to common strategies they can adapt to differentiate instruction. In response both general education and special education teachers were able to enumerate only two common strategies that they use in differentiation of instruction. According to Bailey and Williams-Black (2008), it is important to note that the process is differentiated not only by how the teacher decides to teach (lecture for auditory learners; centres for tactile learners; small group and whole group), but by the strategies the teachers encourage students to use to facilitate thorough exploration of the content taught. This can be done by way of higher-order thinking, open-ended thinking, discovery, reasoning and research. They can decide how best to do this by taking into account their students‟ readiness levels, interests, or learning profiles.

5.2.2 Teachers' Practice of Product Differentiation

In regards to the varying level of JHS mathematics teachers‟ practice of the three elements of differentiated instruction, the findings were consistent with Whipple (2012) findings that revealed the product to be the least practiced among the components she analysed. This may be as result of the pressure accompanied national high stake testing. This test requires all students to pass the same set of questions under the same circumstances. Consequently, most teachers do not see the need to differentiate product when in the end, the same standards would be required of their students. Although this may be true, the reality is, no matter how highly standardized the learning outcome needs to be; students by no measure learn in different ways and will therefore have to be taught in different ways. So as paradoxical as it may sound, the need for differentiation is even more critical if teachers want to get every student to be at the same point at the same time. This by anyway does not suggest that teachers should change the outcome for students, but rather finding different avenues to success with those outcomes (Tomlinson & Moon, 2013).

5.2.3 Teachers' Practice of Content Differentiation

Results of the study further indicate that there are variations in the levels of JHS mathematics teachers‟ practice of differentiated instruction. The findings from Table 4.3 place content at second place after process in terms of how often teacher participants practice the three major elements of differentiated instruction. This is inconsistent with findings of Whipple (2012) where content was rated first in the area of implementation of differentiated instruction. Because teachers are held accountable for covering grade-level standards, many are concerned that they will not be able to do so if they differentiate instruction. Tomlinson and Moon (2013) however argues that differentiated instruction does not interfere with teaching the required standards.

When teachers differentiate content, the same concept or skill is taught to each student; however, the curriculum used to teach the concept or skill might be different for different students.

5.2.4 Hypothesis 2: There is no significant difference in the practice of differentiated instruction between general education and special education teachers.

This study sought to ascertain whether there is significant difference in the practice of differentiated instruction between general education and special education teachers using an alpha level of 0.05. Results from the independent samples *t*-test analysis in Table 4.3.6 revealed that there was no significant difference in the scores obtained by general education teachers (M = 18.39, SD = 3.24, N = 41) compared to that of special education teachers (M = 18.89, SD = 3.48, N = 9) in practice, with $t(48) = -0.41$, p = 0.68. However, the examination of the group means indicates that special education teachers (M = 18.89, SD = 3.48) practice a little more of differentiated instruction than did general education teachers (M = 18.39, SD = 3.24). For p-value to be greater than alpha level, the researcher therefore retains the null hypothesis and conclude that there is no significant difference in the scores obtained on practice of differentiated instruction among general education teachers and special education teachers. However, the examination of the group mean ranks indicate that special education teachers practice more of differentiated instruction than did general education teachers. Whipple (2012) study confirmed this findings when special education teachers had a mean score greater than that of general education teachers. Whipple gave a reason that, special education teachers typically have students with varied abilities and disabilities forcing them to differentiate often. As a result, their hands-on experience could be a factor in the results of the data.

5.3 Challenges JHS Teachers Experience in Differentiated Instruction

Differentiated Instruction has been in use for years with the gifted education crowd, but it has finally arrived in the regular education classroom. Tomlinson and McTighe (2006) began building the concepts of differentiated instruction from use in gifted classrooms to use in all classrooms. Based on this sudden shift, teachers who participated in the study agreed to the belief that differentiated instruction is one of the fads in instructional approaches. Subban (2006) in his study confirmed that teachers perceive differentiated instruction as a fad that would pass over time.

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 was 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. They also expressed their challenge with how to match appropriate resources with teaching. Similar to Good‟s (2006) observation, 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. He explains further that teachers are normally overwhelmed on an individual level, because they are unsure how best to begin this extensive process.

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 et al. (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 expert‟s guidance and support which are essential to ensure efficiency of the strategy across all curriculums.

Added to these is the reluctance of teachers to adjust teaching practice as differentiated instruction is perceived as disorienting and upsetting. Teachers tend to teach the way they were taught. They are more conversant with controlling single-focused activities vis-a-vis coordinating multiple activities. They are most comfortable using teaching materials and strategies that they were exposed to and hence, rarely re-invent the wheel. As stated by Scigliano and Hipsky (2010), differentiated instruction 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 was daunting and sometimes overwhelming for teachers. Differentiated instruction is therefore perceived as discomforting as it mandates teachers to ensure more of these: planning, preparation; creativity; adaptive classroom management and organization; collecting, analysing and evaluating students‟ records; and coordinating multiple tasks.

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 still suggests that the understanding by design framework can be a powerful tool to realize that principle.

CHAPTER SIX

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

6.0 Overview

This chapter presents the summary of findings, conclusions and recommendations on the study.

6.1 Summary of Findings

This study set out to explore JHS mathematics teachers‟ knowledge and practices of differentiated instruction. The study was conducted in the Tano South District in the Brong Ahafo Region of Ghana. A mixed method approach was used to build understanding about JHS mathematics teachers‟ knowledge and practices of differentiated instruction. A sample size of 50 was selected through the stratified proportional sampling technique. The researcher used questionnaire and interview guide as the primary tools for collecting data. The questionnaire and interview guide were employed to collect quantitative and qualitative data respectively. The quantitative data was analysed using the SPSS version 20 whereas the qualitative data was thematically analysed.

6.1.1 Main Findings

The findings of the study revealed that:

1. Though there is varied levels of JHS mathematics teachers‟ knowledge on the three main elements of differentiated instruction, the findings of the study revealed that JHS mathematics teachers on average possess high knowledge in differentiated instruction. The level of the JHS mathematics teachers‟ knowledge determined was in an ascending order as process, content, product

and process, product, content for general and special educators respectively. However, among JHS mathematics teachers who were studied, special educators were found to possess higher level of knowledge than their general educators‟ counterpart even though it was not statistically significant.

2. Majority of JHS mathematics teachers sometimes practice differentiated instruction even though they were found to possess high knowledge of differentiated instruction. Similarly, the JHS mathematics teachers‟ practice of the three main elements varied. The level of the JHS mathematics teachers‟ practice determined was in an ascending order as process, content, product and content, process, product for general and special educators respectively. However, among JHS mathematics teachers who were studied, special educators were found to practice more of differentiated instruction than their general educators‟ counterpart even though it was not statistically significant. Again, there were disparities in the practice of differentiated instruction among JHS mathematics teachers.
3. Majority of JHS mathematics teachers revealed among other challenges the large class size and dearth of time needed to differentiate instruction as teachers. It was also found out that most teachers (66%) were disquiet about the pressure of standardized tests for students‟ assessment.

6.2 Conclusion

Generally, the study revealed differences in the level of knowledge of differentiated instruction among JHS mathematics teachers according to their responses. With the practice of differentiated instruction by JHS mathematics teachers in the classroom, there was also variation among responses. This finding will be helpful when education/training is designed to support teachers in the practice of differentiated

instruction. There was a general level of knowledge and practice of differentiated instruction among the teacher participants (involving general and special educators) in Tano South District. In regards to knowledge, it appears that content and product are the two least understood elements. This indicates that, teachers may be struggling with the knowledge of how to use curriculum to teach the same concept or skill that might be different for different students, how to use student interest and allowing varied products.

With regards to practice, there was a lower rate of practice compared to knowledge. The results indicate content and product as the elements that have lower level of practice. The findings indicate that teachers may be struggling on how to teach the same concept or skill in a way that might be different for each student, and allowing varied products allowing students to use varied products to show what they have learned. According to the responses from general education teachers and special education teachers who teach JHS mathematics, it was noted that special education teachers had a higher level of knowledge of differentiated instruction than their general education counterparts. This response was similar to the practice of differentiated instruction among the same groups of teachers. There was no significant difference in the knowledge of differentiated instruction between general education and special education teachers. Consistently, no significant difference was found regarding the practice of differentiated instruction among general education and special education teachers.

6.3 Recommendations

Based on the study findings, the following recommendations were made for considerations:

1. Despite the fact that teacher participants were found to possess high level of knowledge of differentiated instruction, their practice of this phenomenon was recorded 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 education and special education teachers in each building focusing on the three main elements of differentiated instruction.
2. From the study findings, it seems that more can be done at teacher preparation institutions to expose prospective teachers to differentiated instruction through classroom teaching and modelling. To achieve this ideal, it is recommended that teacher education institutions revise the existing curriculum in a way that would encourage greater participation among teacher trainees in exploring differentiated instructional approaches to teaching at basic levels of our education system.
3. Teachers also stated that, it takes them a lot of time in grouping students for class activities and providing immediate feedback through assessment. Therefore, it is recommended that GES give JHS teachers in Tano South District ample time to engage students‟ learning via differentiated instruction.
4. JHS teachers in Tano South District only focus on the traditional (paper and pen) methods of assessments. However, the GES should encourage and support them to differentiate assessment by assisting and encouraging them to

use alternative forms of assessment that would cater for the diverse needs of their pupils.

6.4 Implications for Further Research

After analysing the findings, it was revealed that teachers normally do not differentiate instruction despite the fair knowledge of the concept exhibited. As the growing number of students increase, failure on the part of teachers to respond to students‟ individual needs may have a lasting impact on the students‟ future achievement. In view of this, the following directions for future research are recommended.

First, this study could be replicated to explore mathematics teachers‟ knowledge and practice of differentiated instruction at different settings with different sample sizes. This study was conducted in the public school system with JHS mathematics teachers. So, other studies can look at the situation at different settings including private institutions.

Another direction for future research would be to interview students who are the utmost beneficiaries of teaching and learning process. The participants in this study were teachers who have had at least some years of teaching experience. Involving students who form the centre of teaching and learning process may provide insight on their experiences during the differentiate instruction and the impact of the differentiated approach to teaching on their daily learning success.

Lastly, future studies might look at how school administration supports teachers with the implementation of differentiated instruction in the classrooms. This is because, teachers were found of not been helped to differentiate instruction through

professional development programmes. This study might involve studying administrative views on differentiated instruction and how those views affect the implementation of differentiated instruction.

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APPENDICES

APPENDIX "A"

QUESTIONNAIRE GUIDE

Section A: Background Demographic Data – Please fill in or check the appropriate item below.

This questionnaire is designed to investigate JHS teachers" knowledge and practice of differentiated instruction in mathematics in the Tano South District. The first section of the questionnaire intends to obtain personal information, and in the second, third and fourth sections there are questions that will find out your knowledge, practice and challenges of differentiated instruction respectively. Please respond honestly to the items and you can be assured that your responses will be kept confidential.

School:…… Date:……

1. Which class level do you teach?

(i) JHS 1 ☐ (ii) JHS 2 ☐ (iii) JHS 3 ☐

2. Which category of teacher do you belong to?

(i) General education teacher ☐ (ii) Special education teacher ☐

3. Gender

(i) Male ☐ (ii) Female ☐

4. Highest Educational Qualification

(i) Cert "A" ☐ (ii) Diploma ☐ (iii) Bachelor"s Degree ☐ (iv) Master"s Degree ☐ (v) Others ☐

5. As a teacher choose the range of years for which you have been teaching?

(i) 1-10 years ☐ (ii) 11-20 years ☐ (iii) 21-30 years ☐ (iv) 30 years and above ☐

Section B: Teachers' Knowledge of Differentiated Instruction

Indicate your level of agreement about differentiated instruction using the scale below:

1=Strongly Disagree; 2= Disagree; 3=Agree; 4=Strongly Agree

S/N	STATEMENT	1	2	3	4
1.	The curriculum is based on major concepts and generalizations.				
2.	Teachers must use a variety of materials other than the standard text in DI.				
3.	Teachers are mandated to clearly articulate what they want students to know, understand and be able to do in differentiated instruction.				
4.	In differentiated instruction, teachers must provide a variety of support mechanisms (e.g., organizers, study guides, study buddies).				
5.	Teachers collaborate with students about their learning in the differentiated classroom.				
6.	In the differentiated instructed classroom, the teacher should assess each student"s readiness level, interest level, and learning profile/style				
7.	Contents, processes and products must constantly be modified in the differentiated classroom.				
8.	Teachers must show respect for their learners" commonalities and differences in the differentiated classroom.				
9.	Every assignments must offer students clear and appropriate criteria for success; focus on real-world relevance and application.				
10.	Using differentiated instruction in the classroom prepares students to take standardized tests.				
11.	When teachers differentiate instruction, they don"t create unfair workloads among students.				
12.	Differentiating instruction in the classroom prepares students to compete in the real world.				
13.	Teachers in differentiated instructed classrooms use whole group instruction.				

Section C: Teachers' Practice of Differentiated Instruction

Indicate the frequency of occurrence to your practice of differentiated instruction using the scale below:

1=Never Occurs; 2=Rarely Occurs; 3=Often Occurs; 4=Always Occurs

S/N	STATEMENT	1	2	3	4
1.	I use materials of varied readability and/or interest.				
2.	I provide a variety of support mechanisms (organizers, study guides, study buddies).				
3.	My lesson involves major concepts of the subject.				
4.	My lessons encourage student to seek and value alternative modes of investigation or problem solving.				
5.	I "teach to the middle" to reach the majority of students.				
6.	The pace of my instruction varies based on individual learner needs.				
7.	I group students for learning activities based on readiness, interests, and/or learning preferences.				
8.	I structure classroom environment to support a variety of activities including group and/or individual work.				
9.	The product form of my instruction connects with student interest.				
10.	My group composition changes based on the activity for the lesson.				
11.	I provide multiple modes of expression in the final product.				
12.	I provide variety of assessment tasks.				
13.	I provide students with the choice to work alone, in pairs or small group.				

Section D: Challenges to differentiated instruction

Indicate your level of agreement about challenges to differentiation using the scale below:

1=Strongly Disagree; 2=Disagree; 3=Agree; 4=Strongly Agree

S/N	STATEMENT	1	2	3	4
1.	Differentiated instruction is another fad in instructional approaches.				
2.	Time factor always poses a threat to differentiated instruction.				
3.	Teachers are apprehensive for the concept-based teaching with the pressure of standardized tests in differentiation of instruction.				
4.	Differentiated instruction is another bureaucratic mandate heaped upon teachers.				
5.	Teachers cannot differentiate instruction if professional development resources are absent.				
6.	Lack of administrative support hinders the practice of differentiated instruction.				
7.	It is very difficult to assess the readiness level of students.				
8.	How to match appropriate resources with teaching is a challenge to teachers in differentiation of instruction.				
9.	Teachers fear that there are no teacher models to talk to about differentiation of instruction.				
10.	Teachers are not able to practice differentiated instruction due to limited space for group work.				
11.	Teachers lack knowledge on how to address academic diversity in differentiation of instruction.				
12.	As a teacher, adjusting teaching practice as differentiated instruction is always disorienting and upsetting.				
13.	Large class size is one of the major threats in differentiated instruction.				

APPENDIX "B"

INTERVIEW SCHEDULE

1. How often do you attend professional events, inside and outside this school building?
2. Do any of these events provide instructional strategies discussing differentiation?
3. What does differentiated instruction mean?
4. What activity do you take students before instructing them in a new lesson?
5. What are some of the common strategies you use to differentiate a lesson?
6. How well do students learn in your classroom? How do you know?
7. Does time pose a threat to differentiation of instruction? If yes, in what way?
8. Does large class size pose a threat in differentiated instruction? If yes, why?

APPENDIX "C"

UNIVERSITY OF EDUCATION, WINNEBA
FACULTY OF EDUCATIONAL STUDIES
DEPARTMENT OF BASIC EDUCATION

Date: December 5, 2017

The Director
Junior Education Directorate
University
P. O. Box CS
Bechem – BAR

Dear Sir/Madam

LETTER OF INTRODUCTION

I write to introduce to you, Mr. Patrick Kyeremeh, a second year M.Ed. student at the Department of Basic Education, University of Education, Winneba with registration number [redacted].

Mr. Patrick Kyeremeh is to carry out a research on the topic *Junior High School Mathematics Teachers' Knowledge and Practice of Differentiated Instruction in Two North Districts in the Brong Ahafo Region*.

I would be grateful if permission is granted him to enable him carry out his studies in your School.

Thank you.

MR. KWEKU ESIA DONKOH
(Ag. Head of Department)

APPENDIX "D"

GHANA EDUCATION SERVICE

In case of reply, the date, the number and this letter should be quoted

Our Ref: GES/TSD/EP/(36)/V.2/[illegible]

Your Ref:

Tano South District Education Office
P. O. BOX 38
Techiman – B/A
Tel: 35320-92029/92040

4th January, 2018

REPUBLIC OF GHANA

ALL JHS HEADS (PUBLIC)
TANO SOUTH

LETTER OF INTRODUCTION
MR. PATRICK KYEREMEH
SCHOOL REGD. NO: 8160030019

Mr. Patrick Kyeremeh is a Second year M. Phil Student of the Department of Basic Education University of Education, Winneba.

The Ag. Head of Department has written to this office for an introductory letter for Mr. Patrick Kyeremeh to enable him carry out a Research on the topic: "**Junior High Schools Mathematics Teachers' Knowledge and Practice of Differentiated instruction in Tano South District in the Brong Ahafo Region.**"

Kindly accord him the necessary assistance needed.

Thank you.

PHILOMENA OWUSU BOAMPONG (MRS.)
DEPUTY DIRECTOR – A/F
FOR: AG. DISTRICT DIRECTOR
TANO SOUTH

Cc:
- THE HEAD, INSPECTORATE UNIT, GHANA EDUCATION SERVICE, **TANO SOUTH**
- ALL CIRCUIT SUPERVISORS, GHANA EDUCATION SERVICE, **TANO SOUTH**
- THE AG. HEAD OF DEPARTMENT, FACULTY OF EDUCATIONAL STUDIES, DEPARTMENT OF BASIC EDUCATION, **WINNEBA**
- MR. PATRICK KYEREMEH, 2ND YEAR M.PHIL STUDENT, DEPARTMENT OF BASIC EDUCATION, **WINNEBA**

[illegible]

APPENDIX "E"

RELIABILITY COEFFICIENTS OF THE VARIABLES

Reliability Statistics of All the Variables (Knowledge, Practice & Challenges)		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.907	0.907	39

Reliability Statistics of Knowledge		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.819	0.827	13

Item-Total Statistics of Knowledge

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
The curriculum is based on major concepts and generalizations	27.60	38.267	0.512	0.803
Teachers must use a variety of materials other than the standard text in DI	27.40	42.489	0.127	0.832
Teachers are mandated to clearly articulate what they want students to know, understand and be able to do in differentiated instruction	26.80	35.956	0.694	0.787
In differentiated instruction, teachers must provide a variety of support mechanisms (e.g., organizers, study guides, study buddies)	27.10	40.767	0.638	0.804
Teachers collaborate with students about their learning	26.90	44.544	-0.012	0.835
Teacher should assess each student"s readiness level, interest level, and learning profile/style	27.10	40.100	0.327	0.817
Contents, processes and products must constantly be modified in DI classroom	27.20	34.400	0.626	0.791
Teachers must show respect for their learners" commonalities and differences	27.00	37.556	0.645	0.793
Every assignments must offer students clear and appropriate criteria for success; focus on real-world relevance and application	27.20	36.622	0.511	0.803
Differentiated instruction prepares students to take standardized tests	27.30	41.344	0.203	0.828
Differentiated instruction creates fair workloads among students	27.10	38.989	0.651	0.797
Differentiated instruction prepares students to compete in the real world	26.80	39.733	0.422	0.810
Teachers in differentiated instructed classrooms use whole group instruction	27.30	34.456	0.813	0.775

Reliability Statistics of Practice		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.866	0.870	13

Item-Total Statistics of Practice

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
I use materials of varied readability and/or interest	27.40	52.933	0.753	0.845
I provide a variety of support mechanisms (organizers, study guides, study buddies)	27.00	58.889	0.215	0.874
My lesson involves major concepts of the subject	26.30	53.789	0.589	0.853
My lessons encourage student to seek and value alternative modes of investigation or problem solving	26.60	58.711	0.268	0.870
I “teach to the middle” to reach the majority of students	26.40	56.711	0.540	0.858
The pace of my instruction varies based on individual learner needs	26.70	57.567	0.307	0.869
I group students for learning activities based on readiness, interests, and/or learning preferences	26.90	44.989	0.813	0.836
I structure classroom environment to support a variety of activities including group and/or individual work.	26.70	53.567	0.606	0.852
The product form of my instruction connects with student interest	27.10	50.767	0.571	0.855
My group composition changes based on the activity for the lesson	26.90	54.322	0.453	0.862
I provide multiple modes of expression in the final product	26.70	56.456	0.589	0.856
I provide variety of assessment tasks	26.40	54.489	0.618	0.852
I provide students with the choice to work alone, in pairs or small group	26.90	51.211	0.751	0.843

Reliability Statistics of Challenges

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.831	0.851	13

Item-Total Statistics of Challenges

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Differentiated instruction is another fad in instructional approaches	27.90	42.322	0.762	0.801
Time factor always poses a threat to differentiated instruction	27.50	53.611	-0.225	0.865
Teachers are apprehensive for the pressure of standardized tests in differentiation of instruction	26.80	42.400	0.655	0.806
Differentiated instruction is another bureaucratic mandate heaped upon teachers	27.30	46.011	0.909	0.811
Teachers cannot differentiate instruction if professional development resources are absent	26.70	47.567	0.193	0.841
Lack of administrative support hinders the practice of differentiated instruction.	27.20	45.289	0.407	0.824
It is very difficult to assess the readiness level of students	27.30	39.567	0.667	0.803
How to match appropriate resources with teaching is a challenge to teachers	27.20	43.956	0.519	0.816
Teachers fear that there are no teacher models to talk to about differentiation of instruction	27.50	42.056	0.601	0.809
Teachers are not able to practice differentiated instruction due to limited space for group work	27.30	45.344	0.311	0.834
Teachers lack knowledge on how to address academic diversity in differentiation of instruction	27.00	43.778	0.613	0.811
As a teacher, adjusting teaching practice as differentiated instruction is always disorienting and upsetting	26.80	45.956	0.426	0.823
Large class size is one of the major threats in differentiated instruction	27.50	39.389	0.823	0.790