OPEN ACCESS JOURNALS
Indiana Journal of Arts & Literature
Abbriviate Tittle- Ind J Arts Lite
ISSN *(Online)*- 2582-869X
Journal Homepage Link- https://indianapublications.com/journal/IJAL

INDIANA PUBLICATIONS
PRODUCTIVE AND QUALITY RESEARCH

Research Article

Volume-02|Issue-07|2021

Exploring Colleges of Education Science Tutors' Views on Differentiated Instruction: A Case Study in the Volta Region, Ghana

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Article History
Received: 01.07.2021
Accepted: 13.07.2021
Published: 30.07.2021

Citation
Agbeko, D. T., Hason, R., & Kumabia, F. K. R. (2021). Exploring Colleges of Education Science Tutors' Views on Differentiated Instruction: A Case Study in the Volta Region, Ghana. *Indiana Journal of Arts & Literature*, 2(7), 30-44.

Abstract: *The study was to explore the viewpoints of science tutors working at colleges of education located in the Volta Region of Ghana regarding the implementation of differentiated instruction. Case study methodology, which is qualitative in nature, was used as the design strategy for this study. The research utilised a method known as purposive sampling to collect data from a group of 32 science tutors working in colleges of education in the Volta Region of Ghana. These science tutors were chosen for the study since they maintained constant direct instructional contact with students and had prior teaching experience both inside and outside of colleges. To acquire data, interviews were conducted. Different science tutors were discovered to have varying levels of understanding about topics, learning styles, learner interest, learner variety, methodology, and lesson planning. The findings also demonstrated that most science teachers who did not implement differentiated instruction in their classrooms were aware of the strategy, but they chose not to implement it in their classes for a variety of reasons, including a lack of available time, the difficulty of the strategy, and an excessive amount of existing work. The findings also demonstrated that most of the scientific tutors did not make use of the feedback provided by the assessments they administered to direct their instruction. According to the science tutors, the students were always provided with the marking schemes so that they could self-correct. The findings of the classroom observation revealed that these instructors do not teach in a way that caters to the various needs of their students. Most participants continue to subscribe to conventional classroom teaching practises that are predicated on a cookie-cutter approach that has been shown to be unsuccessful. The study's results show that tutoring universities should teach student teachers how to use differentiated education and hold seminars for tutors on how to use differentiated education.*

Keywords: Differentiated, Instruction, Science tutors, Perspectives', College of Education.

INTRODUCTION

Teachers differentiate instruction by matching student characteristics to instruction and evaluation. Differentiated instruction allows all students to access the same content by tailoring entry points, learning tasks, and results. In a differentiated classroom, students access content, acquire information, and demonstrate understanding differently (Hall, Strangman & Meyer, 2003). The knowledge and attitude of tutors are crucial in implementing DI. DI ensures that all children in a classroom have equitable access to educational opportunities and resources. Tutors are expected to meet the needs and interests of every student in the classroom. Differentiated Instruction (DI) better meets students' academic needs (Tomlinson, 2004). Tutors are under pressure to ensure every student's academic success matches their talents. Differentiated Instruction gives all students a fair, equal, and significant chance to get a high-quality education. Johnson (2003) suggested that educators must create an environment where every student may thrive. Teachers assist pupils to reach their learning potential. Science tutors are under pressure to enhance learning standards while fulfilling the needs of all students.

Science tutors must use successful instructional alternatives to teach an academically varied group. Science Tutors at colleges of education are constantly forced to modify their lessons to provide positive, exciting, demanding, collaborative, and supportive learning environments that meet each student's academic needs. They must help create educational environments that optimise students' learning possibilities and help them build the necessary information and skills. Beecher and Sweeney (2008) said education should assist each learner to reach their full potential. DI enables educators to tailor content to the specific needs of each student, maximising learning potential. Science Tutors must initiate and implement DI to ensure its integrity. For DI to be successful, science tutors' attitudes are crucial. Differentiation is one answer to these challenges, according to Rock, Gregg, Ellis, and Gable (2008). Rock, Gregg, Ellis, and Gable (2008) found that a varied education increases student creativity, flexibility, and achievement. The DI's goal is to provide a learning atmosphere and opportunity for all students (Anderson, 2007).

DI is seen globally to support learners with various requirements. It asks teachers to revaluate their

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classroom practises by involving all students in instruction (Anderson, 2009). Ghana's situation is discouraging. Ghana agreed to the Education for All (EFA) initiative, which states that every child of school age should get a free and quality education (Ministry of Education, Youth and Sports [MoEYS], 2004; Ministry of Education [MoE], 2012, 2013). Every child in Ghana has the right to a proper education (MoE, 2003; MoE, 2013). The government of Ghana seeks to educate all school-age children through FCUBE, EFA, and Inclusive Education (IE) programmes, among others (Gadagbui, 2008). The inclusive education strategy aims to "meet Ghanaians' different schooling demands" nationally and internationally (MoE, 2013, p. 5). The IE policy direction "recognises the varying learning demands of several types of school-age students" (MoE, 2013, p. 5). The IE policy seeks to provide opportunities for all educators to "address the diverse learning needs" of every individual in the Ghanaian education system in a learner-friendly atmosphere so that every learner has the "best possible opportunities to learn and equitable access to quality teaching and learning" (MoE, 2013, p. 6). Appropriate curricula, teaching styles, and resources should be used (UNESCO cited in MoE, 2013).

Several studies highlight the diversity of Ghanaian basic school students and the necessity to accommodate them (Gyimah, 2011; Agbenyega & Deku, 2011; MoE, 2013; UNICEF Ghana, 2014). Gyimah (2011) claims that some basic schools in Ghana are implementing IE (also called mainstreaming). This is done to strengthen the need to include all learners of different abilities in classroom teaching and learning (Gyimah, 2011). However, Ghana's education system rarely differentiates instruction for inclusion (Kuyini, 2010). Teachers have little knowledge of inclusivity to help and manage such pupils in basic schools (Casely-Hayford et al., 2011). Kuyini and Desai (2006), insufficient skills in inclusive practises (Kuyini and Desai, 2007), and insufficient support for individual learners with diverse learning needs (Kuyini and Desai, 2008; 2009).Thus, they use general rather than customised teaching approaches. These elementary teachers don't alter curricula to match students' needs (Kuyini & Abosi, 2014).

Alhassan (2014) reports that most basic schoolteachers still use the 'traditional deficit-medical' model (a restricted view of biological autism) to teach students with special needs, despite calls for new tactics. Moreover, Ghana's teaching techniques are dogmatic and don't value student diversity (GES cited in Agbenyega & Deku, 2011). Teachers in Ghana's conventional classes don't successfully cater to students with learning challenges (Dotse, 2012; Gyasi, 2011; Henne, 2013; Thomas, 2012). Some teachers criticise students for not understanding lessons and punish them severely to get them to study harder (Agbenyega, 2006). Kuyini and Abosi (2014) revealed that DI (which they named "Adaptive Instruction") is an essential competency domain for teaching learners with learning difficulties in regular classrooms. It is largely absent in the Ghanaian education system. Per recurrent calls for a paradigm shift from traditional methods of instruction to differentiation to fit learners' educational requirements, DI tendencies in the Ghanaian educational system seem dismal.

The researcher found that basic schoolteachers' failure to use differentiated instruction may be linked to the training they obtained from colleges of education and universities in the country. Colleges of education must be targeted to solve this problem since most elementary school teachers are trained there.

LITERATURE REVIEW

Meaning and Concept of Inclusive Education

When all children, regardless of their difficulties, are enrolled in age-appropriate general education courses in their local schools, they get high-quality instruction, interventions, and supports to help them achieve in the core curriculum (Bui, Quirk, Almazan, & Valenti, 2010; Alquraini & Gut, 2012). The premise behind how schools and classrooms operate is that children with disabilities are essentially as competent as those without limitations. As a result, every student can participate fully in both their classes and the larger school community. Legislation mandating that students receive an education in the least restrictive environment is a crucial component of the LRE movementhey get high-quality instruction, interventions, and supports to help them achieve in the core curriculum (Bui, Quirk, Almazan, & Valenti, 2010; Alquraini & Gut, 2012). The premise behind how schools and classrooms operate is that children with disabilities are essentially as competent as those without limitations. As a result, every student can participate fully in both their classes and the larger school community. Legislation mandating that students receive an education in the least restrictive environment is a crucial component of the LRE movement. This means that they are as integrated with their usually developing peers as possible, with general education being the preferred environment for all students (Alquraini & Gut, 2012).

According to Boric and Tomic (2012), inclusion is the process of recognising and supporting the diverse needs of children by enhancing their participation in learning, teaching, cultural activities, and community life and reducing their exclusion from or participation in the educational system. All children of school age must attend school, and it is the school's responsibility to educate all students. This procedure involves modifying and aligning instructional content, method, structure, and tactics. According to Odom (2011), inclusion is a programme or group in which children with problems and those with standard development engage. According to Begeny and Martens (2007), "inclusion" is the practise of integrating all students, regardless of their academic

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background or level of aptitude, into age-appropriate classes and institutions that meet their needs.

According to Farrell (2000), for inclusion to be successful, all children must participate in school activities and be recognised as integral members of the school community. This implies that students from underrepresented groups and those with disabilities should be given special consideration at the school. All students should be a part of the school community, regardless of their competence in particular areas, the researcher may also argue. The researcher reaffirms her conviction that every child's right should be highly respected and that it is the state's responsibility to ensure fair and equal conditions for all kids.

Inclusive Education Policy in Ghana

Every citizen of Ghana is entitled to a great education. The Inclusive Education (IE) Policy is founded on the premise that all students, regardless of their origin or location, should have free and equal access to a rigorous curriculum taught by trained instructors. To ensure that all children in the Ghanaian education system have access to high-quality, individualized instruction, the policy requires that all parties involved in education conform to the universal design for learning and create a welcoming classroom environment for all students.

Pre-service educators are responsible for preparing future educators to properly implement inclusive education policy. Multiple studies have demonstrated that educating future teachers improves their understanding of disability, tolerance for students with special needs, and ability to implement inclusive classroom practises (Campbell, Gilmore, & Cuskelly, 2003; Dart, 2006; Forlin, 2010a; Rouse, 2008; Sharma, Forlin, & Loreman, 2008). Multiple international documents, such as the World Report on Disability (WHO, 2011), the United Nations Standard Rules on the Equalization of Opportunities for Persons with Disabilities, and the UNESCO Policy Guidelines on Inclusion in Education (UNESCO, 2009), have stressed the significance of this role (United Nations, 1993). Collectively, these documents reached a consensus on the need for pre-service and in-service teacher education programmes to adopt inclusive education approaches and materials in order to better prepare teachers with the knowledge, attitudes, and skills to teach students from a variety of backgrounds.

Education for students with special needs should be considered crucial if universal enrollment and high graduation rates are to be realized. In light of this, the Ghanaian government has set the following goal for its Education Strategic Plan 2010-2020: "To provide education for persons with physical and mental impairments, orphans, and those who are slow or quick learners by including them, if possible, in the official mainstream system or, when deemed appropriate, in special units or schools." Over the years, the government of Ghana has prioritised an "all-inclusive" approach to education by enacting policies meant to promote dialogue between educators, parents, students, NGOs, faith-based groups, policymakers, and disability advocacy groups regarding how to best accommodate students with a wide range of abilities. Achieving quality learning outcomes and promoting the well-being of all learners should be the ultimate objectives of our education system, and this may be accomplished by ensuring that all students receive a high-quality education that takes their particular needs and interests into account. However, due to insufficient finance, numerous national planning strategies have fallen short of their objectives. In spite of this, the Ghanaian government has trialled inclusive education in the Central, Greater Accra, and Eastern regions through the GES Special Education Division. The prototype concept was modelled after internationally successful efforts. In 529 classrooms in 34 districts, the Special Education Division of the Ghana Education Service implemented pilot projects for inclusive education by the end of 2011. The approach includes screening school-aged children, educating instructors on how to identify and accommodate students with SEN, including those with disabilities, and raising awareness among communities and key government leaders. However, a policy framework with a more unified and strategic approach to planning and (financial) prioritisation was urgently required so that these programmes could be implemented nationwide and benefit all kids with special education needs.

The National Teacher Standards (NTS) were designed so that college instructors may train pre-service teachers to pay attention to all learners, particularly girls and learners with special educational needs, to ensure their progress toward achieving educational equity and inclusion in Ghana. The teacher makes accommodations for students with special needs, such as moving seats closer to the front of the classroom so they can see and hear better, using Braille or plates to teach geometry to visually impaired students, adapting ICT to meet their specific needs, and noticing when students are absent, disengaged, or not paying attention in order for them to participate and learn.

Differentiated education permits teachers to adapt their lessons to meet the requirements of students of varied ages and abilities within a single classroom. This is achieved by employing tactics such as pairing students of comparable ages and skills for projects, encouraging students to take responsibility for their own education, and offering adequate opportunities for both male and female students to assume leadership roles. When designing courses for children of diverse grade levels, educators utilise tools such as concept grids to successfully integrate the curriculum. Teachers recognise that their overage pupils will have widely diverse levels of maturity, and they alter their teaching strategies and resources accordingly. A teacher who uses

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bilingual texts, diagrams, or displays demonstrates respect for the language diversity of students by employing a variety of linguistic instructional tactics.

As a means of assessment, learners' verbal and written responses, such as sketches, maps, diagrams, stories, descriptions, accounts, experiments, local research, and handicrafts, are routinely incorporated into practice. In addition to periodic evaluations with lower stakes, instructors may also offer periodic examinations with higher stakes to measure a student's progress or provide further feedback. The instructor takes notice of learning gaps (particularly gender gaps) and uses this data to design the following sessions or lessons. Kindergarten and first-grade teachers rely more on qualitative methods when evaluating students.

The government has taken steps to address this urgent issue, including the adoption of the PTPDM policy paper and the establishment of the National Teaching Council, the National Inspectorate Board, and the National Council on Curriculum and Assessment. Ghana's government is aware that a nation's educational system is only as good as its teachers and administrators. The National Teachers' Standards were developed as a professional resource for use by teacher educators, teachers, teacher candidates, and other education stakeholders to clarify in concrete terms the anticipated knowledge, abilities, and attitudes of teachers. In terms of knowledge, skills, beliefs, attitude, behaviour, rights, and responsibilities, the Standards establish the basic minimum of what it takes to be an elementary, middle, or high school teacher. These standards describe the professional competence of educators and guide their education.

Quality Education

The future of education rests on increasing students' potential for high levels of academic success. Therefore, it is crucial for teachers to ensure that their pupils perform well in every classroom.

The relevance of education to the individual (Imran, 2008; Rose & Dyer, 2008; Anamuah-Mensah & Ankomah, 2010; Lochner, 2011) and its importance to national as well as global development (Bloom & Cohen, 2002; Hanushek & Woessmann, 2008; Alaba, 2010; Mazise, 2011) have sparked agitations for more functional and quality education all over the world. The concerns for quality education root from the EFA policy that was inaugurated in Jomtien (Thailand) in 1995 and in Dakar (Senegal) in 2000 (Alaba, 2010). Steer and Wathne cited in Alaba (2010) state that, the decision to embark on the universal education emerged when there was a declaration in 1948 that education is a human right. In line with this the World Nations through Millennium Development Goals (MDGs) came up with a target that all member states should give quality education to all citizens (Alaba, 2010). Moreover, the inclusion of quality universal education in the MDGs is an indication of the world nations' concern for giving quality education to all (Steer & Wathne cited in Alaba, 2010). Policymakers in developing countries have generally accepted the message of the relevance of education and have greatly increased their efforts on education (Glewwe, Hanushek, Humpage & Ravina, 2011). However, the focus of their investment over the past three decades has been on increasing primary school enrolment rates, with the ultimate goal of improving levels of educational attainment (Glewwe *et al.*, 2011). For instance, from 1980 to 2008 primary school enrolment rates as well as government expenditures on education increased in all regions of the developing world, such that by 2008 gross primary enrolment rates were at or above 100% in Latin America and Sub-Saharan Africa including Ghana (Glewwe, 2011).

Education for All (EFA)

Ghana government has been championing and leading West Africa and Africa as a whole on attaining the MDGs in relation to education especially improving universal access and gender equity (Casely-Hayford, 2000). Seeing that education is a key to socioeconomic and nation development, every ruling government in Ghana has consistently emphasized education as its highest priority (Casely-Hayford, 2011). Considering all the benefits of education, Government of Ghana also ascribes to the principles of EFA and is committed to its attainment, particularly the achievement of Universal Primary Completion by 2015 (MoE, 2003).

In addition to the global status, education is a constitutional right for every Ghanaian child of school going age. Chapter 6 Section 38 Sub-Section 2 of the 1992 Constitution of Ghana advocates a Free Compulsory Universal Basic Education (FCUBE) for every school-age child to be realized through the introduction of an FCUBE programme (The 1992 Republican Constitution of Ghana cited in Casely-Hayford, 2011). The main policy goal of the FCUBE programme is to provide opportunity for every school-age child in Ghana to receive free quality basic education (MoE, 2003). With respect to this, the MoE has identified three key objectives for the FCUBE programme which include improving the quality of teaching and learning, improving the management efficiency of the education sector and improving access to and participation in basic education.

In agreement with the MDGs and the EFA goals, the GoG in most recent times introduced a lot of educational interventions and strategies such as My First Day at School, National Literacy Accelerated Programme (NALAP). The School Monitoring and Improvement Plans (SPIPS), Capitation Grant, Ghana School Feeding Programme (GSFP), free uniform and sandals, one laptop one student, etc (Casely-Hayford, Quansah, Tetteh, Adams, & Adams, 2011). All these programmes were implemented to influence enrolment, attendance, retention and provide quality and inclusive

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basic education for all children of school-age in accordance with the international obligations and constitutional mandate on children's right to education (Casely-Hayford *et al.,* 2011). These educational interventions are frameworks of action to cater for all children and meet their diverse academic needs. The interventions also sought to limit inequality in access to good education, promote efficiency in teaching/learning, improve the quality of instruction and make education more relevant to the demands of modern economy (Casely-Hayford *et al.,* 2011).

Also, what is at the centre of quality education is whether children are learning basic skills, especially in the areas of literacy, numeracy and skills for life (UNICEF, 2010). The key feature of the basic school curriculum includes the provision for the acquisition of 4Rs (**R**eading, a**R**ithmetic, w**R**iting and c**R**eativity). Furthermore, the number of children who participate in schooling and the number of years of schooling by them are not as important as the quality of education they receive (UNESCO, 2005). The argument is that, if children attend school but are not able to achieve better learning outcomes, especially in literacy, numeracy and essential life skills, then they do not have meaningful access to education. Unfortunately, the quantitative aspect of Ghanaian education rather than the qualitative aspect has become the main focus of attention in recent years for policy makers and governments (UNESCO, 2005).

Based on the UNICEF Ghana (2013) report, apart from the huge number of children staying out of school in Ghana, there are many others in the Ghanaian basic school classrooms, who do not have access to education. This means that there are numerous learners in Ghanaian basic school classrooms today who do not benefit from quality education and are not equitably and fairly treated in terms of instructional delivery (UNICEF Ghana, 2013). In another research where UNESCO was cited by Dorleku (2013), reveals that, specific groups of children who are in the classrooms have failed to receive the full benefits of public education and as a result have had difficulty achieving success in school throughout the history of public schooling in Ghana. Hayford (2007) also found that, many students who have diverse needs with regards to learning difficulties are being ignored in the mainstream education in Ghana. Moreover, curriculum inflexibility and examination focus leave little room for addressing the diversity in pupils' learning (MoEYS, 2004). All these affirmed Acheampong's (2014) sense to make basic education free but the challenge is not only free access but free meaningful access.

There is a general consensus that good teaching may be the single most important school-based factor in improving learner achievement or otherwise (Dorleku, 2013). Dorleku reaffirms that children's learning failures were mainly attributed to ineffective instructional approaches, methods, techniques and strategies. According to Dorleku, (2013), teaching approaches are key determinants of educational change, improvement and effectiveness or otherwise. Several other studies (Anderson, 2009; Palmer & Maag, 2010; Sakyi, 2014; Acheampong 2014) reaffirm that how children are taught was very crucial to the effectiveness or otherwise of their learning outcomes. Also, what teachers think, believe and do in the classroom ultimately determine the kind of learning that their learners receive (UNICEF Ghana, 2013).

Anamuah-Mensah and Ankomah (2010) also found that many teaching approaches used in Ghanaian basic schools were not informed by findings from evidence-based research. The authors continued to state that too many teachers do not have a clear understanding of the When, What, Why and How (3W&H) to use particular strategies. Due to this, several studies reported that the diverse learners with diverse learning needs in Ghanaian basic school classrooms do not benefit from a quality instruction and are not equitably treated in terms of lessons delivery, in that their learning needs are not catered for (Hayford, 2007; Gyimah, 2011; UNICEF Ghana, 2013).

In view of this, learners in our modern classrooms are at risk of school failure due to their individual differences and diversities (Anderson, 2009). These classrooms possess different categories of learners including the disadvantaged, gifted/talented and slow learners with a variety of needs and a wide range of experiences who should be taught amidst all these diversities (Anderson, 2009). Imran (2008) supports these factors and suggests that teachers should use child friendly language, adapt the school environment to diverse needs of the learners and to foster more participatory child-centred approaches to teaching in the classroom. Erickson (2006) opines that in order to meet the needs of diverse learners, it is necessary for teachers to implement new teaching strategies that do not teach to the middle, but those that address the learning needs of every learner (Franz, 2009). It is therefore necessary that what and how children learn in Ghanaian schools must be reformed (Acheampong, 2014). Thus, more emphasis should be placed on helping learners to learn in Ghanaian school classrooms (Casely-Hayford *et al.* 2013).

Science Education in Ghana

When science education is done right, it can help students develop the critical thinking skills they'll need to use scientific knowledge to solve real-world problems at work, in their communities, and in their personal lives (Akpan, 2010).

The European colonial presence on the Gold Coast is reflected in Ghana's formal education system. Back in 1471, the Portuguese became the first Europeans to reach the coast of Guinea. In 1529, the Portuguese came up with the notion of establishing schools, which

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was formalized by imperial directives that urged the Governor of the Portuguese Castle in Elmina to educate the local populace in literacy and the Catholic faith. It wasn't just the English who saw the value in educating their mulatto children; Danish and Dutch merchants did the same, opening up schools in their forts and castles taught entirely by local women. In 1874, the authorities gave money to the Wesleyan and Basel missions to help them improve the quality of education and address issues like preparing local instructors.

The Phelps-Stokes Commission on Africa published two reports, in 1922 and 1925, in which educators were chastised for not meeting the social and economic requirements of Africa effectively. James Emman Kwegyir Aggrey, a member of the panel, asked for guidance on how to perform the mechanical tasks that would enhance the lives of the vast majority of the population. Education in the sciences and moral development were covered. The Phelps-Stokes Fund, which was established in 1920 and is an African Education Commission, was one of the first attempts to connect black Africa and Negro America.

Multiple charitable and missionary organisations in the United Kingdom and the United States collaborated to make this connection, hoping to draw media and public attention to what appeared to be politically, socially, and economically similar problems. According to some, Ghana is the first independent sub-Saharan African country to actively push science education and the use of science in industrial and social development outside of South Africa (Anamuah-Mensah, 1999). Despite the fact that the Phelps-Stokes Commission was critical in establishing a framework for the development of science education across Africa, particularly on the Gold Coast, Ghana still lacks a coherent national policy in this area (Ahmed, 2013).Nkrumah's government set up a unique scholarship programme that gave scientific and agriculture majors slightly better financial support than their humanities-focused peers. The salaries of science and math educators were likewise found to be slightly higher than those of their humanities-teaching peers. This infrastructure was decommissioned in 1966. (Djangmah, 2007).

Dr. Kwame Nkrumah's seven-year plan for development was criticised for being overly lengthy and theoretical. Therefore, the system was reformed in the Dzobo Education Reforms of 1974, which included the pilot implementation of the Junior Secondary School (now Junior High School). After completing an apprenticeship, students who studied practical subjects and activities in junior high school were qualified to start their own businesses. For a variety of reasons, including a weakening economy, cumbersome bureaucracy, and the willful disinterest of individuals who had previously attended the system, the Experimental JSS-system never made it out of its test phase.By 1983, the education system was in trouble for a number of reasons, such as a drop in government funding, a lack of books and other learning materials, rapid deterioration of school buildings, a small number of students, and a high dropout rate.

The Evans-Anfom Committee conducted a comprehensive evaluation of the educational system and made recommendations for reform in 1987. The reforms were supported by a number of development partners, including the World Bank, the Department for International Development (ODA), and international funds. To replace the old O-level and A-level systems, the Ghanaian Ministry of Education instituted a new educational structure. In June of 1996, the final class took the A-level test, marking the end of the changeover. In June 1994, we gave our last O-level exam, though we did offer a make-up test until 1999. (Keteku, 2013).

Purposes of Science Education

The call for science education all over the world which Ghana is for, is for two very critical purposes. The first and foremost is to ensure that young people are prepared for a field of work that requires knowledge and skills necessary to promote economic, socio-economic, scientific and technological development for industrialization of the nation. Secondly, to give the future citizens all over the globe better knowledge and understanding of scientific and technological approaches and evidence, in order to be able to make critical analysis, take informed decisions on scientific and technological issues and be able to apply this scientific knowledge (Gallangher, 2000).

These two broad purposes are clearly linked to the importance of making sure that all young people have better and quality education in science and technology in order to produce well equipped citizens and members of the workforce so that they can scientifically, critically and creatively engage with opportunities and challenges that relate to science and technology.

Teachers' Views or Perspective of Differentiated Instruction

How educators make sense of the educational world has been a primary focus of research into their brain processes. Teachers' beliefs, attitudes, and modes of thought have been investigated because of the hypothesized connection between these mental constructs and classroom performance (Hall, 2005). How instructors interpret changes in the classroom has been the topic of more research. It is well-established that teachers' beliefs profoundly influence their everyday classroom actions and judgements (Raths, James, & McAniab, 2003).

However, thoughts and opinions cannot replace tried-and-true winning tactics. The way teachers conduct themselves can significantly affect whether their students

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respect and trust them. Students will learn more and teachers will be more successful in the long run if they demonstrate good attitudes and behaviour in the classroom (Rajeswari, Santhanam, Babu, & Rao, 2008). Every teacher-student relationship is colored by the teacher's preexisting beliefs about the students' intelligence, motivation, and worth (Rajeswari et al., 2008). The majority of the time, teachers influence their pupils' self-perceptions indirectly. According to studies, both parents and educators influence the academic performance of their children significantly. Teachers can affect the lives of their students through their own behaviour and actions. Each child possesses unrealized potential, and instructors' attitudes have a lasting effect on their growth. The overwhelming majority of seasoned educators respect, appreciate, and value their students. Consequently, these instructors will be kind, will share responsibility, will tolerate diversity, will encourage individualised education, and will stimulate creativity in their students. Every student should have the opportunity to learn from a teacher who will be there on the other side of every hurdle or difficulty they encounter. Likewise, if a teacher keeps a good attitude, it will motivate the students to work hard and achieve success.

Conceptual Framework

Figure 1 shows the relationship between teachers' knowledge and practices of DI with respect to its major theories and concepts. The diagram explains the link between knowledge and practices of DI. The nature of knowledge the teacher has in principles, theories and concepts in DI and his/her ability to employ them in instructional processes greatly influence successful implementation of DI. The diagram below (adopted and modified from Hellman, 2007) shows the conceptual framework of the interplay of teacher's knowledge and practices of DI and its major concepts.

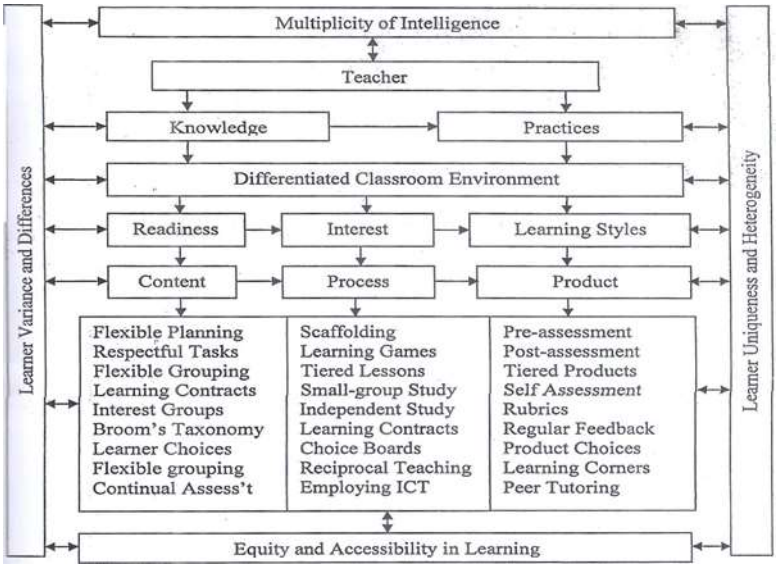

Figure 1: Conceptual Framework (Teachers' Knowledge and Practices of DI)

From the framework the researcher explained the reason for which teachers differentiate instruction is to consider the variety of learning needs of learners. This assertion of DI is situated on the principle of Multiple Intelligence (MI). The MI theories (pluralistic view of the mind) cater for the varied ways learners think, learn or act and the reason of individual difference (Gardner, 2003). As stated elsewhere, literature proved that the concepts and theory of MI are the very foundations upon which DI is built. And their virtues are tantamount to each other.

Considering the duties of the teacher in the teaching and learning process generally, it is justifiable to state that DI is the pivot in all educational or academic endeavours of a child's learning. Kauchak and Eggen (2003) reported that teachers are the most critical influence on school learning apart from children themselves. In a normal educational setting, teachers are probably the most influential facilitators in the teaching/learning process. Researchers maintain that teachers are known to be professionals in search of knowledge that could inform classroom practice (Kauchak & Eggen, 2003). This pertains that the knowledge a teacher possesses on a professional concept such as DI consequently affects his/her practices positively or negatively.

The position of teacher having requisite knowledge of DI is the crucial step a teacher would need to be able to implement differentiation effectively and efficiently. Despite the fact that it is possible for facilitator to employ some ingredients of differentiation in their instructional practices without possessing any aorta of knowledge on it, those practices however may not be as regular and as effective as that of those whose have knowledge about it. According to Tomlinson (2010), teachers who are in the best position to differentiate instruction are those have a strong knowledge on the bases and philosophies of DI.

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As far as DI is known to be a total means for teachers to think and deal with their learners, the thinking and dealings should be linked to solid knowledge of DI practices. Implementing DI requires deep knowledge of its process, theoretical framework and ways through which the theory is translated into action (Franz, 2009), In order not to corrupt their learners, teachers might not want to employ practices that they are not conversant with no matter how beneficial they might think it is to the learners. George (2005) testified that it deters teachers from attempting to use DI if they lack knowledge and inadequate expertise in its use. Moreover, the extent to which teachers know or understand DI is consequential to its implementing according to Whipple (2012). This teachers' knowledge factor inevitably influences the kind of learning atmosphere that is created for student learning.

Science Tutors' knowledge, attitudes and practices of DI are significant to effective learning output. However, they need special classroom environment to be absolutely successful. Several educational theories such as Vygotsky's ZPD and Scaffolding, Cambourne's Conditions for Natural Learning, Clay's Emergent Literacy, Gardner's MI, and Paiget's Cognitive Development among others advocate and advance for inviting learning environment as extremely crucial to effective teaching and learning. The elements involved in a DI classroom environment may include rules, procedures, furniture, available materials, and mood (Tomlinson, 2000).

In a differentiated motivated learning environment, the physical, psychological, social, cultural and emotional practices should be inviting and enticing for every learner. In another development, affect which entails the social and emotional factors that influence learning requires teachers to adjust to accommodate every learner's learning needs by treating them in a way that they will feel safe, comfortable and willing to take risks in their learning (Wormeli, 2007). With respect to this, differentiated learning environment should entail the physical space, the way it is arranged, how well every learner is treated and how each learner is encouraged and motivated to learn to his/her maximum capacity. In all, DI classroom environment provides learners with a more inviting atmosphere to learn (Gangi, 2011). When the expected differentiated environment is created, the teacher can then take the next step to differentiate other areas/aspects of instruction.

Instruction can be differentiated from planning through to assessment. Any aspect of instruction that a teacher alters in order to cater for the differing learning needs of his/her learners entails a differentiation. Tomlinson (2001) reiterated that anytime teachers modify the way a lesson is presented or moderate an assignment for a particular learner, they are differentiating their instruction. The four main areas projected by several researchers and educators (Tomlinson & Allan, 2000; Heacox, 2002; Wormeli, 2007; Levy, 2008; Launder 2011) through which instruction can be differentiated include content, process product and learning environment. Another area that can be differentiated apart from these four is planning. Any of the areas of instruction can be differentiated to address the diverse learning needs of all learners and to help every particular learner to learn to the maximum.

All areas of instruction can be differentiated based on major learner characteristics. Gangi (2011) affirmed that a teacher must address three student characteristics identified by Tomlinson as readiness, interest and learning profiles in order to differentiate instruction. Learner readiness is how much background knowledge a learner possesses in relation to a topic, learner interests are the topics that the learner is ready to learn which will motivate him/her to be engaged in learning while learning profiles of the learner involves how the learner learns (Gangi, 2011). However, a teacher who intends to differentiate instruction effectively must consider these learner characteristics to be able to do so. Fundamentally, all the practices of differentiation can be implemented at every stage or aspect of instruction through a variety of teaching/learning activities. These kind of activities include flexible planning, respectful tasks, flexible grouping, continual assessment, learning contracts, interest groups, broom's taxonomy, learner choices, flexible grouping, scaffolding, learning games, tiered lessons, small-group study, independent study, learning contracts, choice boards, reciprocal teaching, the use of ICT, pre-assessment, post-assessment, tiered products, self-assessment, rubrics, regular feedback, product choices, learning corners, peer tutoring, etc. Although all of these activities are not supposed to be employed in a single instruction, series of them should be considered in every aspect of differentiation.

The basic aspect of this DI framework is that, all the practices illustrated above should be guided by the fundamental learner conceptualizations and principles. These include the leaner diversity, learner variance, learners' uniqueness and learners' difference, multiplicity of learner intelligence and equity and accessibility of learning to every learner. These are the very concepts which prove that learners are not homogeneously equal and should not be treated as such in terms of instructional delivery. Perhaps, these are the very basis upon which instruction must be differentiated.

METHODOLOGY

The study employed a sequential explanatory research design which is under mixed method approach. Mixed method research is a systematic integration of both quantitative and qualitative methods in a single study in order to ascertain a deeper understanding and a full picture of a phenomenon (Yin, 2006). According to Rossman and Wilson cited by Koeze (2007), using mixed method entails a combination of qualitative and

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quantitative study methods and allows the researcher to "confirm or collaborate findings" (p. 40). A combination of qualitative and quantitative data allows researchers to discover new insights into studies (Koeze, 2007).

Population and Sample Size

The sources of data for this study were collected from science tutors of the colleges of education in Volta Region, Ghana. Volta Region has six colleges of education and out of these six colleges, and five of them are public colleges of education. All the five colleges are mixed sex colleges except St. Teresa's Colleges which is single sex. The target population of the study is all the science tutors in the five public colleges of education in the Volta Region. The target population was 209 tutors from the five public colleges of education in the Volta Region. Accessible population is the portion of the population to which the researcher has reasonable access. 'It may be the subset of the target population' (Polit & Hungler cited in Ardilla, 2017, p.43). An accessible population for the study was thirty-two (32) science tutors from the five public colleges of education in the Volta Region.

Table 1. Colleges and Participants

Areas	Colleges	Participants (Science Tutors)
Hohoe Municipal	St. Teresa's College of Edu	4
Hohoe Municipal	St. Francis College of Education	10
North Dayi District	Peki College of Education	4
Akatsi South District	Akatsi College of Education	8
Ho West Municipal	Amedzorfe E.P. College of Edu	6
Total		**32**

Source: Field data 2020

One of the sampling techniques employed in this study was purposive sampling. Purposive sampling was used by researcher to select accessible population (sites and/or participants) intentionally, with some criteria and attributes in mind that address the research questions (Merriam, 2009). All the 32 science tutors who represented the accessible population were chosen by the use of census for the study. By adopting a census one is sure of the representative nature of the population and that the objectives of the study would be attained.

RESULT AND DISCUSSION

What are college of education science tutors' views not attitude towards differentiated instruction in the Volta Region?

This research question focused on exploring college of education science tutors' views towards differentiated instruction in the Volta Region. According to Spurgeon cited in Tsadidey (2002) "Nothing comes out of a sack except what is in it", (p3). This basically means that, a teacher whose knowledge of differentiated instruction is in lower level or lacking might be of low or no position to adopt or apply it in his/her classroom. In view of this, the tutors of the colleges of education involved in this study were interviewed to ascertain their knowledge in differentiated instruction.

The responses were organized into themes and presented in the figure 4.

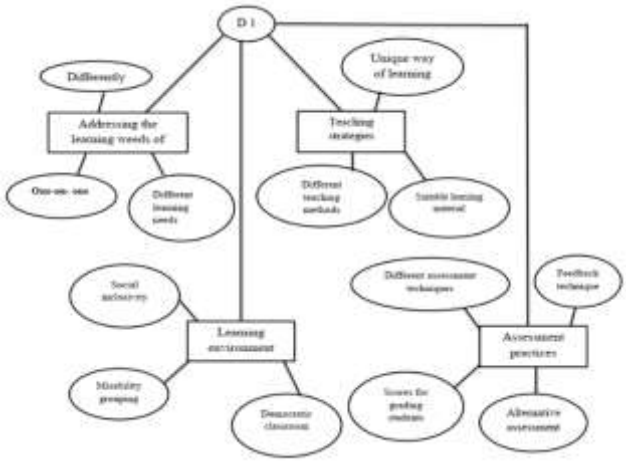

Figure 4: thematic mapping of DI
Source: Author's Construct

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Indiana Journal of Arts & Literature
Abbriviate Tittle- Ind J Arts Lite
ISSN *(Online)*- 2582-869X
Journal Homepage Link- https://indianapublications.com/journal/IJAL

Content/Addressing the learning needs of students

With respect to content (addressing the learning needs of learners), the following views shared by the five key tutors were indicative of the finding from the respondents. There seems to be a consensus among 5 science tutors with these questions. When Tutor 1 was first asked of his understanding of differentiated instruction, he said that "oooh *as for differentiated instruction, it is knowing how to address the needs of the students differently.* From the response of Tutor 1, it is evident that his knowledge in differentiated instruction is inadequate, even though the curriculum gives explicit information on what differentiated instruction is. I further asked him if he thinks that learners in his class have similar characteristics. He stated "*no*" and I asked him how he deals with the different characteristics, he answered that "*well, every learner in the classroom is unique in his own way and I deliver lesson to satisfy each learner in the classroom within the scope of the course outline.* When asked if he has anything to add, he responded by saying "*yeah …. I also identify the learners' academic, emotional, social and physical needs through classroom interaction and I address these needs by talking to them one at a time during the teaching process."*

Similarly, Tutor 2 also has these to say in response to the same questions. Tutor 2: "*oh ohk as for differentiated instruction, hmm …. Per the new curriculum at the basic level it is when the differences between learners are accepted for every learner to be able to learn"* he further stated that "*learners in my class have different learning needs, I only deliver lesson to satisfy each learner when there is adequate time. I also identify the learners' academic, emotional, social and physical needs through my interactions with them and I address by through counselling. This is done on a one on one basis because we all have different learning interest, culture and expectation*

Again Tutor 3 also has this to say in response to the question 'what is your understanding of differentiated instruction?' "hehehe *eeeiii this hot afternoon? Well this is not my first time of hearing it, but I don't know how to explain it to you*" when asked if she thinks that learners in her class have similar characteristics. She answered that "oh *of course not, every learner comes from different homes and background so they all have different characteristics and their learning ability is also not the same*". I further asked her how she deals with this difference in learner characteristics. She answered that "*well the teaching time is very short as compared to the huge number of students in the class so I teach them together and if anyone doesn't understand, he or she comes for further explanation, most of them are scare to approach so their friends teach them*"

There seems to be a consensus among the three respondents which give rise to the theme addressing the learning needs of students. The interview results show that even though they have an idea as to what differentiated instruction is, they don't address the individual needs of learners.

This suggests that some tutors do not really understand differentiated instruction and how to apply it in the everyday classroom. The views shared by participants suggest that most tutors in the college of education do not address the learning needs of students in differentiated classroom, even though they are aware of its importance as stated in the curriculum. They don't know how to put it into practice. This is in support of the assertion of Page cited in Franz 2009, he stated that lack of knowledge and inadequate expertise in the use of differentiated instruction usually deters teachers from attempting its use as a teaching strategy. Tomlinson (2005) also opined that although many teachers see DI to be beneficial to learners, yet they often believe that its execution in their classrooms is unfeasible.

Process/Teaching strategies

According to Stone and Morris as cited in Isaac, 2010, teaching strategy is a generalized plan for a lesson which includes structure, instructional objectives and an outline of planned tactics, necessary to implement the strategies. And differentiated instruction is explained by NaCCA (2019) as a process by which differences between learners (learning styles, interest and readiness to learn etc.) are accommodated so that all students in a group have best chance of learning.

During the interview, three of the participants recalled their own strategies in teaching in their classrooms as well as how their strategies are designed to address the various needs of students. When Tutor 4 was asked about his view on what teaching strategies are, he answered that "*eerm teaching strategies are the methods or procedures a teacher uses in teaching students to understand well*" when Tutor 4 was asked how he apply differentiated instruction when teaching, he answered that "*oh ohk…. With the differentiated instruction, I consider every learner's interest, cultures and expectation through use of different teaching methods, because each learner has a unique way of learning".* I further asked him whether he has something else to add, he replied that "*yeah, I also address learners' abilities and disabilities by providing them with different and suitable learning materials for different teaching methods, I do that to satisfy their needs as much as possible.*

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I further asked him if he engage students in group work and he answered by saying *" oh yeah sometimes I give group works or projects to them to work on, even though there are always complains of some students not taking part, it doesn't discourage me from giving them a group work"* I asked a follow up question " So what do you do with those who don't take part in the group work" he replied that " *oh initial I deduct some marks if you don't take part, but now I give the person an individual work since he won't work with others"*

From the Tutor 4's responses, it is evident that he understands differentiated instruction and puts it in practice during the teaching and learning process. Even though the curriculum gives detailed information on what differentiated instruction is, the implementation in the classroom solely depends on the teachers. When I asked him how he helps every student to learn, she added "*well I don't really get your question but whenever I am teaching, I make sure every student understands the concept before I move on, I use multiple strategies to accomplish this."*

When Tutor 5 was also asked the same questions and here are what he had to say in response "*well during my teaching I consider each learner's interest, cultures and expectation by design a lesson to suit their needs and also use a variety of materials related to the topics"* he also added that "*I implement differentiated instruction in my classroom by giving students tasks to meet their learning needs, and preparing teaching strategies to meet the learning needs of the weak students."* So, I followed up with another question and asked him what he does with the good students. He answered that *"oh as for students like that I don't worry much or choose any different strategy for them, because the understand whatever I teach no matter how I teach, I only pay attention to the weak students"*

From the responses gathered from the tutors, even though they claim to practice inclusivity during the planning and implementation stages of their lesson, there have inadequate understand of differentiated instruction.

Theme 3: Product/Assessment practices

With regards to assessment practices, tutors interviewed claimed they use variety of assessment in the classroom to aide their day to day activities. The following interactions took place between the researcher and the Tutor 1.

Researcher: Do you apply assessment information to guide your instruction?

Tutor 6: "*Yes I do"*

Researcher: Do you provide variety of assessment tasks for learners?

Tutor 6: "*oh yeah I do that*"

Researcher: How do you do that?

Tutor 6: "*with assessment, hmmm I give them tests, quizzes and sometimes assignments."*

I further asked him what he does with the feedback gotten from the assessments done. He replied that "*I record the marks and use to grade them at the end of the semester*"

Again Teacher 8 also has this to say in response to the same question, do you apply assessment information to guide your instruction? Tutor 8 replied by saying "of *course I do"* I further asked whether he provides a variety of assessment tasks for learners. He answered by saying *"yeah I do"* here is what he had to say when I asked him how he provides a variety of assessment tasks. "*I use variety of assessment tasks like tests, quizzes but I don't give them take home assessments like project works because they will copy from each other. I assess them in the class so there will be strict and constant supervision."* Tutor 8 was also asked about what he does with the feedback gotten from assessment; here is what he had to say. "*feedback as in the results gotten from the assessment? Oh, I record the ones they did well to be used to grade them for the end of semester to be used to grade them*" finally, I asked him if he agrees that a variety of assessment tools and strategies should be employed before, during, and after teaching and learning. And he replied that, *"oh yes as for during the lesson it is important to assess learners but before the lesson di3 im not sure because what have you taught them that you are assessing them on"*

And lastly, Tutor 9 also indicated the following in the questions asked.

Researcher: do you apply assessment information to guide your instruction?

Tutor 9: "*yes"*

Researcher: do you provide a variety of assessment tasks for learners

Tutor 9: "*yeah most of the times"*

Researcher: how he provides a variety of assessment tasks.

Tutor 9: "*I use assessment techniques like quizzes, project works and group work"*

Researcher: what do you do with the feedback gotten from assessment?

Tutor 9: "*the marks they get are used to grade them"*

Researcher: Do you agree that a variety of assessment tools and strategies should be employed before, during, and after teaching and learning

Tutor 9: "*oh yes, I do"*

Researcher: why do you do that?

Tutor 9: "*oh I assess them because I will need the results to grade them at the end of the semester"*

There seems to be a consensus among the three respondent which give rise to the theme Assessment practices. The interview results show that even though tutors in the colleges of education use variety of

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assessment tasks to assess their students but do not really understand what assessment is or the purpose of assessment in the teaching and learning process. As Ramaprasad (1983) defines assessment feedback as a resource that provides performance-impact information, stating that "feedback is information about the difference between the actual level and the reference level of a device parameter that is used to modify the difference in some way" (p. 4). Furthermore, Black and Wiliam (1998) point out the importance of the teacher's oral feedback which helps students to reflect on their learning. They write, "The dialog between pupils and a teacher should be reflective in thought, focused on evoking and exploring understanding ... so that all pupils have an opportunity to think and express their ideas" (p. 8).

But the interview response from these Tutors shows they perceive as assessment as just an evaluative tool, thus instead of using assessment feedback to improve upon teaching and learning, they only see feedback as means to award grades and evaluate learners.

Theme 4: Learning Environment

During the interview, three of the Tutors were asked about the learning environment they provide for learners to help them get a conduceive study environment.

> Tutor 1: *I structure my classroom environment to support a variety of activities like flexible grouping and individual work because I believe normal classroom environment should include learners with special needs, I do this for social inclusivity.*
>
> Tutor 2: *Yes, my classroom is structured in support different learner with diverse learning needs, whether cultural, religious emotional or mental, I do this to allow diverse groups to learn side by side with each other.*
>
> Tutor 3*: I have structured my classroom environment to support the diverse needs of my learners. I address the language, cultural, emotional and mental needs of my students.*

With respect to tutors' knowledge of inclusive education, the researcher asked tutors about their understanding of what inclusive education is, and the following excerpts where deduced from the interview.

> Tutor 1: *"oh, inclusive education is putting all learners together regardless of race, ethnicity and gender etc".*
>
> Tutor 2: *An approach which occurs when learners with or without disabilities and from different backgrounds learn together in the same classroom and interact with each other.*
>
> Tutor 3: *erm for inclusive education it is simply given equal opportunity for each learner regardless of disability and IQ.*
>
> Tutor 4: *Inclusive education is including everyone in the classroom during the teaching and learning process, irrespective of their gender or their learning disability.*

From the responses of the respondents, it was evident that they have adequate knowledge in inclusive education.

In summary, this study revealed that in exception of colleges of education science tutors in Volta Region of Ghana having generally and variably knowledgeable of DI concepts, there was a lower level of the teachers' implementation and practices of DI. Science tutors scarcely differentiate instruction but employ several good instructional practices in their pedagogies. Again, the science tutors poorly use instructional materials. It was also found that the teachers did not differentiate assessment for their learner.

CONCLUSION

Based on the findings of this study, the study concluded that majority of colleges of education science tutors had varying knowledge in Differentiated Instruction.

The study also revealed that although there were signs of differentiated practices during their instructional process, science tutors did not cautiously use DI to engage the student teachers during instructional planning, practices and content. The researcher identified that these good signs were because of these science tutors using very good teaching methodologies or instructional practices and had also gained enough experience on the job.

Again, the findings from the interview response from respondents showed that the assessment results were just used as an evaluative tool, instead of using assessment feedback to positively improve upon teaching and learning. They only see assessment feedback as means to award grades and evaluate learners.

However, it was identified that science tutors differentiated their product or assessment during their teaching process. These tutors resulted to using different assessment strategies for assessing their student teachers learning process. They made very good use of alternative assessment to help those student teachers who fell short of paper and pencil test.

The findings of the study also revealed that the learning environment at Colleges of Education were very conducive for the use of different strategies of teaching. It was identified that furniture in the classroom were conducive for differentiation which was conducive enough and supported differentiated instruction.

Recommendations

The study recommends that;

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- National Council for Tertiary Education (NTCE) should cautiously organize series of continuous professional development courses and workshops on the differentiated instructional strategies to give College of Education tutors hands-on training on DI.
- Tutors in the Colleges of Education in Ghana should intensify the teaching of assessment procedures in differentiated instruction to prepare student teachers for effective handling of learners with diverse needs in the classroom. Though, it was revealed from the study that student teachers were introduced to assessing children with special needs and disabilities, the researcher believes that assessment in differentiation instruction goes beyond having knowledge on assessment practices in Special Education. When teachers have adequate knowledge in assessment procedures, they will be able to ensure novelty in assessment practices to foster participation of all learners with diverse learning needs in the classroom

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