Nurturing the Missing Link: Unleashing Talent and Giftedness for Critical Human Capacity Development in Nation Building

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Abstract

Investing in gifted and talented education potentially develops vital human capital necessary for rapid growth of society and economic prosperity. In the developed nations, support and opportunity for gifted students receive far more attention compared to developing African nations. In these nations, creative instructional approaches to develop the gifted are limited. This study explored ten mathematics and science teachers' perspectives about giftedness with a focus on how they provide for gifted children's diverse learning needs in Ghanaian schools. Seven school dropouts were also interviewed to understand the challenges they experienced in school. The study drew on data from semi-structured interviews and document reviews. Results showed that the gifted are overlooked making potentially limiting their future opportunities vulnerable as teachers had little knowledge about giftedness and gifted education instruction. Teachers misunderstood identification, acceleration and differentiated learning techniques and ignored them in developing gifted children as they held varied naïve view patterns and stereotypes in accommodating these children. Only the academically able mathematics and science children were recognised as gifted. The gifted, the average, the gifted but disabled and below average children go through the school system unnoticed. Findings can inform policy on giftedness and gifted education practices. Creative approaches to integrate gifted education within teacher education programs to curtail teachers' stereotypic and naïve belief patterns about the phenomenon in contemporary society.

Keywords missing link; naïve belief patterns; human capacity development; unleashing talent and giftedness; gifted and talented children

Quotes:

1. *"Gifted and talented individuals not only contribute positively to society but are its formidable problem solvers"*
2. *"Our role isn't to mold the future for the gifted and talented; it's to empower them to forge their own path towards a brighter future."*
3. *"Gifted and talented individuals innately possess the tools; our responsibility is to establish robust systems that recognise and cultivate their potential into valuable talents, fostering economic progress."*
4. *"A thriving nation hinges on the collective brilliance and ingenuity of its gifted and talented citizens."*

Introduction

Parents and stakeholders often attempt to dictate their children's career choices, sometimes even before they are born, without recognising their true potential. Consequently, many of these children end up directionless and become problematic for society (Assouline & Lupkowski-Shoplik, 2021; Makel, Plucker, & Hegarty, 2020). Despite

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having a substantial number of universities in developing African societies, we have failed to cultivate giftedness into talent, leaving a deficit of innovative thinkers and creative individuals needed for nation-building (Robinson, Hertzog, & Stanley, 2020), particularly in Ghana and Africa with less or no attention in nurturing STEM students' giftedness into eminent talents (Allotey, Watters, & King, 2020), compared to developed nations. Instead, we have overly relied on depleting natural resources, overlooking the immense potential of gifted and talented children, who are the most valuable resources for human capacity development. To sustain tomorrow's economies, it is important to raise awareness and invest in effective gifted education practices, enabling today's children to shape their own future rather than having it predetermined for them. Human capital development through holistic and inclusive education for the gifted can revolutionise the entire educational system in society (Pfeiffer, 2023; Shavinina, 2009; Sisk & Torrance, 2021). Unfortunately, before a child is born, their future is often determined by their parents without adequate support or opportunities to identify their true potential.

Gifted children have unique learning needs that differ from their peers with average abilities, and educators must move beyond a one-size-fits-all approach to inclusion (Assouline & Lupkowski-Shoplik, 2021; NAGC, 2023; UNESCO, 2016). While no school comprises entirely gifted children, there are gifted individuals in every school (Yakavets, 2014). To unlock their potential, these children require tailored opportunities for identification, acceleration, and differentiated learning, empowering them to achieve outstandingly and make positive contributions to society (Callahan, Plucker, & Vaughn, 2023; NAGC, 2023; Pfeiffer, 2023; Sisk & Torrance, 2021). Investing in all-inclusive, holistic, and equitable education for the gifted is a strategic investment that benefits both the individuals and the broader society. It is essential to recognise that giftedness encompasses various facets and should not be confined to a narrow focus on high academic performance (Borland, 2005; Gagné, 2010; NAGC, 2023; Renzulli, 2005). Unfortunately, many advocates of gifted education perpetuate this view, leading to the misconception that giftedness is solely defined by academic achievements, which has been termed as academic disappointment (Borland, 2005, 2009; Renzulli, 2002).

Background

Presently, industries seek talented individuals to maintain a competitive edge, and human capacity advancement and gifted education are integral to achieving economic prosperity (Assouline & Lupkowski-Shoplik, 2021; Eyre, 2009; Shavinina, 2009). In contrast to developed nations that heavily invest in research contributions and support for gifted education privisions as part of human capacity development (Assouline & Lupkowski-Shoplik, 2021; Eyre, 2009; Sisk & Torrance, 2021), the situation is different in many developing countries including Ghana (Allotey, Watters, & King, 2020; Deku, 2013; Yen & Bharath, 2022), in these nations, support for the gifted often takes a backseat (Deku, 2013; Mafa, 2012; Ngara, 2017), necessitating awareness-raising efforts to emphasise importance of nurturing gifted potential, which is frequently overlooked (Allotey et al., 2020; Deku, 2013). Failure to provide for the learning needs of gifted and talented individuals can lead to their underachievement and pose challenges for society (Pfeiffer, 2023), underscoring the criticality of promoting awareness about giftedness and human capacity development in Ghana.

While Ghana has made progress in its education system, little attention has been given to gifted education and supporting STEM gifted individuals learning needs (Allotey et al., 2020; Deku, 2013). Nevertheless, Ghana designated commitment to sign the 2030 declaration of education with agreed belief of renewing the nation's obligation for leaving no student behind, as framed in the sustainable development goal 4 (SDG4) (UNESCO, 2015).

Besides, the SDG 4 is concerned about ensuring inclusive quality and equal education for all, with lifelong opportunities for learning regardless of students' diverse background cultures and differing learning needs (UNESCO, 2015). Therefore, the implementation of free education for all students in the senior high school level by the current Ghana's President Nana Addo Dankwa Akufo -Addo since 2017 is a great achievement and a pathway to ensure a full IE policy in Ghana. However, there exist insufficient research regarding stakeholders' viewpoints in meeting varied learning needs of gifted and talented children in the context of human capacity development in Ghana. The purpose of this study is to explore teachers' and school dropouts' awareness in Ghana to promote giftedness in relation to human capacity development about the diverse needs of these children within the school system.

Teacher awareness of special needs and support for gifted children

Teachers' and stakeholders' recognition of giftedness is often influenced by their own views, knowledge, and understanding (Allotey, 2019; Ngara, 2017), which may stem from personal experiences (Mafa, 2012; Ngara, 2017). Ministries of Education in African countries expect teachers to meet the multiple learning needs of children, but often, pre-service teachers lack appropriate preparation for providing education tailored to diverse learning needs (Deku, 2013; Opoku et al., 2017).

Teachers can be entangled with stereotypes and myths about giftedness, as observed in other contexts (Carman, 2011; National Association for Gifted Children, NAGC, 2023). Currently, there is little research in Ghana that delve into the issue of schools and society missing the focus on nurturing the gifted and talented as a valuable human capacity resource. This study aims to investigate this gap and shed light on the perceptions and understanding of educators regarding the provision of appropriate support for the gifted in Ghana.

Research Problem

Developed nations have made significant progress in providing support, motivation, and learning opportunities for the gifted, backed by extensive research contributions on giftedness and gifted education practices (Borland, 2005, 2009; Gagné, 2010; Renzulli, 2002, 2005). However, developing nations in Africa, including Ghana, have lagged behind in effectively providing for the gifted through gifted education practices, resulting in a dearth of research on giftedness and human capacity development among teachers. This gap is particularly significant considering that many African economies heavily rely on natural resources rather than harnessing the potential of gifted and talented individuals for economic prosperity (Allotey, 2019; Allotey et al., 2020).

Nations like Singapore have demonstrated that even with limited resources, fostering creativity and intellectual innovations can drive economic growth (Allotey, 2019; Allotey et al., 2020; Makel, Plucker, & Hegarty, 2020; Kaufman & Sternberg, 2010). Nevertheless, in Ghana and most African states, limited research on giftedness remains a concern (Allotey, 2019; Allotey et al., 2020; Deku, 2013), highlighting the need to explore teachers' and stakeholders' awareness of the

relevance for investing in human capacity development through gifted and talented education. Gifted individuals not only possess enthusiasm for learning but are also considered valuable assets for economic progress (Assouline & Lupkowski-Shoplik, 2021; Eyre, 2009; Sisk & Torrance, 2021), which underscores the significance of this study in uncovering various aspects of giftedness.

Moreover, in countries like the United States, gifted education provisions and support for gifted individuals have been prioritised (Yen & Bharath, 2022), signifying the recognition of their potential to contribute positively to society, including proficiency in STEM (H. Res. 5116, 2010). However, it remains uncertain whether teachers in Ghana are adequately aware of giftedness and are offering effective education to develop the human capacity of gifted students for positive returns and sustainable progress in the Ghanaian economy. This study aims to bridge this gap in knowledge.

Significance of the Study

Understanding teachers' awareness about giftedness is crucial for promoting gifted education in Africa (Allotey, 2019; Deku, 2013; Ngara, 2017) and can inform decision-making. Many recent studies on gifted education in Africa have overlooked by soliciting teachers' and school dropouts' awareness, preventing a follow-up on concerns and failing to raise awareness for further research.

This study is significant as it can provide valuable information to the Ghana government, aiding in making better and proactive choices for appropriate gifted education programs in addition to the existing free education policy. Importantly, the study holds economic significance, as providing learning opportunities and support for the gifted is an investment beneficial to tomorrow's society and all economies, particularly in developing nations including Ghana.

Currently, Ghana lacks formal gifted education programs, leaving gifted and talented children vulnerable throughout the education system and society (Allote 2019; Allotey et al., 2020; Deku, 2013). More research is needed not only to fill the existing gap but also to raise awareness among researchers and practitioners, facilitating the development of appropriate concepts for nurturing gifted and talented children and youth toward nation-building. Additionally, the study's findings could lay a solid foundation for future research and help bridge the competition gap of workforce between industry players in Ghana and the international community.

Literature Review

Education for the Gifted and Human Capacity Development

The concept of gifted education can be traced back to Terman's work in 1916, where "intelligence quotient" (IQ) was used as a measure to define giftedness as having a high IQ. However, historically, there has been no widely accepted and agreed-upon definition of giftedness. Many definitions of giftedness and talent are often linked to high test scores (Freeman, Raffan, & Warwick, 2010; Makel et al., 2020). However, Gagné's differentiated model of giftedness and talents (DMGT) proposes a more comprehensive view of giftedness and human capacity development, emphasising various ability domains such as creative, critical, intellectual, problem-solving, and creativity to distinguish between giftedness and talents.

According to Gagné (1991, 1995), giftedness in children refers to the expression and

possession of naturally superior aptitudes (gifts) across multiple ability domains, placing an individual among the top ten percent compared to their age group. On the other hand, talent refers to the excellent mastery of progressively developed abilities (skills) and knowledge within a specific area of human activity, putting a person in the higher ten percent of their age group and actively performing in that domain (Gagné, 1991, 1995). This proposition highlights that giftedness and talent are distinct concepts and the former represents potential that requires progressive development through gifted education programs and coaching to transform into talent or skill, contributing positively to society.

Furthermore, Gagné (2005, 2010) contends that emergent talent is a progressive reflection of giftedness, leading to a developmental model with exceptional abilities evolving into effective attributes in a specific area where the individual can actively perform. This suggests that giftedness can be viewed as a successive transformation of natural aptitudes into skills that define competence or expertise in a given occupational field. This developmental perspective aligns with other studies (e.g., Makel et al., 2020; Reis & Renzulli, 2009; Subotnik, 2009) and emphasises that giftedness is a dynamic and evolving concept rather than a fixed and static ability.

In this study, the Developmental Model of giftedness can be viewed as 'human capacity development,' as both concepts involve progressively developing individuals' potential (gifts) into specialised skills or fields (talents) that produce experts capable of creatively solving problems and driving innovations in society to sustain economies (Beghetto & Kaufman, 2021; Kaufman & Sternberg, 2010). As a result, awareness among teachers and other stakeholders in the context of this study becomes central to prompt action.

In contrast to the developmental model, the psychometric view of giftedness relates giftedness to IQ, considering it as the primary determinant. However, Borland (2005, 2009) and Renzulli (2002) argue that relying solely on IQ measures for identification in gifted education programs may overlook many gifted students with talents in creative arts, leadership, music and dance, language, entertainment, athletics, technology, medicine, and engineering. Advocates of gifted education recommend adopting a multi-faceted approach to identify the gifted (NAGC, 2023; Robinson, Hertzog, & Stanley, 2020; VanTassel-Baska, 2018). With Renzulli (2005, 2009) suggesting to consider various factors, including students' high performance, classroom tasks, portfolios, IQ test scores, and nominations from parents, students, and self, as evidence for students' involvement in gifted education. This highlights the diversity of gifted abilities, necessitating a diverse approach to selection towards classification to avoid exclusion and misidentification.

It remains unknown whether teachers in Ghana are aware of the nature of giftedness and the dynamic aspect of human capacity development. This study seeks to investigate this aspect and shed light on teachers' awareness and understanding of giftedness and the need for progressive development to unlock the full potential of the gifted.

Giftedness and Economic Progress

Although there are exceptions of teachers making positive impacts on students' advancement, there is a lack of emphasis on teachers' awareness about giftedness development. The majority of pre-service and graduate teachers in developing nations, including Ghana, have limited background in gifted education (Carman, 2011; Fraser-Seeto, Howard, & Woodcock, 2015; Hudson et al., 2010; Yen & Bharath, 2022). In contrast, developed nations have implemented measures which focused on research and

professional development in gifted education. Moreover, gifted and talented individuals often drive international innovations that underpin contemporary economic prosperity (Beghetto & Kaufman, 2021). This proposition highlights the critical link between society's interest in gifted individuals and investment in their education which in turn contributes to global innovation through analytical thinking skills, creativity, and problem-solving techniques (Beghetto & Kaufman, 2021; Kaufman & Sternberg, 2010; Sisk & Torrance, 2021; VanTassel-Baska, 2018).

Therefore, innovation and talent are comparable models, both representing essential human resources for human capital development and economic prosperity. With this perspective, investigating teachers' and stakeholders' awareness in Ghana regarding the concept of gifted education provision becomes vital to achieve a balance between giftedness and talent as proposed by Gagné (1991, 2005). The study will explore whether individuals' gifts are being recognised, and if teachers and stakeholders are aware of the need to educate the gifted to contribute to the socio-economic society effectively.

Global Views of Gifted and Talented Education

Investing in gifted and talented education and its socio-economic returns holds global significance, including Ghana. While there are differences in practices and policy guidelines regarding giftedness and gifted education globally, developed nations with support and resources have focused on studies to improve giftedness policy and enhance the competitiveness of their workforce (Beghetto, & Kaufman, 2021; H. Res. 5116, 2010). Some countries, like those influenced by Confucian Cultural Heritage (CHC) such as South Korea, China, Japan, Hong Kong, and Taiwan, are committed to supporting gifted students to achieve highly, and believe that every individual can potentially achieve the same expert skills based on hard work, persistence and diligence, although they hold a sturdily egalitarian view of gifted education (Phillipson & Cheung, 2007). Additionally, countries like Russia, Taiwan, Israel, Italy, and North Korea offer appropriate holistic education for the gifted at the national level (Phillipson et al., 2009). The US, UK, Australia, Singapore, Germany and Finland allocate significant funds for gifted education programs and research, emphasising equitable and inclusive education practices to avoid exclusion.

In the US and the UK, although the modes of defining gifted students differ, gifted education provision is inclusive and equitable, encompassing various categories of schools (Freeman, 2015; National Association for Gifted Children, NAGC, 2023). The focus is on ensuring that gifted students reach their highest potential, with a focus on teacher professional development to influence gifted education provisions (Assouline & Lupkowski-Shoplik, 2021; Callahan, Plucker, & Vaughn, 2023; NAGC, 2023).

In contrast, the situation is different in Ghana, and the gifted are the most susceptible in inclusive education provision (Allotey, 2019; Allotey et al., 2020; Deku, 2013). Teacher preparation rarely considers the existence of gifted children rather children with disabilities see (e.g., Opoke et al., 2017). The outcome of this research will not only raise participating teachers' consciousness but also increase awareness globally. The linkage between abilities (gifts) as natural resources and society's progress will be highlighted through heightened awareness.

Rethinking STEM Skills for 21st Century Workforce

The challenges of the 21st century STEM skills concern with how to integrated disciplines to meet the contemporary workforce demands (English, 2016). This account for rethinking how individuals learning abilities can be met in STEM areas (Dede, 2010) which appear to answer current global workforce concerns in the 21st century, and enable students' reason logically to apply skills toward problem solving (Dede, 2010; English, & King, 2015; Mukaromah, Mustadi, & Nisa, 2022). Widya and Yosi's (2019) work in STEM education seeks to enhance students' skills and cognitive experiential developments needed to address the 21st century challenges. For Moore (2009), STEM education seeks to train the workforce needs of 21st century. The focus of STEM looks beyond elitism and exclusion for full inclusion as its tenet. STEM education improves critical, creative and analytical thinking, innovative, productive, problem- solving skills and connected to other subject areas (Dede, 2010; English, & King, 2015; Mukaromah, Mustadi, & Nisa, 2022; Widya and Yosi, 2019).

A study by Thingwiangthong, Phairoth, Termtachatipongsa, and Yuenyong (2019) drew qualitative data using 42 stakeholders about STEM education curriculum development status quo in Thailand. Findings revealed that the school setting function beyond the real-world to develop appropriate connections between academic content and practice. Findings highlighted that STEM education needs to accommodate and challenge students' diverse learning abilities and that pedagogical approaches without STEM integration neglect some students diverse learning needs, and this supports a US study describing that such neglect contributes to students' underachievement and school dropouts (Sullivan, 2011; Tofei-Grehl & Callahan, 2017). The emphasis lies in guiding students to strategise, devise, execute, engage, and recapitulate as they tackle problems, while also enabling them to categorise newfound knowledge in relevant connections (Mukaromah et al., 2022; Thingwiangthong et al., 2019; Widya and Yosi, 2019).

Limited teacher knowhow to understand STEM related framework needs increasing global attention. A study by Dare, Keratithamkul, Hiwatig, and Feng (2021) do not only show the existence of inadequate understanding concerning how educators perceive and frame real-world contests pertaining to 21st-century skills, but also their role in encouraging STEM-oriented professions through implementation of integrated STEM teaching. Thus, education is seen as a pivot to achieve the 21st century skills of the SDG 4.7 in promoting educational inclusion for all and this is an improved level of education from the former behaviourist to a more constructivist perspective (UNESCO, 2015). A study conducted in Thailand about STEM education syntheses have shown that STEM education integration enables students to observe critically, use numbers, infer, communicate, measure, identify relationship of space and time, classify, recognise and control variables, operational definition of variables, interpret data, formulate hypotheses, experiment, make judgement and draw conclusion are means of basic skills processing for integration (Apaivatin, Srikoon, & Mungngam, 2019). Suggesting that STEM integrated curriculum enhances high reasoning and process skills to fulfil societal challenges in the knowledge base economy.

STEM Education, Bridging the Gap to Meet 21st Century Skills Demands

The 21st century STEM competency skills have the ability to produce both cognition and skills necessary to meet global tasks of the competitive knowledge economy. Such skills include critical thinking, creativity, communication and collaboration

representing 'the four Cs'. The contemporary skill acquisition does not only concern about learning of science for instance (robotics, manufacturing, aerospace, etc), technology, engineering and mathematics, rather, how each of these subjects is connected to pedagogical interface including collaborative interlace with other subjects other than STEM in itself. Besides, it is an interdisciplinary program (Australian Education Council, 2015; Mobley, 2015).

Consequently, the pedagogical STEM connectivity cannot be ignored. For instance, the language of mathematics is science as scientific ideas needs the support of mathematics (modular arithmetic, trigonometry, geometry, etc.) to formulate and explain concepts in music and dance, athletics, creative and performing art. Thus, connection between STEM education and the arts is indisputable (Dell' Erba, 2019). For example, soil porosity, measurement, approximation, weight and units, balancing, equations and mixing of colours all share a common thought in STEM subjects with language as a basis for all content areas. This can evoke a more affluent and substantial creative levels of communique about the real-world experience. Therefore, integrating STEM and arts (visual and performing arts), new competencies and skills such as socio-emotional and interpersonal skills, active learning, cultural capability and divergent and naturalistic thinking skills are introduced towards applications in the school environment, work, and life functioning. For Dell' Erba (2019), whereas STEM education fosters the habits of mind, the arts help with providing opportunity to strengthen learning and intellectual development in a more meaningful process.

Recently, within the global market, high skill group individuals with creative, critical and problem-solving skills, self-managing stressful situations with resilience in active learning engagement are in great demand as noted in 'WEF Future of Jobs, UK Report. The 21st century STEM integrate skills about the deliberate training of untrained skills and cognitive abilities, thus, dual and multiple competencies (Apaivatin et al., 2019; Australian Education Council, 2015; Dell' Erba, 2019; Mobley, 2015; Widya and Yosi, 2019). Thus, STEM education accommodates not only intellectual abilities but also alternates talents or gifts including leadership, music, entertainment, linguistics, athletics or artistic and creative skills than limiting education to only cognitive aspect.

Human Capital Development and 21st Century STEM Skills

STEM and human capital development are synonymous and appear to be a double edge sword, as it prepares individuals for life fulfilment to in turn give back services to society base on their potential. STEM education and individual capital advancement seem to interlace and therefore, parallel. Giftedness is a trained component (Anderson, 2016; Smith & Campbell, 2014) through STEM integrated instruction until developed into talent (Reis & Sternberg, 2009; Subotnik et al. 2011). Students are diverse with diverse learning abilities in experiences; and require an integrated type of education with a well research-informed STEM integrated program intervention (Sullivan, 2011; Tofei-Grehl and Callahan, 2017; Tomlinson, 2013; VanTassel-Baska, 2018). STEM education focus can be classified into three facets including innovation, problem-solving and design (Hernandez, Bodin Elliott, Ibrahim, Rambo-Hernandez, Chen, & Miranda, 2014). As consequence, for STEM education to correspond with knowledge-based economic competencies, integration with other disciplines need not overlooked. With Tofei-Grehl and Callahan (2017), Smith and Campbell (2016), teacher professional

development need to be improved toward challenging students diverse learning ability needs.

Besides, future generations need to be prepared as original creative and innovative thinkers in addressing worldwide challenges. STEM education empowers and submerges educators and students in inquiry, creativity, communication, problem-solving skills, and experiential learning techniques (Hernandez et al., 2014; Mobley, 2015; Moore, 2009; Widya & Yosi, 2019) which deepens individuals' understandings of all subject areas. The challenge is whether in Ghana stakeholders in education are aware of, and are engaging students in STEM integrated education is uncertain, this study will explore. Very little research has been done on stakeholders' awareness about gifted education in Ghana. The purpose of this study is to examine and compare stakeholders' awareness of educators in Ghana to foster giftedness relating human capacity development and what they suggest should be applied to support the gifted.

Research Questions

This study aims to investigate Ghanaian STEM teachers' perspectives on giftedness development and their awareness of informed practices regarding the education of gifted and talented children as a dynamic approach to human capacity development. The research will address the following three research questions:

1. What are teachers' perceptions and understanding of giftedness and its relationship to human capacity development?
2. What resources are currently available to support the development of STEM gifted children's potential into talent?
3. How do teachers integrate and implement instructional interventions to foster the advancement of STEM gifted children's abilities into talents?

Methodology

This study adopted a qualitative design approach (Creswell, 2013, 2015) to gain in-depth insights into teachers' perspectives on giftedness and talent development. Stakes (1995) case study technique was employed to solicit additional information from the cases of seven school dropouts. Semi-structured interviews were conducted with ten Ghanaian classroom teachers to explore their beliefs, experiences, and practices related to gifted education. Data from these interviews were analysed using thematic analysis (Braun & Clarke, 2006, 2019) to identify patterns and themes in teachers' responses. The study also reviewed relevant documents and resources pertaining to gifted education in Ghana to supplement the interview findings. The combination of interviews and document reviews provided a comprehensive understanding of teachers' viewpoints and existing support for gifted education in the Ghanaian context.

Participants

The study was conducted in Accra. Ten classroom STEM teachers and seven gifted school dropouts were interviewed. Respondents were recruited from six junior high schools comprising four public and two private schools and seven school dropouts based on a purposive sampling technique (Guest, Bunce, & Johnson, 2006; Patton, 2015). The ten teachers comprised five male and five female who were professionally trained mathematics and science teachers with four teachers from private and six from public schools participated in the semi-structured interviews. The seven school dropouts included four boys and three girls; interviews were also conducted on one-to-one basis at school libraries. They comprised two disabled but gifted, pseudonym DG1 & DG2, two gifted or able G1 & G2, and the other three

who were either average or below average students; BA1, BA2 & BA3. Participating teachers' pseudonyms include Abena, Adoley, Andy, Bone, Ebo, Enywonam, Esi, George, Joojo and Wasseela. All the ten participants had a bachelor's degree in education, except for George who only had a teaching qualification and taught mathematics. Ebo held a master's degree in Educational Psychology and taught mathematics and science. Adoley held a diploma and B.Ed. in Basic Education and M.Ed. in TESOL and taught mathematics. The remaining seven participants taught both mathematics and science. George and Adoley taught only mathematics and Joojo taught only science. The participating teacher cohort were from varying cultural settings.

Data collection

Data were gathered through semi-structured interviews and teachers' lesson plans. The boundaries definition of this case study included the geographical location, context and time (Poulis, Poulis, & Plakoyiannaki, 2013). That is, interviews were conducted after school sessions in school libraries when a participant has no lesson and availability of school dropouts which lasted between 45 to 60 minutes. The interview questions revealed the teaching and learning processes that teachers used to develop the gifted in the regular classrooms (see Appendix in Allotey, 2019). All interviews were audio recorded and transcribed for analysis.

Ten teachers lesson plans were gathered for examination and exhibited if each teacher was applying differentiated learning techniques; evidence of analytical, creative and problem-solving teaching techniques, and if the content of each lesson was adequately challenging children diverse ability needs. Teachers' lesson plans have proved to be an essential source of data (Tofel-Grehl & Callahan, 2017) and were used to support or disprove data gathered from participants interviews. All the lesson plans examined were combination of mathematics and science and were diverse depending on where each teacher was within the instructional cycle (see Allotey et al., 2019). A checklist of exact giftedness approaches was drawn from literature (Tofel-Grehl & Callahan, 2017; VanTassel-Baska, 2018). Children written tasks in mathematics and science were used as extra data gathered (see also Allotey et al., 2019). Data collected from the seven gifted school dropouts were used to dispute or confirm how classroom instruction challenges children diverse learning needs and accommodate the gifted.

Data Analysis

Analysis of data was in two phases. Deductive coding to recognise teaching styles that teachers executed to address Research Question three (RQ3) to identify evidence of pedagogy associated with approaches used to support gifted children for classroom instruction. Ten lesson plans were analysed with allocated 'a priori' codes (see also Allotey, 2019). Both groups of respondents' interview data were analysed and matched against the 'a priori' codes to reflect the specific pedagogical procedures teachers employed.

Next, was inductive coding applied to analyse the interview data for (RQ1 & RQ2), to create categories about teachers' opinions of thematic intervention methods (Braun & Clarke, 2019). Codes were grouped for the documentation of significant patterns and themes based on parallels, dissimilarities and inconsistencies of respondents' answers.

Emergent codes, categories and subcategories were produced to develop themes by synthesising the coded data. These themes were prearranged and validated with the interview data for full data analysis and were

used to clarify how teachers theorized and expressed their perspectives and understanding of giftedness instructional practices, that they proposed to progressively advance the gifted potential into talent, as human resource capacity development, rather than oil, gold, manganese, diamond or bauxite which are exhaustive natural resources. The sum-ups of these sets of themes were used to address the three research questions.

Results

The results are reported in three stages. Stage One, presents teachers' pedagogical procedures and practices they used in developing STEM gifted children-RQ3, Stage Two reports on the findings that strengthens respondents' understandings about giftedness-RQ1, whereas stage Three presents factors that supports gifted children potential into talent RQ2.

Stage 1: Teacher Respondents were asked to describe some of the gifted education programs they uncovered during their preservice education for teaching gifted children. All the teachers noted that their preparation was not specifically focused on teaching the gifted rather, emphasis was on teaching methods and assessment. For example, five teachers noted, "we have to repeat topics using more methods" making the "gifted boring" causing "frustrations and complacencies" for all children in the classroom to understand, but not helpful to the good or brilliant children… some "become truant and school dropouts". G1, a gifted but school dropout was asked why he/she stopped schooling and expressed that "I stopped schooling.

Moreover, Andy and Esi believed that using "more methods" to support "good" children is expected of teachers but they were not able to clarify what these methods were. With six teachers, "using the same item to examine all students' performance enable us identify the good … and with these many methods of teaching you can meet all children special needs". Nevertheless, teachers did not use these "many methods" in their lesson plans, the same exercises were noted for each entire class, including the physically challenge children. Thus, respondents' Teachers repeat most of the topics which I have already learnt … a waste of time, … when I asked questions, they shout at me that you… questions too much…I'm too know…" (G1, July 28, 2018 at 4.00pm). G2 broadened this view by stating, "I was made a second teacher to help those who are not good, but … they are not serious to learn and you have to waste time on them…I can't be doing that all the time…". (G2, July 29, 2018 at 12:30 pm). The proposition about repetition of material was consistent in most teachers' lesson plans (see chapter 5 of Allotey, 2019). understandings of "more/many methods" requiring a variety of methods to meet the needs of all children.

The lack of teachers' awareness of exposure to giftedness and gifted education practices was evident in all teachers' lesson plans and in Joojo's response, he stated, "in Ghana, teacher education programs focused on using more methods of teaching all children and not how to teach the gifted". Ebo extended this view by responding, "the gifted are not many and we were not given programs about how to cater for their needs…" Enyonam told a story, "if I decide to offer for each student learning needs one by one, it will be difficult for me to finish my syllabus and most of my students are likely to fail in the BECE…." (Enyonam, July 18, 2018, at 2:00 am). Enyonam's view indicates that teacher education did not prepare them for gifted education, besides teaching STEM gifted students. Rather, the focus was on application of different teaching methods during instruction to ensure children could pass national examinations but did not clarify the meaning of the wide-ranging teaching methods. Thus, teacher focus was on academic domain (see also Allotey, 2019).

All the respondents noted that in their teacher preparation inclusive education (IE) principles seemed to relate to 'disability-related agendas'. That is, the interview data revealed that teacher preparation programs focused on special education with an emphasis on children with disabilities; and there were no program models scheduled for teachers in catering for the gifted in either STEM subjects or other subject areas. Bone expanded this proposition by stating "during my teacher training … I had opportunity to learn education and two courses of special education … for children with disabilities .... no courses like how to cater for and teach the geniuses …." (Bone, July 18, 2018, at 10:00am). This suggestion disclosed that teacher education's focus was to support the disabled or physically challenged within IE provisions as revealed by Opoku et al. (2017). This view was not consistent with DG1 and DG2, who dropped from school for the difficulty in reading teachers notes and class exercises detailed on the board due to visual impairment challenges. DG1 noted, "I cannot see or read from the board and some of my classmates used to shout at me when I walked closed… board and I am very tall … can't sit in front…and for me, I can write my own story and shoot movie, so I think the school will not help me … but I am good in math and science, and I teach my classmates oo "(DG1, July 23, at 12:00 pm). Abena broadened this view by articulating: This "child has stopped schooling just recently but very brilliant in mathematics and science, in fact, reading … the board was a difficult task and making his/her writing 'basabasabi'…." in Twi, and in English as 'not readable']. (Abena, July 12, 2018 at 3:00pm). DG2 also told a story, "me … I can't read from the board, I learnt all what they…will teach in class before I come to school, … teaching us the same thing in class made me unhappy, so I like to draw when the teacher … repeating … things and a waste of time for me…" (DG2, July 25, at 2:00 pm). George in his opinion stated, "you see, we want better people to study mathematics, technology and science and not just the visual impaired children because they will waste your…. time to not finish the syllabus". This assertion revealed that the disabled but gifted are not appropriately accommodated for instruction in the Ghanaian regular classrooms (see also appendix- Allotey, 2019).

Higher subject content knowledge emerged as an essential factor towards gifted children talent development (human resource development). Nine teachers believed that gifted children can only succeed through advanced content knowledge, a view consistent with Tofel-Grehl and Callahan (2017). However, Maker (1982), Tomlinson (2013) and Van Tassel-Baska (2018) advocate for the curriculum to integrate with a more advanced content knowledge, processes and products with appropriate techniques of giftedness practices. Ebo expressed his view by stating, "these brilliant children, when you teach them difficult things in mathematics and science, they pay attention in class". Contrasting this view, one teacher noted, "if you depend on teaching them difficult things in the subject, the majority of … will not understand the concept". For Esi, "advanced subject matter knowledge is first when developing gifted children". When the school dropout BA2 was interviewed why dropping out of school, the interviewee stated, "… me I didn't understand … that maths … [*eye beberee bi ema me nhu hwee*]" the response was in Twi (meaning in English, 'was due to several reasons making me to know very little maths') and further explained that the subject becomes more complex making it difficult to follow and comprehend; … "but I can repair computers, TV, fun and radio you… can even call me to repair yours …" (BA2, July 29, 2018 at 4:30pm). BA1 broadened this belief

by voicing, "me I like drawing… and I like working with computers so I work every day and every night … with friends … if you like bring your broken computer, I will repair it … but for maths … [*neke akontaa babaoo ebgannatwo, ehaa ne nnhwibaa waa*] … the response was in Ga (meaning in English 'as that complex mathematics was not making me happy in class, it provokes my anger') (BA1, July 29, 2018 at 3: 40 pm). When BA1 was asked about what they learn at nights using the computer he told a story, "…we use some skill …to scam people and make money and it is safe to do that late in the nights…" With BA3, "me I can make my own song and sing and dance to make people happy, [sic], [Entertain people], I use the up and down bits to make the music and I am good at using science to produce electricity, but that kind of mathematics I can't see top…[understand], and I like playing violin and my friends like me…. but that 'huhuduos' maths I hate it, and they say… I am not good…". [sic…complex mathematics] (BA3, July 30, 2018 at 2:00 pm). The emergent theme that gifted children development depends on advanced-level content knowledge with numerous methods was not evidently noted in teachers lesson plans (see Appendix-Allotey et al., 2019). All the teachers were aware of the usefulness in addressing individual differences, however, application in the instructional classroom was said to be a challenge (see Allotey, 2019), and making the gifted of diverse abilities unnoticed and vulnerable contributing to truancy in children and some dropping out of school.

In brief, five themes emerged relating to teachers' repetitive classroom instruction practices for developing gifted children. First, very limited teachers exhibited knowledge of any of the approaches as intervention to support the gifted. Teachers lesson plans did not show evidence of meeting all children diverse learning needs. Second, teacher education programs disclosed evidence of the provision of several courses to meet the academic needs of the average cohort group making the gifted more vulnerable with some dropping out of school and creating problem for society. Third, there was inadequate grounding in providing for children varied ability learning needs. It seemed teacher education focused mostly on methodologies and assessment, and presumed classroom instruction was to ensure all students passed national examination, and the more able children would perform if introduced to advanced content. Fourth, teachers recognised they were teaching children of different abilities, but scant approaches in pedagogy were appropriate to meet all children learning needs. Fifth, teachers assumed the gifted and talented children are those proficient in mathematics and science areas, 'a naïve belief', (see also Allotey, 2019).

Stage Two: Findings are now presented that demonstrate respondents' opinions about approaches for developing giftedness in children as a measure of human capital development. The findings of the interview data revealed that respondents misunderstood techniques for teaching the gifted and this underpins their style of teaching the gifted.

Teachers were asked about their opinions about differentiated learning techniques they apply to challenge children varied ability needs. The answer was that all the teachers assumed methods that they believed could offer fairness in classroom pedagogy. Respondents' familiarity at individual level of differentiation varied and appeared puzzling. Five teachers believed that differentiation was a method of categorising children ability levels. For example, Wasseela described differentiation as "…to classify children with many abilities". The remaining five teachers believed differentiated instruction was "recognising individuals' abilities and providing them work that relate to their level". Andy was designating children with disabilities by saying, "with teaching you need

to cater for all children with special needs and that's inclusive education". These results confirm the analysis of teachers' lesson plans, which had no strong claim of differentiated instruction. Each teacher's lesson plan introduced a concept for each entire class and supports the technique Megay-Nespoli (2001, pp. 22) defined as the "one-size-fits-all" method (see also Allotey et al., 2019, 2020). In the teachers' lesson plans, references were made from only two textbooks, signifying that teachers frequently relied on textbook with no provisions to challenge the gifted diverse learning experiences, enriching their capabilities and intercessions to advance their style of learning.

When teachers were asked how successful they apply differentiated learning instruction' they all replied, "we do not use it". It was revealed in the interview data that a large class size was constraining teachers' efforts towards differentiated learning (see Allotey et al., 2019, 2020). Bone broadened this belief by saying, "…only one teacher allocated for a class of about 50-100 children, effective work cannot be expected…," and "so we overlook differentiated instruction." To provide for all children diverse learning needs was "tedious", alternatively, we teachers would "leave the gifted, those with disabilities and the [sic…academically] weak and focus on the average children who are many in the classrooms…." Presumably, diverse needs support, learning opportunities and motivation as recommended by advocates (NAGC, 2023; Neihart, Reis, Robinson, & Moon, 2022; Pfeiffer, 2023; VanTassel-Baska, 2018), for the gifted who are a nation's 'human capacity resource' other than oil or gold that depletes were ignored.

When teachers were asked whether differentiation instruction opposed inclusive education (IE) philosophies, teachers' thoughts were diverse. Six teachers assumed differentiation instruction contradicts with IE philosophies, whereas four teachers expressed their inadequate understanding and application. Five teachers held judgmental viewpoints about differentiated coaching and described them as unhelpful, because such methods maginalised "… children who are physically challenged and those with low ability", (see also Allotey et al., 2019, 2020). George broadened this view by stating "I hate differentiating…my pupils everybody is everybody, everybody is good everybody is bad. … I told you when you tend to differentiate them… the child who is not good accepts he is not good, so he doesn't even make any effort anymore. (George, July 20, 2018, at 4: 30 pm).

Six teachers felt that differentiated techniques were difficult to implement due to insufficient teacher familiarity about the concept. The findings align with teachers' lesson plans, because there was no response on model-related approaches to promote individual learning experience, and all children study "the same thing at the same time and… pace". This result was consistent with teachers' lesson plans, which revealed preparation for all children in every class to solve tasks or address the same questions using the same information of content (Allotey et al., 2020).

Stage Three: This section discusses the available learning opportunities for developing gifted children potential (human capacity) into talent (specialised skill). Teachers were asked to tell how they provide for children who complete tasks other than others. They expressed common views by remarking, "we focus on academic achievement of the child" because "the average children are more compare to the gifted who are not many in our classrooms". Nine teachers said, "…we haven't seen anything like that ….". The interview data disclosed that all the teachers used their own

understandings and experiences to inform classroom instruction to avoid exclusiveness (see also Allotey et al., 2020).

Teachers were asked of the measures they used to support the gifted but physically challenged children. They noted that "we allow the short to sit in front" but at times the allocated "instructional time do not permit us to help them" and this…to truancy in most children and finally drop out…". Wasseela added, "those clever children I used to make them second tutors to help the weak ones…", and with Andy stating, "…we … use experience and knowledge when…you see this child is different from others…". All the participating teachers believed that the gifted are few and it is ideal to use personal experience in developing the gifted diverse learning ability needs (human capacity) into talent (expertise skill) and with Bone, he "treats everyone equally in class" and that "all-inclusive teaching" methods will apply to "help all children". However, the meaning of the "all-inclusive teaching" technique, was not detailed in any of the teachers' lesson plans (see also Allotey, 2019). Thus, a general approach would apply rather than using 'gifted-related approaches' like creativity, critical, analytical and problem-solving techniques. Additionally, teachers were asked if it was necessary to support the gifted and the talented learning needs. Nine of the teachers noted that "these individuals are icons of society;", they are creative and innovators"; "we teachers cherish them because they are smart" and "they make our work less difficult" and are … good". One teacher noted, "the gifted and talented are job creators and they already have in mind their future jobs…".

In short, participating teachers were puzzled about how to differentiate the curriculum for gifted children. Misperception occurred because there were no appropriate national curricula defined for diverse learning needs support services. Furthermore, limited teacher education about exposure to giftedness contributed a challenge for the application of gifted education practices and diverse learning needs, which seemed complex for the teachers. Moreover, large class sizes also constrained teachers' efforts to sufficiently accommodate for all children varied needs (see also Allotey et al., 2020; and Graphic 2017, November 13). Hence, to offer support in instruction for the gifted, teachers depended on their own knowledge, sympathies and experiences which are grounded in 'naïve belief patterns', see also (Allotey, 2019).

Discussion

This study seeks to make a follow up of findings in relation to previous work (Allotey et al., 2019; Allotey, Watters, & King, 2020; Deku, 2013), and raise awareness about the existence of gifted and talented children in STEM school system towards teachers' understandings of support needs services necessary for such students. Results established that teachers are not sufficiently prepared to provide appropriate instruction for the gifted and talented in the Ghanaian school system.

Firstly, inadequate exposure to giftedness and the practices of the education for the gifted enable teachers ignore their varied learning needs and this is consistent with former studies (e.g., Allotey et al., 2020; Deku, 2013; Carman, 2011; Megay-Nespoli, 2001). Although teacher education is crucial, it is useful to integrate gifted education practices and complementing with coursework to advance teachers stereotypical perspectives for improved teaching skills (Carman, 2011). Consistent with previous studies, findings revealed that teacher education focused on methodology and assessment to enable children high success in national tests (Allotey et al., 2020, Avoke & Avoke, 2004). Moreover, a US study detailed that efficient provision of children different learning needs depend on teacher preparation (Fraser-Seeto, Howard, & Woodcock, 2015; Moon &

Brighton, 2008; NAGC, 2023; Robinson, Shore, & Enersen, 2007; VanTassel-Baska, 2018), and similar to Deku and Vanderpuye's (2017) work on IE provision in Ghana suggesting that teachers are ill prepared to sufficiently provide for children differing learning needs.

Additionally, giftedness and gifted education practices have not been clearly articulated within the Ghanaian IE policy and hence, not obligatory for instruction, this shows that the gifted and talented children are capable to study without extra teacher support (Allotey et al., 2019), see also (Moon & Brighton, 2008). Findings from this recent study expand on earlier results (Allotey et al., 2019; Allotey et al., 2020; Deku, 2013; Deku & Vanderpuye, 2017; Ngara, 2017), suggesting that due to teachers limited informed knowledge relating to gifted and talented education, the gifted, gifted but disabled, the low average, the normal intelligent and the average only "passed through the school system" with limited support, opportunity and motivation, leading to gifted children school dropouts and the most susceptible in the school system.

Lastly, a lack of teacher familiarity with gifted education exposure, flexible curricula for pedagogy to accommodate each child learning needs was absent contributing to the 'missing link' and unleashing the gifted and the talented human capacity development. However, with UNESCO, (2016), NAGC (2023) and VanTassel-Baska, (2018), a nation's curriculum needs to be flexible to enable suitable adjustment of classroom instruction approaches and application. Nevertheless, previous studies disclosed that the curriculum was not flexible as teachers have insufficient 'control over the content', with a mandatory structure of all teachers' lesson plans (Allotey et al., 2019). In the lesson plans, teachers are provided with a 'mandated uniform template' with no allocated empty space for groundwork and modifications (Abgenyega & Deku, 2011); (see also Allotey et al., 2019 and Allotey et al., 2020), and (Deku & Vanderpuye, 2017). Teachers misidentified who the gifted are as they misunderstood and confused with recognising the academically gifted and talented children as proficient in only mathematics and science, leaving those skillful and gifted in creative art, leadership, language, athletics, music and dance, engineering, and/ information technology as unidentified, (see also Allotey et al., 2019; Borland, 2005, 2009) and (Renzulli, 2005, 2009).

Limitations

This research is limited to ten teachers and seven school dropouts in one region of Ghana and cannot be generalised. Although the researcher interviewed school dropouts, due to time constrain, regular classroom children were not interviewed and unable to also observe teachers' classroom instruction, and this may be essential for future research and interviews with other stakeholders in at least two regions across the country.

Conclusion

To improve on teacher limited knowledge in relation to gifted education practices, professional development should integrate STEM disciplines with formal enclosure of gifted education (Fraser-Seeto et al., 2015; Hudson et al., 2010; NAGC, 2023; VanTassel-Baaska, 2018) and University Education programs including coursework models (Carman, 2011; Megay-Nespoli, 2001). It would be helpful to complement with clear policy guidelines that identify and provide support services to address the special learning needs of the gifted categories, see also (Allotey, 2019; Robinson et al., 2020). In-service teacher education through in-service training and workshops could complement. The US, UK, Germany, Russia, Singapore,

Australia, Finland, South Korea, France, Italy and other developed nations have found progress in gifted education research boosting teacher self-efficacy on giftedness pedagogical practices through investment on teacher professional development, regarding gifted and talented education with a combination of gifted education models and talented coaching towards recruiting indispensable mindset (Assouline & Lupkowski-Shoplik, 2021; Eyre, 2009; Gagné, 1991 ; Makel et al., 2020; Renzulli, 2005, 2009; VanTassel-Baaska, 2018) in fostering economic progress and human capital development in diverse contexts.

Previous study found that large class sizes and mandated curriculum discourages effective instruction and adjustment to varied needs support services for the gifted may curb the occurrence of individual socio-emotional challenges (National Association for Gifted Children, NAGC, 2023; Neihart, Reis, Robinson, & Moon, 2022; Pfeiffer, 2023). Significantly, a day can be set aside at least within the school system and the curriculum for all children to display their giftedness potential and creativity, as pertaining to developed nations like the US, UK, Germany, Russia, Singapore, Australia, Finland, north Korea, France, Italy, Taiwan, Israel and other developed nations. This could curtail teachers' naïve view patterns and improve the reliant on academic domain to address the challenges of the 'missing valuable link' 'the gifted and talented' human capacity development in schools to positively contribute to the larger society.

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Appendix

Sample Interview Questions

a) What do you do to STEM gifted children who complete classroom work rather than others?

b) How do you provide for children who are gifted but disabled and cannot finish their class work within the allocated instruction time?

c) How do you provide for gifted children both the 'disabled and able' who do not pay attention in class during classroom instruction when they attempted to do reading or draw?

d) What giftedness program models did you learn during your pre-service teacher education?

e) How do you differentiate your classroom lessons to challenge all children varied needs?

f) How frequent do you differentiate your classroom teaching to successfully meet all children learning needs?

g) What do you do to gifted children who do not like learning mathematics and science in class?

h) What support services do you offer STEM gifted children who like writing stories and drawing in class?