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SCHOOL GARDENS AS A PEDAGOGICAL TOOL IN TEACHING AND LEARNING OF AGRICULTURE IN SENIOR HIGH SCHOOLS IN GHANA

Karim Abdul Rahaman,
Ibrahim M. Gunu,
Abdul-Halim Abubakari[i]
Faculty of Education,
Department of Agriculture and Consumer Science Education
University for Development Studies,
Tamale, Ghana

Abstract:
The study explored school gardens as a pedagogical tool in teaching and learning in Senior High Schools in Ghana. The study employed the descriptive survey design with a mixed-method approach. Purposive and census sampling techniques were used to sample schools offering agriculture science as a programme and agriculture science teachers. A total of 100 Agricultural science teachers were used as respondents for the study. Open-ended and closed-ended questionnaires were used to collect data from the respondents. Descriptive statistics, including mean and standard deviations, were also used to analyze and present the data. The study revealed that SHS will not have land for the school garden in the future. The study indicated that there is no policy document for gardens in SHS in Ghana. The study results further revealed that school gardens are in a poor state and do not support academic activities all year round. Based on the findings of the study, it was recommended that the government and donor organizations support school gardens with funding from SHS in Ghana.

Keywords: school garden, agriculture, pedagogical tool, teaching and learning

1. Introduction

In general, gardens offer a variety of advantages, including the addition of beauty to our surroundings, the provision of fresh fruits and vegetables, air purification, and the provision of a therapeutic atmosphere (Klemmer *et al.*, 2005; Marsh, 2021). For every academic subject, a school garden is the ideal resource for providing practical learning experiences (Williams, 2018). Williams (2018) mentioned that by providing a dynamic setting where students can observe, learn, explore, and grow, gardens engage students.

[i] Correspondence: email arkarim@uds.edu.gh, igunu@uds.edu.gh, ahalim@uds.edu.gh

The school garden can be thought of as a living laboratory where lessons are learned from real-world situations rather than textbook models. Eugenio-Gozalbo (2020) indicates that with this practical learning exercise, students can take an active role in teaching and learning. Vegetable gardening offers students a variety of options to expand their knowledge (Rector, 2021). It also helps students develop an appreciation for the natural world. Through manual labor tasks like weeding, digging, and basic garden maintenance, gardening promotes children's physical development. These activities require both fine and large muscular action of the body (Bradley & Skelly, 2000; Cairns, 2017). Because working in the garden frequently burns a few calories, these activities encourage learners' and teachers' overall health. One of the most significant and fascinating benefits school gardens offer young people is the development of a strong sense of connection and an appreciation for the environment, which may not be experienced in other subject areas of education. This indicates that, besides agricultural science, teaching and learning in other subject areas could benefit from applying agriculture through gardening (Trendov, 2018). Gardening imparts essential life skills in addition to key academic courses (Kallhoff, 2017). Planning a garden requires cooperation, endurance, and patience (Rector, 2021).

2. Problem Statement

All around the world, basic and secondary schools ought to teach agriculture and agricultural science (Amadi, 2012; Bahaman *et al.*, 2010; Lyocks *et al.*, 2013; Man, 2012; Mangal, 2009; Webster & Ganpat, 2014). Oenema *et al.* (2020) pronounce that agriculture science should be included in the curriculum to encourage students to consider potential careers in the agricultural industry.

It is interesting to note that throughout time, both the agricultural education in schools as a subject and choosing to pursue a career in agriculture have decreased (Twumasi *et al.*, 2019).

Additionally, Cabu *et al.* (2018), the school gardens served as real-world classrooms for experiential learning in the subjects of home economics, English, math, and science. Lesson plans were created by teachers that included organic agriculture, climate change, solid waste management, and edible landscaping themes. All primary and secondary education curricula should include instruction on agriculture, according to government mandates (Amadi, 2012; Lyocks *et al.*, 2013; Man, 2012; Webster & Ganpat, 2014). Bahaman *et al.* (2010) recommends that to encourage young people to pursue careers in agriculture, Malaysian institutions offer courses on contractual farming or additional related subjects.

Webster & Ganpat (2014) recommend that curricula be changed to reflect more "*experiential and technology driven learning, with greater emphasis being placed on the use of non-formal setting to facilitate the engagement and learning process*." Mangal (2009) believes that primary and secondary schools should reestablish school gardens and that 4H

groups and schools should collaborate to share resources for planning and education that will engage children.

In spite of efforts by succeeding governments to entice young people into agriculture by providing employment while supplying food for the growing population, Naamwintome and Bagson (2013) noted that the youth in Ghana, the ones that have led agricultural growth and development, are turning away from the industry.

The agriculture industry is facing a number of challenges on a global scale, including urbanization, drought, temperature increases, and scarcity of water. (Al-Thawwad, 2008; Chandio and Shirazi, 2022).

Kabugi (2013) found that agricultural implements, agricultural classes, and school farms are all insufficient. The investigation also discovered that the majority of the schools lacked livestock units/tools and agricultural laboratories. Kabugi (2013) further discovered that teaching and learning agriculture in secondary schools in the Kakuyuni division is hampered by the lack of adequate teaching and learning materials. Muchena (2013) also revealed that most schools lacked land since it was being used for form four KCSE (Kenya Certificate of Secondary Education) examination projects. This demonstrated unequivocally that students studying agriculture other than form four pupils do not complete fieldwork. Kabugi (2013) also discovered that inadequate classrooms, farm facilities, and other resources made teaching and learning about agriculture difficult. The students found several subjects, like agricultural economics, farm power, and machinery, to be quite challenging.

It is based on this that the researcher wants to look into this issue because the researcher believes school gardening programs play a key role in teaching of agriculture and correcting the misconceptions that students have about agriculture education and farming.

3. Research Objectives

The objectives of the study seek to:

1) Assess the current state, structure and practices of school gardens in Senior High Schools in Ghana.
2) Ascertain the existing curriculum support for school gardens in Senior High Schools in Ghana.

3.1 Research Questions

1) What is the current state, structure and practices of school gardens in Senior High Schools in Ghana?
2) How is the existing curriculum supporting school gardens in Senior High Schools in Ghana?

4. Literature Review

4.1 Rationale for Teaching General Agriculture in Ghanaian Schools

Food production, money generation, and employment prospects, agriculture is widely acknowledged to be important to the national economy. Ghana uses only a small portion of its agricultural potential, nevertheless. Therefore, the government's strategy is to modernize the agricultural sector in order to make Ghana an agro-industrialized nation, resulting in the nation's ruralization. While aggressively encouraging the growth of medium and large-scale agricultural firms, the strategy seeks to increase the productivity of small-scale producers. (Ministry of Education, 2010, Ghana Senior High School General Agriculture Teaching Syllabus)

In accordance with government policy, the Ministry of Education is responsible for reviewing agricultural education to ensure the development of a well-trained agricultural workforce, including managers and specialists of various kinds. It is essential that agricultural students receive a well-rounded education in order to give them the scientific, practical, and technological skills they need to succeed in a variety of agricultural fields. The agricultural education provided at the secondary school level, especially in the study of General Agriculture, lays the groundwork for future employment in agriculture at the tertiary level.

4.2 General Aims

The General Agriculture syllabus is designed to help students to:

1) appreciate the role that agriculture plays in Ghana's socioeconomic development,
2) gain decision-making abilities by applying the scientific concepts of data gathering, analysis, interpretation, and observation.
3) through experience and hands-on learning, cultivate the knowledge, abilities, and mindset necessary for lucrative and successful agriculture.
4) recognize agriculture as a business and a feasible source of income;
5) develop positive attitudes, interests, routines, and best practices in agriculture,
6) recognize the roles that extension services play in the agricultural value chain,
7) identify employment opportunities in agriculture,
8) acquire the knowledge to manage agribusinesses effectively,
9) acquire the knowledge and skills necessary for additional training in agriculture.

4.3 The Evolution of School Gardens in Ghana

The history of school gardens in Ghana dates back to the 17th century, when formal teaching began in the colonial masters' castles and forts, which came to be known as the Castle schools. The main goal of growing ornamental plants was to enhance the aesthetics of the institution. Following Ghana's liberation from British rule in 1957, administrations made conscious attempts to institutionalize gardening, which resulted in the establishment of the Ministry of Parks and Gardens and Tourism with the passage of the 1961 Local Government Act 54. The Department of Parks & Gardens is charged with

improving the country's horticultural potential in both the urban and rural areas in addition to its core mandate (Department of Parks & Gardens, 2018). Through institutionalized gardening, it is also tasked with providing horticultural training and extension services to students and pupils from universities and second-cycle institutions. Much greenery was destroyed during the urbanization boom that followed independence to make room for rising industrialization and population. This global trend resulted in the invention of the garden city model in the late 19th century as a means of protecting more of the natural environment and fostering what was referred to as a combination of town and rural life in an urban setting (Howard, 1902). Letchworth and Welwyn, the earliest garden cities in the UK, Singapore, Melbourne, Putrajaya, and Kumasi are a few well-known towns where garden city ideas have been successfully implemented. Ghana adopted this technique to make sure that all open spaces in metropolitan areas, whether they are controlled by the government or privately, are covered in lush, natural flora. Due to the implementation of this program, Kumasi, one of Ghana's cities, was awarded the title of "Garden City of West Africa" in the 1960s (Asare, 2013; Mensah, 2014; Narh, 2020), demonstrating how highly Ghanaian's respect gardens. However, one fast, important question that comes to me in relation to gardening is: Given the advantages that gardening has, do our schools still value it today?

School gardening initiatives are inextricably linked to the many advantages of the garden city model, including improving the health, convenience, and beauty of cities. The school garden includes both ornamental and edible plants, in contrast to the city garden model, which focuses primarily on the growth of ornamental plants. A school garden can range in size from a few pots of flowers or herbs in the hallway or entryway to a quarter- to half-acre plot of fruits and vegetables in the schoolyard (Beláková, 2018).

4.4 Integrating School Garden into School Curriculum

For the majority of learners, senior high school serves as their final educational destination, and it often turns out that these graduates lack the employable skills needed to find employment (Dzobo, 1987; Danso, 2018). Ghana's unemployment rate is rising to worrying levels (Amankrah, 2014). It raises serious questions about the curriculum's ability to develop the capacity for learners to think critically, solve problems, collaborate effectively, be tech literate, be flexible and adaptable, be innovative and creative, be globally competent, and be financially literate (Partnership for 21st Century Skills, 2009; Chu, Tavares, & Lee, 2017).

Few students who graduate from high school are able to pursue further education, and the majority of them 90% are "*erroneously referred to as dropouts*" (Ghana Education Service [GES], 2010), which leads to 60% of young people being unemployed, making it one of the highest rates of youth unemployment (Amankrah, 2014). It is important to highlight that Ghana has undergone a number of educational reforms and reviews with the goal of ensuring that students have the skills needed for decent employment in industries, self-employment, and the pursuit of further education (Ministry of Education [MOE], 2002).

It is suggested by Ganpat (2014) that curricula be changed to reflect more experiential and technology-driven learning, with greater emphasis being placed on the use of non-formal settings to facilitate the engagement and learning process (2014). The inclusion of agriculture in all primary and secondary education curricula should be required by the government (Amadi, 2012; Lyocks *et al.*, 2013; Man, 2012; Webster & Ganpat, 2014). In order to encourage more young people to pursue careers in agriculture, Bahaman *et al.* (2010) advise Malaysian universities to add courses on contract farming or related subjects.

4.5 Conceptual Frame Work

A conceptual framework serves as the foundation for an empirical inquiry. The conceptual framework serves as a road map and anchor for research (Ravitch and Riggan 2016), acting as an integrating ecosystem that aids in bringing all elements together through a process that explains their connections, conflicts, overlaps, intentions, and the contexts influencing the research setting and the study of the phenomena in that setting.

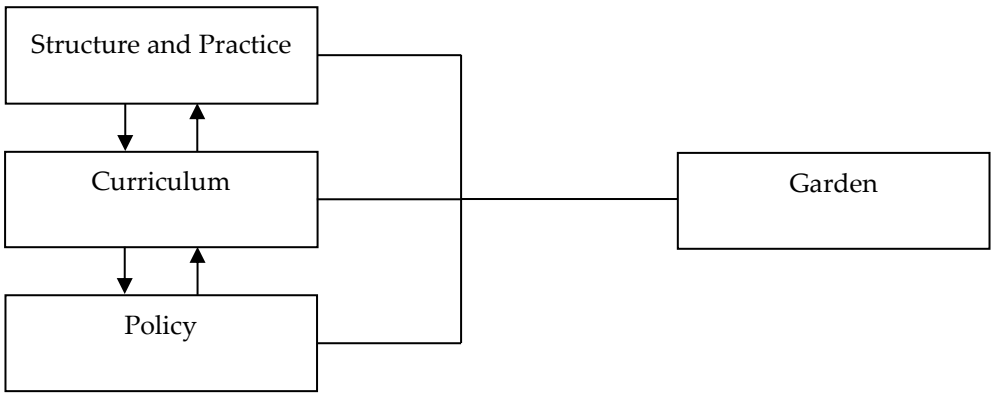

Figure 1: A Conceptual Frame

4.6 Theoretical Frameworks of Garden-based Learning

Theories of experiential education and intelligence, and theories explaining the advantages of integrated curricula could all contribute to a scientific investigation into why gardens are a helpful setting for learning. Experiential Learning Theory, in the view of Baker, Jensen, & Kolb (2002), provides a holistic model of the learning procedure and a multi-linear model of adult development. In other words, this is an all-inclusive model of adult learning that intends to clarify the complexities of and differences between adult students within a single framework. Experience is the focus of this theory, which serves as the core driving force in knowledge, as knowledge is constructed through the transformative reflection on one's experience (Baker, Jensen, & Kolb, 2002). A process called experiential education uses first-hand encounters to build knowledge, skill, and value. Kolb's experiential learning model (Kolb, 1975 in Weatherford & Weatherford, 1987) states that direct experience results in observations and reflections. In turn, these lead to the development of abstract concepts, their generalizations, and the ability to

evaluate their applications in novel contexts. The significance of experience and its function in the learning process is emphasized by the Experiential Learning Theory (ELT) (Kolb, 1984). Additionally, it employs experience to highlight how it differs significantly from behavioral learning theory and cognitive learning theory, which place a strong emphasis on cognition. These theories "*ignore the possible role of subjective experience in the learning process*" (Cherry, 2019), while, as Kolb (1984) attests, "*learning is the process whereby knowledge is created through the transformation of experience*"

4.7 Model of the Theory of Experiential Learning (ELT)

The model of ELT (see Figure 1) shows the process and sequence of experiential learning with its concepts, constructs, and propositions. These components are briefly explained below.

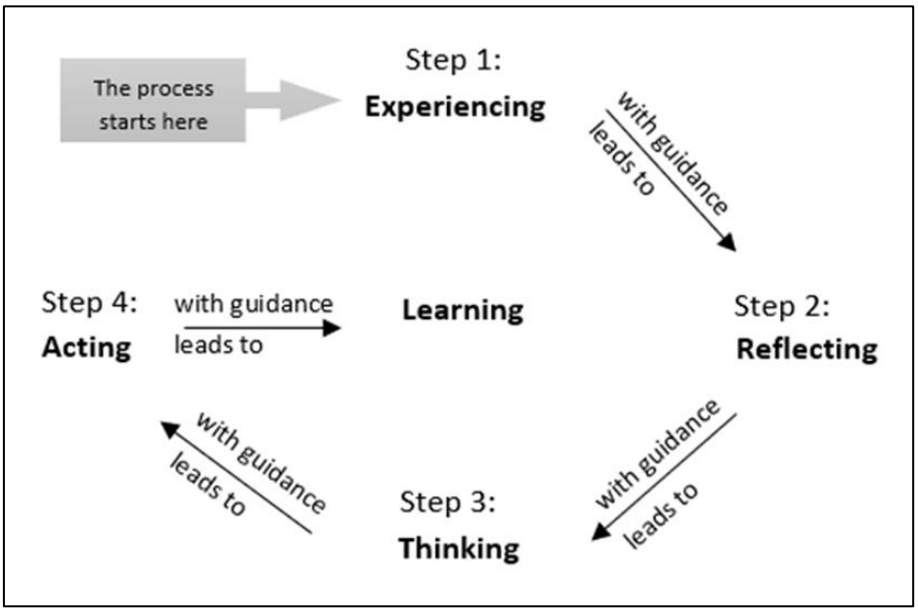

Figure 1: Model of Experiential Learning Theory (Kolb, 1984)

5. Methodology

5.1 Research Design

The study employed a descriptive research design. Best and Kahn (1998) explained that descriptive research focuses on the relationships or conditions that already exist, such as identifying the types of trends, practices, and attitudes that are prevalent, as well as opinions held and ongoing processes.

Apuke (2017) indicated that the quantitative approach uses particular statistical approaches to analyze and answer problems using numerical data.

5.2 Rationale for the Design

It is important to note that the goal of descriptive surveys is to collect data at a certain moment in time in order to characterize the nature of current conditions or to provide

benchmarks by which current conditions can be measured (Creswell, 2012). Additionally, surveys can yield descriptive, inferential, and explanatory data that can be utilized to determine relationships between survey topics and item content (Cohen, Manion, & Morrison, 2007).

5.3 Study Location

The research was conducted in Ghana, taking into consideration all the sixteen (16) regions. Ghana is a west African nation that lies on the Gulf of Guinea, a few degrees north of the Equator. A portion of the Greenwich Meridian also goes via Ghana. The majority of the coast is made up of low, sandy beaches that are dotted with numerous rivers and streams and bordered by plains and bush. There formerly was a belt of tropical rainforest that stretched northward from the coast, broken up by hills covered in dense forest and numerous streams and rivers. However, most of the rainforest was destroyed in the 20th century, leaving only sporadic remnants, mostly in the southwest, some of which are protected. The region north of this belt is made up of grassy plains and savanna. It has a tropical climate. The north is hot and dry, the southwest is hot and humid, and the eastern coastal belt is warm and rather dry. Lake Volta, a vast artificial lake, spans through considerable areas of eastern Ghana.

5.4 Population

Population is defined by Pilot and Hungler (1996) as the entire aggregation of cases that meet a designated set of criteria. In this particular study, all agricultural Science teachers in Senior High Schools in the sixteen regions of Ghana were targeted. However, these categories of teachers were considered for the reason that most often they are supposed to use the school gardens for academic activities.

5.5 Sampling Technique and Size for the Study

The process of choosing a number of groups of units by means of purposeful sampling aims to create results that, for the features that are already known statistically, are as near to the totality's average or proportion as possible (Thomas, 2022). Purposive sampling techniques were used to sample schools perusing agriculture science programmes as well as agriculture science teachers. Censuses' sampling technique was used to sample all agricultural science teachers in SHS in Ghana. However, the total population for the study comprises 100 participants.

5.6 Research Instruments

Research instruments are the tools for data collection, which include questionnaires, interviews, observation and reading (Godfred, 2017). Open-ended and closed-ended questionnaires were used to collect data from the participants. Primary and secondary data were both utilized in this study. The primary data was obtained through the questionnaire. The aspect of the research instrument that utilized a four-point Likert scale, ranging from 1 (Strongly Disagree) to 4 (Strongly Agree), measured the level of

agreement with the various statements, with higher values indicating greater agreement. A mean value of 2.5 and above indicated that the majority of participants agreed with a particular statement. In the process of coding the data, negatively worded items were reversed to ensure consistency in the analysis. This approach enabled the researcher to effectively assess attitudes, opinions, and beliefs related to the topic under study.

5.7 Data Collection Procedures

Data collection is the systematic process of obtaining and evaluating information on variables of interest in order to test hypotheses, evaluate results, and respond to research questions (Muhammad & Kabir, 2016). Data was collected through surveys and personal observations. A survey and personal observation were used to collect data on research questions 1 and 2 on the structure of the school garden.

5.8 Data Validity and Reliability

To validate the instrument, piloting was conducted on the instruments.

5.8.1 Ethical Considerations

The researcher took an introductory letter from the dean of the faculty of education UDS; ethically, the mandate and consent were sorted from all participants considered for the study.

5.8.2 Data Analysis and Reporting of Research Results

Data analysis is the systematic process of utilizing logical and/or statistical methods to evaluate, summarize, and explain data (Shamoo & Resnik, 2009). Data gathered in the field was double-checked to ensure accuracy. Version 20 of the Statistical Package for Social Science (SPSS) software was used to code and analyze the raw data from the completed questionnaires. It should be noted that tables, percentages, and frequencies were utilized to examine the respondents' background data. For research question one, which sought to assess the current state, structure and practices of school gardens in Senior High Schools in Ghana, descriptive statistics such as mean and standard deviations were used to analyze the data.

For research question two, which sought to explore how the existing curriculum supports school gardens in Senior High Schools in Ghana, descriptive statistics such as mean and standard deviations were used to analyze the data.

6. Results and Discussion

Research question 1: What is the current state, structure and practices of school gardens in Senior High Schools in Ghana?

Table 1: School Garden in the respondents' school

Response	Frequency	Percent (%)
Yes	89	89.0
No	11	11.0
Total	**100**	**100.0**

Source: Field survey, 2024.

Research has established that the majority of senior high schools (SHS) in Ghana have school gardens. The SHS is required to have school gardens to serve as the platform for teaching aspects of agricultural science that cannot be taught in the classroom as prescribed in the agricultural science syllabus. The idea of schools having gardens is in line with the theories of experiential education and intelligence (Kolb, 1984). The theories which explain the advantages of integrated curricula could all contribute to a scientific investigation into why gardens are a helpful setting for learning (Baker *et al.*, 2002). Kolb (1984) attests, "*learning is the process whereby knowledge is created through the transformation of experience*". It is important for schools to have a garden, just like any other laboratory. The garden serves as a platform for teaching practical agricultural science. It could then be inferred that schools' decision to establish school gardens is a recommended practice and, therefore, should be encouraged.

Monville-Oro *et al.* (2020) acknowledged that garden-based learning is an educational technique that uses school gardens to amplify instruction across a range of subject areas. It offers a setting that includes practical tasks and improves academic, interpersonal, and social abilities. Also, Eugenio-Gozalbo (2020) argues that the school garden can be compared to a living laboratory where lessons are derived from actual experiences rather than examples from textbooks.

Table 2: Duration of Professional Development or In-service Training Attended on Garden in the Past 5 Years by respondents in SHS in Ghana

Duration	Frequency	Percent (%)
Not at all	82	82.0
One day	12	12.0
Two weeks	3	3.0
Periodically	3	3.0
Total	**100**	**100.0**

Source: Field survey, 2024.

Even though SHS in Ghana have school gardens, agricultural science teachers in the past five (5) years never had professional development or in-service training on gardening (Table 2). Staff training is an accepted practice and should be encouraged in institutions; failure to implement it could result in low productivity at workplaces. Teachers need professional development or in-service training to keep themselves updated in the classroom. The lack of professional development teaching for agricultural science teachers in SHS could lead to under usage of school gardens for academic activities. The finding that agricultural science teachers never attended professional development

training on gardening is worrying since it is established by Burke *et al.* (2018) that professional development aimed at teaching the technology and implementation approaches support teachers to embrace and apply technology in the classroom context. Additionally, it is recognized that those educational institutions should offer effective training to teachers to ensure higher academic achievements of students (Rasheed *et al.*, 2020). Based on the findings of the results, it can be concluded that lack of professional development or in-service training for teachers on school garden could lead to ineffectiveness in using garden to teach agricultural practical in schools, this is confirmed by Bronyah (2016) who suggested that students do not understand agricultural science when an ineffective teacher with low professional development efficacy teaches it.

Table 3: State of School Garden, Size and Structure in SHS

Size	**Frequency**	**Percent (%)**
Less than an acre	52	58.4
1–2 acres	23	25.8
3–6 acres	12	13.5
6 acres and above	2	2.2
Total	**89**	**100.0**

Source: Field survey, 2024.

Table 5 shows that 58.4 % of the respondents stated that their school garden was less than an acre, while 2.2 % said their school garden size was above 6 acres. There is no specific size for a school garden as the size of a school garden depends on the availability of land and resources to schools.

In terms of the structure of gardens in SHS in Ghana, with regards to the size of school garden in SHS, even though school garden is significant tool for teaching agricultural science in schools, there is no specific size for school gardens in schools as the size would depend on the availability of resources. Regardless of the size of schools, they all serve the same objectives and goals. The results are supported by Williams (2018), who stated that many different types and sizes of school gardens have the same general goal of raising plants. In some circumstances, even animals support the teaching and learning agricultural science in schools. Although the importance of school garden is established in literature there is no mandatory recommended size for garden in schools as garden size in schools depends on the availability resources in schools, it is therefore necessary to adopt greenhouse technology in schools as garden with a policy document as it is revealed in (Table 3), this will bring standardization on the operationalization of greenhouse as garden in schools.

Table 4: School land/space availability for school garden in SHS in the future

Responses	**Frequency**	**Percent (%)**
Yes	43	48.3
No	46	51.7
Total	**89**	**100.0**

Source: Field survey, 2024.

It has been revealed from the study that shortly, schools will not have enough land to establish school gardens. Land is one of the most substantial factors a school has to consider when establishing a garden. However, rapid population growth and urbanization have led to land scarcity in schools, which has dire consequences on a school's decision to establish a garden. In fact, this research revealed that in the not-too-distant future, schools will not have enough land for gardens. This is the reason why greenhouse technology needs to be adopted in schools since it does not require much land to be established compared to open field gardens. The outcome of this study supports the findings by Ayambire *et al.* (2019), who reported that in order to help accomplish SDG 15 (life on land), the small amount of land needed for greenhouse technology is expected to lessen issues with land deficiencies and degradation. It is further indicated by Ayambire *et al.* (2019) that the productivity of agriculture and its related activities are further hampered by land scarcity (which results from rising population expansion and competition for varied land uses) and complex land tenure arrangements. For instance, urban and peri-urban agriculture is being quickly replaced by rapid urbanization, with most sites being taken over by estate developers for residential and commercial uses, which are seen as more lucrative than agriculture.

Table 5: Committee to manage and supervise school garden in SHS in Ghana

Responses	**Frequency**	**Percent (%)**
Yes	26	29.2
No	63	70.8
Total	**89**	**100.0**

Source: Field survey, 2024.

The study furthermore revealed that school gardens are not managed and supervised by any committee in the SHS. The school garden, just like any other facility in the school, is supposed to be managed and supervised by the school management. When a garden is not managed properly, the schools lose their academic significance, which subsequently affects the purpose for which it exists, therefore, garden management in schools is a key factor which should not be overlooked. The respondents' impression that there is no committee set up to manage and supervise gardens in schools is not a standard practice and should not be encouraged. The current garden management practice in SHS contradicts the standard garden practice where gardens are supposed to be managed and supervised by committees in schools. It has been found by FAO (2019) that schools need to establish a garden management committee made up of students, parents, teachers, members of the school board of administration and local technical staff from key ministries like agriculture, health, and education to properly manage gardens.

Table 6: Fenced school garden in SHS in Ghana

Responses	Frequency	Percent (%)
Yes	64	71.9
No	25	28.1
Total	**100**	**100.0**

Source: Field survey, 2024.

It has been revealed from the study that school gardens in SHS are fenced. A school garden, just like any other learning environment, is supposed to be enclosed and not open to the general public in order to prevent distraction during lesson delivery. When school gardens are fenced, they are always kept in good condition and this supports teaching and learning processes at all times. The respondents who agreed that their school gardens are fenced recommended that the practice should be encouraged by school authorities. This result of the study agrees with the reports presented by Berle and Westerfield (2022), who note that fencing a garden may be useful to keep out animals, to protect a garden from vandalism, to define garden boundaries or just to help organize a garden area. A properly designed fence can help keep out animal pests like rabbits, dogs and deer, which are a major garden pest and are just as likely to be found in urban gardens as in a rural setting. Additionally, Berle and Westerfield (2022) stated that a garden fence can also help deter minor vandalism, though no fence will prevent serious vandals. Fencing will also help redirect foot traffic in public areas.

Table 7: Source of water for school garden in the rainy season in SHS in Ghana

Sources of water	Responses	
	N	Percent (%)
Stand pipe	3	3.2
Mechanized borehole	2	2.2
Rainfed	87	93.5
No water sources	1	1.1
Total	**93**	**100.0**

Source: Field survey, 2024.

One of the factors to consider when establishing a school garden is water source, Table 10 shows a widely held view of respondents on the source of water to the school garden in the rainy season, 93.5 % of the respondents stated that their schools rely on rainfed as a source of water for the school garden.

Research has discovered that rain is the major source of water for school gardens in the rainy season. The availability of water to the garden is a vital component to consider when establishing a garden in schools. Water scarcity has been a major challenge for gardens in schools across the globe. It is, therefore not surprising when it has been revealed that Senior High Schools rely on natural rainfed as a water source for school gardens in schools. The school garden is supposed to have a permanent source of water, regardless of the season in order for the garden to support academic activities throughout the years. When the garden depends on natural rainfed the garden can only be a seasonal

teaching and learning tool, which in actual case should not be so. The fact that schools do not have a permanent source of water in Ghana is a general concern, the study finding is not different from the research conducted by Adeosun *et al.* (2020) who discovered that majority of Ghana's agriculture is rainfed and conducted in open fields, making it extremely susceptible to climate change.

Table 8: Source of water to the school garden during the dry season in SHS in Ghana

Sources of water	Frequency	Percent (%)
Stand pipe	10	11.2
Reservoir	1	1.1
Mechanized borehole	2	2.2
No water source	75	84.3
Dam	1	1.1
Total	**89**	**100.0**

Source: Field survey, 2024.

It has been revealed that there is no source of water for the school garden in Senior High Schools in the dry season. Water is a significant factor which globally affects the operation of gardens in schools. Conclusively, SHS in Ghana do not have a permanent source of water for school gardens during the rainy and the dry seasons in Ghana. Lack of permanent sources of water for school garden in SHS hinders garden operations both in the rainy and dry seasons and this leads to the garden not being able to serve its academic purpose all year round. For a school garden to serve its academic purposes all year round, schools should have permanent sources of water for gardening activities. This discovery is in line with existing literature of (Al-Thawwad, 2008; Chandio and Shirazi, 2022), which illustrates that globally, the agriculture sector is facing several threats like water scarcity, rising temperatures and drought, which apparently makes it difficult to practice.

Table 9: Frequency at which respondents utilize school garden facility as a teaching and learning tool in SHS in Ghana

Duration	Frequency	Percent (%)
Once in an academic year	21	23.6
Twice in an academic year	13	14.6
Thrice in an academic year	17	19.1
Not at all	2	2.2
As frequent as possible during the rainy season	22	24.7
As frequent as possible during the academic year	9	10.1
Weekly	5	5.6
Total	**89**	**100.0**

Source: Field survey, 2024.

Table 9 shows that 24.7 % of the respondents use the school garden as a teaching and learning tool as frequently as possible during the rainy season.

It is established that agricultural science teachers in SHS use the school garden as a teaching and learning tool as frequently as possible during the rainy season. School

gardens can be used to teach all subjects regardless of the season within the year; it is, therefore, significant to encourage the use of school gardens for academic activities all year round instead of just for the rainy season. The assertion that the garden is used as frequently as possible to deliver lessons during the rainy season is a recommended practice and should be encouraged. This idea is supported by the fact that the garden offers chances to educate not only science but also arithmetic, history and social science, English language and arts, and visual and performing arts (Trendov, 2018). In a garden setting, ideas that seem abstract in a classroom come to life (Eugenio-Gozalbo, 2020).

Table 10: Type of crops cultivated in school gardens in SHS in Ghana

Crops	**Responses**	
	N	**Percent (%)**
Vegetables	88	74.6
Grains	30	25.4
Total	**118**	**100.0**

Source: Field survey, 2024.

It has been discovered from the study that school gardens are used to cultivate vegetables. The fact that the school garden is used by the Senior High School to cultivate vegetables is a common practice in schools since the garden is supposed to be a place for teaching and learning of activities such as eating habits and values of vegetables. The study is in line with the findings of Cooke (2007) and Opitz (2017), who revealed that school gardening is one method for teaching learners to value agriculture and the consumption of wholesome foods like fruits and vegetables. Understanding and appreciating where our food originates from is one of the most significant benefits of vegetable gardening.

Table 11: Uses of harvested produce from school gardens in SHS in Ghana

Uses	**Responses**	
	N	**Percent (%)**
Food supplement for school feeding	30	23.8
Internally generated funds for the school	27	21.4
Internally generated funds for the agriculture department	68	54.0
Food supplement for staff feeding	1	0.8
Total	**126**	**100.0**

Source: Field survey, 2024.

The research discovered in Table 11 that harvested yield from the school gardens is a source of internally generated funds for the agriculture department. Agriculture science departments in various schools do not get financial support for garden activities as shown in Table 11**,** but rather depend on proceeds from school garden as a source of IGF. This calls for the adoption of greenhouses in SHS as gardens since the area per yield of greenhouses is higher compared to gardens, and consequently, greenhouses could serve as a better source of IGF than gardens. The idea that harvested produce from the school

garden serves as a source of internally generated funds for the agriculture department is encouraging and, therefore, should be supported through the greenhouse project, which is already under the government of Ghana's programme Planting for Food and Jobs. When greenhouse is adopted, it could help reduce the financial burden on government with regards to provision of fund for the running of schools, this finding is in connection with the evidence established by Oenema *et al.* (2020) that historically school garden has been earning money for the school and therefore governments and foreign development partners are becoming more and more interested in school gardens.

Table 12: Types of activities performed in school garden in SHS in Ghana

Activities	**Responses**	
	N	**Percent (%)**
Academic activities	87	77.0
Non-academic activities	23	20.4
Reform ground for students/punishment	3	2.7
Total	**113**	**100.0**

Source: Field survey, 2024.

Table 12 shows that 77.0 % of the respondents had a widely held view that the school garden is used for academic activities in SHS.

Participants in the study have widely indicated that the school garden is used for academic activities in SHS. School gardens are mainly used for teaching practical agricultural science in schools as mandated in the agriculture science syllabus. Agricultural science requires practical sessions, and the garden is often a place where practical sessions are carried out. Teaching practicals in agriculture enable students to achieve the knowledge they require, as indicated by the Ministry of Education (2010, Ghana Senior High School General Agriculture Teaching Syllabus. The practical aspect of the subject is essential, and teachers should give adequate attention to it. In line with literature, Kolb's experiential learning model (Kolb, 1975 in Weatherford & Weatherford, 1987) stated that direct experience results in observations and reflections and these lead to the development of abstract concepts, their generalizations, and the ability to evaluate their applications in novel contexts, experiential education uses first-hand encounters to build knowledge, skill, and value. This is further supported by the study of Monville Oro *et al.* (2020), who indicated that garden-based learning is an educational technique that makes use of school gardens to amplify instruction across a range of subject areas. It offers a setting that includes practical tasks and improves academic, interpersonal, and social abilities. Additionally, school gardens give kids the chance to practice life skills like leadership, decision-making, and nutrition. Shisha (2020) reported that the goal of these school gardens is to improve students' connections to farming, to improve knowledge transfer between generations, and to increase dietary diversity in the learners' meals. Additionally, the Agriculture Organization of the United Nations (2020) said that the school garden should be mainly for learning about life, better eating, livelihoods and the environment. "Garden lessons" therefore have enormous educational value. They bridge

theory and practice, reinforcing classroom learning with hands-on experience and observation and vice versa.

Table 13: Challenges of school-based gardens in SHS in Ghana

Challenges	Mean	Std. Deviation	Interpretation	Rank
Inadequate water for garden activities	2.2921	1.92000	Severely challenging	1st
Inadequate funds to manage the school garden	2.4944	2.24683	Severely challenging	2nd
Lack of clear policy document backed by legislation on school garden	2.9326	2.40642	Severely challenging	3rd
Lack of existing political commitment	3.7753	2.80322	Moderately challenging	4th
Poor state of school garden to support academic work	4.7640	2.16911	Moderately challenging	5th
Inadequate time to utilize the garden on a school day	4.8989	2.39339	Moderately challenging	6th
Inadequate land for school gardens	5.3258	3.16865	Moderately challenging	7th
Inadequate training on how to use the garden within the current curriculum	5.3596	2.33183	Moderately challenging	8th
Inadequate teaching experience or training in garden activities	6.6966	2.55131	Least challenging	9th
Mean of means/SD	**4.2821**	**2.44342**		

Source: Field survey, 2024.

There are numerous challenges facing school garden activities in SHS, table 13 shows ratings of challenges of school-based garden in SHS, respondents agreed to the statement "Inadequate water for garden activities" (Mean = 2.29, Std. Dev = 1.92) as the 1st most Severely challenged to school garden in SHS, additionally, respondents also agreed to the statement "Inadequate funds to manage school garden" (Mean = 2.49, Std. Dev = 2.24) as the 2nd most Severely challenged to school garden in SHS in Ghana, and finally, another category of the respondents also agreed to the statement "Lack of clear policy document backed by legislation on school garden" (Mean = 2.93, Std. Dev = 2.40) as the 3rd most Severely challenged factor to school garden in SHS.

Inadequate water for garden activities is the most severe challenge to school gardens in SHS in Ghana. Water is among the key factors to consider when establishing a school garden. Generally, it will be impossible to run a successful school garden without water, although water scarcity has a significant impact on garden design in SHS in Ghana. Water has been a major challenge for school gardens in schools and is a matter of worldwide concern, and this makes it academically impossible for school gardens to serve their purposes in SHS. It is established in literature that the agriculture sector, including school gardens, is facing several threats like water scarcity, rising temperatures and drought (Al-Thawwad, 2008; Chandio and Shirazi, 2022). Unlike school garden

which is threaten by climate change and scarcity of water, greenhouse is always under a direct control and consequently water usage is also under control, therefore there is the need for schools to adopt greenhouse technology as gardens for effective and efficient use for academic activities in schools, this is in line with the work of Benke and Tomkins (2017) argued that greenhouse technology can be promoted to have positive effects on the society and environment. Since growing takes place in a controlled environment, increased adoption of greenhouses will reduce the influence of extreme climatic events (for instance, water scarcity, floods and droughts) on agricultural production. This will help achieve SDG 13, which focuses on lessening the impact of extreme weather events on production.

Additionally, inadequate funds to manage school garden was identified as the second most severely challenged to school garden in SHS in Ghana, this disclosure is indeed not strange since funds for managing school garden have been a global challenge and turn to hinder the efficient operations of garden in schools which results to gardens not been able to support academic sessions in schools. This is backed by the Diaz et al. (2018) report, which indicated that the lack of available funding and financial support to sustain gardens has been a significant challenge to managing gardens in schools. It is established in literature by Waite (2011) that resources and support (lack of funding, insufficient support from administrators and academic staff) pose a serious threat to the successful operation of school gardens globally. Burt *et al.* (2018) stated that funding is frequently listed as a time-related challenge for garden operations in schools in SHS.

Lack of clear policy document backed by legislation on school garden is the third most severely challenged factor to school garden in SHS in Ghana. It is apparent that the effectiveness of the school garden is stalled by numerous challenges. The nonexistence of policy documents accounts for the lack of incorporation of gardening into teaching and learning activities in schools since most teachers and students considered gardening as not being part of curriculum activities. Meanwhile, gardens are supposed to be incorporated into agricultural science academic activities in schools. This is similar to the report of Gonsalves *et al.* (2020), who argued that school garden interventions will continue to face sustainability challenges when the government does not make significant moves to put supportive policies to mandate gardens in schools.

Taking into consideration the lack of financial commitment and policy document on school garden account to the challenges encountered in gardening activities in schools, Ghana's commitment on greenhouse technology both locally and internationally has served as a platform for greenhouses to be used as garden in schools. The Paris Agreement, Agenda 2030, and 2063 are just a few examples of the regional and international agreements Ghana has signed that provide a vehicle for funding the adoption and promotion of clean and sustainable production technology (Benke and Tomkins 2017). It is further established in literature that Ghana is one of the African nations that has acknowledged the potential of greenhouse technology and has since gradually promoted it. International donor organizations like the World Bank (WAAPP,

2020), local banks (Ghana EXIMBANK, 2018), and the private sector have since made investments in greenhouses.

Table 14: Respondents' description of the current state of school garden in SHS in Ghana

Responses	Frequency	Percent (%)
Good state	8	9.0
Poor state	81	91.0
Total	**89**	**100**

Source: Field survey, 2024.

School gardens are in a poor state and possibly do not support academic activities all year round. Like any other academic laboratory or facility, the school garden is supposed to be functional all the time to support teaching and learning activities in schools. Teaching agricultural science practicals in schools should not be done on a seasonal basis because gardens are in a poor state; instead, it should be done all year round since the syllabus is planned. Failure to cover the syllabus affects students' academic progress. The indication that school gardens are in poor state and do not support academic activities all year round is an academic deficiency and a common problem which needs to be addressed among schools operating gardens. This finding is in connection with the report of Susan *et al.* (2018), who stated that a lack of continuity of maintenance activities on the school garden led to the school's inability to use the garden throughout the year for academic purposes.

Research Question 2: How is the existing Senior High School agriculture science curriculum supporting school gardens in Ghana?

To answer the above research question, items were constructed and measured on a four-point Likert scale with 1- strongly disagree, 2- disagree, 3- agree and 4- strongly agree, where 1 indicates the least agreement to the statement and 4 indicates the most vigorous agreement to the statements. Means and standard deviation were used to analyse the responses of respondents. In the analysis, mean values above 2.5 (1+2+3+4/4 =2.5) show that the majority of the respondents agreed with the statement, while a mean value below 2.5 shows that the majority of the respondents disagreed with the statement.

Table 15: Respondents' view on review of current Agriculture Science Curriculum in SHS in Ghana

Response	Frequency	Percent (%)
Yes	78	78.0
No	22	22.0
Total	**100**	**100.0**

Source: Field survey, 2024.

Table 15 indicated that out of the total number of respondents, 78 % indicated that the current agriculture science curriculum used to teach agriculture science in SHS in Ghana should be reviewed. However, 22 % of the respondents think otherwise.

It is established in the research findings that the current Senior High School agriculture science curriculum used to teach agriculture science needs to be reviewed. The revision is necessary because the current curriculum does not support school gardens which is the means to teaching effective practical skills in agriculture in SHS. Curriculum revision is a requirement in every educational system, and it is therefore not strange when respondents called for the current SHS curriculum used for teaching agriculture science to be reviewed to reflect societal needs and national demand with respect to teaching agriculture in SHS in Ghana. The call to review the agriculture science curriculum used to teach agricultural science in school is in the with the move been taken by National Teacher Council (NTC) to review the current second cycle curriculum to reflect STEM and 21st century learning needs which is lacked in the current curriculum. The call for the review has created space for stakeholders and authority to integrate into the new curriculum modern technology for instruction delivery such as greenhouses as a garden in schools. This finding is in connection with the work of Ganpat (2014), who reported that curricula should be changed to reflect more experiential and technology-driven learning, with greater emphasis being placed on the use of non-formal settings to facilitate the engagement and learning process.

Table 16: Reasons for review of the current curriculum used in SHS in Ghana

Reasons	**Responses**	
	N	**Percent (%)**
Curriculum not well-structured	70	81.4
Inadequate resource allocation and teacher training	4	4.7
Inadequate student engagement and interest	2	2.3
Inadequate integration and lack of clear documentation on practical education	10	11.6
Total	**86**	**100.0**

Source: Field survey, 2024.

The majority of the respondents stated that the current curriculum used to teach agricultural science in SHS should be reviewed because the curriculum is not well-structured. The rigidness of the current agricultural science curriculum as revealed by the respondents may lead to the ineffectiveness and inefficient of agriculture science practicals in schools, the current curriculum does not permit and indicate when agricultural practicals should be conducted in schools which makes some teachers and learners think that agricultural science practicals and all garden related activities are co-curricular issues. This is in connection with the statement of Burt *et al.* (2018), who stated that the greatest barrier to school gardens is the curriculum's inability to support garden-related activities in schools. The study finding has further been supported by the work of Daiz *et al.* (2018), who outlined that practical, logistical, and institutional barrier cause issues for the development and sustainability of school gardens.

This present finding is consistent with that of (Wallace 1997; Adam *et al.*, 2016), who stated that teaching strategies and curriculum must be kept current, need-based, and market-oriented. Curriculum integration enables a paradigm in which "*students*

become teachers and teachers become learners" (Pate, 2013). It was created to be sensitive to the concerns of students. Additionally, Kroma (2003) stated that in order to meet the needs of the 21st century development in Sub-Saharan Africa, educators on the continent must: 1) carefully consider and critically analyze the fundamental underlying values and academic curricula (philosophies, epistemologies, subject matter content, and pedagogical practices) that have historically shaped agricultural and extension education; and 2) create alternative frameworks for curricula revitalization that support extension training pertinent to the sustainability challenges and interests of rural producers, communities, and households in the area. The unstructured nature of the current curriculum, as discovered in the study, could be reviewed to allow the use of a greenhouse as a school garden to enhance the teaching of agricultural science practicals as it is required in the agricultural science syllabus (GES, 2010).

Table 17: Descriptive statistics on existing curriculum and its support for school gardens in SHS in Ghana (N=100)

S/N	Items	Mean	Std. Deviation
1	The existing curriculum supports teaching learners about garden concepts in Senior High Schools in Ghana.	2.4400	0.87985
2	The existing curriculum increases overall critical thinking skills and scientific learning of learners in Senior High Schools in Ghana.	2.2400	0.88899
3	The existing curriculum supports the school gardens strategy in Senior High Schools in Ghana.	2.0300	0.97913
4	The existing curriculum supports in-service training for agriculture science teachers on maintenance of school gardens in Senior High Schools in Ghana.	1.9900	1.11460
5	The existing school curriculum meets the criteria and philosophy of the garden in Senior High Schools in Ghana.	1.9600	0.90921
6	Lack of support from the School Governing Body (SGB) affects school gardens in Senior High Schools in Ghana.	1.6100	0.88643
7	The absence of clear national policies and guidelines for the utilization of school gardens as a learning tool hinders school garden operation in Schools.	1.6000	0.87617
8	Lack of training on how to integrate school gardens with the current curriculum is a challenge of school gardens in Senior High in Ghana.	1.5800	0.81872
	Mean of means/SD	**1.9313**	**0.91914**

Source: Field survey, 2024.

Table 17 captured the means and their corresponding standard deviations, indicating that respondents disagreed with all the statements. The respondents' responses show that the existing curriculum used for teaching agricultural science in SHS does not support school gardens as a tool for teaching and learning.

The current curriculum used for teaching agricultural science in SHS does not support school gardens as a tool for teaching and learning. Once the current curriculum lacks support for the garden as a teaching and learning tool, garden usage in SHS will be unproductive, therefore rendering practical agricultural science ineffective. Meanwhile,

it is a requirement. The implication is that students studying agricultural science in SHS lack the required skills they need to perform academically. The current curriculum does not support school gardens as a tool for teaching and learning, which is the more reason why revising the curriculum is necessary to create room for greenhouses to be adopted as a tool for teaching and learning agricultural science in schools. The finding of this study is in connection with the statement that in order to satisfy existing demands, agricultural education and training in sub-Saharan Africa "*lacks proper mechanisms for identifying emerging needs as well as for reforming curricula*" (Kidane & Worth, 2012, p. 2743) and is "*slow to adapt to new patterns of demand*".

In line with the literature, Waite (2011) stated that the challenges of identifying links to educational objectives and standards, as well as the lack of curricular support that links to academic standards, are identified as significant challenges in schools. However, Susan *et al.* (2018) also pointed out the complexity of school systems as a barrier to the existing curriculum. Furthermore, Susan *et al.* (2018) indicated that issues of implementing an innovative program into an already existing system built upon traditional classroom instruction is a challenge to the curriculum. Kroma (2003), stated that teachers should stop teaching courses that emphasize scientific concepts, subject-matter expertise, and a linear research methodology since they train farmers to be specialists in a field that requires generalists. Instead, Curriculum designers should take inspiration from African curricula that successfully incorporate social learning, project-, problem-, or theme-based learning, competency-based programs, and shorter, more concentrated courses.

Table 18: Factors that make it impossible for current curriculum to support school gardens in SHS in Ghana

Factors	**Responses**	
	N	**Percent (%)**
Policy and Governance Issues	45	32.8
Educational System Challenges	75	54.7
Practical Implementation Challenges	17	12.4
Total	**137**	**100.0**

Source: Field survey, 2024.

Policy and governance issues are the topmost factor which makes it impossible for the current SHS curriculum used to teach agriculture science to support garden in schools (Table 18). There is no mandatory policy for SHS to deliberately include garden teaching on the current timetable in schools; this makes it difficult for teachers to in cooperate garden teaching in the current curriculum. Teachers, therefore, are certain that it is extra work for them to organize practical and garden activities for learners after school hours. This is a short fall of the current SHS agricultural Science curriculum which is not different from what has been established in literature, the findings of this research present an opportunity for stakeholders in education to draft a policy document for greenhouse to be adopted in school as garden since there is an ongoing process by ministry of

Education in Ghana to review the entire current SHS curriculum. This finding is backed by literature which states that the benefits of these school gardening programs are numerous; yet, there is still no formal inclusion of these practices into the curriculum (Zelenika, Moreau, Lane, & Zhao, 2018). Additionally, it has also been established by Bruce and Morales (2020) that among the several obstacles for teachers to overcome in order to have successful garden programs include; the challenge of coordinating garden growth with the nationally-established curriculum calendar; principals, supervisors, colleagues, and, occasionally, parents who are unaware of the educational benefits of gardens; the uncertainty that comes with managing a garden, especially for educators who do not have a lot of gardening experience.

7. Conclusion

Based on the study findings, the following conclusions are drawn:

1) The majority of Senior High Schools in Ghana have school gardens.
2) It is revealed that the majority of the Agricultural Science Teachers in the past five (5) years never had staff development or in-service training on gardening.
3) The study revealed that school gardens are not managed and supervised by any committee in schools.
4) It has been revealed from the study that water challenge for school garden in Senior High Schools.
5) It has been revealed that school gardens are established on the basis of instructional objectives or goals in Senior High Schools.
6) It is discovered from the study that the school garden is used for academic activities in Senior High Schools.
7) It is concluded based on the study findings that inadequate funds to manage school gardens is a challenge in Senior High Schools.
8) It is revealed that lack of clear policy document backed by legislation on school garden is a challenge in Senior High Schools.
9) It has been revealed from the study that school gardens are in a poor state and do not support academic activities all year round.
10) The study findings indicated that the current Senior High School agriculture science curriculum used to teach agriculture science should be reviewed.
11) The study findings revealed that the current curriculum used for teaching agricultural science in SHS does not support school gardens as a tool for teaching and learning.

7.1 Recommendations

The findings from this study have the under-listed recommendations for policy and programme interventions in the Senior High School schools in Ghana in the following key areas:

- It is recommended that government and donor organizations should support school gardens with funding in SHS
- It is also recommended that water sources should be provided for the school garden in SHS
- It is recommended that a policy document should be put in place for the greenhouse to be used as a garden in SHS since schools will not have enough land for gardens in the future.

Conflict of Interest Statement

This research, including its authorship and publication, is free from any potential conflicts of interest.

About the Author(s)

Karim Abdul Rahaman is a Lecturer and Head of the Department of Agricultural and Consumer Science Education at the University for Development Studies, Tamale Ghana. He has 6 years of working experience at the University for Development Studies. His research interests include teacher education, general agriculture, and agriculture pedagogies. Email: arkarim@uds.edu.gh

Ibrahim Mohammed Gunu (PhD) is Associate professor Lecturer with the Department of Educational Management and Policy Studies, and Dean of the Faculty of Education, Tamale Campus. He has over 15 years of working experience at the University for Development Studies. His research interests include, Teacher education, andragogy, and primary education. Email: igunu@uds.edu.gh

Abdul-Halim Abubakari (PhD) is an Associate Professor with the Department of Horticulture Vice Dean of the Faculty of Agriculture, Food and Consumer Sciences. He has more than 17 years of teaching and research experience in Landscape Science and ecologically sustainable production systems. Email address: ahalim@uds.edu.gh

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