AGRICULTURAL SCIENCE

CURRICULUM FOR SECONDARY EDUCATION (SHS 1 - 3)

NaCCA
NATIONAL COUNCIL FOR CURRICULUM & ASSESSMENT OF MINISTRY OF EDUCATION

MINISTRY OF EDUCATION
REPUBLIC OF GHANA

SEPTEMBER 2023

MINISTRY OF EDUCATION

REPUBLIC OF GHANA

AGRICULTURAL SCIENCE

CURRICULUM FOR SECONDARY EDUCATION

(SHS 1-3)

September, 2023

NaCCA NATIONAL COUNCIL FOR CURRICULUM & ASSESSMENT OF MINISTRY OF EDUCATION

AGRICULTURAL SCIENCE

Enquiries and comments on this Curriculum should be addressed to:

The Director-General
National Council for Curriculum and Assessment (NaCCA)
Ministry of Education

P. O. Box CT PMB 77
Cantonments Accra

Telephone: 0302909071, 0302909862

Email: info@nacca.gov.gh

Website: www.nacca.gov.gh

FOREWORD

Through the National Council for Curriculum and Assessment (NaCCA), Ghana's Ministry of Education has introduced a series of curriculum reforms to improve the quality and relevance of learning experiences in pre-tertiary schools in the country. These reforms will improve learning through the introduction of innovative pedagogies that encourage critical thinking and problem-solving. For a long time, our learners memorise facts and figures, which does not develop their analytical and practical skills. The Ministry recognises that learners need to be equipped with the right tools, knowledge, skills and competencies to deal with the fast-changing environment and the challenges facing their communities, the nation and the world.

These curriculum reforms were derived from the Education Strategic Plan (ESP 2018-2030), the National Pre-tertiary Education Curriculum Framework (NPTECF) and the National Pre-Tertiary Learning Assessment Framework (NPLAF), which were all approved by Cabinet in 2018. The new standards-based curriculum implemented in 2019 in basic schools, aims to equip learners to apply their knowledge innovatively to solve everyday problems. It also prioritises assessing learners' knowledge, skills, attitudes, and values, emphasising their achievements. The content of the basic school standards-based curriculum was therefore designed to promote a curriculum tailored to the diverse educational needs of the country's youth. It addresses the current curriculum's deficiencies in learning and assessment, especially in literacy and numeracy. These reforms have been carried out in phases. The curriculum for the basic school level – KG, Primary and Junior High School (JHS) – was developed and implemented from 2019 to 2021.

The curriculum for Senior High School (SHS), Senior High Technical School (SHTS) and Science, Technical, Engineering and Mathematics (STEM), which constitutes the next phase, is designed to ensure the continuation of learning experiences from JHS. It introduces flexible pathways for progression to facilitate the choice of subjects necessary for further study, the world of work and adult life. The new SHS, SHTS and STEM curriculum emphasises the acquisition of 21st Century skills and competencies, character development and instilling of national values. Social and Emotional Learning (SEL), Information Communications Technology, Gender Equality and Social Inclusion, have all been integrated into the curriculum. Assessment – formative and summative has been incorporated into the curriculum and aligned with the learning outcomes throughout the three-year programme.

The Ministry of Education's reform aims to ensure that graduates of our secondary schools can successfully compete in international high school competitions and, at the same time, be equipped with the necessary employable skills and work ethos to succeed in life. The Ministry of Education, therefore, sees the Senior High School (SHS) curriculum as occupying a critical place in the education system – providing improved educational opportunities and outcomes for further studies, the world of work and adult life – and is consequently prioritising its implementation.

ACKNOWLEDGEMENTS

This standards-based SHS curriculum was created using the National Pre-Tertiary Learning Assessment Framework (NPLAF), the Secondary Education Assessment Guide (SEAG), and the Teacher and Learner Resource Packs which include Professional Learning Community (PLC) Materials and Subject Manuals for teachers and learners. All the above-mentioned documents were developed by the National Council for Curriculum and Assessment (NaCCA). The Ministry of Education (MoE) provided oversight and strategic direction for the development of the curriculum with NaCCA receiving support from multiple agencies of the MoE and other relevant stakeholders. NaCCA would like to extend its sincere gratitude, on behalf of the MoE, to all its partners who participated in the professional conversations and discussions during the development of this SHS curriculum.

In particular, NaCCA would also like to extend its appreciation to the leadership of the Ghana Education Service (GES), the National School Inspectorate Authority (NaSIA), the National Teaching Council (NTC), the Commission for Technical and Vocational Education and Training (Commission for TVET), West African Examinations Council (WAEC) and other agencies of the MoE that supported the entire process. In addition, NaCCA acknowledges and values the contributions made by personnel from various universities, colleges of education Industry players, Vice Chancellors Ghana, Vice Chancellors Technical Universities as well as educators and learners working within the Ghana education landscape.

Special appreciation is extended to consultants who contributed to development of the curriculum. The development process involved multiple engagements between national stakeholders and various groups with interests in the curriculum. These groups include the teacher unions, the Association of Ghana Industries, and heads of secondary schools.

CONTENTS

THE SHS CURRICULUM OVERVIEW

The vision for this curriculum is to ensure the nation has a secondary education system that enables all Ghanaian children to acquire the 21st Century skills, competencies, knowledge, values and attitudes required to be responsible citizens, ready for the world of work, further studies and adult life. The nation's core values drive the SHS curriculum, and it is intended to achieve Sustainable Development Goal 4: 'Inclusive, equitable quality education and life-long learning for all'. Above all, it is a curriculum enabling its graduates to contribute to the ongoing growth and development of the nation's economy and well-being.

The curriculum is inclusive, flexible, and robust. It was written under the auspices of the National Council for Curriculum and Assessment by a team of expert curriculum writers across Ghana. It reflects the needs of critical stakeholders, including industry, tertiary education, the West African Examination Council, SHS learners, teachers, and school leaders. It has been written based on the National Pre-Tertiary Learning and Assessment Framework and the Secondary Education Policy.

The key features of the curriculum include:

- flexible learning pathways at all levels, including for gifted and talented learners and those with deficiencies in numeracy and literacy, to ensure it can meet the needs of learners from diverse backgrounds and with different interests and abilities.
- the five core learning areas for secondary education: science and technology, language arts, humanities, technical and vocational and business; with emphasis placed on STEM and agriculture as integral to each subject.
- a structured, standards-based approach that supports the acquisition of knowledge, skills and competencies, and transition and seamless progress throughout secondary education, from JHS to SHS and through the three years of SHS.
- a focus on interactive approaches to teaching and assessment to ensure learning goes beyond recall enabling learners to acquire the ability to understand, apply, analyse and create.
- guidance on pedagogy, coupled with exemplars, demonstrating how to integrate cross-cutting themes such as 21st Century skills, core competencies, the use of ICT, literacy and mathematics, Social Emotional Learning, Gender Equality and Social Inclusion as tools for learning and skills for life. Shared Ghanaian values are also embedded in the curriculum.

The curriculum writing process was rigorous and involved developing and using a Curriculum Writing Guide which provided systematic instructions for writers. The process was quality assured at three levels: through (a) evaluation by national experts, (b) trialling curriculum materials in schools and (c) through an external evaluation by a team of national and international experts. Evidence and insights from these activities helped hone the draft's final version. The outcome is a curriculum coherently aligned with national priorities, policies and the needs of stakeholders. A curriculum tailored to the Ghanaian context ensures that all learners benefit from their schooling and develop their full potential.

The following section highlights the details of the front matter of the draft curriculum. The vision, philosophy and goal of the curriculum are presented. This is followed by the details of the 21st Century skills and competencies, teaching and learning approaches, instructional design and assessment strategies. The template for the curriculum frame, which outlines the scope and sequence, the design that links the learning outcomes to particular 21st Century skills and competencies, as well as Gender Equality and Social Inclusion, Social and Emotional Learning and Ghanaian values are presented together with the structure of the lesson frame showing the links between the content standards, learning indicators with their corresponding pedagogical exemplars and assessment strategies.

INTRODUCTION

Effective implementation of this Senior High School (SHS) curriculum is the key to creating a well-educated and well-balanced workforce that is ready to contribute to Ghana's progress by harnessing the potential of the growing youth population, considering the demographic transition the country is currently experiencing (Educational Strategic Plan [ESP] 2018-2030). SHS curriculum aims to expand equitable, inclusive access to relevant education for all young people, including those in disadvantaged and underserved communities, those with special educational needs and those who are gifted and talented. Senior High School allows young people to develop further skills and competencies and progress in learning achievement, building from the foundation laid in Junior High School. This curriculum intends to meet the learning needs of all high school learners by acquiring 21st Century skills and competencies to prepare them for further studies, the world of work and adult life. Changing global economic, social and technological context requires life-long learning, unlearning, and continuous processes of reflection, anticipation and action.

Philosophy of Senior High School Curriculum

The philosophy underpinning the SHS curriculum is that every learner can develop their potential to the fullest if the right environment is created and skilled teachers effectively support them to benefit from the subjects offered at SHS. Every learner needs to be equipped with skills and competencies of interest to further their education, live a responsible adult life or proceed to the world of work.

Vision of Senior High School Curriculum

The vision of the curriculum is to prepare SHS graduates equipped with relevant skills and competencies to progress and succeed in further studies, the world of work and adult life. It aims to equip all learners with the 21st Century skills and competencies required to be responsible citizens and lifelong learners. When young people are prepared to become effective, engaging, and responsible citizens, they will contribute to the ongoing growth and development of the nation's economy and well-being.

Goal of Senior High School Curriculum

The goal of the curriculum is to achieve relevant and quality SHS through the integration of 21st Century skills and competencies as set out in the Secondary Education Policy. The key features to integrate into the curriculum are:

- Foundational Knowledge: literacy, numeracy, scientific literacy, information, communication and digital literacies, financial literacy and entrepreneurship, cultural identity, civic literacy and global citizenship
- Competencies: critical thinking and problem-solving, innovation and creativity, collaboration, and communication
- Character Qualities: discipline, integrity, self-directed learning, self-confidence, adaptability and resourcefulness, leadership, and responsible citizenship.

The JHS curriculum has been designed to ensure that learners are adequately equipped to transition seamlessly into SHS, where they will be equipped with the relevant knowledge, skills and competencies. The SHS curriculum emphasises character building, acquisition of 21st Century skills and competencies and nurturing core values within an environment of quality education to ensure the transition to further study, the world of work and adult life. This requires the delivery of robust secondary education that meets the varied learning needs of the youth in Ghana. The SHS curriculum, therefore, seeks to develop learners to become technology-inclined, scientifically literate, good problem-solvers who can think critically and creatively and are equipped to communicate with fluency, and possess the confidence and competence to participate fully in Ghanaian society as responsible local and global citizens – (referred to as 'Glocal citizens').

The SHS curriculum is driven by the nation's core values of truth, integrity, diversity, equity, discipline, self-directed learning, self-confidence, adaptability and resourcefulness, leadership, and responsible citizenship, and with the intent of achieving the Sustainable Development Goal 4: 'Inclusive, equitable quality education and life-long learning for all'. The following sections elaborate on the critical competencies required of every SHS learner:

Gender Equality and Social Inclusion (GESI)

- Appreciate their uniqueness about others.
- Pay attention to the uniqueness and unique needs of others.
- Value the perspective, experience, and opinion of others.
- Respect individuals of different beliefs, political views/ leanings, cultures, and religions.
- Embrace diversity and practise inclusion.
- Value and work in favour of a democratic and inclusive society.
- Be conscious of the existence of minority and disadvantaged groups in society and work to support them.
- Gain clarity about misconceptions/myths about gender, disability, ethnicity, age, religion, and all other excluded groups in society
- Interrogate and dispel their stereotypes and biases about gender and other disadvantaged and excluded groups in society.
- Appreciate the influence of socialisation in shaping social norms, roles, responsibilities, and mindsets.
- Identify injustice and advocate for change.
- Feel empowered to speak up for themselves and be a voice for other disadvantaged groups.

21st Century Skills and Competencies

In today's fast-changing world, high school graduates must be prepared for the 21st Century world of work. The study of Mathematics, Science, and Language Arts alone is no longer enough. High school graduates need a variety of skills and competencies to adapt to the global economy. Critical thinking, creativity, collaboration, communication, information literacy, media literacy, technology literacy, flexibility, leadership, initiative, productivity, and social skills are needed. These skills help learners to keep up with today's fast-paced job market. Employers want workers with more than academic knowledge. The 21st Century skills and competencies help graduates navigate the complex and changing workplace. Also, these help them become active citizens who improve their communities. Acquisition of 21st Century skills in high school requires a change in pedagogy from the approach that has been prevalent in Ghana in recent years. Teachers should discourage and abandon rote memorisation and passive learning. Instead, they should encourage active learning, collaboration, and problem-solving, project-based, inquiry-based, and other learner-centred pedagogy should be used. As well as aligning with global best practices, these approaches also seek to reconnect formal education in Ghana with values-based indigenous education and discovery-based learning which existed in Ghana in pre-colonial times. This is aligned with the 'glocal' nature of this curriculum, connecting with Ghana's past to create confident citizens who can engage effectively in a global world. Digitalisation, automation, technological advances and the changing nature of work globally mean that young people need a new set of skills, knowledge and competencies to succeed in this dynamic and globalised labour market.

Critical Thinking and Problem-Solving Competency

- Ability to question norms, practices, and opinions, to reflect on one's values, perceptions, and actions.
- Ability to use reasoning skills to come to a logical conclusion.
- Being able to consider different perspectives and points of view
- Respecting evidence and reasoning
- Not being stuck in one position
- Ability to take a position in a discourse
- The overarching ability to apply different problem-solving frameworks to complex problems and develop viable, inclusive, and equitable solution options that integrate the above-mentioned competencies, promote sustainable development,

Creativity

- Ability to identify and solve complex problems through creative thinking.
- Ability to generate new ideas and innovative solutions to old problems.
- Ability to demonstrate originality and flexibility in approaching tasks and challenges.
- Collaborating with others to develop and refine creative ideas
- Ability to incorporate feedback and criticism into the creative process
- Utilising technology and other resources to enhance creativity
- Demonstrating a willingness to take risks and experiment with new approaches
- Adapting to changing circumstances and further information to maintain creativity

- Integrating multiple perspectives and disciplines to foster creativity
- Ability to communicate creative ideas effectively to a variety of audiences

Collaboration

- Abilities to learn from others; to understand and respect the needs, perspectives, and actions of others (empathy)
- Ability to understand, relate to and be sensitive to others (empathic leadership)
- Ability to deal with conflicts in a group
- Ability to facilitate collaborative and participatory problem-solving
- Ability to work with others to achieve a common goal.
- Ability to engage in effective communication, active listening, and the ability to compromise.
- Ability to work in groups on projects and assignments.

Communication

- Know the specific literacy and language of the subjects studied
- Use language for academic purposes
- Communicate effectively and meaningfully in a Ghanaian Language and English Language
- Communicate confidently, ethically, and effectively in different social contexts.
- Communicate confidently and effectively to different participants in different contexts
- Ability to communicate effectively verbally, non-verbally and through writing.
- Demonstrate requisite personal and social skills that are consistent with changes in society
- Ability to express ideas clearly and persuasively, listen actively, and respond appropriately
- Ability to develop digital communication skills such as email etiquette and online collaboration.
- Ability to engage in public speaking, debate, and written communication.

Learning for Life

- Understand subject content and apply it in different contexts
- Apply mathematical and scientific concepts in daily life
- Demonstrate mastery of skills in literacy, numeracy, and digital literacy.
- Develop an inquiry-based approach to continual learning.
- Be able to understand higher-order concepts and corresponding underlying principles.
- Participate in the creative use of the expressive arts and engage in aesthetic appreciation.
- Use and apply a variety of digital technologies
- Be digitally literate with a strong understanding of ICT and be confident in its application.
- Be equipped with the necessary qualifications to gain access to further and higher education and the world of work and adult life
- Ability to apply knowledge practically in the workplace so that they are able to utilise theory by translating it into practice.
- Develop their abilities, gifts and talents to be able to play a meaningful role in the development of the country
- Be able to think critically and creatively, anticipate consequences, recognise opportunities and be risk-takers
- Ability to pursue self-directed learning with the desire to chart a path to become effective lifelong learners.
- Independent thinkers and doers who show initiative and take action.
- Ability to innovate and think creatively, building on their knowledge base so that they take risks to achieve new goals
- Ability to think critically and solve problems so that they become positive change agents at work, in further study and in their personal lives.
- Be motivated to adapt to the changing needs of society through self-evaluation and ongoing training
- Be able to establish and maintain innovative enterprises both individually and in collaboration with others.
- Be able to ethically prioritise economic values to ensure stability and autonomy
- Show flexibility and preparedness to deal with job mobility
- Be committed towards the improvement of their quality of life and that of others
- Feel empowered in decision-making processes at various levels e.g., personal, group, class, school, etc.

- Be able to seek and respond to assistance, guidance and/or support when needed.
- Ability to make and adhere to commitments.
- Adopt a healthy and active lifestyle and appreciate how to use leisure time well.
- Be enthusiastic, with the knowledge, understanding and skill that enable them to progress to tertiary level, the world of work and adult life.
- Ability to transition from school to the world of work or further study by applying knowledge, skills and attitudes in new situations.
- Be independent, have academic and communication skills such as clarity of expression (written and spoken), and the ability to support their arguments.
- Be innovative and understand the 21st Century skills and competencies and apply them to everyday life.

Global and Local (Glocal) Citizenship

- Appreciate and respect the Ghanaian identity, culture, and heritage
- Be conscious of current global issues and relate well with people from different cultures
- Act in favour of the common good, social cohesion and social justice
- Have the requisite personal and social skills to handle changes in society
- Appreciate the impact of globalisation on the society.
- Ability to be an honest global citizen displaying leadership skills and moral fortitude with an understanding of the wider world and how to enhance Ghana's standing.

Systems Thinking Competency

- Ability to recognise and understand relationships
- Ability to analyse complex systems
- Ability to think of how systems are embedded within different domains and different scales
- Ability to deal with uncertainty

Normative Competency

- Ability to understand and reflect on the norms and values that underlie one's actions
- Ability to negotiate values, principles, goals, and targets, in a context of conflicts of interests and trade-offs, uncertain knowledge and contradictions

Anticipatory Competency

- Ability to understand and evaluate multiple futures – possible, probable, and desirable
- Ability to create one's vision for the future.
- Ability to apply the precautionary principle
- Ability to assess the consequences of actions
- Ability to deal with risks and changes

Strategic Competency

- Ability to collectively develop and implement innovative actions that further a cause at the local level and beyond.
- Ability to understand the bigger picture and the implications of smaller actions on them

Self-Awareness Competency

- The ability to reflect on one's role in the local community and (global) society
- Ability to continually evaluate and further motivate one's actions
- Ability to deal with one's feelings and desires

Social Emotional Learning (SEL): Five Core Competencies with Examples

1. *Self-Awareness*

Understanding one's emotions, thoughts, and values and how they influence one's behaviour in various situations. This includes the ability to recognise one's strengths and weaknesses with a sense of confidence and purpose. For instance:

- *Integrating personal and social identities;*
- *Identifying personal, cultural, and linguistic assets;*
- *Identifying one's emotions;*
- *Demonstrating honesty and integrity;*
- *Connecting feelings, values, and thoughts;*

- *Examining prejudices and biases;*
- *Experiencing self-efficacy;*
- *Having a growth mindset;*
- *Developing interests and a sense of purpose;*

2. *Self-Management*

The capacity to control one's emotions, thoughts, and actions in a variety of situations and to realise one's ambitions. This includes delaying obtaining one's desires, dealing with stress, and feeling motivated and accountable for achieving personal and group goals. For instance:

- *Managing one's emotions;*
- *Identifying and utilising stress-management strategies;*
- *Demonstrating self-discipline and self-motivation;*
- *Setting personal and group goals;*
- *Using planning and organisation skills;*
- *Having the courage to take the initiative;*
- *Demonstrating personal and collective agency;*

3. *Social Awareness*

The capacity to comprehend and care for others regardless of their backgrounds, cultures, and circumstances. This includes caring for others, understanding larger historical and social norms for behaviour in different contexts, and recognising family, school, and community resources and supports. For instance:

- *Recognising others' strengths*
- *Demonstrating empathy and compassion*
- *Caring about others' feelings*
- *Understanding and expressing gratitude*
- *Recognising situational demands and opportunities*
- *Understanding how organisations and systems influence behaviour*

4. *Relationship Skills*

The capacity to establish and maintain healthy, beneficial relationships and adapt to various social situations and groups. This includes speaking clearly, listening attentively, collaborating, solving problems and resolving conflicts as a group, adapting to diverse social and cultural demands and opportunities, taking the initiative, and asking for or offering assistance when necessary. For instance:

- *Communicating effectively;*
- *Building positive relationships;*
- *Demonstrating cultural competence;*
- *Working as a team to solve problems;*
- *Constructively resolving conflicts;*
- *Withstanding negative social pressure;*
- *Taking the initiative in groups;*
- *Seeking or assisting when needed;*
- *Advocating for the rights of others.*

5. *Responsible Decision-Making*

The capacity to make thoughtful and constructive decisions regarding acting and interacting with others in various situations. This includes weighing the pros and cons of various personal, social, and group well-being actions. For example:

- *Demonstrating curiosity and an open mind;*
- *Solving personal and social problems;*
- *Learning to make reasonable decisions after analysing information, data, and facts;*
- *Anticipating and evaluating the effects of one's actions;*
- *Recognising that critical thinking skills are applicable both inside and outside of the classroom;*
- *Reflecting on one's role in promoting personal, family, and community well-being;*
- *Evaluating personal, interpersonal, community, and institutional impacts*

Learning and Teaching Approaches

Learning and teaching should develop learners as self-directed and lifelong learners. Learners must be helped to build up deep learning skills and competencies to develop the ability to acquire, integrate and apply knowledge and skills to solve authentic and real-life problems. Learners need to be exposed to a variety of learning experiences to enable them to collaborate with others, construct meaning, plan, manage, and make choices and decisions about their learning. This will allow them to internalise newly acquired knowledge and skills and help them

to take ownership of their education. The 21st Century skills and competencies describe the relevant global and contextualised skills that the SHS curriculum is designed to help learners acquire in addition to the 4Rs (Reading, wRiting, aRithmetic and cReativity). These skills and competencies, as tools for learning and teaching and skills for life, will allow learners to become critical thinkers, problem-solvers, creators, innovators, good communicators, collaborators, digitally literate, and culturally and globally sensitive citizens who are life-long learners with a keen interest in their personal development and contributing to national development.

Given the diverse needs of learners, teachers need to have a thorough grasp of the different pedagogies as they design and enact meaningful learning experiences to meet the needs of different learners in the classroom. The teaching-learning techniques and strategies should include practical activities, discussion, investigation, role play, problem-based, context-based, and project-based learning. Active learning strategies have become increasingly popular in education as they provide learners with meaningful opportunities to engage with the material. These strategies emphasise the use of creative and inclusive pedagogies and learner-centred approaches anchored on authentic and enquiry-based learning, collaborative and cooperative learning, differentiated teaching and learning, holistic learning, and cross-disciplinary learning. They include experiential learning, problem-based learning, project-based learning, and talk-for-learning approaches. Some of the pedagogical exemplars to guide learning and teaching of the SHS curriculum include:

- **Experiential Learning:** Experiential learning is a hands-on approach to learning that involves learners in real-world experiences. This approach focuses on the process of learning rather than the result. Learners are encouraged to reflect on their experiences and use them to develop new skills and knowledge. Experiential learning can take many forms, including internships, service learning, and field trips. One of the main benefits of experiential learning is that it allows learners to apply what they have learned in the classroom to real-world situations. This can help them develop a deeper understanding of the material and make connections between different concepts. Additionally, experiential learning can help learners develop important skills such as critical thinking, problem-solving and communication.
- **Problem-Based Learning:** Problem-based learning is an approach that involves learners in solving real-world problems. Learners are presented with a problem or scenario and are asked to work together to find a solution. This approach encourages learners to take an active role in their learning and helps them develop important skills such as critical thinking and problem-solving. One of the main benefits of problem-based learning is that it encourages learners to take ownership of their learning. By working together to solve problems, learners can develop important skills such as collaboration and communication. Additionally, problem-based learning can help learners develop a deeper understanding of the material as they apply it to real-world situations.
- **Project-Based Learning:** Project-based learning is a hands-on approach to learning that involves learners in creating a project or product. This approach allows learners to take an active role in their learning and encourages them to develop important skills such as critical thinking, problem-solving, collaboration, and communication. One of the main benefits of project-based learning is that it allows learners to apply what they have learned in the classroom to real-world situations. Additionally, project-based learning can help learners develop important skills from each other and develop a deeper understanding of the material.
- **Talk for Learning Approaches:** Talk for learning approaches (TfL) are a range of techniques and strategies that are used to encourage learners to talk by involving them in discussions and debates about the material they are learning. This approach encourages learners to take an active role in their learning and helps them develop important skills such as critical thinking, collaboration and communication and also makes them develop confidence. One of the main benefits of TfL is that it encourages learners to think deeply about the material they are learning. By engaging in discussions and debates, learners can develop a deeper understanding of the material and make connections between different concepts.
- **Initiating Talk for Learning:** Initiating talk for learning requires the use of strategies that would encourage learners to talk in class. It helps learners to talk and participate meaningfully and actively in the teaching and learning process. Apart from developing skills such as communication and critical thinking, it also helps learners to develop confidence. Some strategies for initiating talk among learners are Activity Ball; Think-Pair-Share; Always, Sometimes, Never True; Matching and Ordering of Cards.
- **Building on What Others Say:** Building on what others say is an approach that involves learners in listening to and responding to their classmates'

ideas. This approach encourages learners to take an active role in their learning and helps them develop important skills such as critical thinking and communication. One of the main benefits of building on what others say is that it encourages learners to think deeply about the material they are learning. By listening to their classmates' ideas, learners can develop a deeper understanding of the material and make connections between different concepts. Additionally, building on what others say can help learners develop important skills such as collaboration and reflection. Some of the strategies to encourage learners to build on what others say are brainstorming, concept cartoons, pyramid discussion, and 5 Whys, amongst others.

- **Managing Talk for Learning:** Managing talk for learning requires the use of various strategies to effectively coordinate what learners say in class. Effective communication is a crucial aspect of learning in the classroom. Teachers must manage talk to ensure that learners are engaged, learning, and on-task in meaningful and purposeful ways. Some strategies for managing learners' contributions are debates, think-pair-share, sage in the circle etc.
- **Structuring Talk for Learning:** One effective way to shape learners' contributions is to structure classroom discussions. Structured discussions provide a framework for learners to engage in meaningful dialogue and develop critical thinking skills. Teachers can structure discussions by providing clear guidelines, such as speaking one at a time, listening actively, and building on each other's ideas. One popular structured discussion technique is the "think-pair-share" method. In this method, learners think about a question or prompt individually, and then pair up with a partner to discuss their ideas. Finally, the pairs share their ideas with the whole class. This method encourages all learners to participate and ensures that everyone has a chance to share their thoughts. Another effective way to structure talk for learning is to use open-ended questions. Open-ended questions encourage learners to think deeply and critically about a topic. They also promote discussion and collaboration among learners. Teachers can use open-ended questions to guide classroom discussions and encourage learners to share their ideas and perspectives. Other strategies that can be used are Concept/Mind Mapping, "Know," "Want to Know," "Learned" (KWL); Participatory Feedback; and the 5 Whys.
- **Diamond Nine:** The Diamond Nine activity is a useful tool for managing talk for learning in the classroom. This activity involves ranking items or ideas in order of importance or relevance. Learners work in groups to arrange cards or sticky notes with different ideas or concepts into a diamond shape, with the most important idea at the top and the least important at the bottom. The Diamond Nine activity encourages learners to think critically about a topic and prioritise their ideas. It also promotes collaboration and discussion among group members. Teachers can use this activity to introduce a new topic, review material, or assess student understanding.
- **Group Work/Collaborative Learning:** Group work or collaborative learning are effective strategies for managing talk for learning in the classroom. These strategies encourage learners to work together to solve problems, share ideas, and learn from each other. Group work and collaborative learning also promote communication and collaborative skills that are essential for success in the workplace and in life. To implement group work effectively, teachers must provide clear guidelines and expectations for group members. They should also monitor group work to ensure that all learners are participating and on-task. Teachers can also use group work as an opportunity to assess individual student understanding and participation.
- **Inquiry-Based Learning:** Learners explore and discover new information by asking questions and investigating.
- **Problem-Based Learning:** Learners are given real-world problems to solve and must use critical thinking and problem-solving skills.
- **Project-Based Learning:** Learners work on long-term projects that relate to real-world scenarios.
- **Flipped Classroom:** Learners watch lectures or instructional videos at home and complete assignments and activities in class.
- **Mastery-Based Learning:** Learners learn at their own pace and only move on to new material once they have mastered the current material.
- **Gamification:** Learning is turned into a game-like experience with points, rewards, and competition.

These strategies provide learners with opportunities to engage with the material in meaningful ways and develop important skills such as critical thinking, problem-solving, collaboration, and communication. By incorporating these strategies into their teaching, teachers can help learners develop a deeper understanding of the material and prepare them for success in the real world. Effective communication is essential for learning in the classroom. Teachers must manage talk to ensure that learners are engaged in learning and on-task. Strategies such as structuring

talk for learning, using Diamond Nine activities, and implementing group work/ collaborative learning can help teachers manage talk effectively and promote student learning and engagement. By implementing these strategies, teachers can create a positive and productive learning environment where all learners can succeed.

Universal Design for Learning (UDL) in the SHS Curriculum

The design of the curriculum uses UDL to ensure the creation of flexible learning environments that can accommodate a wide range of learner abilities, needs, and preferences. The curriculum is designed to provide multiple means of engagement, representation, and action and expression, so teachers can create a more inclusive and effective learning experience for all learners. UDL is beneficial for all learners, but it is particularly beneficial for learners needing special support and learners who may struggle with traditional teaching approaches. The integration of UDL in the pedagogy is aimed at making learning accessible to everyone and helping all learners reach their full potential. For instance, teachers need to:

- incorporate multiple means of representation into their pedagogy, such as using different types of media and materials to present information.
- provide learners with multiple means of action and expression, such as giving them options for how they can demonstrate their learning.
- consider incorporating multiple means of engagement into their choice of pedagogy, such as incorporating games or interactive activities to make learning more fun and engaging.

By doing these, teachers can help ensure that the curriculum is accessible and effective for all learners, regardless of their individual needs and abilities.

Curriculum and Assessment Design: Revised Bloom's Taxonomy and Webb's Depth of Knowledge

The design of this curriculum uses the revised Bloom's Taxonomy and Webb's Depth of Knowledge (DoK) as frameworks to design what to teach and assess.

The Revised Bloom's Taxonomy provides a framework for designing effective learning experiences. Understanding the different levels of learning, informed the creation of activities and assessments that challenge learners at the appropriate level and help them progress to higher levels of thinking. Additionally, the framework emphasises the importance of higher-order thinking skills, such as analysis, evaluation, and creation, which are essential for success in today's complex and rapidly changing world. This framework is a valuable tool for educators who want to design effective learning experiences that challenge students at the appropriate level and help them develop higher-order thinking skills. By understanding the six levels of learning and incorporating them into their teaching, educators can help prepare students for success in the 21st century. The six hierarchical levels of the revised Bloom's Taxonomy are:

1. **Remember** – At the foundation is learners' ability to remember. That is retrieving knowledge from long-term memory. This level requires learners to recall concepts—identify, recall, and retrieve information. Remembering is comprised of identifying, listing, and describing. Retrieving relevant knowledge from long-term memory includes, recognising, and recalling is critical for this level.
2. **Understand** – At understanding, learners are required to construct meaning that can be shown through clarification, paraphrasing, representing, comparing, contrasting and the ability to predict. This level requires interpretation, demonstration, and classification. Learners explain and interpret concepts at this level.
3. **Apply** – This level requires learners' ability to carry out procedures at the right time in a given situation. This level requires the application of knowledge to novel situations as well as executing, implementing, and solving problems. To apply, learners must solve multi-step problems.
4. **Analyse** – The ability to break things down into their parts and determine relationships between those parts and being able to tell the difference between what is relevant and irrelevant. At this level, information is deconstructed, and its relationships are understood. Comparing and contrasting information and organising it is key. Breaking material into its constituent parts and detecting how the parts relate to one another and an overall structure or purpose is required. The analysis also includes differentiating, organising and attributing.
5. **Evaluate** – The ability to make judgments based on criteria. To check whether there are fallacies and inconsistencies. This level involves information evaluation, critique, examination, and formulation of hypotheses.
6. **Create** – The ability to design a project or an experiment. To create, entails learners bringing something new. This level requires generating information—planning, designing, and constructing.

Webb's Depth of Knowledge (DoK) is a framework that helps educators and learners understand the level of cognitive engagement required for different types of learning tasks. The framework includes four levels. By understanding the four DoK levels, educators can design learning activities that challenge students to engage in deeper thinking and problem-solving. DoK is an essential tool for designing effective instruction and assessments. By understanding the different levels of DoK, teachers can design instruction and assessments that align with what they intend to achieve. DoK is a useful tool for differentiating instruction and providing appropriate challenges for all learners. Teachers can use DOK to identify students who need additional support or those who are ready for more advanced tasks. The four levels of Webb's' DoK assessment framework are:

- **Level 1: Recall and Reproduction –** Assessment at this level is on recall of facts, concepts, information, and procedures—this involves basic knowledge acquisition. Learners are asked specific questions to launch activities, exercises, and assessments. The assessment is focused on recollection and reproduction.
- **Level 2: Skills of Conceptual Understanding –** Assessment at this level goes beyond simple recall to include making connections between pieces of information. The learner's application of skills and concepts is assessed. The assessment task is focused more on the use of information to solve multi-step problems. A learner is required to make decisions about how to apply facts and details provided to them.
- **Level 3: Strategic Reasoning** – At this level, the learner's strategic thinking and reasoning which is abstract and complex is assessed. The assessment task requires learners to analyse and evaluate composite real-world problems with predictable outcomes. A learner must apply logic, employ problem-solving strategies, and use skills from multiple subject areas to generate solutions. Multitasking is expected of learners at this level.
- **Level 4: Extended Critical Thinking and Reasoning –** At this level of assessment, the learner's extended thinking to solve complex and authentic problems with unpredictable outcomes is the goal. The learner must be able to strategically analyse, investigate, and reflect while working to solve a problem, or changing their approach to accommodate new information. The assessment requires sophisticated and creative thinking. As part of this assessment, the learner must know how to evaluate their progress and determine whether they are on track to a feasible solution for themselves.

The main distinction between these two conceptual frameworks is what is measured. The revised Bloom's Taxonomy assesses the cognitive level that learners must demonstrate as evidence that a learning experience occurred. The DoK, on the other hand, is focused on the context—the scenario, setting, or situation—in which learners should express their learning. In this curriculum, the revised Bloom's taxonomy guided the design, and the DoK is used to guide the assessment of learning. The taxonomy provides the instructional framework, and the DoK analyses the assignment specifics. It is important to note that Bloom's Taxonomy requires learners to master the lower levels before progressing to the next. So, suppose the goal is to apply a mathematical formula. In that case, they must first be able to identify that formula and its primary purpose (remember and understand). The cognitive rigour is therefore presented in incremental steps to demonstrate the learning progression. When measuring assessments in DoK, learners move fluidly through all levels. In the same example, while solving a problem with a formula, learners recall the formula (DoK 1) to solve the problem (DoK 2 and DoK 3). Depending on the difficulty of the problem to be solved, the learner may progress to DoK 4.

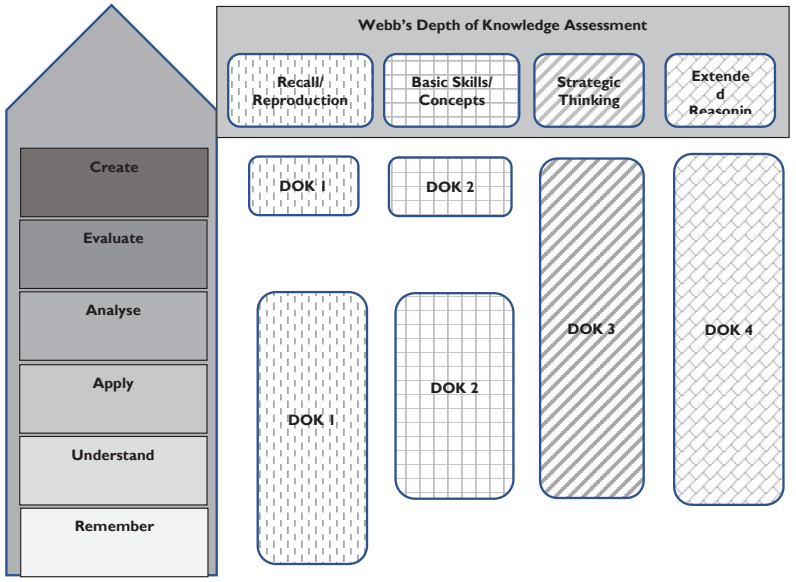

Figure 1: Revised Bloom Taxonomy combined with Webb's Depth of Knowledge for Teaching and Assessment

The structure of teaching and the assessment should align with the six levels of Bloom's knowledge hierarchy and DoK shown in Figure 1. Each level of DoK should be used to assess specific domains of Bloom's Taxonomy as illustrated in the table below:

Depth of Knowledge (DoK) Assessment	Bloom's Taxonomy applied to DoK
• Level 1: Recall and Reproduction	• Remembering, Understanding, Application, Analysis and Creation
• Level 2: Basic Skills and Concepts	• Understanding, Application, Analysis and Creation
• Level 3: Strategic Thinking	• Understanding, Application, Analysis, Evaluation and Creation
• Level 4: Extended Reasoning	• Understanding, Application, Analysis, Evaluation and Creation

In line with the National Pre-Tertiary Learning and Assessment Framework, the Secondary Education Assessment Guide (SEAG) requires that classroom assessments should cover **Assessment as learning (AaL), Assessment of learning (AoL) and Assessment for learning (AfL).** Therefore, teachers should align the Revised Bloom's Taxonomy with the DoK framework of assessment. Formative assessments should include classroom discussions, project-based assignments, and self-reflection exercises, while summative assessments should include standardised tests and rubric-based evaluations of learners' work. It is important to seek feedback from learners themselves, as they may have unique insights into how well they are developing these skills in the classroom.

To assess 21st Century skills and competencies in the classroom, teachers will have to use a combination of both formative and summative assessments to evaluate learners' acquisition of these skills and competencies. For instance:

- Identify the specific 21st Century skills and competencies to be assessed. For instance, you might want to assess *critical thinking, problem-solving, or creativity*.
- Align the skills and competencies with the DoK levels. For example, lower DoK levels might be more appropriate for assessing basic knowledge and comprehension, whereas higher DoK levels might be more appropriate for assessing more complex skills such as *analysis, synthesis, and evaluation*.
- Develop assessment items that align with the DoK levels and the skills and competencies you want to assess. These items should be designed to elicit evidence of learning across the different levels of the DoK framework.
- Administer the assessment and collect data. Analyse the data to gain insights into student learning and identify areas where learners may need additional support or instruction.

The DoK framework is a powerful tool for assessing the acquisition of 21st Century skills and competencies in the classroom, helping teachers to better understand how learners are learning and identify areas for improvement.

Educational success is no longer about producing content knowledge, but rather about extrapolating from what we know and applying the knowledge creatively in new situations.

The overall assessment of learning at SHS should be aligned with the National Pre-Tertiary Learning and Assessment Framework and the Secondary Education Assessment Guide. Formative and summative assessment strategies must be used.

Definition of Key Terms and Concepts in the Curriculum

- **Learning Outcomes:** It is a statement that defines the knowledge, skills, and abilities that learners should possess and be able to demonstrate after completing a learning experience. They are specific, measurable, attainable, and aligned with the content standards of the curriculum. It helps the teachers to determine what to teach, how to teach, and how to assess learning. Also, it communicates expectations to learners and helps them to better master the subject.
- **Learning Indicators:** They are measures that allow teachers to observe progress in the development of capacities and skills. They provide a simple and reliable means to evaluate the quality and efficacy of teaching practices, content delivery, and attainment of learning outcomes.
- **Content Standards:** It is a statement that defines the knowledge, skills, and understanding that learners are expected to learn in a particular subject area or grade level. They provide a clear target for learners and teachers and help focus resources on learner achievement.
- **Pedagogical Exemplars:** They are teaching examples used to convey values and standards to learners. Pedagogical Exemplars are usually demonstrated through teacher behaviour.
- **Assessment:** It is the systematic collection and analysis of data about learners' learning to improve the learning process or make a judgement on learner achievement levels. Assessment is aimed at developing a deep understanding of what learners know, understand, and can do with their knowledge because of their educational experiences. Assessment involves the use of empirical data on learners' learning to improve learning. Assessment is an essential aspect of the teaching and learning process in education, which enables teachers to assess the effectiveness of their teaching by linking learner performance to specific learning outcomes.
- **Teaching and Learning Resources:** Teaching and learning resources are essential tools for teachers to provide high-quality education to their learners. These resources can take various forms, including textbooks, audiovisual materials, online resources, and educational software. It is also important to avoid stereotypes and use inclusive language in teaching and learning resources. This means avoiding language that reinforces negative stereotypes and using language that is respectful and inclusive of all individuals regardless of their background. Using a consistent tone, style, and design is very important.

PHILOSOPHY, VISION AND GOAL OF AGRICULTURAL SCIENCE

Philosophy

The next generation of learners of Agriculture can reach their full potential through climate-aware learner-centred pedagogies to develop an interest in agriculture to improve food production.

Vision

Learners equipped with 21st Century skills and competencies who are excited about agriculture and create employment and wealth through the application of technology in agriculture.

Goal

To guide students, change their negative perceptions about Agriculture, build learners' competencies to thrive in further agricultural education, create agro-based enterprises and employment, and contribute meaningfully to other private sector development.

Contextual Issues

Context of Teaching the Subject (potential barriers to learning the subject).

1. Misconceptions about agriculture e.g., Agriculture is considered difficult, involving manual work and therefore not for females; it is for poor, unlettered, rural people.
2. Knowledge and skills gap in practical agriculture in the current curriculum
3. The content of the curriculum is too theoretical
4. Assessment concentrated on few cognitive domains and not comprehensive
5. Unstable agricultural markets e.g., market gluts
6. Land challenges including land tenure issues
7. Climate change issues e.g., Agriculture is a high-risk occupation, especially when it is entirely weather (rain-fed) dependent.
8. That there's no connection between computing technologies and Agriculture (e.g., the use of drones, artificial intelligence, etc.).

The youth who should remain in the farming areas are migrating to the urban centres, because of these reasons, for jobs which are non-existent. By making teaching and learning attractive and with the right motivation, the youth would stay and venture into agriculture.

Rationale

The study of the Agriculture Programme in the Science, Technology, Engineering and Mathematics (STEM) programme from SHS 1 through to SHS 3 will enable learners to build on the Agriculture learnt from Integrated Science at the JHS level and to further develop their practical skills in Agriculture. Learners will be trained to achieve all the positive global competencies associated with agricultural production and entrepreneurial skills so that they can play a significant role in the development of the country.

AGRICULTURAL SCIENCE CURRICULUM DEVELOPMENT PANEL

WRITERS		
	Name	**Institution**
1.	**Dr Kwadwo Amankwah**	Faculty of Agriculture, Kwame Nkrumah University of Science and Technology, Kumasi
2.	**Benedicta Carbilba Foli**	Retired, Ghana Education Service (Pope John S.H.S. and Minor Seminary)
REVIEWERS		
	Name	**Institution**
1.	**Prof (Mrs) Margaret Esi Essilfie**	Akenten Appiah-Menka University of Skills Training and Entrepreneurial Development
2.	**Prof Jakpasu Victor Kofi Afun**	Faculty of Agriculture, Kwame Nkrumah University of Science and Technology, Kumasi
3.	**Dr Afishata Abujaja**	University of Development Studies
CURRICULUM WRITING GUIDE TEAM		
	Name	**Institution**
1.	**Prof Winston Abroampa**	Kwame Nkrumah University of Science and Technology, Kumasi
2.	**Cosmos Eminah**	University of Education, Winneba
3.	**Aaron Akwaboah**	Ministry of Education
4.	**Evans Odei**	Achimota School, Accra
5.	**Paul Michael Cudjoe**	Prempeh College, Kumasi
6.	**Ahmed Amihere**	University of Education, Winneba

NaCCA TEAM			
1.	**Prof K. O. Kwarteng**	12.	**Bridget Anku**
2.	**Prof Edward Appiah**	13.	**Anthony Sarpong**
3.	**Mr Matthew Owusu**	14.	**Seth Nii Nartey**
4.	**Reginald Quartey**	15.	**Kenneth Wontumi**
5.	**Joana Vanderpuije**	16.	**Sharon Antwi-Baah**
6.	**Anita Collison**	17.	**Dennis Adjasi**
7.	**Rebecca Abu Gariba**	18.	**Ogyampo S. Amankwah**
8.	**Genevieve Mensah**	19.	**Abigail Owusu Oduro**
9.	**Veronica Odom**	20.	**Priscilla B. Plange**
10.	**Joachim Seyram Honu**	21.	**Abigail Birago Owusu**
11.	**Dr Mercy Nyamekye**	22.	**Uriah Otoo**
EXTERNAL QUALITY ASSURANCE TEAM			
1.	**Prof Kwame Akyeampong**	4.	**Dr Esinam Avornyo**
2.	**Dr Jane Cullen**	5.	**Dr Christopher Yaw Kwaah**
3.	**Dr Sean Higgins**		

SCOPE AND SEQUENCE

Agricultural Science Summary

S/N	STRAND	SUB-STRAND	YEAR 1			YEAR 2			YEAR 3		
			CS	LO	LI	CS	LO	LI	CS	LO	LI
1.	New Dawn in Agriculture	Misconceptions and Prospects in Agriculture and Farming	2	2	4	1	1	2	1	1	2
		Emerging Technologies in Agriculture.	2	2	5	2	2	5	2	2	5
		Agricultural Machineries	2	2	5	2	2	6	2	3	6
2.	Farming for jobs and income	Economic Production of Crops	1	1	3	1	1	3	1	1	3
		Economic Production of Animals	1	1	3	1	1	3	1	1	3
3.	Mobilisation of Resources and Networks	Land Tenure Systems for Agriculture.	1	1	3	-	-	-	-	-	-
		Support Systems in Agriculture.	2	2	5	2	2	5	2	2	5
4	Agriculture and Climate	Climate Variability	1	1	2	2	2	2	2	2	2
		Climate Change Adaptation	1	1	2	-	-	-	-	-	-
		Climate Change Mitigation Strategies	1	1	1	-	-	-	-	-	-
Total			**14**	**14**	**33**	**11**	**11**	**26**	**11**	**12**	**26**

Overall Totals (SHS 1 – 3)

Content Standards	**36**
Learning Outcomes	**37**
Learning Indicators	**85**

YEAR ONE

Subject AGRICULTURAL SCIENCE
Strand 1 NEW DAWN IN AGRICULTURE
Sub-Strand 1 MISCONCEPTIONS AND PROSPECTS IN AGRICULTURE AND FARMING

Learning Outcomes	21St Century Skills and Competencies	GESI[1], SEL[2] and Shared National Values
1.1.1.LO.1		
Explain the importance of agriculture and address misconceptions about the sector	**Digital Literacy, Communication and Collaborative Skills:** Acquired and or enhanced as they watch videos and communicate. **Critical Thinking:** Learners compare evidence on successful farming enterprises and reflect on their misconceptions.	**GESI:** Embrace diversity in agriculture, and encourage inclusion and allow learners to question their stereotypes and biases to clear the misconceptions. **National core values:** • Respect • Tolerance • Resourcefulness
1.1.1.LO.2		
Explain how to start and manage successful vegetable crop and ornamental plant enterprises in Ghanaian communities.	• Digital literacy skills, inquiry skills, and teamwork and communication skills of learners would improve through operating and watching videos and documentaries, farm visits and presentation of group work. • They become critical thinkers by interrogating how challenges in enterprises are addressed during farm visits. • Learners build digital literacy skills through operating video gadgets. As they communicate, they collaborate. They gain leadership skills as they work in mixed-ability groups and communicate their observations.	**GESI:** • Gender tolerance, inclusion and equity be aware of personal biases and stereotypes about successful women in agriculture. • Gender tolerance, embracing diversity, practising inclusion **National core values:** • Tolerance • Respect • Responsible citizenship

[1] Gender Equality and Social Inclusion
[2] Socio-Emotional Learning

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI		Assessment
1.1.1.CS.1	1.1.1.LI.1		1.1.1.AS.1
Demonstrate knowledge and understanding of the meaning and importance of Agriculture	**Meaning and Importance of Agriculture** **Initiating Talk for Learning**: Learners review the meaning of Agriculture in mixed ability groups. **Think Pair and Share:** In mixed ability groups, learners discuss the importance of Agriculture to society. **Structuring Talk for Learning**: In gender-based groups, learners make a presentation on the importance of Agriculture in a plenary session.		Level 1 Recall **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**
1.1.1.CS.2	1.1.1.LI.2		1.1.1.AS.2
Demonstrate knowledge and understanding of the meaning and importance of Agriculture.	**Identify and address misconceptions about agriculture and farming at the community and national levels** **Talk for learning:** In various mixed-ability groups, learners brainstorm to identify misconceptions about agriculture and farming. **Digital Learning:** Watch documentaries on successful farmers and agribusiness enterprises locally and internationally. **Collaborative Learning:** In pairs, learners discuss remedies to misconceptions in agriculture. Learners work in groups to reflect and make presentations on evidence that challenges their misconceptions about agriculture and farming.		**Level 1 Recall** Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
Teaching and Learning Resources	• Pictures • Projector	• Computer • Smartphones.	

<table>
<tr><th>Content Standards</th><th colspan="3">Learning Indicators and Pedagogical Exemplars with 21st Century and GESI</th><th>Assessment</th></tr>
<tr><td>1.1.1.CS.2</td><td colspan="3">1.1.1.LI.1</td><td>1.1.1.AS.1</td></tr>
<tr><td rowspan="3">Demonstrate knowledge and understanding of factors and processes that influence successful vegetable crop and ornamental plant enterprises.</td><td colspan="3">Identify characteristics of successful startup packages of vegetable crop and ornamental plant enterprises.

Digital Learning: In mixed-ability groups learners watch videos, documentaries and pictures of successful start-up patterns of male and female farmers.

Collaborative Learning: Learners discuss or talk about their observations in class

Experiential Learning: In groups embark on educational visits to successful vegetable crop farms and ornamental plant enterprises for learners to observe, ask questions and take field notes on start-up patterns.</td><td>Level 1 Recall
Level 2 Skills of conceptual understanding
Level 3 Strategic reasoning
Level 4 Extended critical thinking and reasoning</td></tr>
<tr><td colspan="3">1.1.1.LI.2</td><td>1.1.1.AS.1</td></tr>
<tr><td colspan="3">Catalogue the characteristics and patterns of growth of successful vegetable crop and ornamental plant enterprises.

Talk for Learning: Learners brainstorm to come up with characteristics of a successful enterprise.

Digital and Exploratory Learning: Watch videos, documentaries and pictures on patterns of growth of vegetable crops and ornamental plants.

Experiential Learning: Visit successful vegetable and ornamental crop enterprises to observe, ask questions, take field notes on patterns of growth, and present reports.</td><td>Level 1 Recall
Level 2 Skills of conceptual understanding
Level 3 Strategic reasoning
Level 4 Extended critical thinking and reasoning</td></tr>
<tr><td>Teaching and Learning Resources</td><td>• Video documentaries
• Vegetable crop farms and ornamental parks and gardens
• Projector</td><td>• Laptop computer
• Smartphones
• Field notebooks</td><td>• Protective footwear
• Pictures</td><td></td></tr>
</table>

Subject AGRICULTURAL SCIENCE
Strand 1 NEW DAWN IN AGRICULTURE
Sub-Strand 2 EMERGING TECHNOLOGIES IN AGRICULTURE.

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
1.1.2.LO.1		
Identify emerging technologies in vegetable crop and ornamental plant enterprises.	• Learners improve networking skills by interacting with vegetable growers and ornamentists who use emerging technologies in their ventures (where available). • They also build their digital literacy skills by operating videos. • Improve their communication skills using talk for learning procedures.	**GESI:** • Dialogue among mixed genders and deep respect for each other; giving constructive feedback. • Open-mindedness and analytical skills **National Core Values:** Respect, Tolerance. Responsible citizenship,
1.1.2.LO.2		
Compare and contrast existing and emerging technologies used in vegetable crop and ornamental plant enterprises and their benefits.	• Learners develop communication, creativity and critical thinking skills on how best to use soil, water and substrate to produce selected vegetables and ornamental plants. • Communication, collaboration, creativity and critical thinking skills would be acquired and or enhanced during brainstorming and group work. • Learners acquire and enhance digital literacy and communication skills during the brainstorming and operation of video equipment. Learners also develop critical thinking skills while deliberating on the role and benefits of drones.	**GESI:** • Open-mindedness, embracing diversity, analytical skills, and gender tolerance. • Embrace diversity in agriculture and be gender-sensitive. • As they work in mixed-gender groups, they learn to tolerate each other's viewpoints and respect each other. **National Core Values:** • Responsible • Citizenship • Respect • Self-confidence • Self-discipline.

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
1.1.2.CS.1	1.1.2.LI.1	1.1.2.AS.1
Demonstrate knowledge and understanding of emerging technologies in vegetable crop and ornamental plant enterprises.	**Explain the use of selected emerging technologies in vegetable crop and ornamental plant enterprises.** **Exploratory Learning:** Work in pairs to research from different sources about selected emerging technologies (GMOs, tissue culture, hydroponics, greenhouse planting), discuss the key findings, and present reports. **Structured Talk for Learning:** Watch videos on selected emerging technologies in vegetable crop and ornamental plant enterprises, discuss the key observations, and report through PowerPoint presentations.	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	1.1.2.LI.2	1.1.2.AS.2
	Appraise emerging technologies in vegetable crop and ornamental plant production. **Project-Based Learning:** In groups research from different sources such as books and online articles on the feasibility and impact of selected emerging technologies on farmers, analyse the articles and draw conclusions.	Level 1 Recall Level 2 Skills of conceptual understanding Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**
Teaching and Learning Resources	• Relevant textbooks • Laptop computer • Project • Wi-FI and information from the internet	• Video documentaries on the technologies mentioned • Pictures of emerging technologies used in vegetable crop and ornamental plant enterprises • Farm Technicians or Guides

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
1.1.2.CS.2	1.1.2.LI.1	1.1.2.AS.1
Demonstrate knowledge and skills in emerging technologies of vegetable crop and ornamental plant production and their benefits relating to real-life situations.	**Grow vegetable and ornamental crops using the known procedures and technologies.** **Exploratory Learning:** All learners embark on field visits to vegetable crop farms and ornamental plant parks to learn emerging technology procedures and management. **Project-Based Learning:** In mixed groups (of 10), carry out a project on the production of selected vegetable crops and ornamental plants using water, substrate, and other media.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
	1.1.2.LI.2	1.1.2.AS.2
	Describe the use and importance of issue culture in vegetable crop and ornamental plant enterprises. **Talk for Learning:** Learners in mixed-ability and mixed-gender groups brainstorm the meaning and importance of tissue culture in the cultivation of vegetable crops and ornamental plants. **Collaborative Learning:** Task learners in mixed-gender groups (of 4) to research and come up with the importance of tissue culture in vegetable crop and ornamental plant production. **Activity-Based Learning:** Learners discuss the benefits of using tissue culture and present their findings on cardboard posters and paste them on the walls.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
	1.1.2.LI.3	1.1.2.AS.3
	Identify other emerging technologies used to make growing of vegetable and ornamental crops easier. **Inquiry-Based Learning:** Learners in mixed-gender groups, identify other emerging technologies used to ease work in vegetable and ornamental cultivation (e.g., drones that use digital platforms to connect farmers and tractor services). **Digital Learning:** Learners watch video documentaries on the use and application of drones. **Talk for Learning**: In mixed-gender groups, learners discuss how the technologies help ease	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning

	work in vegetable crop and ornamental plant production.			
Teaching and Learning Resources	• Parks and Gardens • Vegetable farms • Reading materials • Functional Internet facility • Laptop computer	• Wi-Fi • Seeds of selected vegetables • Ornamental plants • Containers for planting • Water	• Field notebook • Pens • Functional Internet facility • Video documentaries on tissue culture	• Smartphones • Recorded videos on other emerging technologies • LCD projector • Internet facility

Subject AGRICULTURAL SCIENCE
Strand 1 NEW DAWN IN AGRICULTURE
Sub-Strand 3 AGRICULTURAL MACHINERIES

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
1.1.3.LO.1		
Evaluate the various forms of irrigation systems in vegetable crop and ornamental plant production	**Learners develop Leadership Skills, Communication and Collaborative Skills as they engage in discussions in groups**. As they download and watch videos and carry out practical field activities, learners develop digital literacy, communication, collaboration, and critical thinking skills. As learners use the irrigation facilities, they develop skills in communication, collaboration, and critical thinking. Learners develop and enhance their decision-making skills.	**GESI:** • Tolerance for different proficiency levels of learners • Respect for individuals of different beliefs • Gender tolerance. • Dialogue among mixed genders, value each other's opinion, respect for each other; clearing personal biases about low proficient level learners. **National core values:** • Respect • Tolerance
1.1.3.LO.2		
Explain the functions of farm tools and equipment	**Teamwork and Digital Literacy Skills:** Learners develop these skills as they operate electronic and electrical gadgets and watch video documentaries. **Teamwork, Digital Literacy and Observation Skills:** Learners develop these skills as they watch and work with some selected machinery.	**GESI:** • Tolerance for learners with different proficiency levels and gender. • Tolerance for learners with different proficiency levels and gender. Address stereotype ideas on farm machinery. **National core values:** • Self-confidence • Resourcefulness • Fairness • Respect • Excellence

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI			Assessment
1.1.3.CS.1	1.1.3.LI.1			1.1.3.AS.1
Demonstrate knowledge, understanding and skills in the use of various forms of irrigation systems in vegetable crop and ornamental plant cultivation.	**Describe the modern and efficient ways of crop irrigation** **Talk for Learning:** In mixed-gender groups, learners brainstorm on existing methods of supplying water to vegetable crops and ornamental plants (e.g. use of watering cans, buckets, water hose, rainfall, drip irrigation, sprinkler irrigation). **Collaborative Learning:** In pairs, learners discuss the merits and demerits of the different means of supplying water to vegetable crops and ornamental plants. **Experiential Learning:** All learners visit a farm in their communities to observe and practice different ways of watering vegetable crops and ornamental plants.			Level 1 Recall **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**
	1.1.3.LI.2			1.1.3.AS.2
	Analyse the profitability of selected forms of irrigation **Talk-for-Learning:** Listen to a talk by a resource person on modern and efficient ways of crop irrigation. **Collaborative Learning:** Learners in mixed-gender and mixed-ability groups discuss and tabulate the summary of the advantages associated with various modern forms of irrigation.			**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
	1.1.3.LI.3			1.1.3.AS.3
	Use the appropriate irrigation system to produce vegetable crops and ornamental plants. **Experiential Learning:** Embark on field trips to farms or gardens that use modern forms of irrigation e.g., Sprinkler, Surface irrigation - where water is distributed over and across land by gravity without mechanical pump, localised irrigation, drip irrigation, centre pivot irrigation, lateral move irrigation, sub-irrigation and manual irrigation. **Project-Based Learning:** Practice irrigation using the various forms mentioned above to produce vegetable or ornamental crops.			Evaluate the adapted or basic irrigation systems used for students' enterprise on vegetable and ornamental crops.
Teaching and Learning Resources	• Watering can	• Scheduling tool drip lines	• Functional internet facilities	• Gardens/farms employing different forms of

	• Bucket, water hose • Poly tanks • Dugouts	• Sprinkler • Video documentaries	• Computer • Smartphone	irrigation • Sprinklers • Drip irrigation facilities

<table>
<tr><th>Content Standards</th><th colspan="4">Learning Indicators and Pedagogical Exemplars with 21st Century and GESI</th><th>Assessment</th></tr>
<tr><td>1.1.3.CS.2</td><td colspan="4">1.1.3.LI.1</td><td>1.1.3.AS.1</td></tr>
<tr><td rowspan="3">Demonstrate knowledge, understanding and skills in the operation of farm tools, implements and machines.</td><td colspan="4">Identify the functions of the parts and uses of Agricultural tools and implements used in crop production.

Activity-Based Learning: Observe some agricultural tools or watch videos or pictures of farm machinery and try to identify each tool or machinery.

Talk-for-Learning: After watching the videos, learners in mixed-ability groups discuss the functions of the parts of the machinery.</td><td>Level 1 Recall
Level 2 Skills of conceptual understanding
Level 3 Strategic reasoning
Level 4 Extended critical thinking and reasoning</td></tr>
<tr><td colspan="4">1.1.3.LI.2</td><td>1.1.3.AS.2</td></tr>
<tr><td colspan="4">Classify and operate different types of machinery used in crop production.

Enquiry-Based Learning: Learners in mixed groups (of 5), surf the Internet and come up with classes of farm machinery used in crop production (Land tillers, planters, harvesters).

Project-Based Learning: Learners visit large-scale farms to observe the practical or simulated demonstrations of the different farm machinery in crop production and present a report.</td><td>Level 1 Recall:
Level 2 Skills of conceptual understanding
Level 3 Strategic reasoning
Level 4 Extended critical thinking and reasoning</td></tr>
<tr><td>Teaching and Learning Resources</td><td>• Functional internet facilities
• Video documentaries
• Hoes
• Cutlasses</td><td>• Mattock
• Pickaxe
• Shovel
• Hand trowel</td><td>• Tractor
• Ploughs
• Harrows</td><td colspan="2">• Planters
• Combined harvesters
• Large-scale farm.</td></tr>
</table>

Subject AGRICULTURAL SCIENCE
Strand 2 FARMING FOR JOBS AND INCOME
Sub-Strand 1 ECONOMIC PRODUCTION OF CROPS

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
1.2.1.LO.1		
Produce vegetables and ornamental plants for profit	• Entrepreneurial, communication, innovation collaboration, and creativity skills are developed by learners. • These activities will help learners develop creativity, communication, leadership, entrepreneurial and collaboration skills.	**GESI:** • Dialogue among mixed-ability and gender groups, value others' opinion, respect each other; clear personal biases about low proficient level learners. • Tolerance for learners with different proficiency levels and gender. Accept roles irrespective of cultural and religious differences as they work together. • National values of accountability and integrity will be acquired and projected. **National core values:** Self-confidence, resourcefulness, fairness, self-control, respect, honesty, truthfulness.

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
1.2.1.CS.1	1.2.1.LI.1	1.2.1.AS.1
Demonstrate knowledge and understanding of market-oriented production of vegetables and ornamentals	**Identify market needs for vegetables and ornamental plants.** **Experiential Learning:** Learners in various mixed-ability groups visit the community and offices to observe types of ornamental plants used for hedges and home decoration; visit the local markets, to check for the types of vegetables being sold, and related market needs. **Collaborative Learning:** Learners in their original groups discuss their findings and present reports.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	1.2.1.LI.2	1.2.1.AS.2
	Organise and produce selected vegetable crops and ornamental plants. **Project-Based Learning:** Learners in mixed-ability groups select some of the vegetables and ornamental crops to grow. Regular visits are made, and records are taken for discussion.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**
	1.2.1.LI.3	1.2.1.AS.3
	Carry out required post-harvest practices and market the produce. **Project-Based Learning:** Learners in mixed-ability and mixed-gender groups are assigned to vegetable crops and ornamental plants. Learners form subgroups to harvest and market the produce. Appropriate post-harvest practices are carried out where necessary. Various groups sell the produce and render accounts to the class.	Level 1 Recall **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning

Teaching and Learning Resources			
	• Well-planned community • Community market • Pocket notebooks • Plots of land or boxes or cans or large plastic bottles with soil	• Seeds of selected vegetables • Tools and implements for growing the crops • Land • Boxes	• Cans • Large plastic bottles • Seeds of selected vegetables and ornamentals • Black soil

Subject **AGRICULTURAL SCIENCE**
Strand 2 **FARMING FOR JOBS AND INCOME**
Sub-Strand 2 **ECONOMIC PRODUCTION OF ANIMALS**

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
1.2.2.LO.1		
Explain the key processes involved in poultry production.	• These activities will help develop the creativity, communication, collaboration, and digital literacy skills of learners. • Going through all the stages of poultry production will help develop or acquire creativity, innovation, communication, and collaboration skills. • In addition, they will acquire the values of self-reliance and accountability. • Learners acquire negotiation, innovation and communication skills.	**GESI:** • Dialogue among mixed-ability and gender groups, value others' opinion, respect each other; clear personal biases about low proficient level learners. • Tolerance for learners with different proficiency levels and gender. • Accept roles irrespective of cultural and religious differences. **National core values:** • Self-confidence • Resourcefulness • Fairness • Self-control • Respect • Honest • Truthful

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
1.2.2.CS.1	1.2.2.LI.1	1.2.2.AS.1
Demonstrate knowledge, skills and understanding of the economic production of poultry	**Identify resources and market needs for poultry production** **Talk for Learning:** Learners in mixed groups identify and list commonly/frequently used poultry products in their homes and food joints. **Enquiry-Based Learning**: Learners, in mixed groups (of 10), visit the community market (cold stores), with a checklist to ask for types of poultry and poultry products people patronise most. One group of learners visits recognised hatcheries to identify types of day-old chicks. Another group visits to recognised poultry shops to identify types of feed, drinkers, waterers, perches, and vaccines. **Exploratory Learning:** Learners in the same groups visit a poultry farm or watch a video on farms, and record activities of the farm on the sale of produce and products.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	1.2.2.LI.2	1.2.2.AS.2
	Organise and produce poultry type that is common in the locality for eggs and meat. **Project-Based Learning:** • Select a site for a semi-intensive poultry farm. • Obtain hen coops, day-old chicks and feed, drinkers, waterers, perches, vaccines etc. from agro-input dealers. • Set the birds on site and visit the site daily to provide feed, water and vaccination to birds and to take records for discussion.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**
	1.2.2.LI.3	1.2.2.AS.3
	Outline various distribution outlets and ways of marketing poultry produce and products. **Exploratory Learning:** • Individually, research various poultry distribution outlets in the community and ways of marketing the poultry produce. Examples of outlets are retailers of live birds, eateries, restaurants, hotels, supermarkets, and event organisers. Examples of how to market the produce: Advertise on Google and social media.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning

	• Process and package for festive seasons and special events, network with other farmers and businesses.		
Teaching and Learning Resources	• Community market • Cold storage facilities • Video documentaries • Functional internet facilities • Computer • Projector	• Smartphone • Hen coops • Day-old chick • Feed • Drink dispensers • Vaccines	• Pocket notebooks • Advertising Billboards • Information Centres and FM stations • Posters • Weighing scale • Plastic or paper bags.

Subject AGRICULTURAL SCIENCE
Strand 3 MOBILISATION OF RESOURCES AND NETWORKS
Sub-Strand 1 LAND TENURE SYSTEMS FOR AGRICULTURE.

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
1.3.1.LO.1		
Explain the different types of land tenure systems.	• Learners acquire or enhance digital literacy and communication skills while surfing the Internet and writing and presenting reports. • Learners need values of Respect and Humility to go before traditional and government authorities. They also develop negotiation and communication skills, as they seek and solicit information from various people. • Learners acquire and develop innovation, leadership, negotiation and communication skills, as they discuss findings from the internet.	**GESI:** • Dialogue among mixed-ability and gender groups, value others' opinion, respect each other; accept roles assigned to them irrespective of culture or religion. • Tolerance among mixed-ability and genders groups, value others' opinion, respect each other; clear personal biases about low proficient level learners. **National core values:** • Respect • Tolerance • Self-confidence • Resourcefulness • Fairness • Self-control

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
1.3.1.CS.1	1.3.1.LI.1	1.3.1.AS.1
Demonstrate knowledge and understanding of the different types of land tenure systems for agricultural production.	**Describe various types of customary and statutory land tenure systems.** **Enquiry-Based Learning:** Learners in mixed groups research from different sources to identify the factors that affect land tenure systems. For example, issues related to land inherited through maternal lineage, family land inherited through paternal lineage, spouse's family land, rented or leased land, sharecropping and personally owned land. **Digital Learning:** Prepare and make PowerPoint presentations based on the findings.	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	1.3.1.LI.2	1.3.1.AS.2
	Describe land acquisition and land title registration procedures. **Project-Based Learning:** Different mixed groups of learners visit the head of a family/clan, dikro, or chief, with a checklist/questionnaire to find out how land is acquired in the locality, and present reports on their findings. **Exploratory Learning:** Visit nearby Land Commission Offices to get information on how lands acquired for agricultural purposes are registered and present reports on the findings.	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	1.3.1.LI.3	1.3.1.AS.3
	Examine challenges in customary and statutory land tenure systems. **Enquiry-Based Learning:** Learners in mixed-ability groups search the Internet and other sources for information on the challenges to land acquisition and tenure. **Managing Talk for Learning:** Learners in mixed ability groups discuss challenges in customary and statutory land tenure systems and summarise and present their findings in a plenary session.	**Level 1 Recall** Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
Teaching and Learning Resources	• Functional Internet facility • Computer • Smartphones • Projector • Checklist/ questionnaire • Land Commission Offices	

Subject AGRICULTURAL SCIENCE
Strand 3 MOBILISATION OF RESOURCES AND NETWORKS
Sub-Strand 2 SUPPORT SYSTEMS IN AGRICULTURE.

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
1.3.2.LO.1		
Explain the different types of support systems in vegetable and ornamental crop production and marketing.	• Interacting and communicating with various actors in selected value chains will help learners acquire and develop innovation, leadership, negotiation, critical thinking and communication skills. • Learners acquire and develop innovation, leadership, digital literacy and communication skills, as they surf the internet and brainstorm. • Role play allows learners to exhibit/acquire and enhance communication, innovation, creativity, critical thinking and interpersonal skills.	**GESI:** • Tolerance among mixed-ability and gender groups, value others' opinion, and respect each other; clear personal biases about low proficient level learners • Accept roles assigned to them irrespective of culture or religion. **National core values:** • Self-confidence • Resourcefulness • Fairness • Self-control • Respect • Excellence.
1.3.2.LO.2		
Evaluate extension services delivery on vegetable and ornamental crop enterprises in the school's catchment area.	Critical thinking and communication skills are necessary and enhanced as learners present findings and brief written reports.	**GESI:** Tolerance among mixed-ability groups, Respect of opinions irrespective of culture, religion or proficiency level. **National core values:** • Self-confidence • Resourcefulness • Fairness • Self-control • Respect

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
1.3.2.CS.1	1.3.2.LI.1	1.3.2.AS.1
Demonstrate knowledge and understanding of the different types of support systems in vegetable and ornamental crop production and marketing.	**Describe the economic importance of selected vegetable crops and ornamental plants in the livelihood of the producers and the broader value chain.** **Enquiry-Based Learning:** • Learners in mixed-ability groups visit vendors of selected agricultural commodities to map the movement of such commodities from producers to consumers. • Learners in mixed-ability groups contact producers, middle (wo)men and vendors of the selected agricultural commodities and solicit information on the effect of producing and or trading in the commodities on their livelihood. **Activity-Based Learning:** Design mid-maps on the importance of vegetable crops and ornamental plants to producers and other persons in the value chain.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	1.3.2.LI.2	1.3.2.AS.2
	Identify all relevant support organisations that offer various services to key actors such as farmers, traders and processors. **Enquiry-Based Learning:** Learners in mixed-gender and mixed-ability groups surf the internet and other sources to come up with a list of national and international organisations involved in agriculture. **Talk for Learning:** Learners in mixed ability groups categorise the services of the organisations and discuss their roles. Learners then present reports.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
	1.3.2.LI.3	1.3.2.AS.3
	Describe the interactions within the various key stakeholders in the commodity value chains. **Role play/dramatisation:** Learners act/play the role of the different stakeholders (producers, processors, storage facility operators, distributors, retailers, and support organisations) in the commodity value chains.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
Teaching and Learning	• Questionnaire/Interview • Smartphone • Flip charts • Detailed knowledge of	

Resources	Checklist • Field notebooks • Camera	• Projector • Computer	• Marker • Functional Internet connectivity	each stakeholder and their interactions. • Relevant costume • Samples of produce/products

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
1.3.2.CS.2	1.3.2.LI.1	1.3.2.AS.1
Demonstrate knowledge and understanding of the approaches and methods of agricultural extension delivery.	**Describe transfer-of-technology approaches and methods involved.** **Structured Talk for Learning:** Learners in mixed-ability groups study cases of extension delivery (by the Department of Extension Services and a Non-governmental Organisation e.g., World Vision International). Analyse the key component of the Training and Visit (T & V) system of extension implemented in the 1970s and 1980s to enhance food production and present reports in a plenary session.	Level 1 Recall **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
	1.3.2.LI.2	1.3.2.AS.2
	Explain the participatory extension approach and methods. **Structured Talk for Learning:** Learners in mixed-ability groups study cases of participatory technology development approach in extension delivery, and present reports in a plenary session.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
Teaching and Learning Resources	• Documents and documentaries on case studies of training and visit interventions including the National Agricultural Extension Project (NAEP) • Documents and documentaries on case studies of participatory technology development projects including interventions by Northern Ghana LEISA Group.	

Subject AGRICULTURAL SCIENCE
Strand 4 AGRICULTURE AND CLIMATE
Sub-Strand 1 CLIMATE VARIABILITY

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
1.4.1.LO.1		
Explain climate change and its repercussions on agriculture	• Digital literacy, collaboration and communication skills are necessary and enhanced as learners surf the internet and present findings and brief written reports. • Digital literacy, critical thinking, collaboration, leadership and communication skills will be acquired and developed during the learning.	**GESI:** Tolerance among mixed-ability and gender groups, value others' opinion, respect each other**.** **National core values:** • Self-confidence • Resourcefulness • Excellence • Respect

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI			Assessment
1.4.1.CS.1	1.4.1.LI.1			1.4.1.AS.1
Demonstrate knowledge and understanding of climate change and its threat to environmental stability and rural livelihood sustainability.	**Explain the causes of current world disasters** **Enquiry-Based Learning:** Learners of all proficiency levels in mixed groups surf the internet, come up with causes of current world disasters, and present reports.			Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	1.4.1.LI.2			1.4.1.AS.2
	Discuss increasing drought, pestilence and decreasing crop yields. **Enquiry-Based Learning:** Learners in small mixed groups surf the internet and read about the topic before the lesson. **Talk for Learning:** Various groups discuss information generated from reading assignments and present reports.			Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
Teaching and Learning Resources	• Video documentaries and pictures on climate change challenges in agriculture • Computer • Smartphone	• Notebooks • Functional Internet connectivity	• Field notebooks relevant textbooks • Projector	

Subject AGRICULTURAL SCIENCE
Strand 4 AGRICULTURE AND CLIMATE
Sub-Strand 2 CLIMATE CHANGE ADAPTATION

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
1.4.2.LO.1		
Explain the adaption of society and agriculture to climate change.	Leadership, digital literacy, collaboration and communication skills will be acquired and enhanced as learners surf the internet and present findings and brief written reports.	**GESI:** Tolerance among mixed-ability groups, Respect for others' opinions irrespective of culture, religion or proficiency level. **National core values:** • Self-confidence • Resourcefulness • Self-control

<table>
<tr><th>Content Standards</th><th colspan="2">Learning Indicators and Pedagogical Exemplars with 21st Century and GESI</th><th>Assessment</th></tr>
<tr><td>1.4.2.CS.1</td><td colspan="2">1.4.2.LI.1</td><td>1.4.2.AS.1</td></tr>
<tr><td rowspan="3">Demonstrate knowledge and understanding of climate change and its relevance to sustainable rural agriculture.</td><td colspan="2">Explain indigenous strategies for dealing with climate change and variability.

Project-Based Learning: Work in small groups to study indigenous strategies for combating climate change and unpredictability and present reports.</td><td>Level 1 Recall
Level 2 Skills of conceptual understanding
Level 3 Strategic reasoning
Level 4 Extended critical thinking and reasoning</td></tr>
<tr><td colspan="2">1.4.2.LI.2</td><td>1.4.2.AS.2</td></tr>
<tr><td colspan="2">Discuss conventional responses to climate change.

Digital Learning: Learners in mixed-ability groups surf the internet and other sources to identify conventional strategies for mitigating climate change and unpredictability and present reports.</td><td>Level 1 Recall
Level 2 Skills of conceptual understanding
Level 3 Strategic reasoning
Level 4 Extended critical thinking and reasoning</td></tr>
<tr><td>Teaching and Learning Resources</td><td>• Video documentaries and pictures on indigenous strategies for dealing with climate change in agriculture
• Computer
• Smartphone</td><td colspan="2">• Projector
• Notebooks
• Video documentaries and pictures on conventional strategies for mitigating climate change in agriculture</td></tr>
</table>

Subject AGRICULTURAL SCIENCE
Strand 4 AGRICULTURE AND CLIMATE
Sub-Strand 3 CLIMATE CHANGE MITIGATION STRATEGIES

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
1.4.3.LO.1		
Explain climate change mitigation measures in relation to society and agriculture.	**Critical Thinking** on adaptation and mitigation measures to climate change.	**GESI:** Tolerance among mixed-ability groups, Respect of other opinions irrespective of culture or religion or proficiency level. **National core values:** • Self-confidence • Resourcefulness • Fairness • Self-control • Respect

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
1.4.3.CS.1	1.4.3.LI.1	1.4.3.AS.1
Demonstrate knowledge and understanding of climate change mitigation measures and their relevance to sustainable rural agriculture.	**Discuss the effects of indigenous and conventional mitigation measures for combating climate change on agricultural production.** **Talk for learning:** Through a whole class session, brainstorm on the effects of climate change mitigation measures on agricultural production. **Digital Learning:** Individually, write detailed reports and present them in PowerPoint format	**Level 1 Recall** Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
Teaching and Learning Resources	• Video documentaries and pictures on climate change adaptation and mitigation measures in agriculture • Projector • Computer • Smartphone	

YEAR TWO

Subject AGRICULTURAL SCIENCE
Strand 1 NEW DAWN AGRICULTURE
Sub-Strand 1 MISCONCEPTIONS AND PROSPECTS IN AGRICULTURE AND FARMING

Learning Outcomes	21st Century Skills and Competencies	GESI[3], SEL[4] and Shared National Values
2.1.1.LO.1		
Analyse patterns in the start-up and growth of successful arable crop enterprises (cereals, legumes, and tuber crops)	• Build digital literacy skills of learners: They watch videos and through operating links on video documentaries as they communicate, and collaborate. • They gain critical thinking by interrogating how challenges in enterprise activities were addressed. They gain leadership skills as they form mixed-ability groups and communicate their observation from the video. They learn to speak clearly as they engage on the way to and from the farms. • Learners build digital literacy skills through operating video gadgets.	**GESI:** • Gender tolerance, inclusion and equity; being aware of personal biases and stereotypes about successful women in agriculture. • Gender tolerance, embracing diversity and practising inclusion **National core values:** • Tolerance • Respect • Responsible citizenship • Respect

[3] Gender Equality and Social Inclusion
[4] Socio-Emotional Learning

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
2.1.1.CS.1	2.1.1.LI.1	2.1.1.AS.1
Demonstrate knowledge and understanding of factors and processes that influence successful arable crop enterprises (cereals, legumes, and tuber crops)	**Discuss characteristics of successful startup packages of arable crop enterprises.** **Experiential Learning:** Watch videos or pictures of successful start-up patterns of both male and female farmers. Learners discuss or talk about their observations in class. **Experiential Learning:** In mixed-ability and mixed-gender groups, embark on educational visits to successful arable crop enterprises to observe, ask questions and take field notes on start-up patterns. **Structuring Talk-for-Learning:** Learners discuss or talk about their observations in class in mixed ability groups.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	2.1.1.LI.2	2.1.1.AS.2
	Catalogue the characteristics and patterns of growth of successful arable crop (cereals, legumes, and tuber crops) enterprises. **Enquiry-Based Learning:** Learners source from the Department of Agriculture for a list of successful arable crop (cereals, legumes, and tuber crops) enterprises. **Experiential Learning:** Visit successful arable crop (cereals, legumes, and tuber crops) enterprises to observe, ask questions, take field notes on patterns of growth, and present reports. **Talk-for-Learning:** Learners brainstorm to come up with characteristics of a successful enterprise.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
Teaching and Learning Resources	• Video documentaries • Pictures • Projector	• Laptop computer • Computer • Smartphones	• Field notebooks • Protective footwear • Arable crop enterprises (cereals, legumes, and tuber crops)

Subject AGRICULTURAL SCIENCE
Strand 1 NEW DAWN AGRICULTURE
Sub-Strand 2 EMERGING TECHNOLOGIES IN AGRICULTURE

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
2.1.2.LO.1		
Appraise and use emerging technologies in arable crop (cereals, legumes, and tuber crops) enterprises.	**Learners improve networking skills by interacting with vegetable growers and ornamentists who use emerging technologies in their ventures (where available)** • They also build their digital literacy skills by operating the videos. • Improve their communication skills using talk and learning procedures. • Learners improve Innovation, communication, collaboration and personal development skills	**GESI:** • Open-mindedness and analytical skills • Dialogue among mixed genders and deep respect for each other; giving constructive feedback. **National core values:** • Responsible citizenship • Respect • Tolerance
2.1.2.LO.2		
Distinguish between existing and emerging technologies used in arable crop (cereals, legumes, and tuber crops) enterprises and their benefits.	• Learners develop communication and innovation skills, creativity and critical thinking on how best to use soil, water and substrate to produce selected vegetables and ornamental plants. • Communication, collaboration, creativity and critical thinking skills would be acquired and or enhanced during brainstorming and group work. • Learners acquire and enhance digital literacy and communication skills during the brainstorming and operation of video equipment. • Learners also develop critical thinking skills while deliberating on the role and benefits of drones.	**GESI:** • Open-mindedness, embracing diversity, analytical skills, and gender tolerance. • Embrace diversity in agriculture, and be gender sensitive. • As they work in mixed-gender groups, they learn to tolerate each other's viewpoints and respect each other. **National core values:** • Responsible citizenship • Respect • Tolerance • Resourcefulness • Self-confidence • Self-discipline

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
2.1.2.CS.1	2.1.2.LI.1	2.1.2.AS.1
Demonstrate knowledge and understanding of emerging technologies and their benefits in arable crop enterprises (cereals, legumes, and tuber crops) and relate it to what is in the community.	**Appraise emerging technologies in arable crop (cereals, legumes, and tuber crops) production.** **Structuring talk for learning:** Listen to a presentation by a resource person on the feasibility and impact of selected emerging technologies on farmers and discuss the key points of the presentation. **Activity-based learning**: In pairs, identify and write down the key emerging technologies in arable crop production and list some of their key features.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	2.1.2.LI.2	2.1.2.AS.2
	Explain the use of selected technologies like hydroponics, greenhouse planting, Genetically Modified Organisms (GMOs), tissue culture, and precision agriculture in arable crop enterprises (cereals, legumes, and tuber crops) and relate it to what is in the community. **Structuring talk for learning:** Learners have discussions with entrepreneurs on how emerging technologies became established. **Digital Learning**: Learners in pairs surf the internet on selected emerging technologies (GMOs, tissue culture, hydroponics, greenhouse planting), as well as precision agriculture, discuss their findings, and present reports. **Structured Talk for Learning:** Learners engage in discussions on how selected technologies can be used in crop production within local communities	**Level 1 Recall** **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
Teaching and Learning Resources	• Textbooks • Internet • Video documentaries on emerging technologies	• Pictures of emerging technologies used in arable crop (cereals, legumes, and tuber crops) enterprises • Farm Technicians or Guides • Video documentaries on the technologies mentioned

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
2.1.2.CS.2	2.1.2.LI.1	2.1.2.AS.1
Demonstrate knowledge and skills in emerging technologies of arable crop (cereals, legumes, and tuber crops) enterprises and their benefits relating to real life situation	**Grow arable crops (cereals, legumes, and tuber crops) using emerging procedures and technologies.** **Structured Talk for Learning:** All learners embark on field visits to vegetable crop farms and ornamental plant parks to learn emerging technology, procedures and management. **Project-Based Learning:** In mixed groups (of 10), learners carry out a project on the production of selected arable crops (cereals, legumes, and tuber crops) using soil substrate and other media.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
	2.1.2.LI.2	2.1.2.AS.2
	Describe the use and importance of tissue culture in arable crop (cereals, legumes, and tuber crops) enterprises. **Problem-Based Learning:** Learners in mixed-gender groups (of 4) are tasked to research and come up with the importance of tissue culture in arable crop (cereals, legumes, and tuber crops) production. **Activity-Based Learning:** Learners discuss the benefits of using tissue culture, present their findings on cardboard posters and paste them on the walls.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
	2.1.2.LI.3	2.1.2.AS.3
	Identify other emerging technologies used to make growing arable crop (cereals, legumes, and tuber crops) easier. **Collaborative Learning:** Learners in mixed-gender groups, identify other emerging technologies used to ease work in arable crop (cereals, legumes, and tuber crops) cultivation (e.g., drones and TROTRO Tractor that use digital platform to connect farmers and tractor services). **Digital Learning:** Watch video documentaries on the use and application of drones. **Talk for Learning:** In mixed-gender groups, learners discuss how the technologies help ease work in the arable crop (cereals, legumes, and tuber crops) production.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning

Teaching and Learning Resources	• Parks and Gardens • Vegetable farms • Reading materials • Functional Internet facility • Laptop computer • Wi-Fi	• Seeds of selected arable crops (cereals, legumes, and tuber crops) • Containers for planting • Water • Field notebook • Pens	• Video documentaries on tissue culture • Laptop computer • Smartphones • Recorded videos on other emerging technologies • LCD projector

Subject AGRICULTURAL SCIENCE
Strand 1 NEW DAWN AGRICULTURE
Sub-Strand 3 AGRICULTURAL MACHINERIES

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
1.1.3.LO.1		
Compare the production of arable crop enterprises (cereals, legumes, and tuber crops) under rainfed agriculture and irrigation.	• Learners develop interpersonal skills, communication and collaboration skills as they engage in discussions in groups. • Learners develop leadership skills, communication and collaboration and digital literacy skills as they set up the video and projector and engage in discussions in groups. • As they download and watch videos and carry out practical field activities, learners develop digital literacy, communication, collaboration and critical thinking skills. • As learners use the irrigation facilities, they develop skills in communication, collaboration and critical thinking. Learners develop and enhance their decision-making skills.	**GESI:** • Tolerance for different proficiency levels of learners; Gender tolerance. • Respect for individuals of different beliefs. • Dialogue among mixed genders, value each other's opinion, respect for each other. **National core values:** • Respect • Tolerance
1.1.3.LO.2		
Explain the roles of farm machinery and equipment in arable crop (cereals, legumes, and tuber crops) production.	• Teamwork and digital literacy skills: Learners develop these skills as they operate electronic and electrical gadgets and watch video documentaries. • Teamwork, digital literacy and observation skills: Learners develop these skills as they watch and work with some selected machinery.	**GESI:** • Tolerance for learners with different proficiency levels and gender. • Tolerance for learners with different proficiency levels and gender. Address stereotypical ideas on farm machinery. **National core values:** • Self-confidence • Resourcefulness • Fairness • Self-confidence • Fairness • Excellence

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
2.1.3.CS.1	2.1.3.LI.1	2.1.3.AS.1
Demonstrate knowledge and skills in the use of various forms of irrigation systems in arable crop (cereals, legumes, and tuber crops) enterprises.	**Examine similarities and differences in the production of arable crop enterprises (cereals, legumes, and tuber crops) under rainfed agriculture and irrigation.** **Talk-for-Learning:** Learners in mixed-ability and mixed-gender groups, brainstorm on existing modes of watering crops such as using buckets of water, water hose and relying on rainfall. **Think-Pair-Share:** In pairs, learners discuss the merits and demerits of using the existing means of watering crops in arable crop (cereals, legumes, and tuber crops) production.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	2.1.3.LI.2	2.1.3.AS.2
	Describe the modern and efficient ways of crop irrigation **Structured Talk-for-Learning:** In mixed-gender groups, learners brainstorm on modern methods of supplying water to vegetable crops and ornamental plants (e.g. use of drip irrigation, and sprinkler irrigation) after watching a PowerPoint presentation on modern forms of irrigation. **Think-Pair-Share:** In pairs, learners discuss the merits and demerits of the different means of supplying water to vegetable crops and ornamental plants. **Experiential Learning:** All learners visit a farm in their communities to observe and discuss existing means of watering vegetable crops and ornamental plants.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	2.1.3.LI.3	2.1.3.AS.3
	Analyse the profitability of selected forms of irrigation **Collaborative Learning:** Discuss and compare the modern and traditional ways of crop irrigation. **Experiential Learning:** Explain why the modern ways of irrigation are better than the traditional ways.	**Level 1 Recall** **Level 2 Skills of conceptual** understanding Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
	2.1.3.LI.4	2.1.3.AS.4

	Use the appropriate irrigation system to produce arable crops (cereals, legumes, and tuber crops). **Experiential Learning:** Embark on field trips to farms or gardens that use modern forms of irrigation e.g., Sprinkler, Surface irrigation - where water is distributed over and across land by gravity without mechanical pump, localised irrigation, drip irrigation, centre pivot irrigation, lateral move irrigation, sub-irrigation and manual irrigation. **Project-Based Learning:** Practice irrigation using the various forms mentioned above on selected arable crop (cereals, legumes, and tuber crops).		Level 1 Recall **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**
Teaching and Learning Resources	• Preparatory materials (e.g., land, seeds /seedlings) • Simple irrigation materials (e.g., spraying materials; sprinklers) • Sprinklers • Tool drip lines • Video documentaries on forms of irrigation and pictures of emerging technologies which is applicable to agriculture • Projector • Video documentaries	• Functional Internet facilities • Computer • smart phone • Gardens/farms employing different forms of irrigation • Sprinklers • Drip irrigation facilities	

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI				Assessment
2.1.3.CS.2	2.1.3.LI.1				2.1.3.AS.1
Demonstrate knowledge, understanding and skills in the operation of farm machinery and implements used in arable crop (cereals, legumes, and tuber crops) production.	**Identify and classify different types of machinery used in arable crop (cereals, legumes, and tuber crops) production.** **Talk for Learning:** Watch videos or pictures showing different types of farm machinery and identify the machines and their functions**.** **Collaborative learning:** Classify the various machines observed based on their uses and other criteria.				Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	2.1.3.LI.2				2.1.3.AS.2
	Classify and operate different types of machinery used in crop production. **Enquiry-Based Learning:** Learners in mixed groups (of 5), surf the Internet and come up with classes of farm machinery used in crop production (land tillers, planters, harvesters). **Exploratory Learning:** Visit large-scale farms for practical or simulated demonstrations on the different farm machinery in crop production and present a report.				Level 1 Recall **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
Teaching and Learning Resources	• Functional internet facilities • Video documentaries • Hoes, cutlasses • Mattock	• Pickaxe • Shovel • Hand trowel	• Tractor • Ploughs • Harrows	• Planters • Combined harvesters • Large-scale farm.	

Subject AGRICULTURAL SCIENCE
Strand 2 FARMING FOR JOBS AND INCOMES
Sub-Strand 1 ECONOMIC PRODUCTION OF CROPS

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
2.2.1.LO.1		
Describe the role of farm machinery in arable crop production (cereals, legumes, and tuber crops) for profit.	• Entrepreneurial, communication, innovation, collaboration, and creativity skills are developed by learners. • These activities will help learners develop creativity, communication, leadership, entrepreneurial and collaborative skills.	**GESI:** • Dialogue among mixed-ability and gender groups, value others' opinion, respect each other; clear personal biases about low proficient level learners. • Tolerance for learners with different proficiency levels and gender. Accept roles irrespective of cultural and religious differences as they work together. **National core values:** • Accountability • Integrity • Self-confidence • Resourcefulness • Fairness • Self-control • Responsible citizenship • Honest • Truthful

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
2.2.1.CS.1	2.2.1.LI.1	2.2.1.AS.1
Demonstrate knowledge and understanding of market-oriented production of arable crops (cereals, legumes, and tuber crops).	**Identify market needs for arable crops (cereals, legumes, and tuber crops).** **Experiential Learning:** Learners in various mixed-ability groups visit the community and offices and the local markets, to check for the types of arable crops (cereals, legumes, and tuber crops) being sold, and related market needs. **Talk for Learning:** Learners in their original groups discuss their findings and present reports.	**Level 1 Recall** Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	2.2.1.LI.2	2.2.1.AS.2
	Organise and produce selected arable crop (cereals, legumes, and tuber crops). **Project-Based Learning:** Learners in mixed-ability groups select some of the arable crops (cereals, legumes, and tuber crops) to grow. Visit regularly, and record observations for discussions.	**Level 1 Recall** **Level 2 Skills of conceptual** understanding Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
	2.2.1.LI.3	2.2.1.AS.3
	Carry out required post-harvest practices and market crops produced. **Project-Based Learning:** Learners in mixed-ability and mixed-gender groups are assigned to the arable crop (cereals, legumes, and tuber crops). Learners form sub-mixed groups to harvest and market the produce. Appropriate post-harvest practices are carried out where necessary. Various groups sell the produce and render accounts to the class.	Level 1 Recall **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
Teaching and Learning Resources	• Community market • Offices • Pocket notebooks • Plots of land or boxes with soil and seeds of selected arable crops (cereals, legumes, and tuber crops) • Tools and implements for growing the crops.	• Land, boxes • Cans • Large plastic bottles • Seeds of selected vegetables and ornamentals • Black soil

Subject AGRICULTURAL SCIENCE
Strand 2 FARMING FOR JOBS AND INCOMES
Sub-Strand 2 ECONOMIC PRODUCTION OF SMALL RUMINANTS

Learning Outcomes	21St Century Skills and Competencies	GESI, SEL and Shared National Values
2.2.2.LO.1		
Use the knowledge acquired to produce ruminants.	• These activities will help develop the creativity, communication, collaboration and digital literacy skills of learners. • Going through all the stages of poultry production will help develop or acquire creativity, innovation, communication and collaboration skills in addition they will acquire the values of self-reliance and accountability. • Learners acquire negotiation, innovation and communication skills.	**GESI:** • Dialogue among mixed-ability and gender groups, value others' opinion, respect each other; clear personal biases about low proficient level learners. Accept roles assigned to them irrespective of culture or religion. • Tolerance for learners with different proficiency levels and gender. • Accept roles irrespective of cultural and religious differences **National core values:** • Self-confidence • Resourcefulness • Fairness • Self-control • Respect • Honest • Truthful

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
2.2.2.CS.1	2.2.2.LI.1	2.2.2.AS.1
Demonstrate knowledge, skills and understanding of the economic production of ruminants	**Identify resources and market needs for small and large ruminant production** **Talk for Learning:** Learners in mixed groups identify and list commonly/frequently used small and large ruminant products in their homes and food joints. **Project-Based Learning:** • Learners, in mixed groups (of 10), visit the community market (cold stores), with a checklist to ask for types of small and large ruminant products people patronise most. • Learners in the same groups visit small and large ruminant farms, or watch a video of the farm, and record activities of the farm on the sale of produce and products.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	2.2.2.LI.2	2.2.2.AS.2
	Organise and produce small and large ruminants common in the locality for meat. **Project-Based Learning:** All Learners select a site for semi-intensive small and large ruminant farms. Obtain small and large ruminants, vaccines etc. from agro-input dealers. Set the small and large ruminants on site and visit the site daily to provide feed, water and vaccination to animals and to take records for discussion.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**
	2.2.2.LI.3	2.2.2.AS.3
	Outline various distribution outlets and ways of marketing small and large ruminant produce and products. **Collaborative Learning:** Learners in pairs brainstorm to come up with various distribution outlets in the community and ways of marketing the small and large ruminants produced. Examples of outlets are live animal retailers, eateries, restaurants, hotels, supermarkets, event organisers. Examples of ways to market the produce: Advertise on Google and social media Process and package for festive seasons and special events, and network with other farmers and businesses.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
Teaching and Learning Resources	• Community market • Cold storage facilities • Smartphone • Pen • Pocket notebooks • Advertising billboards	

	• Video documentaries • Functional internet facilities • Computer • Projector	• Small and large ruminants • Feed • Water • Vaccines	• Information Centres and FM stations • Posters • Weighing scale • Plastic or paper bags.

Subject AGRICULTURAL SCIENCE
Strand 3 MOBILISATION OF RESOURCES AND NETWORKS
Sub-Strand 2 SUPPORT SYSTEMS IN AGRICULTURE

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
2.3.2.LO.1		
Explain the different types of support systems in arable crop (cereals, legumes, and tuber crops) production and marketing.	• Interacting and communicating with various actors in selected value chains will help learners acquire and develop innovation, leadership, negotiation, critical thinking and communication skills. • Learners acquire and develop innovation, leadership, digital literacy, critical thinking and communication skills, as they surf the Internet and brainstorm. • Role play allows learners to exhibit/acquire and enhance communication, innovation, creativity, critical thinking and interpersonal skills.	**GESI:** • Tolerance among mixed-ability and gender groups, value others' opinion, respect each other; clear personal biases about low proficient level learners. Accept roles assigned to them irrespective of culture or religion. **National core values:** • Self-confidence • Resourcefulness • Fairness • Self-control • Respect
2.3.2.LO.2		
Evaluate extension services delivery on arable crop (cereals, legumes, and tuber crops) enterprises in the school's catchment area.	Critical thinking and communication skills are necessary and enhanced as learners present findings and brief written reports.	**GESI:** Tolerance among mixed-ability groups, respect of opinion irrespective of culture or religion or proficiency level **National core values:** • Self-control • Respect • Excellence

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI				Assessment
2.3.2.CS.1	2.3.2.LI.1				2.3.2.AS.1
Demonstrate knowledge and understanding of the different types of support systems in arable crop (cereals, legumes, and tuber crops) production and marketing.	**Describe the economic importance of selected arable crops (cereals, legumes, and tuber crops) in the livelihood of the producers and the broader value chain.** **Enquiry-Based Learning:** Learners in mixed-ability groups visit vendors of selected arable crops (cereals, legumes, and tuber crops) to map the movement of such commodities from producers to consumers. **Activity-Based Learning:** In groups write reports on the effect of producing and or trading in the commodities on the livelihoods of producers and the broader chain**.**				Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	2.3.2.LI.2				2.3.2.AS.2
	Identify all relevant support organisations that offer various services to key actors such as farmers, traders and processors. **Enquiry-Based Learning:** Learners in mixed-gender and mixed-ability groups surf the Internet to come up with a list of national and international organisations involved in agriculture. **Talk-for-Learning:** Learners in mixed ability groups categorise the services of the organisations and discuss their roles. Learners then present reports.				**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
	2.3.2.LI.3				2.3.2.AS.3
	Describe the interactions within the various key stakeholders in the commodity value chains. **Role play/dramatisation:** Learners the role of the different stakeholders (producers, processors, storage facility operators, distributors, retailers, and support organisations) in the commodity value chains.				**Level 1 Recall** Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
Teaching and Learning Resources	• Questionnaire/Interview Checklist • Field notebooks • Camera	• Projector • Computer • Flip charts • Markers	• Functional Internet connectivity • Computer • Smartphone		• Notebooks. • Detailed knowledge of each stakeholder and their interactions • Relevant costume

				• Samples of produce/products

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
2.3.2.CS.2	2.3.2.LI.1	2.3.2.AS.1
Demonstrate knowledge and understanding of the approaches and methods of agricultural extension delivery.	**Describe transfer-of-technology approaches and methods involved.** **Enquiry-Based Learning:** Learners in mixed-ability groups study cases of extension delivery (by Department of Extension Services and a Non-governmental Organisation e.g., World Vision International). Analyse the key component of the Training and Visit (T & V) system of extension implemented in the 1970s and 1980s to enhance food production. **Collaborative Learning**: Develop and make PowerPoint presentations to the rest of the class on your findings.	Level 1 Recall **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
	2.3.1.LI.2	2.3.2.AS.2
	Describe the Agricultural Knowledge and Information Systems (AKIS) approach and methods **Structured Talk-for-Learning:** Learners in mixed ability groups study cases of Agricultural Knowledge and Information Systems (AKIS) approach and methods in extension delivery, and present reports in a plenary session.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
Teaching and Learning Resources	• Documents and documentaries on case studies on training and visit interventions including the National Agricultural Extension Project (NAEP). • Documents and documentaries on case studies on Agricultural Knowledge and Information Systems (AKIS) approach and methods	

Subject AGRICULTURAL SCIENCE
Strand 4 AGRICULTURE AND CLIMATE
Sub-Strand 1 CLIMATE CHANGE VARIABILITY AND CHANGE

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
2.4.1.LO.1		
Analyse global warming and its threat to environmental and rural livelihood sustainability.	Digital literacy, collaboration and communication skills are necessary and enhanced as learners surf the internet and present findings in brief written reports.	**GESI:** Tolerance among mixed-ability and genders groups, value others' opinion, respect each other. **National core values:** • Develop self-confidence • Resourcefulness • Excellence
2.4.1.LO.2		
Examine key atmospheric changes and their threat to environmental and rural livelihood sustainability.	Digital literacy, critical thinking, collaboration, leadership and communication skills will be acquired and developed during the learning**.**	**GESI:** Tolerance among mixed-ability and genders groups, value others' opinion, respect each other. **National core values:** • Self-confidence • Leadership ability • Resourcefulness • Excellence • Respect

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI			Assessment
2.4.1.CS.1	2.4.1.LI.1			2.4.1.AS.1
Demonstrate knowledge and understanding of global warming and its threat to environmental and rural livelihood sustainability.	**Describe global warming and its effect on environmental and rural livelihood sustainability.** **Enquiry-Based Learning:** Learners study a case on climate variability, change and global warming in the catchment area of the school.			Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
Teaching and Learning Resources	• Video documentaries and pictures on global warming and its challenges in agriculture • Computer	• Projector • Notebooks	• Smartphone	

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI			Assessment
2.4.1.CS.2	2.4.1.LI.1			2.4.1.AS.1
Demonstrate knowledge and understanding of other atmospheric changes and their threat to environmental and rural livelihood sustainability.	**Describe other atmospheric changes and their threat to environmental and rural livelihood sustainability.** **Collaborative Learning:** Learners in small groups discuss reading assignments on the topic and present group reports. **Activity-based Learning:** Design posters to create awareness on human activities that contribute to atmospheric changes			**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
Teaching and Learning Resources	• Functional Internet connectivity • Computer	• Smartphone • Projector	• Field notebooks • Relevant textbooks	

YEAR THREE

Subject AGRICULTURAL SCIENCE
Strand 1 NEW DAWN AGRICULTURE
Sub-Strand 1 MISCONCEPTIONS AND PROSPECTS IN AGRICULTURE AND FARMING

Learning Outcomes	21St Century Skills and Competencies	GESI[5], SEL[6] and Shared National Values
3.1.1.LO.1		
Analyse patterns in the startup and growth of successful plantation and fruit tree enterprises in Ghanaian communities.	• **Digital Literacy Skills**, inquiry skills, and teamwork and communication skills of learners would improve through operating and watching videos and documentaries, farm visits and presentation of group work. • They gain **Critical Thinking** by interrogating how challenges in enterprise activities were addressed during farm visits. Leadership skills gained as learners work in mixed ability groups. • Learners build D**igital Literacy Skills** through operating video gadgets. As they communicate, they collaborate. • They gain **Critical Thinking** by interrogating how challenges in enterprise activities were addressed. They gain leadership skills as they work in mixed ability groups and communicate their observations.	**GESI:** • Gender tolerance, inclusion and equity, be aware of personal biases and stereotypes on successful women in agriculture. • Gender tolerance, embrace diversity, practise inclusion **National core values:** • Tolerance • Respect • Responsible citizenship

[5] Gender Equality and Social Inclusion
[6] Socio-Emotional Learning

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI			Assessment
3.1.1.CS.1	3.1.1.LI.1			2.1.1.AS.1
Demonstrate knowledge and understanding of factors and processes that influence successful plantation and fruit tree enterprises.	**Discuss characteristics of successful startup packages of plantation and fruit tree enterprises.** **Exploratory Learning:** Embark on educational visits to successful plantation and fruit tree enterprises for learners to observe, ask questions and take field notes on start-up patterns. **Collaborative Learning**: Learners discuss or talk about their observations in class			**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**
	3.1.1.LI.2			2.1.1.AS.2
	Catalogue the characteristics and patterns of growth of successful plantation and fruit tree enterprises. **Talk-for-Learning:** Learners brainstorm to come up with characteristics of a successful enterprise. **Experiential Learning:** All learners visit successful plantation and fruit tree enterprises to observe, ask questions, take field notes on patterns of growth, and present reports.			**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**
Teaching and Learning Resources	• Plantation and fruit tree farms • Video documentaries • Pictures	• Projector • Computer	• Smartphones • Field notebooks • Protective footwear	

Subject AGRICULTURAL SCIENCE
Strand 1 NEW DAWN AGRICULTURE
Sub-Strand 2 EMERGING TECHNOLOGIES IN AGRICULTURE

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
3.1.2.LO.1		
Identify emerging technologies in plantation and fruit tree enterprises.	• Learners improve their communication and collaboration, creativity and innovation, and personal development skills • Learners improve innovation, communication, collaboration and personal development skills	**GESI:** Dialogue among mixed genders and deep respect for each other; giving constructive feedback. **National core values:** • Respect • Tolerance
3.1.2.LO.2		
Distinguish between existing and emerging technologies used in plantation and fruit tree enterprises and their benefits.	• Learners develop communication skills, creativity and critical thinking on how best to use soil, water and substrate to produce selected plantation and fruit tree plants • Communication, collaboration, creativity and critical thinking skills would be acquired and or enhanced during brainstorming and group work. • Learners acquire and enhance digital literacy and communication skills during the brainstorming and operation of video equipment. Learners also develop critical thinking skills while deliberating on the role and benefits of drones.	**GESI:** • Open-mindedness, embracing diversity, analytical skills, and gender tolerance. • Embrace diversity in agriculture and be gender sensitive. • As they work in mixed-gender groups, they learn to tolerate each other's viewpoint and respect each other. **National core values:** • Responsible citizenship • Respect • Self-discipline

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI			Assessment
3.1.2.CS.1	3.1.2.LI.1			3.1.2.AS.1
Demonstrate knowledge and understanding of emerging technologies and their benefits in plantation and fruit tree enterprises.	**Explain the use of selected emerging technologies in plantation and fruit tree enterprises.** **Talk-for-Learning:** Listen to a talk by a cash crop expert on emerging technologies (GMOs, tissue culture, Hydroponics, greenhouse planting), and ask questions where necessary. **Structured Talk-for-Learning:** Learners in mixed-ability and gender groups watch video documentaries on selected technologies, discuss their observations, and report in PowerPoint presentations.			**Level 1 Recall** Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
	3.1.2. LI.2			3.1.2.AS.2
	Explain the use of selected technologies like hydroponics, green house planting, Genetically Modified Organisms (GMOs), tissue culture and precision agriculture in plantation and fruit tree cultivation and relate it to what is in the community. **Think-Pair-Share:** Learners in pairs surf the internet on selected emerging technologies (GMOs, tissue culture, hydroponics, greenhouse planting), as well as precision agriculture, discuss their findings, and present reports. **Structured Talk-for-Learning:** Learners in mixed-ability and gender groups watch video documentaries on selected technologies, discuss their observations, and report in PowerPoint presentations.			**Level 1 Recall** Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** **Level 4 Extended critical thinking and reasoning**
Teaching and Learning Resources	• Relevant textbooks • Laptop computer	• Projector • Wi-Fi and information from the Internet	• Video documentaries on the technologies mentioned	

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
3.1.2.CS.2	3.1.2. LI.1	3.1.2.AS.1
Demonstrate knowledge and skills in emerging technologies of plantation and fruit tree and their benefits relating to real life situation	**Grow plantation and fruit trees using the known procedures and technologies.** **Exploratory Learning:** All learners embark on field visits to plantation and fruit tree farms to learn emerging technology procedures and management. **Project-Based Learning:** In mixed groups (of 10), learners carry out a project on the production of selected plantation and fruit trees using water, substrate and other media.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
	3.1.2. LI.2	3.1.2.AS.2
	Describe the use and importance of issue culture in plantation and fruit tree enterprises. **Talk-for-Learning:** Learners in mixed-ability and mixed-gender groups review the meaning and importance of tissue culture in the cultivation of vegetable crops and ornamental plants. **Collaborative Learning:** Task learners in mixed gender groups (of 4) to research and come up with the importance of tissue culture in plantation and fruit tree production. **Activity-Based Learning:** Learners discuss the benefits of using tissue culture and present their findings on cardboard posters and paste them on the walls.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
	3.1.2. LI.3	3.1.2.AS.3
	Identify other emerging technologies used to make growing plantation and fruit trees easier. **Inquiry-Based learning:** research about other emerging technologies used to facilitate work in plantation and fruit tree cultivation (e.g., drones and TROTRO Tractors that use digital platforms to connect farmers and tractor services). **Digital Learning:** Learners observe video documentaries on the use and application of drones. **Talk-for-Learning:** In mixed-gender groups, learners discuss how the technologies help	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning

	ease work in plantation and fruit tree production.	
Teaching and Learning Resources	• Parks and Gardens • Plantation and fruit tree farms • Reading materials • Functional Internet facility • Laptop computer • Wi-Fi, seeds and other planting materials of selected plantation and fruit tree • Containers for planting	• Water • Field notebook • Pens • Video documentaries on tissue culture • Smartphones • Recorded videos on other emerging technologies for plantation and fruit tree production • LCD projector

Subject AGRICULTURAL SCIENCE
Strand 1 NEW DAWN AGRICULTURE
Sub-Strand 3 AGRICULTURAL MACHINERIES

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
3.1.3.LO.1		
Evaluate the relevance of using various forms of irrigation systems in agricultural production	• As learners use the irrigation facilities, they develop skills in communication, collaboration and critical thinking. Learners develop and enhance their decision-making skills • As they download and watch videos and carry out practical field activities, learners develop digital literacy, communication, collaboration and critical thinking skills	**GESI:** Dialogue among mixed genders, value each other's opinion, respect for each other; clear personal biases about low proficient level learners **National core values:** • Respect • Tolerance
3.1.3.LO.2		
Explain the functions of parts of various machinery provided	• **Teamwork and Observation Skills:** Learners develop these skills as they watch and work with some selected machinery.	**GESI:** Communication and collaboration in mixed-ability and mixed-gender groups to ensure ideas shared receive constructive feedback
3.1.3.LO.3		
Use the application of machines and computing tools to reduce drudgery in agriculture	• As they download and watch videos and carry out practical field activities, learners develop digital literacy, communication, collaboration and critical thinking skills. • As they download and watch videos and carry out practical field activities, learners develop digital literacy, communication, collaboration and critical thinking skills.	**GESI:** Tolerance for different proficiency levels of learners; gender tolerance. **National core values:** • Respect • Tolerance

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
3.1.3.CS.1	3.1.3.LI.1	3.1.3.AS.1
Demonstrate knowledge and skills in the use of various forms of irrigation systems in plantation and fruit tree enterprises and relate them to the community.	**Continue to cultivate selected crops using the simple irrigation system constructed** **Experiential Learning:** Embark on field trips to farms that use modern forms of irrigation e.g., sprinkler, surface irrigation - where water is distributed over and across the land by gravity without mechanical pump, localised irrigation, drip irrigation, centre pivot irrigation, lateral move irrigation, sub-irrigation and manual irrigation. **Activity-Based Learning:** Learners practice irrigation using the various forms mentioned above on selected plantation and fruit trees.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	3.1.3.LI.2	3.1.3.AS.2
	Describe the extent of adaptation to simple irrigation systems for the cultivation of selected plantation and fruit trees. **Project-Based Learning:** Practice irrigation on selected plantations and fruit trees based on the various forms mentioned above.	Level 1 Recall Level 2 Skills of conceptual understanding **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	3.1.3.LI.3	3.1.3.AS.3
	Conduct a cost-benefit analysis on the cultivation of selected crops using the simple irrigation constructed **Inquiry-Based Learning:** Research from various sources about how to conduct cost-benefit analysis. **Experiential Learning:** Learners in mixed-gender and mixed-ability groups conduct a cost-benefit analysis on the cultivation of selected crops using the simple irrigation constructed.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
	3.1.3.LI.4	3.1.3.AS.4
	Identify and classify different types of machinery used in Agriculture **Collaborative Learning:** • Learners in pairs discuss knowledge of simple farm tools.	Knowledge and skills demonstrated in operating selected machinery.

	• Visit places where machinery is used for a practical activity or undertake simulated demonstrations on the use of machinery in agriculture including tractors/ • Classify machines into different types based on their uses		
Teaching and Learning Resources	• Gardens/farms or videos of farms employing different forms of irrigation • Sprinklers • Drip irrigation facilities • Video documentaries	• Functional Internet facilities • Computer • Smart phone • Selected machinery on farms or homes or simulated demonstrations on machinery in agriculture provided for practical sessions. Machinery includes hoes, cutlasses, mattocks, pickaxes, shovels, hand trowels, tractors, ploughs, harrows, planters, combine harvesters etc. videos/real machinery on nearby farms/homes	

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI			Assessment
3.1.3.CS.2	3.1.3.LI.1			3.1.3.AS.1
Demonstrate knowledge and application of machines and computing tools to reduce drudgery in agriculture	**Demonstrate the application of machines to reduce drudgery in Agriculture** **Digital Learning:** Learners in mixed-ability groups, surf the Internet to download and watch video documentaries on how machines reduce drudgery in Agriculture. **Experiential Learning:** Learners in mixed-gender and mixed-ability groups discuss how machines reduce drudgery in Agriculture, write reports and make presentations to the class.			**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
	3.1.3.LI.2			3.1.3.AS.2
	Demonstrate the application of computing tools to reduce drudgery in Agriculture **Digital Learning:** Download and watch video documentaries that demonstrate the application of computing tools to reduce drudgery in Agriculture. **Collaborative Learning:** Learners in mixed-gender and mixed-ability groups use computing skills to reduce drudgery in Agriculture, write reports and make presentations to the class.			**Level 1 Recall** **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
Teaching and Learning Resources	• Video documentaries • Functional internet facilities	• Computer • Smartphone	• Notebooks	

Subject AGRICULTURAL SCIENCE
Strand 2 FARMING FOR JOBS AND INCOMES
Sub-Strand 1 ECONOMIC PRODUCTION OF CROPS

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
3.2.1.LO.1		
Explain how to produce plantation and fruit trees for profit	• Business-oriented, communication, collaboration, creativity and innovation skills are developed by learners. • These activities will help learners develop their creativity, communication, leadership, entrepreneurial and collaboration skills.	**GESI:** • Dialogue among mixed-ability and gender groups, value others' opinion, respect each other; clear personal biases about low proficient level learners. • Tolerance for learners with different proficiency levels and gender. Accept roles irrespective of cultural and religious differences as they work together. • National values of accountability and integrity will be acquired and projected. **National core values:** • Self-confidence • Resourcefulness • Fairness • Self-control • Respect

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
3.2.1.CS.1	3.2.1.LI.1	3.2.1.AS.1
Demonstrate knowledge and understanding of market-oriented production of plantation and fruit trees	**Identify market needs for selected plantation and fruit trees.** **Experiential Learning:** Learners in various mixed-ability groups visit the community and offices to observe types of plantation and fruit trees being sold, and related market needs. **Talk-for-Learning:** Learners in their original groups discuss their findings and present reports.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	3.2.1.LI.2	3.2.1.AS.2
	Organise and produce selected plantation and fruit trees. **Project-Based Learning:** Learners in mixed-ability groups select some of the plantation and fruit trees to grow. Regular visits are made, and records are taken for discussion.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**
	3.2.1.LI.3	3.2.1.AS.3
	Carry out required post-harvest practices and market the produce of plantation and fruit trees **Project-Based Learning:** Learners in mixed-ability and mixed-gender groups are assigned to the plantation and fruit trees. Learners form sub-mixed groups to harvest and market the produce. Appropriate post-harvest practices are carried out where necessary. Various groups sell the produce and render accounts to the class.	Level 1 Recall **Level 2 Skills of conceptual** understanding Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
Teaching and Learning Resources	• Well-planned community • Community market • Pocket notebooks • Plots of land or boxes or cans or large plastic bottles with soil • Seeds of selected vegetables • Tools and implements for growing the crops	• Land, boxes • Cans • Large plastic bottles • Seeds of selected vegetables and ornamentals • Black soil • Notebooks

Subject AGRICULTURAL SCIENCE

Strand 2 FARMING FOR JOBS AND INCOMES

Sub-Strand 2 ECONOMIC PRODUCTION OF PIGS AND FISH

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
3.2.2.LO.1		
Explain the key processes in the successful production of pigs or fish.	• These activities will help develop the creativity, communication, collaboration and digital literacy skills of learners. • Going through all the stages of pig and fish production will help develop or acquire creativity, innovation, communication and collaboration skills in addition they will acquire the values of self-reliance and accountability. • Learners acquire negotiation, innovation and communication skills.	**GESI:** • Dialogue among mixed-ability and genders groups, value others' opinion, respect each other; clear personal biases about low proficient level learners. • Tolerance for learners with different proficiency levels and gender. Accept roles irrespective of cultural and religious differences **National core values:** • Self-confidence • Resourcefulness • Fairness • Self-control

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
3.2.2.CS.1	3.2.2.LI.1	3.2.2.AS.1
Demonstrate knowledge, skills and understanding of the economic production of pigs or fish.	**Identify resources and market needs for pigs or fish production** **Talk-for-Learning**: Learners in mixed groups identify and list commonly used pigs or fish products in their homes and food joints. **Exploratory Learning:** • Learners, in mixed groups (of 10), visit the community market (cold stores), with a checklist to ask for types of poultry and poultry products people patronise most. One group of learners visits a recognised fish farm to identify types of day-old chicks. Another group visits a recognised pig farm to identify types of feed, drinkers, waterers, and vaccines used. • Learners in the same groups visit a pigs or fish farm, or watch a video of a pig or fish farm, and record activities of the farm on the sale of produce and products.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	3.2.2.LI.2	3.2.2.AS.2
	Organise and produce pigs and fish **Project-Based Learning:** All Learners select a site for a semi-intensive pig farm and a dug-out fishpond. Learners obtain fingerlings, piglets, feed, drinkers, waterers, vaccines etc. from Agro-input dealers. Learners set up the farms on the site, visit the site daily to provide feed, water and vaccination to animals and to take records for discussion.	**Level 1 Recall** Level 2 Skills of conceptual understanding Level 3 Strategic reasoning **Level 4 Extended critical thinking and reasoning**
	3.2.2.LI.3	3.2.2.AS.3
	Outline various distribution outlets and ways of marketing pig and fish products. **Collaborative Learning:** • Learners in pairs brainstorm to come up with various distribution outlets in the community and ways of marketing the pigs and fish products. Examples of outlets: Live animal retailers, eateries, restaurants, hotels, supermarkets, event organisers. Examples of marketing the produce: Advertise on Google and social media • Process and package for festive seasons and special events, network with other farmers and businesses.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
Teaching and Learning	• Community market • Fingerlings • Pocket notebooks	

Resources	• Cold storage facilities • Video documentaries • Functional internet facilities • Computer • Projector • Smartphone	• Piglets • Feed • Drinkers • Waterers • Vaccines	• Advertising Billboards • Information Centres and FM stations • Posters • Weighing scale • Plastic or paper bags

Subject AGRICULTURAL SCIENCE
Strand 3 MOBILISATION OF RESOURCES AND NETWORKS
Sub-Strand 2 SUPPORT SYSTEMS IN AGRICULTURE

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
3.3.2.LO.1		
Explain the different types of support systems in vegetable and ornamental crop production and marketing.	• Interacting and communicating with various actors in selected value chains will help learners acquire and develop innovation leadership, negotiation, critical thinking, and communication skills. • Learners acquire and develop innovation, leadership, digital literacy and communication skills, as they surf the internet and brainstorm. • Role play allows learners to exhibit/acquire and enhance communication, innovation, creativity, critical thinking and interpersonal skills.	**GESI:** • Tolerance among mixed ability and genders groups, value others' opinion, respect each other; clear personal biases about low proficient level learners. Accept roles assigned to them irrespective of culture or religion. **National core values:** • Self-confidence • Resourcefulness • Fairness • Self-control • Respect
3.3.2.LO.2		
Evaluate extension services delivery on vegetable and ornamental crop enterprises in the school's catchment area.	• Critical thinking and communication skills are necessary and enhanced as learners present findings and brief written reports. • Critical thinking, digital literacy and communication skills	**GESI:** Tolerance among mixed ability groups, respect of opinion irrespective of culture or religion or proficiency level. **National core values:** • Resourcefulness • Fairness • Excellence

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
3.3.1.CS.1	3.3.1.LI.1	3.3.1.AS.1
Demonstrate knowledge and understanding of the different types of support systems in pig or fish production and marketing.	**Describe the economic importance of pigs or fish production in the livelihood of the producers and the broader value chain.** **Enquiry-Based Learning:** • Learners in mixed-ability groups visit vendors of selected agricultural commodities to map the movement of such commodities from producers to consumers. • Learners in mixed-ability groups contact producers, middle(wo)men and vendors of the selected agricultural commodities and solicit information on the effect of producing and or trading in the commodities on their livelihood.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
	3.3.1.LI.2	3.3.1.AS.2
	Identify all relevant support organisations that offer various services to key actors such as farmers, traders and processors **Enquiry-Based Learning:** • Learners in mixed-gender and mixed-ability groups surf the internet to come up with a list of national and international organisations involved in agriculture. • Learners in mixed-gender and mixed-ability groups watch videos and pictures of the support organisations interacting with local producers and write and present reports on it. **Talk for Learning:** Learners in mixed-ability groups categorise the services of the organisations and discuss their roles. Learners then present the reports of their groups.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
	3.3.1.LI.3	3.3.1.AS.3
	Describe the interactions within the various key stakeholders in the commodity value chains. **Activity-Based Learning:** Learners act the roles of the different stakeholders (producers, processors, storage facility operators, distributors, retailers, and support organisations) in the commodity value chains.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
Teaching and Learning Resources	• Questionnaire/Interview Checklist • Field notebooks • Computer • Flip charts • Notebooks • Detailed knowledge of each	

	• Camera • Smartphone • Projector	• Marker • Videos and pictures of the support organisations interacting with local producers • Functional internet connectivity	stakeholder and their interactions • Relevant costume • Samples of produce/products

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
3.3.1.CS.2	3.3.1.LI.1	3.3.1.AS.1
Demonstrate knowledge and understanding of the approaches and methods of agricultural extension delivery.	**Describe transfer-of-technology approaches and methods involved.** **Exploratory Learning:** Learners in mixed-ability groups study cases of value chains approach and methods (by Department of Extension Services and by a non-governmental organisation e.g., World Vision International) on pig and fish production and present reports in a plenary session.	Level 1 Recall **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
	3.3.1.LI.2	3.3.1.AS.2
	Explain the operations of rural credit. **Structured Talk-for-Learning:** Learners in mixed-ability groups discuss rural credit - meaning and sources of obtaining it and present reports in a plenary session.	Level 1 Recall **Level 2 Skills of conceptual understanding** **Level 3 Strategic reasoning** Level 4 Extended critical thinking and reasoning
Teaching and Learning Resources	• Documents and documentaries on case studies of training and visit interventions including the National Agricultural Extension Project (NAEP) • Resources including research on rural credit from the internet and textbooks.	

Subject AGRICULTURAL SCIENCE
Strand 4 AGRICULTURE AND CLIMATE
Sub-Strand 1 CLIMATE VARIABILITY AND CHANGE

Learning Outcomes	21st Century Skills and Competencies	GESI, SEL and Shared National Values
3.4.1.LO.1		
Analyse global and national policies relating to climate change.	Critical thinking, communication, collaboration, and digital literacy skills are developed.	**GESI:** Tolerance among mixed-ability groups, respect of opinion irrespective of culture or religion or proficiency level. **National core values:** • Fairness • Self-control • Respect
3.4.1.LO.2		
Explain REDD+ mechanisms	Critical thinking, digital literacy, collaboration and communication skills	**GESI:** Tolerance among mixed ability groups, respect of opinion irrespective of culture or religion or proficiency level. **National core values:** • Develop self-confidence • Resourcefulness • Fairness • Self-control • Excellence

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
3.4.1.CS.1	3.4.1.LI.1	3.4.1.AS.1
Demonstrate knowledge and understanding of global and national policies relating to climate change	**Discuss global and national policies relating to climate change** **Enquiry-Based Learning:** Research from different sources to obtain literature on global and national policies relating to climate change. Also, find factors contributing to climate variability and their related consequences. **Think-Pair-Share:** Pairs of learners discuss materials obtained from the Internet. **Collaborative Learning:** Learners evaluate the implementation of global and national policies relating to climate change.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
Teaching and Learning Resources	Video documentaries and pictures on climate change challenges in Agriculture	

Content Standards	Learning Indicators and Pedagogical Exemplars with 21st Century and GESI	Assessment
3.4.1.CS.2	3.4.1.LI.1	3.4.1.AS.1
Demonstrate knowledge and understanding of REDD (Reducing Emissions from Deforestation and Forest Degradation) + mechanisms.	**Identify the causes of REDD and relate it to climate change** **Collaborative Learning:** Learners in pairs discuss reading assignments on the topic. **Structured Talk-for-Learning:** Learners in mixed-ability and mixed-gender groups discuss the REDD+ strategy and the phases of the strategy.	**Level 1 Recall** **Level 2 Skills of conceptual understanding** Level 3 Strategic reasoning Level 4 Extended critical thinking and reasoning
Teaching and Learning Resources	• Functional Internet • Textbook	