ASEAN Journal for Science Education

Journal homepage: https://ejournal.bumipublikasinusantara.id/index.php/ajsed

# Exploring Effective Differentiated Instruction in The Teaching and Learning of Mathematics

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## ABSTRACT

This study, seeks to explore the use of differentiated instruction to facilitate effective teaching and learning. The sequential explanatory mixed methods design was used to guide this study. In this design, the researchers first collected quantitative, analyzed and interpreted the results, and thereafter collected qualitative data on typical issues that emerged from the quantitative data to support and further explain the quantitative findings. In the quantitative phase, a sample of 125 participants, comprised 50 early-grade facilitators, 25 upper primary facilitators, 30 Junior High School facilitators, 10 head facilitators, 9 School Inspection Officers, and 1 Mathematics coordinator. The instruments used were a questionnaire and interview for the facilitators, and interviews with the mathematics coordinator, head teachers, and school inspection officers. The findings of the paper revealed that the implementation of differentiated instruction contributes to the improved academic performance of learners. Other important issues that emerged were overcrowded classrooms, limited time, lack or very little support from stakeholders, over-concentration on examinable topics, and lack of resources availabilities. It was recommended that mathematics teachers and other stakeholders get themselves acquainted with modern theories and methodologies in differentiated instruction.



## ARTICLE INFO

***Article History:***
*Submitted/Received 21 Feb 2023*
*First Revised 20 Apr 2023*
*Accepted 14 Jun 2023*
*First Available online 15 Jun 2023*
*Publication Date 01 Mar 2024*

***Keyword:***
*Differentiated instruction,*
*Facilitators,*
*Learners,*
*Mathematics,*
*Teaching and learning.*

## 1. INTRODUCTION

Differentiation describes the range of techniques that facilitators employ to better serve all needs of students in the classroom (Roiha & Polso, 2021). The facilitator's responsibilities are changing, and it's more important than ever to use pedagogies that effectively meet the requirements of all students by fostering an inclusive learning environment (Fountas & Pinnell, 2018). Students with disabilities or a history of poor accomplishment in mathematics have been systematically excluded from high-quality mathematics curricula. Although it is relevant to practice, there is still a lack of research on how facilitators seek to differentiate instruction and how they might be better supported to offer rich learning opportunities for all learners. Effectively differentiating teaching is a challenging component of mathematics facilitation at all levels of education, but it is especially crucial at the foundational level of the educational system because that is the level at which all learners are in terms of foundation, critical thinking, and development (Fountas & Pinnell, 2018).

According to Pozas *et al.,* (2020), and Sharp *et al.,* (2020), differentiated education relates to addressing learners' various learning phases. That did increase students' capacity for improved academic performance. Differentiated instruction should be used in the mathematics classroom to accelerate student growth (Hackenberg *et al.*, 2020). By applying this technique to the learning process, students can reach their goals in mathematics education on their terms. With differentiated instruction, students are allowed to learn subjects in a variety of ways, process ideas, and create products (Roiha & Polso, 2021). To account for the differences across learners, differentiated instruction can be. According to the learners' readiness, interests, and learning profiles, facilitators can differentiate the teaching through content, procedure, product, and environment research (Goddard *et al.,* 2015).

Differentiated instruction is linked to offering techniques and methods to heterogeneous groups (Marks *et al.*, 2021). Giving different groups of students alternative areas to learn to help them reach their different learning objectives is one way to implement differentiating instruction through content. By creating a variety of learning activities, facilitators can also distinguish along the process. The key to distinguishing the training through the product is to demonstrate the learning by generating distinct products. In contrast, facilitators should modify the classroom environment when differentiating education through the environment. Small-group instruction, tiered assignments, and individual projects are just a few examples of the several tactics that can be employed to implement instruction.

Although many facilitators may already be using tactics to address the diversity of their students, Melesse (2016) argues that they are still far from understanding differentiated instruction. Although there are some courses on differentiated instruction available for facilitators, additional information on differentiated instruction methodologies is still required (Njagi, 2014; Hidayati, 2020).

The usefulness of using differentiated instruction in the classroom was described in recent studies. Differentiated instruction improved students' mathematics achievement, according to Awofala and Lawani (2020). When instruction was differentiated, students were more engaged and motivated (Hapsari *et al.*, 2018). Learners' achievement benefited from facilitators' professional development for individualized teaching in the classroom (Prast *et al.,* 2018). Ismajli and Imami-Morina (2018) demonstrated that facilitators who use interactive tactics to address all of the learners' demands can successfully execute differentiated instruction.

Although most students are multimodal to some level, many of them have a particular learning style that they find most effective for helping them learn and retain new material.

DOI:
p- ISSN 2828-3287 e- ISSN 2828-3295

Each learner gets the chance to learn since lessons are presented in many ways. Numerous research looked into how diversified instruction affected student involvement, academic achievement, and other factors. Results showed that there were noticeable discrepancies in the findings (Aranda & Zamora, 2016; Muthomi & Mbugua, 2014). According to the majority of research, flexible grouping, scaffolding, and differentiation of instruction based on learner requirements improved student performance. Some obstacles and limitations must be overcome to give students the chance to receive customized instruction. It was discovered that learners whose teaching was differentiated as compared to those whose instruction was not differentiated did not significantly differ as a result of inadequate training, support, and resources in the differentiation of instruction (Aranda & Zamora, 2016).

Although this method has been used in many nations, including the United States, Australia, Europe, Germany, Scotland, the Middle East, and Asian nations, differentiated instruction is now recommended at the Basic Education level in Ghana. The Ministry of Education in Ghana places a high value on differentiated teaching, which is why it has pushed for and encouraged its adoption in classrooms at every grade level nationwide through the National Council for Curriculum and Assessment. Since each learner would be exposed to the subject in a way that best suits his or her learning preferences, differentiation will aid in motivating and making mathematics learning in Ghanaian classrooms meaningful and enjoyable.

Differentiated instruction is a way for meeting the unique requirements of all students by utilizing a variety of instructional strategies. All students will benefit from receiving differentiated instruction in math sessions because multiple pathways are constantly developed to encourage academic success among them. Because of this, the existing educational system in Ghana and the rest of the globe call on facilitators to satisfy learners' requirements regardless of how different those needs are, as well as their cultural and social contexts. The Ghanaian mathematics curriculum emphasized the use of contemporary pedagogies, such as differentiated instruction, to enhance math learning. According to Borja *et al*. (2015), differentiated instruction techniques are meant to increase student academic performance by assisting learners in resolving disparities and inequalities in their various skills, capacities, and learning styles. Additionally, it accelerates students' academic achievement (Hackenberg *et al.,* 2020).

However, the results in mathematics show that students performed poorly at the end of their eleven (11) years of attendance at the basic level, despite the Ministry of Education and other Non-Governmental Organizations encouraging facilitators to use differentiated instruction in the classroom to improve subject learning. Results from the BECE showed that students underperformed; for instance, in 2018, roughly 56% of students failed, in 2019, about 54% failed, and in the 2020 BECE, 53% failed. A below-average 43% of students passed in 2021. Despite the advantages of using differentiated instruction to meet the needs of all students in the mathematics classroom, most facilitators do not use it due to its concepts and application. Others simply complain that there is not enough time, and others also lament the absence of the resources required to implement such instruction in the classroom. The majority of facilitators have never heard of the idea and are unable to use it in math classes. This background served as the backdrop for the paper, which examined the implementation of differentiated education and the difficulties encountered in the Wa municipality of Ghana's upper west area.

Specifically, the study sought to answer the following questions:

(i) How can effective implementation of differentiated instruction improve performance in mathematics?

DOI:
p- ISSN 2828-3287 e- ISSN 2828-3295

(ii) What factors can impede effective differentiated instruction in Mathematics?

## 2. THEORETICAL FRAMEWORK

Vygotsky provides one of the proven methods for teaching mathematics to all students, regardless of their social, cultural, religious, or economic background. Vygotsky's zone of proximal development and socio-cultural theory of learning were the two premier theories that most strongly advocated for the use of tailored teaching to facilitate mathematics sessions. In particular, the socio-cultural theory, which is founded on the idea that social contact within a cultural context is necessary for learners to develop cognitively, is crucial for facilitating mathematics instruction and general training for all learners (Riyanto *et al*., 2021; Shah, 2022; Jadhav *et al*., 2022).

Vygotsky's theory is essential for differentiation as education is regarded as a process rather than a finished product. Since everyone enters the classroom with some level of knowledge and experience, this theory emphasizes social interaction and believes that the learner-facilitator connection should be cooperative and cordial (Marks *et al.*, 2021). As applied to this theory, mathematics instructors are urged to employ differentiation in mathematics instruction to create learning communities where students can collaborate and interact with one another, while at the same time, taking all their cultural and social contexts into account.

Recently, the theory of differentiation adds more impetus to Vygotsky (Dixon *et al.,* 2014). In this light, differentiation means modifying content, process, products, and learning environment based on students' readiness, interests, and learning profiles. Content refers to what students are expected to learn. Process designates the activities implemented to ascertain that students understand the topics covered whereas products denote the ways students demonstrate their learning. Learning environment simply means the psycho-social learning environment and the atmosphere in the classroom. Readiness refers to students' current stage concerning particular learning goals, interests to students' affinity and preferences, and learning profile to the ways students prefer to learn.

In addition, teachers should annually opt for a few strategies that require little preparation and one strategy that requires a lot of preparation. Teachers should equally annually add a similar set of new strategies on top of the existing ones, which, in a few years, results in an extensive repertoire of differentiation practices. This classification provides a more concrete tool for teachers to approach differentiation in much more vigorous ways.

## 3. METHODS

### 3.1. Research design

The sequential explanatory mixed methods design was used in this paper. This made the collection of both qualitative and quantitative possible. In the sequential explanatory design, quantitative data were collected first and analyzed, followed by the collection and analysis of qualitative data to support and further explain the quantitative findings. To support the quantitative findings from the questionnaire, interview guides were administered to augment and buttress the findings robustly.

### 3.2. Participants

The study was made up of 125 participants of the Wa Municipality in the Upper West Region of Ghana, comprising 50 early grade facilitators, 25 upper primary facilitators, 30 Junior High School facilitators, 10 head teachers, 9 school inspection officers, and 1

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p- ISSN 2828-3287 e- ISSN 2828-3295

mathematics coordinator. While the facilitators, head teachers, and school inspection officers were randomly selected, the mathematics coordinator was purposely sampled since the Municipality has only one Mathematics coordinator.

The facilitators were included in the study because of their role in implementing the curriculum in the classroom by using instructional methods that will help benefit all learners in the classroom. Headteachers played the role of ensuring that facilitators implement the right methods in the classroom. School Inspection Officers ensured that facilitators and headteachers in their circuits implement the right curriculum and use instructional methods that will benefit all learners. The Mathematics Coordinator ensured that Mathematics was taught through differentiation strategies.

### 3.3. Instruments and procedure

The instrument used were questionnaires and interview guides for the facilitators, and interviews with headteachers, School Inspection Officers, and the Mathematics coordinator. The questionnaire was distributed over a month for the respondents to use and respond appropriately. The researchers used to call the respondents every weekend to remind respondents and encourage them to see the need to answer the survey questions. After, one month, the questionnaire was collected from respondents. Also, on the other side the headteachers, School Inspection Officers, and Mathematics coordinator were interviewed face to face in their offices, which took about 23 minutes. The questionnaire for facilitators, headteachers, and School Inspection Officers was of a closed type and a few open questions for respondents to express themselves further.

## 4. RESULTS AND DISCUSSION

**Table 1** shows that the majority (76.2%; 80 respondents) agree that in differentiating instruction facilitators first need to recognize learners' relevant previous knowledge and a few 25 (23.8%) disagree with it. From the table, the majority of the respondents agree that facilitators need to know and recognize learners' relevant previous knowledge before actual facilitating is done which is a core mandate of every topic. In an interview with a Mathematics facilitator got this too, *"……infacilitatingMathematics especial one needs to know your learners' previous knowledge before facilitating…. you know what? Mathematics is a build-up subject which must be taught from known to unknown…". In addition, the Mathematics coordinator said, "...we have always encouraged our facilitators to know the relevant previous knowledge before facilitating and will continue to do that until every practice that…."*

Again, the majority (50 respondents;47.6%) disagree, while 36 (34.3%) of the respondents agree and only 19(18.1%) of the respondents were uncertain that facilitators do take into consideration learners' readiness and interests before facilitating. Confirming this in an interview a facilitator said, "*…how will I consider the learner's readiness and interests before facilitating. If the child is not ready, why is he/she in that class…… I only teach to cover my syllabus as proposed by curriculum because examiners do not consider learners readiness and interest before examining them….*"

In addition, the majority (48 respondents; 45.7%) were uncertain that facilitators show respect for their learners' commonalities and differences, while 40 (38.1%) respondents disagreed, and only 17 (16.2%) respondents agree that facilitators do show respect for their learners' commonalities and differences. In an interview, a facilitator had this to… "*boss just walk into my class and see things for your…a class of seventy-two how will one study the individual difference of these learners…it is just not possible*". This was confirmed by a

DOI:
p- ISSN 2828-3287 e- ISSN 2828-3295

headteacher "*…classes are too large for this approach of facilitating to be applied during facilitating. The method is good but the resources are not available….hmmmmm..*".

**Table 1.** Implementation of differentiated instruction and improved performance.

| No. | Facilitatorperceivedknowledge of differentiated instruction | Agree F (%) | Uncertain F (%) | Disagree F (%) | Total |
|---|---|---|---|---|---|
| 1 | In differentiated instruction, facilitators first need to recognize learners' relevant previous knowledge. | 80 (76.2%) | 0 (0%) | 25 (23.8%) | 105 (100%) |
| 2 | Facilitators do take into consideration learners' readiness and interests before facilitating. | 36 (34.3%) | 19 (18.1%) | 50 (47.6%) | 105 (100%) |
| 3 | Facilitators do show respect for their learners' commonalities and differences | 17 (16.2%) | 48 (45.7%) | 40 (38.1%) | 105 (100%) |
| 4 | Facilitators must use a variety of materials other than the standard text. | 23 (21.9) | 7 (6.7%) | 75 (71.4%) | 105 (100%) |
| 5 | Facilitators must provide a variety of support mechanisms (e.g., organizers, study guides,) in differentiating instruction in the Mathematics classroom | 6 (5.7%) | 79 (75.2%) | 21 (20%) | 105 (100%) |
| 6 | Facilitators do not create unfair workloads among learners in differentiated instruction in the Mathematics classroom | 49 (46.7%) | 37 (35.2%) | 19 (18.1%) | 105 (100%) |
| 7 | Facilitators do allow learners to select their way of showing mastery of the content taught in differentiating instruction in the Mathematics classroom. | 1 (0.95%) | 10 (9.2%) | 94 (89.5%) | 105 (100%) |

Also, the majority (75 respondents; 71.4%) disagree, while a few 23 (21.9%) agree, and only 7 (6.7%) of the respondents are uncertain that facilitators must use a variety of materials other than the standard text. This a facilitator has to say in an interview… "*variety of material in which class…this one of over sixty learners even if the materials are available…it simply not possible my son…not now…*" A head also added that *"…common curriculum materials for the new curriculum implemented since 2021 for the JHS are not available…government and the ministry of education are too relaxed in terms of education making facilitators also relaxed…how will the education sector ever improve…. we all new to wake from our sleep…*".

Furthermore, **Table 1** shows that many (79 respondents; 75.2%) were uncertain, while a few 21 (20%) disagreed and only 6 (5.7%) of the respondents agreed that facilitators must provide a variety of support mechanisms in differentiating instruction in the Mathematics classroom. In an interview, the Mathematics coordinator has this to say, "*…we have always reminded these facilitators to give the maximum support to their learners and I hope they are doing just that…*". This a facilitator confirmed by saying, "*…we give all the necessary support to our dear learner…every facilitator will do just that for facilitating and learning to be made easy…but sometimes this number thing makes it difficult to give the maximum support they need…*".

DOI:
p- ISSN 2828-3287 e- ISSN 2828-3295

The majority (49 respondents; 46.7%) agreed while 37 (35.2%) were uncertain and only 19 (18.1%) of the respondents disagreed that facilitators do not create unfair workloads among learners in differentiated instruction in the Mathematics classroom. In an interview, a mathematics facilitator said, "…*I do give the same work, that is exercises, homework, assignment to my learners, and all learners are expected to give the same feedback*…". Another facilitator said that "…*all learners are taught the same reading materials and the same content are taught to the same group of learners and hence it is expected that the same workload is given to the same group of learners*..."

The majority (94 respondents; 89.5%) disagree. A few 10 (9.2%) of the respondents were uncertain and only 1 (0.95%) of the respondents agree that facilitators do allow learners to select their way of showing mastery of the content taught in differentiating instruction in the Mathematics classroom. In an interview a facilitator had this to say, "…*my class population is 67, how do I use differentiated instruction in such a class…. It not possible…for things to be made easier for you one need to use the traditional methods of facilitating*…". Another facilitator said, "…*for one to use differentiated instruction in the classroom, the class population of 25 to 30 will be okay but in my case, my class population is about 59 learners, how can I use differentiated instruction in this class*…"

The results in **Table 2** show that the majority (71 participants; 67.6%) of the agree that the lack of a structured curriculum based on prerequisites, substantive and transformational knowledge, and skills in differentiated instruction. While, 30(28.6%) disagree with this assession and a few 4(4.8%) were uncertain that the lack of a structured curriculum based on prerequisites, substantive and transformational knowledge, and skills on differentiated instruction is a challenge in implementing differentiated instruction in the classroom. In an interview, the Mathematics coordinator had this to say, "…my bro, we indeed have the curriculum for all the subjects including Mathematics…this curriculum talks about the area that needs to be dealt with, that is the strands, sub-strands, core points and even the suggested resources needed for each strand …. but did not indicate how each strand will be taught using differentiated instruction…".

A facilitator said, "…even though the curriculum suggested the used of differentiated instruction but one challenge is the curriculum did not indicate how it can be done…" Also, the majority (53 participants; 50.5%) agree that Facilitators' inability to sufficiently ascertain their learners' ability and readiness, while 38(36.2%) disagree with that Facilitators' inability to sufficiently ascertain their learners' ability and readiness, and few 14(12.3%) were uncertain that Facilitators' inability to sufficiently ascertain their learners' ability and readiness. A facilitator had this to say in an interview, "…hmmm…to me if the learner is in a class, I assume the child is ready for that class and is supposed to learn what the curriculum in the stage has proposed for the learner to learn…it is a bigger challenge to wanting to know learner readiness before facilitating and learning…"

Again, the majority (69 respondents; 65.7%) agree that Facilitators' inexperience in designing appropriate activities to address learners' readiness, ability, interests, learning style, and incentives is a challenge while 31(29.5%) disagree and a few 5(4.8%) were uncertain that Facilitators' inexperience in designing appropriate activities to address learners' readiness, ability, interests, learning style and incentives is a challenge. In an interview a facilitator has this to say, "…sir, I must confess this is about my third time of hearing differentiated instruction and I do not know the details of it and how to apply that in the Mathematics classroom…. I have never attended a workshop or Inservice training on something like this since I started facilitating for the past ten years…". Another facilitator has this to, "…I do not even know if our authorities know something like this. I am even surprised

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p- ISSN 2828-3287 e- ISSN 2828-3295

that workshops and In-service training of such has not been organized for us as facilitators…ask the Mathematics coordinator whether he knows something like that…it will surprise you sir…. hahaha hahaha…".

**Table 2**. Factors that impede effective differentiated instruction of mathematics.

| No. | Challenges | Agree | Disagree | Uncertain | Total |
|---|---|---|---|---|---|
| 1 | The lack of a structured curriculum based on prerequisites, substantive and transformational knowledge, and skills in differentiated instruction. | 71 (67.6%) | 30 (28.6%) | 4 (4.8%) | 105 (100%) |
| 2 | Facilitators' inability to sufficiently ascertain their learners' ability and readiness | 53 (50.5%) | 38 (36.2%) | 14 (12.3%) | 105 (100%) |
| 3 | Facilitators' inexperience in designing appropriate activities to address learners' readiness, ability, interests, learning style, and incentives. | 69 (65.7%) | 5 (4.8%) | 31 (29.5%) | 105 (100%) |
| 4 | Poor class organization and weaknesses in the organization of group work due to overcrowded class sizes resulted in facilitators not being able to manage the class and facilitating time being wasted. | 73 (69.5%) | 21 (20%) | 11 (10.5%) | 105 (100%) |
| 5 | Much support is not given to facilitators in the area of differentiated instruction from the necessary agency like the Ministry of Education, Ghana Education Services, Non-Governmental Organizations, etc. | 93 (88.6%) | 0 (0%) | 12 (11.4%) | 105 (100%) |
| 6 | The use of the facilitator-centred method of facilitating in the classroom due to facilitators' misconceptions such as the idea that the facilitator is the source of knowledge and has to transfer it to his or her learners. | 83 (79.04%) | 3 (2.9%) | 19 (18.1%) | 105 (100%) |
| 7 | Most facilitators do not implement differentiated instruction in their facilitating due to the fear of not completing the Mathematics curriculum even if the learners have knowledge gaps | 91 (86.7%) | 12 (11.4%) | 2 (1.9%) | 105 (100%) |
| 8 | Most facilitators fear and uncertainty about their ability to successfully differentiate their lessons. | 87 (82.9%) | 10 (9.5%) | 8 (7.6%) | 105 (100%) |

Confirming this the Mathematics coordinator has this to say, "…hmmmmm!... The challenges in our education are so many that the ministry does not even allocate funding for such projects even if you propose…my first time hearing differentiated instruction over my twenty years of the facilitator was when I was a masters learner in UEW…how to promote the use of this differentiated instruction thing will be difficult because my facilitators themselves do not understand the concept well… where will I get the necessary resource for that training by bro…".

Also, the majority (73 respondents; 69.5%) agree, while 21(20%) and a few 11(10.5%) of the respondents were uncertain that Poor class organization and weaknesses in the organization of group work due to overcrowded class size resulted in facilitators not being able to manage the class and facilitating time being wasted. in an interview a facilitator has

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p- ISSN 2828-3287 e- ISSN 2828-3295

this to say, "…look, my dear, even if facilitators are taken through properly on this differentiated thing, our classroom organization and overcrowded classroom will not permit you to use this method of facilitating…" Another facilitator has this to say, "…the class size in this country will not allow a facilitator to use the right method in facilitating...this differentiated thing needs not more than thirty learners in the class…". This confirmed that in the implementation of differentiated instruction, the difficulties are a large number of classroom learners and poor classroom organization.

Also, the majority (93 respondents; 88.6%) agree that much support is not given to facilitators in the area of differentiated instruction from the necessary agency like the Ministry of Education, Ghana Education Services, Non-Governmental Organizations, etc and a few 12(11.4%) disagree to that assertion. In an interview, too much support was not given to facilitators in the area of differentiated instruction from the necessary agency like the Ministry of Education, Ghana Education Services, Non-Governmental Organizations, etc a facilitator has this to say, "…not only this area that facilitators are not given this support but all areas…the ministry do not have time for we facilitators in the classroom….".

Another facilitator has this to say. "…can you believe as a facilitator for the past three years, I have not attended a single workshop to equip myself on new methods and others about facilitators…for differentiated instruction, since I started facilitating almost twenty (20) years I have never attended any workshop on differentiated instruction…". In confirming this the Mathematics coordinator has this to say, "….

The majority (83 respondents; 79.04%) agree, while a few 19(18.1%) disagree and only 3(2.9%) of the respondents were uncertain that, the use of the facilitator-centered method of facilitating in the classroom due to facilitators' misconceptions such as the idea that the facilitator is the source of knowledge and has to transfer it to his or her learners is a challenge. In an interview a facilitator has this to say, "…my son or what, these learners are not ready to learn… after the lesson or during and sometime before the lesson, learners are not ready to answer a question or even contribute during facilitating… they would even ask questions for clarification, making the lesson boring and facilitator centered…". Another facilitator confirmed this by saying, "… hmm, today's children are not ready to learn...ask them questions and they would not mine you…well, it is not easy using this method of facilitating considering the number of children in the classroom…".

Again, the majority (91 respondents; 86.7%) agree, while a few 12(11.4%) were uncertain and only 2(1.9%) of the respondents disagree that most facilitators do not implement differentiated instruction in their facilitating due to the fear of not completing the Mathematics curriculum even if the learners have knowledge gaps. Confirming this in an interview a facilitator has this to say, "…how will you complete the curriculum with this method of facilitating…I do not even understand well…. let me confess this is my time of hearing this method of facilitating…".

Another facilitator said, "… the curriculum is so loaded that if one wants to use a method like this, then be ready you can never finish…". This, the Mathematics coordinator said, "…the truth is most of these facilitators do not understand how to use this method of facilitating and hence the claim of not completing the curriculum…and resources are not available for us to organize workshops, and in-service training for these facilitating…"

Also, the majority (87 respondents; 82.9%) agree while a few 10(9.5%) were uncertain and only 8(7.6%) of the respondents disagree that most facilitators fear and uncertainty about their ability to successfully differentiate their lessons. In an interview, a facilitator said, "…… indeed, I do not use differentiated instruction in the classroom….since I do not want to disgrace myself…if you do not know something, you do not try it…." Another facilitator added

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p- ISSN 2828-3287 e- ISSN 2828-3295

saying, "…. how do I differentiate instruction when I do not know the learning styles of my learners…they are so many in the class that it will be difficult for one to differentiate your instruction…."

## 5. DISCUSSION

This section discusses the two research questions in the order of their appearance. Firstly, the results of the study suggest that overall, facilitators saw differentiated instruction very positively but difficult to implement due to so many factors. Findings from both the quantitative and qualitative analyses of the study were in support of each other. The survey results as well as interview findings indicated that similar to many previous studies, facilitators had a strong faith in using differentiation for their learners. Although facilitators' perception of differentiation was high, they had a remarkably low perception concerning the amount of support they get from management. Besides, the interview results revealed that facilitators viewed the implementation of differentiated instruction as a challenging thing, which is time-consuming, lack of resource availabilities, overcrowded classrooms, over-concentrated curriculum, tiring endeavor, lack of management support, and many others. Hence, the overall positive perception found in the study can be attributed to facilitators' beliefs concerning the benefits. Most studies in general support the notion that facilitators do have a positive perception of the use of differentiated instruction as is found in this study (Sharp *et al.*, 2020).

On the other hand, studies that engaged a different conceptualization of perception have come up with different findings. For instance, studies that investigated facilitators' perceived ability to differentiate lessons reported negative or low levels of perception scores. Similarly, facilitators viewed differentiation implementation as complex, challenging, and daunting. Hence, the negative perception of most facilitators on such items about challenges and support for its implementation. Facilitators' perception of differentiated instruction can vary depending on the type of inquiry that is made. If their perception of differentiation is studied based on the advantages to learners, the results are likely to be positive, whereas if it is regarding the provision of the actual implementation, the result might be negative or low. For instance, most of the respondents agree that in differentiated instruction facilitators first need to recognize learners' relevant previous knowledge and that was a daily routine for most facilitators and they see it very necessary to be done. On the issue of facilitators taking into consideration learners' readiness and interests before facilitating, most of the responses were very negative, since facilitators in both qualitative and quantitative data suggest that facilitators teach what is provided to them by NaCCA and they are instructed to teach the learners base on that since that will be examinable. In an interview, facilitators saw the need to consider learners' readiness and interests before facilitating (Pozas *et al.*, 2020) but the curriculum will not permit them to do so since they are guarded as to what to do.

With regards to facilitators showing respect for their learners' commonalities and differences most of them in practice do not do so with the excuses that the learners population in the class is so much that one cannot easily identify learners' commonalities and differences which in principle in an interview they agree it was an important thing one need to consider (Bondie *et al.*, 2019) but with the number of learners in their classroom and with the limited time provided for them to complete the overloaded curriculum it will be very difficult for one to consider learners' commonalities and differences hence the negative response.

On facilitators using a variety of materials other than the standard text, it either too had low or negative responses since data available suggested that most facilitators do not use

DOI:
p- ISSN 2828-3287 e- ISSN 2828-3295

different material other than the standard one provided since learning is concentrated in learners writing final exams based on what is provided. Therefore, one needs to only use the standard curriculum for the fear of the learners failing BECE if they use a variety of materials in facilitating, even though most of them agree in an interview that in using differentiated instruction one needs to use a variety of materials to satisfy the needs of all learners in the classroom since most of them come with different learning styles (Pozas *et al.*, 2020; Sharp *et al.*, 2020) but in practice, they do not because of the fear of examination which direct them as what to teach.

Also, on facilitators providing a variety of support mechanisms in differentiating instruction in Mathematics classrooms in principle most of the respondents agree that it was very necessary to give support mechanisms to learners in differentiating instruction but in practice facilitators do not do it most of the time, all in the name of overcrowded classroom and some also complain of the workload in the classroom for a single person to handle effectively in the classroom (Magableh & Abdullah, 2020).

Concerning the second question on challenges in implementing differentiated instruction in facilitating mathematics at the basic school level, the study found no significant difference in facilitators' perceptions based on the two demographic factors. Given the existence of these findings in related studies, the findings of this study are not surprisingly different. The importance of facilitators' experience and qualifications and their potential influence on facilitators' perception of differentiation cannot be denied. The findings of this study do not, in any way, discredit the role facilitators' experience and qualifications can play in changing their perception. The essence of the debate is that these facilitators simply might not have had enough experience in using differentiated instruction appropriately in Mathematics classrooms although they have been facilitating for many years. Furthermore, training programs that led to their qualifications might not have covered enough content that could have an impact on their perception of differentiation (Morgan, 2014).

Available findings suggest most facilitators are not able to sufficiently ascertain their learners' ability and readiness which poses a lot of challenges to the use of differentiation in Mathematics lessons. Also, facilitators' inexperience in designing appropriate activities to address learners' readiness, ability, interests, learning style, and incentives was a challenge in both the qualitative and quantitative available. This finding confirmed most research work that most facilitators do not use differentiation due to the simple facts of inexperience (Hidayati, 2020).

Again, overcrowded class size was also one of the challenges facilitators encounter in the implementation of differentiated instruction in Mathematics classrooms, discouraging them from implementing it. Many argued how they can use differentiation in the classroom with such huge numbers of learners suggesting until such numbers are reduced it would be very difficult to implement it in the classroom. Concerning stakeholders' support, findings indicate that much support is not given to facilitators in the area of differentiated instruction from the necessary agency like the Ministry of Education, Ghana Education Services, Non-Governmental Organizations, etc. which most facilitators lamented that they lack the basic knowledge of differentiated instruction yet no or little support is gotten from necessary agencies for them to be equipped with those skills (Ríordáin *et al.*, 2017).

Also, the use of the facilitator-centered method of facilitating in the classroom due to facilitators' misconceptions such as the idea that the facilitator is the source of knowledge and has to transfer it to his or her learners. Thus, most facilitators do not implement differentiated instruction in their lessons due to the fear of not completing the curriculum

DOI:
p- ISSN 2828-3287 e- ISSN 2828-3295

even if the learners have knowledge gaps. Some simply fear and are uncertain about their ability to successfully differentiate their lessons (Prast *et al.,* 2018).

## 6. CONCLUSION

The findings suggested that most facilitators do not implement differentiation in the Mathematics lesson due to so many factors like overcrowded classrooms, lack of resources, limited time, no or the lack of support from stakeholders, and lack of experience and knowledge hindering the implementation of differentiated instruction in the Mathematics classroom even though many research works to support the use of differentiated instruction as one of the appropriate and effective facilitating pedagogy that Mathematics facilitators can use to meet the needs of all learners since they come into the Mathematics classroom with different learning styles.

Most research work shows that the use of differentiation in the Mathematics classroom will help improve the learning of which qualitative data suggested that most facilitators held the view that when differentiation is implemented well in the Mathematics classroom learning will be effective and efficient. But the challengesMathematics facilitators faced in implementing differentiated instruction in the reason that discourage them from implementing in the classroom, hence one of the factors causing poor performance of learner academic performance in Mathematics.

It was recommended that stakeholders in education like the Government of Ghana, the Ministry of Education, and Ghana Education Service should frequently organize in-service training, workshops, and seminars for Mathematics facilitators' professional development on the use of differentiated instruction in the classroom.

Also, it is recommended that Mathematics coordinators, School Improvement Support Officers (SISO), and head teachers must try to maintain and encourage the use of differentiated instruction among Mathematicsfacilitator This will help build positive attitudes as to the use of differentiation instruction and also by addressing the challengesMathematicsfacilitators encounter in the use of this of it in the classroom.

Again, it is recommended that NaCCA should review the curriculum to emphasize more on the use of differentiated instruction and if possible, recommend how it can be used for each topic. Also, the necessary resource to accompany the curriculum must be looked at seriously in differentiated instruction.

Since most research works suggested a class size of not more than thirty learners for effective learning to be done, it is recommended that the Government of Ghana, the Ministry of Education, the Ghana Education Service, and Non-Governmental Organisations must build more schools to do away of the overcrowded classroom it when this is done that effective implementation of differentiation. Also, the school must come with the necessary resources for effective learning.

Mathematics facilitators should not be overburdened by management like SISO, and headteachers with a lot of workloads for them to get more time to adequately prepare to use differentiated instruction in the classroom.

## 7. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

DOI:
p- ISSN 2828-3287 e- ISSN 2828-3295

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DOI:
p- ISSN 2828-3287 e- ISSN 2828-3295