Cogent Education

ISSN: 2331-186X (Online) Journal homepage: www.tandfonline.com/journals/oaed20

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To cite this article: Hellen Joseph Njura & Isaac Kubai (2026) Enhancing household food security through the secondary school agriculture student: the stakeholders' perceptions in Kenya, Cogent Education, 13:1, 2636234, DOI: 10.1080/2331186X.2026.2636234

To link to this article: https://doi.org/10.1080/2331186X.2026.2636234

Published online: 18 May 2026.

COGENT EDUCATION
2026, VOL. 13, NO. 1, 2636234
https://doi.org/10.1080/2331186X.2026.2636234

EDUCATION POLICY | RESEARCH ARTICLE

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Enhancing household food security through the secondary school agriculture student: the stakeholders' perceptions in Kenya

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ABSTRACT

This study investigates stakeholders' perceptions of the role of secondary school agriculture students in enhancing household food security. Despite extensive research on agricultural education and skills development, limited studies have explored how stakeholders perceive students' specific roles as learners, innovators, trainers, informants and implementers of food security policy. Using descriptive and correlational designs, data were collected from 376 students, 111 agriculture teachers and 323 parents. Findings show that agriculture students play a significant role in promoting food security through learning, innovation and policy engagement yet, their participation is hindered by the absence of clear policy guidelines. Addressing this gap, the study proposes integrating practical food security initiatives into the secondary agriculture curriculum through experiential learning such as school gardens and community projects. It urges education policymakers, including KICD and the Ministry of Education to institutionalize student participation in food security initiatives, aligning school agriculture with national policies and strengthening cross-sector collaboration with the Ministry of Agriculture.

ARTICLE HISTORY
Received 8 April 2022
Revised 25 November 2025
Accepted 19 February 2026

KEYWORDS
Agriculture students; food security; secondary education; stakeholder perceptions; role

SUBJECTS
Curriculum Studies; Educational Research; Research Methods in Education; Secondary Education

1. Introduction

Globally, the agricultural sector faces an aging farming population, with the average age of farmers exceeding 60 years (FAO, 2018). This trend poses a serious threat to future food production, especially as many youths increasingly migrate to urban areas and disengage from agriculture, viewing it as outdated, unprofitable and labour-intensive (IFPRI, 2018). Rapid urbanization expected to reach two-thirds of the global population by 2050, with 90% of this growth occurring in Africa and Asia further compounds challenges to food security and nutrition (IFPRI, 2019).

Urbanization brings economic opportunities but also exacerbates malnutrition and diet-related diseases, driven by unhealthy dietary habits and limited access to nutritious food (FAO, 2019; IFPRI, 2019; WFP, 2018). In Sub-Saharan Africa, many young people do not view agriculture as a viable livelihood, resulting in their exclusion from the food system and limiting their potential contribution to food security (FAO, 2018). Crises such as the COVID-19 pandemic, desert locust invasions and economic downturns have further highlighted the vulnerability of food systems and the need for inclusive engagement of all societal groups in food production and distribution (IFPRI, 2020).

In Kenya, agriculture remains the backbone of the economy, contributing about 33% of the Gross Domestic Product (USAID, 2018). However, the sector faces major challenges including rapid population growth, climate change, pest invasions and unequal access to resources that continue to threaten food and nutrition security (FAO, 2020; WFP, 2018). Recognizing this, Kenya has developed several policy frameworks, such as the National Food and Nutrition Security Policy (NIPFSN, 2023), the Agricultural Sector Transformation and Growth Strategy (ASTGS, 2019–2029), and the Kenya Youth Agribusiness

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Strategy (2017–2021), which emphasize inclusive participation and youth engagement in achieving food security.

The NFNSP Sessional Paper No. 1 of 2012 outlines an overarching framework that addresses multiple dimensions of food and nutrition security, aiming to integrate and strengthen existing sectoral efforts across government and stakeholders (Government of Kenya, 2012). The policy emphasizes that achieving food and nutrition security is a shared responsibility framed within the context of human, child and women's rights. The researcher considers youth and in particular the secondary school agriculture student to be integrated in this framework as human. Hence, their vital role in food and nutrition security cannot be underrated.

The success of the NFNSP is anchored in several international and national initiatives and commitments to end hunger and extreme poverty. The policy is formulated within the context of international conventions, such as the World Food Summit (WFS) of 1996; the United Nations (UN) Sustainable Development Goals (SDGs); the African Union Commission (AUC) and the African Task Force on Food and Nutrition Development (ATFFND); the New Partnership for African Development (NEPAD) of 2002; the Comprehensive African Agriculture Development Programme (CAADP); and the Malabo Declaration of 2014. The Policy is also aligned to relevant national strategic planning documents including the Kenya Vision 2030 and the Agricultural Sector Development Strategy (ASDS) 2010–2020.

Further, the policy is framed in the context of basic Human Rights, Child Rights and Women's Rights; the Constitution of Kenya 2010: Article 43 (1) (c), Article 53 (l) (c), Article 21 and Article 27 (Government of Kenya [GOK, 2010]). All these guarantee the right to food and adequate nutrition and the universal right to food and nutritional health and protection from discrimination.

In order to work in tandem with the NFNSP to deliver a coordinated and multisectoral approach, the NFNSP complements other Kenyan policies that emphasize youth in agriculture. For instance, the Kenya Youth Agribusiness Strategy (2017–2021) operationalizes youth empowerment in agrifood systems while the Agricultural Sector Transformation and Growth Strategy (ASTGS 2019–2029) focuses on attracting youth through innovation, financing, and market systems. Additionally, the Kenya National Youth Policy (2019) identifies agriculture as a strategic sector for youth employment and entrepreneurship.

The overall goal of the policy is to ensure that all Kenyans throughout their lifecycle enjoy safe food in sufficient quantity and quality to satisfy their nutritional needs for optimal health. The Policy provides an overarching framework covering all the four dimensions of food security namely its availability, accessibility, utilization and stability as recognized by the World Food Summit. It also addresses the synergy linking food security and nutrition with poverty eradication (MoALF, 2017).

Despite these efforts, the implementation of food security policies in Kenya has faced persistent challenges, including limited stakeholder participation, inadequate funding and weak coordination among implementing agencies (MoALF, 2017). The NFNSP calls for a multisectoral approach that integrates various stakeholders, yet the specific role of secondary school agriculture students who form a critical link between schools and households remains underexplored. These students possess the potential to apply agricultural knowledge and skills learned in school to enhance household-level food production, thereby contributing to national food security goals.

In light of these gaps, this study focuses on examining stakeholders' perceptions of the role of secondary school agriculture students in enhancing household food security in Kenya. Specifically, it seeks to determine the extent to which these students act as learners, innovators, trainers, informants, and implementers of food security strategies and policies. By clarifying these roles, the study aims to inform the development of clear policy guidelines for engaging agriculture students in national and county-level food security efforts.

2. Literature review

2.1. Engagement of youth as innovators in enhancing food security and nutrition

Youth in Kenya increasingly serve as key innovators in strengthening food security and nutrition through policy-driven initiatives, grassroots entrepreneurship, technological adoption, and multi-sectoral

partnerships (Kenya News Agency, 2024; UNICEF, 2023). Their innovations span various stages of the food system from production and processing to distribution and nutrition awareness.

2.1.1. Policy frameworks supporting youth innovation

Several national and international policies underscore the strategic role of youth in agricultural and nutritional innovation. The Kenya Youth Agribusiness Strategy (2017–2021) promotes youth-led agribusiness innovation hubs and incubation programs (MoALF, 2017). Similarly, the Agricultural Sector Transformation and Growth Strategy (ASTGS 2019–2029) encourages digital innovations, data platforms and smart farming tools for young people (MOALF, 2019). The National Food and Nutrition Security Policy (NFNSP, 2011), further advances youth inclusion in decision-making, technology adoption and capacity building for food system innovations. Collectively, these frameworks reflect a growing recognition of youth as central agents in achieving national food security goals.

2.1.2. Youth-driven innovations at the grassroots level

At the grassroots level, Kenyan youth are pioneering agri-tech and smart farming innovations using mobile applications, drones, sensors, and artificial intelligence to monitor crop health, optimize irrigation, and predict yields. For example, Twiga Foods, founded by young Kenyan entrepreneurs, leverages digital technology to link farmers to markets, reduce post-harvest losses and increase household incomes (Food Tank, 2019; Safaricom, 2021; TechCrunch, 2019).

Beyond technology, youth are also advancing urban agriculture and vertical farming through hydroponics, aquaponics and rooftop gardens, significantly improving urban food security in cities such as Nairobi and Kisumu (The Standard Kenya, 2022; The Star, 2024). Many young entrepreneurs are diversifying the food sector through value addition and nutrition-focused enterprises, producing fortified flours, organic juices, dried vegetable snacks and micronutrient powders (Standard Media – Farm Kenya, 2019).

Digital marketplaces such as M-Farm, iCow and Selina Wamucii offer further innovation by connecting farmers directly to consumers through e-commerce platforms, thereby reducing food waste and improving access to fresh, nutritious produce (Green Dreams Tech Ltd, 2019; Bizna Reporter, 2018).

2.1.3. Youth engagement in nutrition advocacy and education

Youth-led organizations also play a critical role in nutrition education and advocacy. They promote dietary diversity through school and community gardens, social media campaigns, and educational workshops targeting low-income communities. The 4K Clubs (Kuungana, Kufanya, Kusaidia Kenya), recently rebranded to engage school-going children, exemplify such initiatives by combining agricultural production with healthy eating promotion (Kenya News Agency, 2025).

2.1.4. Innovation ecosystems and capacity-building platforms

Several innovation ecosystems support youth engagement in agricultural transformation. The Alliance for a Green Revolution in Africa (AGRA) Youth in Agriculture Strategy funds youth-led agri-enterprises (AGRA, 2025). Similarly, the Food and Agriculture Organization (FAO, 2018) and the CTA Initiative (Lohento & Koutchade, 2021) organize hackathons and innovation labs for young agri-entrepreneurs. The Youth AgriHack Challenge by CTA and the Agripreneurship Alliance further nurture digital agriculture startups, while Kenya's Ajira Digital Program prepares youth to apply digital skills in agricultural contexts (Government of Kenya, 2024).

2.1.5. Pedagogical theories that are founded on engaging youth as innovators in enhancing food security and nutrition

The Experiential Learning Theory (Kolb, 1984) core idea is that learners construct knowledge through concrete experiences, reflection, conceptualization and active experimentation. This is applied where youth work on real-life food security challenges such as designing low-cost irrigation systems, creating nutrient-rich school garden produce or testing innovative preservation methods then reflect and refine their solutions.

Problem-Based Learning (PBL) on the other hand is where learning is driven by tackling complex, real-world problems without predetermined solutions (Nicholus et al., 2023). It is applied where students

investigate a local food security issue like post-harvest loss, community malnutrition, research it and develop an innovation, like solar dryers or fortified snacks while learning science, economics, and policy in the process.

The Constructivist Learning Theory (Mishra, 2023) has the idea of learners actively building knowledge based on prior experiences with social interaction and scaffolding playing a key role. This is applicable where youth co-create food solutions in groups like urban hydroponic systems drawing on their lived experience, cultural food knowledge and expert mentorship.

The Social Constructivism and Communities of Practice (Barraclough et al., 2025) is where learning occurs through participation in communities where members share a common goal. It is applicable where youth join agricultural innovation clubs or online platforms, sharing experiments and receiving peer feedback on their food security projects.

The Service-Learning Pedagogy has the idea of combining academic learning with meaningful community service (Kaliappen, 2024). This is applicable where the youth partner with local farmers or food banks, applying classroom knowledge to improve nutrition programmes while reflecting on their role in sustainable food systems.

2.1.6. Innovation gaps in enhancing food security and nutrition

There are several gaps in how stakeholders perceive and support youth involvement in agricultural innovation to enhance house hold food security and nutrition. These gaps often undermine the full potential of youth-driven innovation in transforming food systems; whether it is the youth in or out of school. A perception gap like celebrating youth as symbolic innovators but not fully including them in strategic decision-making or resource allocation may not add up well to their role in food security and nutrition as innovators (Gaithuma et al. (2025). Key stakeholders such as the government, donors, private sector may highlight youth-led innovation in policy statements or campaigns but fail to back it with access to finance, land rights and seats at policymaking tables. These finally end up to tokenistic inclusion rather than transformative engagement. In this case therefore, youth participation must move beyond showcasing to shaping innovation policies, budgets and programmes.

Stakeholders often view youth as inherently tech-savvy or entrepreneurial but overlook the diversity of youth skills, interests and barriers (Mumi et al., 2025). This leads to misalignment between stakeholder expectations and youth realities. For instance, not all youth have access to smartphones, internet or digital literacy. The case where the youth in school is restricted from carrying a mobile phone to school escalates the gap. Others lack entrepreneurial training, land or family support while many are either unemployed or underemployed and therefore view agriculture as a last resort. Innovation programmes therefore need to address basic needs first such as training, mentoring and psychosocial support before expecting innovation.

The narrow definition of innovation by stakeholders as tech-based or profit-driven, ignoring grassroots, indigenous or social innovations is a gap that may lead to underrepresentation in critical areas. These include innovations in local food processing, indigenous seed saving, school feeding programmes and nutrition education by youth groups. There is therefore the need for broader definitions of innovation that include low-tech, social and cultural practices to enhance nutrition and food systems.

Youth are often underrepresented in institutional structures. For instance, few youth sit in governing bodies, taskforces or advisory boards for food security and nutrition. Such could be engagement in policy formulation committees, agriculture research programmes and national nutrition action planning (Abubakar et al., 2024). There is therefore the need for structural inclusion of youth voices including the agriculture student; in governance, research and investment decisions.

Other innovation gaps arise when many stakeholders support youth innovation through short-term grants or competitions but not through long-term ecosystems for sustainability. For instance, hackathons and incubators are common, but once funding ends, most ideas fail to scale (Sakyi Boadu, 2024). There is limited focus on market access, mentorship and regulatory support. The need for long-term investment in youth agribusiness ecosystems, including mentorship, cooperative models and infrastructure is important for sustainable innovation.

Equity gaps in innovation are also realized when stakeholders generalize youth without disaggregating by gender, location or marginalization (Ebenstål Almeida et al., 2024). For instance, rural, female or

disabled youth both in and out of school often face greater barriers and are overlooked in innovation programmes. At the same time, most urban-based innovation hubs exclude remote youth. It is therefore important to come up with targeted inclusion strategies for marginalized youth especially rural girls, refugees and differently-abled innovators.

2.2. Engagement of youth as learners in enhancing food security and nutrition in Kenya

The engagement of youth as learners is central to sustainable food security and nutrition in Kenya. Both national and international frameworks recognize the importance of equipping young people with the knowledge, skills and opportunities necessary to participate meaningfully in agri-food systems. These frameworks foster experiential learning, entrepreneurship and civic engagement among students, linking classroom learning to real-world food system challenges.

2.2.1. National policies and programmes supporting youth learning in food security

Kenya has adopted a range of policies that integrate youth learning into agricultural and nutritional development. The Kenya Youth Development Policy (2019) mainstreams youth empowerment across sectors such as education, entrepreneurship and agribusiness. It establishes an enabling policy environment for youth learning, skills development and participation in food security initiatives (Ministry of ICT, Innovation and Youth Affairs, Kenya, 2019). Through this policy, learners gain opportunities to participate in agricultural clubs, mentorship programs, and community-based projects that promote food security.

The Kenya National Nutrition Action Plan (KNAP 2018–2022) complements these efforts by adopting a multisectoral approach that integrates nutrition-specific and nutrition-sensitive interventions. It emphasizes school-based and community learning programmes to improve dietary practices and nutrition outcomes (Ministry of Health, Kenya, 2018). School-based activities such as nutrition clubs, community outreach and peer education empower learners to apply classroom knowledge in improving local nutrition practices.

Similarly, the Agricultural Sector Transformation and Growth Strategy (ASTGS 2019–2029) prioritizes youth engagement, digital extension services and value-chain development aimed at modernizing agriculture and increasing smallholder incomes (MOALF, 2019). Under this strategy, youth can engage through agri-tech incubators, digital platforms and agribusiness financing programmes, developing entrepreneurial and technological competencies (Kenya News Agency, 2025).

The Home-Grown School Meals Programme (HGSMP) and related school feeding policies further demonstrate the government's commitment to linking education, agriculture and nutrition. Implemented in partnership with the World Food Programme (WFP), these initiatives aim to enhance child nutrition, improve school attendance, and strengthen local food markets (Gupta et al., 2025). Youth in schools can actively participate in school garden projects, join Young Farmers' Clubs or serve on school feeding monitoring committees, thereby learning about sustainable agriculture and nutrition management in practical contexts.

Additionally, the National Food and Nutrition Security Policy (2017) and corresponding county-level frameworks provide the institutional and legal foundation for youth inclusion in agricultural development, post-harvest management, and food storage resilience programs (Government of Kenya, 2010). These frameworks create spaces for youth participation in county food security planning, community grain banks and youth agricultural cooperatives

2.2.2. International and non-governmental programmes supporting youth learning

A number of international organizations and local NGOs complement government efforts to engage youth in food security and nutrition.

The World Food Programme plays a pivotal role through its school feeding and Home-Grown School Meals programmes, offering technical and financial support to enhance nutrition and capacity building. By linking local producers, including youth-led enterprises, to institutional markets, WFP initiatives strengthen local food systems and provide youth with opportunities as suppliers, producers, or interns (WFP, 2025).

Food4Education, a leading Kenyan non-governmental organization, operates one of the largest local school-feeding initiatives in the country. By sourcing food locally and employing community members, it not only improves child nutrition but also provides avenues for youth employment, social enterprise training and entrepreneurial learning within food systems (Food4Education, 2025). Youth can engage as employees, trainees or managers of local feeder kitchens, acquiring both technical and business skills.

The Food and Agriculture Organization supports a range of youth-centered agri-food system initiatives in Kenya, including county-level pilot projects such as the Kilifi Youth Initiative, which provide guidance on youth participation in agricultural value chains and nutrition-sensitive interventions (FAO, 2024). Through these programmes, youth can access FAO-sponsored training, entrepreneurship development and networking platforms for agri-food innovation.

The International Fund for Agricultural Development (IFAD), the World Bank and other development partners also invest heavily in rural youth livelihoods through initiatives that strengthen agri-value chains, microfinance and vocational skills development. These programmes aim to connect learning to livelihood outcomes and enhance food security among youth (World Bank, 2025). Youth can apply for grants, loans and incubation support under these initiatives to advance their agribusiness projects.

Furthermore, the Alliance for a Green Revolution in Africa supports youth-focused programs in agribusiness development, seed systems and extension services aligned with national strategies such as the ASTGS. AGRA initiatives often emphasize the cultivation of nutritious crops, digital agricultural solutions and entrepreneurship for young agripreneurs (AGRA, 2025). Students and young graduates can participate through training programmes, innovation grants, and community-based agricultural projects.

2.2.3. Pedagogical theories founded on perceiving youth as learners in enhancing food security and nutrition

A range of pedagogical theories offer strong conceptual foundations for viewing youth as active learners and change agents in efforts to enhance food security and nutrition. These theories emphasize experiential engagement, critical reflection and contextual application of knowledge within agricultural and nutritional systems.

Experiential Learning Theory (Kolb, 1984) is applicable where youth participate in hands-on activities like school gardens, cooking demos, community farming and nutrition outreach. Students grow drought-tolerant crops, reflect on yield challenges, research solutions and then try improved practices.

The Constructivist Learning Theory advocates that learners actively construct knowledge based on prior experiences and social interaction (Frontiers in Education, 2025). For instance, the youth can link existing knowledge like the family farming traditions to new concepts like climate-smart agriculture and balanced diets. They can also collaborate in projects and peer-led research on local nutrition gaps, designing culturally appropriate food interventions.

The social Learning Theory has the core idea that people learn by observing, imitating and modeling behaviors in social contexts (Bandura, 1977). The youth can observe skilled farmers, nutritionists or cooks then model sustainable farming or healthy cooking practices. The extension workers for example can demonstrate soil conservation or food preservation techniques for replication.

In Problem-Based Learning, learning starts with a real-world problem and students develop solutions through research and collaboration. It can be applied where youths can present a challenge like how a school can reduce malnutrition among pupils. Youth can work in teams to design interventions like gardens, meal plans, and awareness campaigns as they integrating science, economics, and culture.

Transformative Learning Theory (Jack Mezirow) advocates that deep learning occurs when learners critically examine and change their perspectives (Pang et al., 2023). This is applicable where youth engage with issues like post-harvest losses, climate change and food waste, leading to shifts in attitudes and sustainable behaviors. Example, exposure to data on child stunting inspires youth to advocate for local food programs.

Situated Learning Theory is where learning is most effective when it happens in the same context where it will be applied (Azorín & Muijs, 2025). It is applied where youth learn farming, nutrition and food marketing in real farms, markets or feeding programmes instead of only in classrooms. Mentorship programmes can also be where experienced farmers/nutritionists guide youth in live projects. This is therefore part of learning.

The Critical Pedagogy advocates that education should empower learners to challenge inequities and transform their communities (Najjar & Menassa, 2024). For instance, the youth can investigate root causes of hunger, analyze local food systems and design advocacy campaigns for equitable access to nutritious food. This encourages youth to see themselves as change agent not just recipients of aid.

2.2.4. Learning gaps in enhancing food security and nutrition

Despite these pedagogical potentials, significant learning and implementation gaps persist within agricultural education and practice in Kenya, limiting the full engagement of youth in advancing food security and nutrition outcomes

Curriculum–Reality Gap where Agricultural education curricula often remain theoretical with insufficient alignment to real-world food security and nutrition challenges (Turyamureba et al., 2024). Example, Students may learn crop production in class but not link it to local malnutrition patterns or market access. This consequently leaves students lacking the applied problem-solving skills to address community food and nutrition needs.

Skills employment gap occurs where stakeholders see students as future workers rather than current contributor. Therefore, there is less investment in giving them entrepreneurial, agribusiness and nutrition advocacy skills now. For instance, there is limited exposure to value chain development, post-harvest technologies or agritech tools while still in school (Ouko et al., 2022).

The limited integration of nutrition education in Agriculture lessons due to more focus on production without equally addressing nutrition outcomes and dietary diversity. Example, students learn to grow maize but not how to design balanced school meals from local produce.

The inadequate practical learning platforms due to few school farms, community demonstration plots or partnerships that allow agriculture students to apply learning in real settings is a major barrier (Recha et al., 2024). Example, there is lack of internships or apprenticeships programmes for secondary school students in Kenya in local agribusinesses or nutrition programmes. This limits their ability to apply the knowledge and skills acquired in real life situations.

Stakeholder coordination gaps arise when the Ministries of Education, Agriculture and Health plus NGOs and private sector work in silos (Kilelo et al., 2023). For instance, nutrition NGO may run school feeding programmes without involving agriculture students in sourcing, monitoring or menu design.

There is the youth voice & agency gap when students are rarely treated as co-creators of solutions hence decisions are made for them not with them (Walker et al., 2024). For instance, school feeding menus are decided by adults without input from student agricultural clubs. They cannot therefore participate in voicing issues that may arise from such initiatives.

Gender and inclusion gap occur example when girls, students from marginalized communities and those with disabilities may have fewer opportunities to participate in agricultural learning and leadership (Kadzamira et al., 2024). For instance, gender stereotypes that farming is men's work limit engagement of girls in production-focused activities.

Technology and innovation gap where stakeholders underestimate students' capacity to adopt and innovate with agri-tech for food security (KIPPRA, 2024). Example, there is limited exposure of secondary school students to mobile-based extension services, hydroponics or digital market platforms.

The Monitoring and recognition gap occurs when achievements of agriculture students in contributing to food security are rarely documented or celebrated (Njura, 2020). Example, student-led projects that improve local diets often go unrecognized in policy forums or media. This is evidenced in the national examinations reports written by students as they conclude their Agriculture projects. Once scoring is done, no evidence of follow up on their recommendations is consolidated for policy improvement in learning.

2.3. Engagement of youth as implementers of food security and nutrition

The active participation of youth as implementers of food security and nutrition programs has gained significant attention in Kenya's agricultural and development agenda. Multiple national and international initiatives now position young people not merely as learners or beneficiaries, but as key actors in

executing policies, managing agri-food systems and driving innovations that enhance food and nutrition security.

2.3.1. National programmes

The Integrated Country Approach (ICA), a Food and Agriculture Organization (FAO) initiative launched in 2019, plays a central role in building youth capacity within Kenya's agricultural sector (FAO, 2023). Through this programme, youth receive training in integrated pest management, aquaculture, poultry production, and agribusiness management. They also gain access to land, finance, and market platforms to support agribusiness value chain implementation (Opportunities for Youth, 2025). Importantly, youth organizations under ICA receive training on public policy processes to enhance their participation in implementing and monitoring county-level agricultural strategies.

Aligned with Kenya's broader rural development agenda, the Opportunities for Youth in Africa (OYA) programme implemented jointly by FAO, the United Nations Industrial Development Organization (UNIDO), and the African Union (AU) has made significant contributions. It has incubated over 270 youth-led agribusinesses and trained more than 300 young people in digital, financial, and business skills, fostering innovation in micro-irrigation, value addition, and market access (FAO, UNIDO, & AU, 2024). The programme adopts an integrated approach to create quality on- and off-farm employment for African youth by strengthening skills, agricultural value chains and institutional support systems.

The Kenya Youth in Agriculture Strategy, under the Ministry of Agriculture and Livestock Development, aligns with the Agricultural Sector Transformation and Growth Strategy (ASTGS) 2018–2022 and the Big Four Agenda's Food Security Pillar (MOALFI, 2018). Through this framework, youth manage demonstration farms, lead community training in climate-smart agriculture and operate agribusiness ventures. The strategy demonstrates the government's commitment to integrating youth into the agricultural sector to create employment opportunities and enhance food security, thereby contributing to the objectives of both the ASTGS and the Big Four Agenda.

Complementary school-based initiatives also reinforce youth engagement in agriculture. The 4K Clubs and Young Farmers Clubs, supported by the Ministries of Agriculture and Education, contribute directly to the National Food and Nutrition Security Policy and the School Meals and Nutrition Strategy (MOALD, 2025). These programmes encourage pupils to implement kitchen gardens, conduct nutrition awareness campaigns, and undertake small-scale crop and livestock projects. The revival of 4K Clubs in over 31,000 public primary schools aims to instill agricultural skills, entrepreneurship, and environmental consciousness among learners, aligning with national policies on food security and nutrition.

Similarly, the Home-Grown School Meals Programme (HGSMP) implemented by the Ministries of Education and Agriculture in collaboration with the World Food Programme (WFP) operationalizes the Kenya School Meals and Nutrition Strategy (2017–2022) (Gupta et al., 2025). Under this initiative, youth-led farmer groups supply fresh produce to schools, manage community gardens and design nutrition education activities. According to Walker et al. (2024), such youth-led initiatives enhance both food security and nutrition education in schools through hands-on agricultural activities and awareness campaigns.

Digital innovation has also become an emerging pillar of youth participation in agriculture. The Ajira Digital for AgriTech Programme, under the Ministry of ICT, Innovation and Youth Affairs, supports the Digital Economy Blueprint and the ASTGS (Ajira Digital Program, 2025). Through this initiative, youth develop and manage digital platforms that facilitate farmer advisory services, market access and nutrition-sensitive data collection. In parallel, the Kenya Climate-Smart Agriculture Project (KCSAP), a partnership between the Ministry of Agriculture and the World Bank, supports the National Climate-Smart Agriculture Strategy (Republic of Kenya, 2017). Youth involved in this project lead soil conservation efforts, conduct drought-resilient crop trials and develop water management systems to strengthen community-level food security.

2.3.2. Regional and international programmes

Beyond national frameworks, Kenya participates in several regional and international programmes that reinforce youth inclusion in agricultural transformation. The FAO Rural Youth Action Plan and the African Youth Agripreneurs (AYA) Platform emphasize youth as active managers of agri-food systems rather

than passive learners. The AYA Platform connects over 3,000 young agripreneurs across Africa, offering mentoring, training and opportunities for practical implementation (FAO, 2023). Similarly, the Young Professionals for Agricultural Development (YPARD) network active in Kenya through the African Centre for Technology Studies (ACTS) empowers young agricultural professionals, researchers, and entrepreneurs to influence policy and practice in sustainable food systems (YPARD, 2023).

The Alliance for a Green Revolution in Africa (AGRA), based in Nairobi and aligned with Africa's Comprehensive Africa Agriculture Development Programme (CAADP) agenda, drives agricultural transformation across the continent with a strong focus on youth engagement (AGRA, 2025). AGRA's initiatives promote innovation in seed production, soil health practices and market-linked agribusinesses that advance food security and nutrition policy implementation. Similarly, the FAO Youth in Agribusiness Programme aligns with FAO's Strategic Framework and Kenya's ASTGS by supporting youth-managed farmer field schools, agribusiness start-ups and nutrition-sensitive agriculture training (FAO, 2025).

The WFP Purchase for Progress (P4P) initiative also contributes to the National Food and Nutrition Security Policy by supporting youth cooperatives that aggregate and supply produce to institutional buyers including school feeding programmes (WFP, 2025). Complementing this, the IFAD Rural Youth Employment and Entrepreneurship Project implemented in partnership with the Ministry of Agriculture, aligns with the IFAD Rural Development Strategy and Kenya's ASTGS. Under this programme, youth manage agro-processing units, provide extension services and lead post-harvest management to minimize food loss (IFAD, 2019).

In addition, the AGRA Youth Agripreneurship Initiative, which supports both the Malabo Declaration and CAADP, focuses on enabling youth to produce improved seeds, promote soil health, and operate market-linked agribusinesses (AGRA, 2024). The African Union's CAADP Youth Engagement Framework similarly supports youth hubs that implement projects in food production, storage and nutrition advocacy at community and county levels.

Other innovative initiatives include the One Acre Fund Youth Extension Model, which aligns with Kenya's Food Security Policy by employing youth as field officers responsible for input delivery, farmer training and data collection for smallholder productivity (One Acre Fund, 2024). Likewise, the Youth Agripreneurs Program (YAP) under the International Youth Foundation contributes to the Global Food Security Agenda, with youth-led enterprises implementing climate-smart, nutrition-focused agriculture projects in local communities (International Youth Foundation, 2025). This programme underscores the role of youth as innovators and leaders in transforming global food systems.

2.3.3. Pedagogical theories that support agriculture youth as implementers of food security and nutrition policies and strategies

In reference to the Experiential Learning Theory (Kolb, 1984) youth gain knowledge by running real projects like school gardens, food preservation units and nutrition campaigns that directly implement policy objectives. For instance, youth in 4K Clubs manage kitchen gardens to support the Kenya School Meals and Nutrition Strategy then refine practices based on harvest outcomes.

Based on PBL, youth identify and solve actual food security challenges in their community like post-harvest loss and dietary diversity (Mumma, 2025). By adopting PBL, youth transition from passive recipients to active problem-solvers, fostering innovation and sustainable practices in local food systems. Example, Agriculture students work with county governments to design drought-resilient crop projects aligned with Kenya's Climate-Smart Agriculture Strategy.

In reference to the Situated Learning Theory, knowledge is acquired through participation in communities of practice. Youth work alongside experienced farmers, extension officers and nutritionists to apply national and international strategies in the field (Chanyau, 2025). For instance, youth extension workers help implement FAO-backed county nutrition plans, learning within real farming and market environments.

Albert Bandura's Social Learning Theory (1977) posits that individuals acquire new behaviors, attitudes, and emotional reactions through observing others within a social context. This theory emphasizes the importance of imitation, modeling, and reinforcement in the learning process. It suggests that learning can occur purely through observation or direct instruction, even without physical practice or direct reinforcement. In the context of youth involvement in sustainable agriculture and nutrition programmes,

this theory is applicable as youth observe and model successful practices from experts and peers, thereby acquiring and implementing effective strategies. Example, young agripreneurs replicates techniques from AGRA's seed production projects to improve local food supply chains.

The application of Jack Mezirow's Transformative Learning Theory (TLT) to youth transitioning from passive beneficiaries to active policy implementers in sustainable food systems is well-supported in contemporary literature. This theory emphasizes critical reflection and discourse as mechanisms for profound personal and societal change, aligning with the role of youth in questioning traditional agricultural practices and innovating for sustainability (Horner, 2021). The youth shift from passive beneficiaries to active policy implementers who question old methods and innovate for sustainable food systems. Example, Youth-led cooperatives adopt climate-smart practices after analysing gaps in traditional farming that hinder food security policy targets.

The Critical Pedagogy (Freire, 2018), advocates that education should empower learners to challenge inequalities and transform the society. This fits where youth address systemic barriers to nutrition and food access while applying policy frameworks. For instance, youth advocacy groups influence county-level budget allocations for school feeding under the National Food and Nutrition Security Policy.

The Service-Learning Theory combines academic learning with community service to address real needs. It is applicable where Youth apply agricultural and nutrition knowledge while directly serving community needs. This is based on the key elements such as structured reflection, community partnership, and the linking of academic learning with community-identified issues (Novoa & Radovic, 2023). Example, students partner with county health and agriculture departments to run food safety workshops in alignment with WHO nutrition guidelines.

2.3.4. Implementation gaps in enhancing food security and nutrition

Many stakeholders see youth primarily as beneficiaries or learners and not as policy implementers. Youth participation is limited to training sessions or awareness campaigns rather than decision-making or operational leadership. For instance, County food security committees rarely give youth voting rights or budget oversight roles. Additionally, youth receive agricultural or nutrition training but lack platforms and resources to apply these skills at scale. The knowledge gained from policy-driven programmes doesn't translate into measurable community impact. Example, graduates of climate-smart agriculture training do not necessarily get access to land, inputs or market linkages to implement what they learned.

There is also policy practice gap which reflects a disconnect between high-level policies and the operational frameworks that youth can engage with. Some policies mention youth inclusion but lack clear, funded roles for them in implementation. Example, National Food and Nutrition Security Policy includes youth empowerment goals but doesn't specify measurable targets for youth-led activities.

Poor collaboration between ministries such as Agriculture, Education, Health, Youth Affairs and development partners may leave gaps or overlap. Youth-led initiatives in food security operate in isolation without integration into official programmes, example, an NGO school-feeding project is not linked to county agriculture youth strategies so efforts overlap or leave gaps.

Limited financial mechanisms are targeted at youth as policy implementers. Youth-led agribusinesses and nutrition initiatives lack seed funding, credit and insurance. Example, few counties allocate specific budget lines for youth in agricultural policy implementation.

Stakeholders often doubt youth capacity to manage large-scale or high-responsibility projects leading to perception gap. Leadership positions and control over resources are given to older actors, sidelining youth. Example, youth are invited to community planning meetings but excluded from signing authority on project accounts.

The lack of systematic tracking and celebration of youth contributions to policy outcomes result to youth-led successes remaining invisible with reduced motivation and policy support. Example, there is no evidence of inclusion of youth impact metrics in county or national food security reports. Lastly, there is inclusion and equity gap where rural, marginalized and female youth face additional barriers in access to leadership opportunities. The implementation roles are dominated by urban or better-connected youth. Example, youth from arid and semi-arid lands (ASALs) are underrepresented in national food policy committees.

2.4. Engagement of youth as trainer of trainers

The engagement of youth, particularly agriculture students, as Trainers of Trainers (ToTs) represents a transformative approach to strengthening food security and nutrition in Kenya. This strategy positions students not merely as learners but as facilitators and multipliers of knowledge within their communities, bridging the gap between education, practice and policy implementation.

2.4.1. National programmes supporting youth ToTs

Several national initiatives have embraced the ToT model to empower youth in agricultural training and community development. The Farmer Business School (FBS) programme initiated by the Food and Agriculture Organization (FAO) is a key example. In 2022, the programme trained over 90 facilitators—including extension officers, lead farmers, and students in a 21-day ToT course held in Migori and Kisumu (FAO, 2022). Graduates, known as Community Business Coaches, now support farmer aggregation, commercialization, and the development of resilient value chains.

Similarly, the Food Forestry Training of Trainers programme in Makueni trained 11 young farmers in regenerative and nutrient-rich food forestry methods (SkillEd, & Feedback to the Future, 2024). These trained youth now cascade knowledge to others, promoting diversified farming systems that enhance community food security from the ground up. The FreshCrop initiative also contributes by annually training outstanding agriculture students as ToTs in climate-smart potato production (Mureithi, 2022). These youth trainers, in turn, mentor networks of over 10,000 smallholder farmers, translating academic learning into scalable community impact.

2.4.2. Regional and international ToT initiatives

International and regional programmes have further reinforced this approach. The IFOAM Biovision Africa Trust Training of Teams of Trainers (ToToT) initiative conducted a regional ToT in Nairobi in 2020, preparing East African master trainers to implement ecological organic agriculture models (IFOAM, 2020). These master trainers, many of whom are young professionals or students, now mentor rural service providers across the region.

Likewise, the Eastern Africa Grain Council (EAGC) under its programme Strengthening Competitiveness in Export-Oriented Staple Food Value Chains (EAGC & USAID, 2024), engaged ToTs to train smallholder organizations and grain hubs in organizational development, climate-smart production, post-harvest management, and marketing. These ToTs continue to advance best practices along staple grain value chains, directly supporting policy objectives related to sustainable production and food system competitiveness.

2.4.3. Theoretical frameworks applicable to agriculture trainers of trainers (ToTs)

The effectiveness of Agriculture students serving as Trainers of Trainers (ToTs) in advancing food security and nutrition can be understood through several complementary learning theories. These theories illuminate how agricultural knowledge is acquired, shared, and internalized within communities.

The Experiential Learning Theory (Kolb, 2015) is particularly relevant to agriculture ToTs, as it emphasizes learning through experience and reflection. Students gain hands-on agricultural skills such as crop management and post-harvest handling, and subsequently teach peers and community members using real-life demonstrations. Reflection on the results of these practices enables the student trainers to adapt their methods to address specific local food security challenges.

Similarly, the Social Learning Theory (Bandura, 1986) underscores the importance of observation and modeling in learning processes. In the context of agriculture ToTs, student trainers model best practices in sustainable farming and nutrition-sensitive agriculture. Peers and community members observe these practices and replicate them after witnessing successful outcomes, thereby reinforcing the diffusion of improved agricultural techniques.

The Constructivist Learning Theory (Piaget, 1972; Vygotsky, 1978) also finds application in agriculture ToT programmes. It emphasizes that learners construct knowledge through active engagement and collaboration. Agriculture students, acting as trainers, guide other farmers or youth through problem-based learning on issues such as soil fertility, pest control and food safety. Knowledge is co-created through

dialogue and experimentation, making training content more relevant and responsive to local agricultural conditions.

In addition, the Transformative Learning Theory (Mezirow, 1997) provides a framework for understanding how agricultural training can foster critical reflection and behavioral change. Student trainers challenge traditional, unsustainable agricultural practices by introducing climate-smart and nutrition-sensitive innovations. Through this process, participants undergo shifts in mindset that promote sustainable food production and healthier dietary practices.

The Adult Learning Theory (Andragogy) (Knowles, 1980; Knowles et al., 2015) further supports the ToT approach by recognizing that adults learn most effectively when training is self-directed, problem-centered, and relevant to real-life situations. Within agriculture ToTs, students employ facilitative teaching methods rather than didactic lectures, allowing farmers to take ownership of problem-solving. Training content is tailored to immediate food security needs, thereby enhancing its practical relevance and adoption.

Finally, the Communities of Practice (CoP) model (Wenger et al., 2002) highlights that learning is sustained through social participation within groups sharing common interests and practices. In agriculture ToTs, student trainers often serve as community agricultural facilitators who establish farmer learning groups for the exchange of experiences and innovations. Such communities of practice sustain long-term peer-to-peer learning beyond the initial training phase, fostering continuous improvement in agricultural practices.

2.4.4. Training gaps in enhancing food security and nutrition

Despite the potential of Agriculture students to serve as effective Trainers of Trainers (ToTs), several training and systemic gaps hinder their full contribution to food security and nutrition. A primary challenge arises from limited practical exposure. Many Agriculture students possess strong theoretical knowledge but lack adequate field-based experience prior to engaging in training roles. Consequently, stakeholders often perceive them as 'still in training', rather than as qualified trainers. This perception is compounded by weak stakeholder confidence farmers, NGOs and policymakers may question the students' credibility when compared to experienced agricultural extension officers. Age related bias further undermines their acceptance, as youth trainers are sometimes viewed as inexperienced regardless of their actual competence.

Another significant limitation concerns pedagogical capacity. While students may have solid technical knowledge, many lack formal training in facilitation techniques, adult learning principles and community engagement. This deficiency constrains their effectiveness in conducting participatory, learner-centered training sessions essential for ToT success.

In addition, misalignment between agricultural curricula and local context presents a major gap. Existing curricula often fail to fully address community-specific food security challenges, local climate conditions and traditional agricultural practices. As a result, students may promote technically sound solutions that are not contextually appropriate, thereby weakening the linkage between theory and local realities.

Institutional support structures for student ToTs are also inadequate. Few formal programmes exist to systematically integrate students into national agricultural extension or training systems. Moreover, limited recognition, incentives and clear career pathways diminish students' motivation and capacity to sustain their ToT engagement in enhancing food security and nutrition.

Resource constraints further exacerbate these challenges. Insufficient agricultural resources including training materials, demonstration plots, transport and ICT tools restrict the ability of students to deliver high-quality training, particularly in rural areas. Additionally, the lack of monitoring and evaluation mechanisms means that there are no systematic approaches for tracking the impact of student-led training on food security and nutrition outcomes. In the absence of measurable results, stakeholders may undervalue their contributions.

Finally, limited policy integration remains a critical structural gap. Most national food security and nutrition policies do not explicitly recognize Agriculture students as key ToT actors. This omission creates a policy vacuum that undermines their inclusion in large-scale agricultural and nutrition programmes.

Collectively, these training, institutional, and policy gaps highlight the need for more structured, well-supported frameworks that build the practical, pedagogical, and professional capacities of Agriculture students as credible and effective Trainers of Trainers in Kenya's food security and nutrition agenda.

2.5. Engaging agriculture students as informants of policies on food security and nutrition

Several national and international programmes in Kenya actively engage agriculture students as contributors to policy development processes aimed at enhancing food security and nutrition. These initiatives build students' capacity to bridge the gap between grassroots experiences and formal policymaking, equipping them with skills in policy analysis, research and advocacy.

At the national level, the FAO's Integrated Country Approach (ICA), launched in 2022, has been instrumental in empowering youth, including agriculture students, to participate in public policy processes. Through a three-day training on the public policy cycle held in Kisumu in October 2022, participants gained practical understanding of how to influence policy formulation and implementation at the county level (FAO, 2022). The establishment of steering committees for county youth agribusiness strategies further strengthened their engagement. By translating grassroots challenges into formal proposals and engaging directly with government institutions, these youth act as important informants in shaping local agricultural and nutrition policies.

Similarly, the International Livestock Research Institute (ILRI), through the Regional Strategic Analysis and Knowledge Support System (ReSAKSS–ECA) and AgriFoSe2030, focuses on building the capacity of young scientists, including agriculture students, to undertake policy-relevant research (ILRI, 2020). Participants are trained to develop policy briefs and communicate research findings to policymakers, thereby becoming active contributors to policy analysis and formulation. This initiative enables students to transform empirical research into actionable policy insights that address agricultural and nutrition challenges in Kenya.

Beyond national programmes, several international and regional initiatives provide platforms for agriculture students to engage in policy processes. One such initiative is the Young Professionals for Agricultural Development (YPARD), a global network connecting young agricultural professionals across 72 countries. YPARD empowers youth including agriculture students to participate in policy dialogue, research, and advocacy through multi-stakeholder platforms (YPARD, 2020). By sharing field-based experiences and research outcomes, students contribute to evidence-based policy discussions and collective action in the agricultural sector.

The International Food Policy Research Institute (IFPRI) also partners with African governments, including Kenya's, to conduct policy research and strengthen local institutional capacities in food systems and nutrition (IFPRI, 2022). Agriculture students engage in IFPRI-supported country programmes through data collection, research assistance, and provision of local insights. Their involvement enhances the contextual relevance of policy analyses and contributes to informed decision-making in agricultural and nutritional governance.

Complementing these efforts, the Agriculture, Nutrition and Health (ANH) Academy provides a global platform for knowledge exchange among over 9,000 researchers, practitioners and policymakers. The Academy's annual meetings and learning laboratories facilitate dialogue on the intersections of agriculture, nutrition and health (ANH, 2015). Agriculture students, particularly from low- and middle-income countries, participate by sharing locally grounded experiences that enrich global policy-oriented discourse.

Additionally, the Swedish International Agricultural Network Initiative (SIANI) serves as a neutral, multi-stakeholder platform promoting informed dialogue on food security, nutrition and sustainable agriculture in support of SDG 2 (SIANI, 2022). Through participation in SIANI dialogue forums, agriculture students articulate youth perspectives and research insights, contributing to policy discussions at both national and international levels.

Finally, the UN Food Systems Youth Leadership Programme (YLP) coordinated by the FAO, targets early-career professionals, including agriculture students, with training in policy advocacy, leadership, and science-based decision-making (FAO, 2024). Through this initiative, students play a direct role in shaping youth-driven policy guidance and contribute to global processes such as the UN Food Systems Summit.

All these programmes demonstrate a growing recognition of agriculture students as credible informants in policy development. By integrating academic knowledge with field experiences, these youth contribute meaningfully to the formulation and implementation of food security and nutrition policies in Kenya and beyond.

2.5.1. Pedagogical theories supporting agriculture students as informants in policy development for food security and nutrition

Several pedagogical theories provide a foundation for understanding how agriculture students can effectively serve as informants in policy development processes aimed at enhancing food security and nutrition. These theories emphasize experiential, participatory, reflective and transformative learning approaches that bridge academic study with real-world policy engagement.

Experiential Learning Theory (Kolb, 1984) emphasizes learning through experience, reflection and application. In the context of policy development, this theory is applied when agriculture students engage in community-based projects such as food security assessments or nutritional surveys. Through active participation, reflection and theoretical integration, students generate data that can inform evidence-based policy briefs. This approach ensures that their policy inputs are grounded in practical experience and authentic community realities, thereby enhancing the relevance and applicability of their contributions.

Complementing this, Participatory Action Research (PAR) (Kemmis et al., 2014) positions learners as co-researchers who collaborate with stakeholders to identify problems and co-create solutions. When agriculture students engage with farmers, local leaders, and policymakers, they help generate findings that are co-owned by all participants. This shared ownership increases the acceptance and legitimacy of resulting policy proposals. PAR also enhances students' credibility as policy informants by embedding them directly in community-driven processes of inquiry and change.

Social Constructivism (Vygotsky, 1978) further enriches this process by emphasizing that knowledge is constructed collaboratively through social interaction and cultural context. Applied to policy development, the theory supports group-based learning in which students guided by mentors analyze agricultural policies and propose improvements. Peer-to-peer learning and multi-stakeholder dialogues deepen understanding of the socio-economic and political dimensions of food security. Consequently, students are able to frame policy suggestions that are culturally sensitive, socially relevant, and contextually grounded.

Transformative Learning Theory (Mezirow, 1991) underscores the role of critical reflection in reshaping learners' perspectives toward socially responsible action. Agriculture students applying this theory critically analyze existing agricultural and nutrition policies, question underlying assumptions, and propose inclusive and forward-looking alternatives. Through this reflective engagement, they are empowered to challenge systemic barriers to food security and develop policy inputs that address structural causes rather than surface-level symptoms.

Similarly, Civic Engagement and Service-Learning Theory (Bringle & Hatcher, 1995) links academic learning with structured community service. Within policy development contexts, agriculture students may volunteer in government extension services or collaborate with NGOs, collecting and documenting field insights that inform nutrition and agricultural reform recommendations. This integration of community engagement with curricular objectives ensures that students' policy contributions are both academically rigorous and socially impactful.

Finally, Critical Pedagogy Theory (Freire, 1970) emphasizes education as a means of empowerment and social transformation. Applied to policy development, it encourages agriculture students to critically interrogate power relations within agricultural and food systems, advocating for marginalized voices in policy dialogues. By fostering equity-oriented and justice-focused analysis, this approach enables students to produce policy recommendations that promote inclusivity and challenge systemic inequalities.

The above pedagogical frameworks collectively highlight the transformative potential of engaging agriculture students in policy development. Through experiential, participatory, and critical learning processes, students not only acquire technical knowledge but also develop the agency, analytical capacity and social consciousness required to contribute meaningfully to food security and nutrition policymaking.

2.5.2. Policy information gaps in enhancing food security and nutrition

Despite the growing recognition of youth potential in agricultural transformation, several policy information gaps hinder the effective engagement of agriculture students as contributors to food security and nutrition policy development. These gaps stem from institutional, curricular and perceptual barriers that limit students' influence within policy spaces.

Limited recognition of students' expertise remains a major impediment. Policymakers and senior stakeholders often perceive agriculture students primarily as learners rather than as credible contributors to policy dialogue. Consequently, student-generated research and field findings are frequently dismissed or underutilized. For example, community food security assessments conducted by students often remain confined to academic reports instead of informing county or national policy frameworks (Winne et al., 1997). This challenge is compounded by weak institutional linkages between academia and policy platforms as few structured mechanisms exist to connect agricultural faculties with government policy-making bodies or international agencies. As a result, valuable field-based evidence rarely reaches policymakers.

Another critical gap lies in the absence of policy engagement skills within the agricultural curriculum. While students acquire strong technical competencies in agriculture and nutrition, they often lack training in policy analysis, advocacy and communication. Without these skills, their technical data are presented in formats or timelines that do not align with policy decision-making processes (Pitan & Muller, 2023). Moreover, stakeholder perceptions of student inexperience particularly assumptions regarding their limited maturity, practical exposure or political understanding—further discourage their inclusion in strategic dialogues. For instance, student representatives are often excluded from high-level stakeholder forums on food security, reducing opportunities for authentic youth participation.

The restricted access to decision-making forums further exacerbates the problem. Agriculture students are rarely invited to official consultative meetings, stakeholder workshops or parliamentary hearings. This exclusion perpetuates a top-down policy development process with minimal youth perspectives. Agricultural bills and food security frameworks are therefore often drafted without structured youth consultation. Even when students are engaged, their involvement is typically short-term and project-based concluding with the end of internships or academic projects. Such discontinuity prevents the sustained flow of student-generated evidence into policy cycles, resulting in missed opportunities for long-term influence.

Additionally, tokenism in youth inclusion undermines the authenticity of student participation. In many cases, students' involvement in policy processes is symbolic used to demonstrate inclusivity rather than to meaningfully shape decisions. This superficial engagement is further constrained by resource and logistical limitations, including inadequate funding, transportation and digital infrastructure. Consequently, valuable insights collected by students often remain fragmented, unrefined and inaccessible to decision-makers (Citizen Digital, 2024; Pete et al., 2021; Scholar Media Africa, 2025).

Finally, there is a lack of systematic documentation and data on youth contributions to policy development. The absence of monitoring and evaluation mechanisms means that the impact of student-generated insights often goes unrecorded, perpetuating their invisibility within policy narratives. Compounding this issue are negative cultural perceptions of agriculture, which portray the field as non-lucrative, labour-intensive or outdated. Such stereotypes diminish institutional and societal motivation to value youth voices in agricultural policymaking.

Collectively, these challenges illustrate the systemic barriers that prevent agriculture students from effectively informing policy decisions. Addressing these gaps requires deliberate institutional reforms, curriculum redesign and inclusive policy frameworks that acknowledge and harness students' unique insights in advancing food security and nutrition agendas.

2.6. Research objective

To establish the stakeholders' perceptions on the role of the secondary school agriculture student in enhancing household food security

3. Methodology

3.1. Research design

The study adopted a mixed-method approach, combining descriptive survey design and correlational research design. The descriptive design enabled the researcher to collect both quantitative and qualitative data describing the opinions of students, teachers, and parents on the role of secondary school agriculture students in enhancing household food security. Descriptive surveys are appropriate for exploring existing conditions, summarizing responses and interpreting perceptions without manipulating variables (Borg & Gall, 1989; Orodho, 2003).

The correlational design was used to determine the strength and direction of relationships between the opinions of the three respondent categories: students, agriculture teachers and parents/guardians regarding the agricultural student's contribution to food security. This design allowed the researcher to assess naturally occurring relationships among variables without any experimental manipulation (Anderson & Arsenault, 2001).

3.2. Location of study

The study was conducted in Embu County which is a representative of the forty-seven counties in Kenya. The county has diverse ecological conditions ranging from the highlands of the slopes of Mount Kenya to the arid areas of the Mbeere sub-counties. Though coastal regions do not feature in Embu County, the pockets of hot and humid microclimates due to rivers and the presence of Mwea Tebere irrigation scheme attribute to a common feature of the coastal region. Embu County is well placed to allow for surgical measures to mitigate food insecurity due to its diverse agro-ecological zones that allow the growing of many crops that include: maize, beans, sorghum, root crops, horticulture and industrial crops mainly coffee, tea, macadamia and cotton as well as household dairy farming (MoALF, 2016). Due to these diverse features, the researcher purposively selected the County as a representative of the forty-seven counties in Kenya.

Secondary schools in Embu County are broadly divided into public and private schools distributed in the five sub-counties occupying the varied features of the County in regards to rural versus urban areas, highlands versus lowlands as well as diversity in population distribution. Such differences have an influence on the number, type and distribution of schools as well as the students', teachers' and parents/guardians' opinions on the role of the secondary school agriculture student in enhancing household food security. The Kenyan counties are presented as Appendix A from where Embu County was selected.

3.3. Sampling procedures and sample size

Purposive sampling was done for Embu County and stratified random sampling was administered to select the number of schools required in the public and private categories. Secondary schools in Embu County are broadly divided into public and private schools distributed in the five sub-counties occupying the varied features of the County.

Systematic random sampling followed to get the specific schools as well as the agriculture teachers. Simple random sampling was then conducted to get the required number of students. The agriculture teachers helped to track down the number of students specializing in agriculture in Form Three and Four from each sampled school. Through proportionate sampling, twelve groups of students were obtained from the public schools while eight groups were obtained from the private school category. The researcher established the scheduled school academic clinics and parents' meetings from the offices of the school principals to be able to reach them for issuance and filling in of the questionnaires. The sample size reached is presented in Table 1 from where 68 schools, 376 students, 111 agriculture teachers and 323 parents were obtained. This was based on Krejcie and Morgan (1970) sample size determination procedure presented in Appendix B.

Table 1. Sample size.

Subject category	Target population	Actual sample
Public schools	186	60
Private schools	12	8
Agriculture teachers	235	111
Agriculture students	46,340	376
Parents/Guardians	46,340	323
Total respondents	9, 2915	810

3.4. Data collection procedures

A letter of introduction was obtained from the University of Embu to help the researcher obtain a research permit from the National Commission for Science, Technology and Innovation (NACOSTI). The researcher also obtained a consent letter from the County Director of Education (CDE) before contacting the school principals to prepare for data collection within Embu County. Three types of research instruments namely: Parents Questionnaire (PQ), Agriculture Teachers' Interview Schedule (ATIS) and Students' Focus Group Discussion Guide (SFGDG) were administered over three months. These are presented as Appendices C, D, and E, respectively. Parents filled out the questionnaires during school gatherings and returned them the same day. The interviews with the agriculture teachers and the group discussions with the agriculture students were conducted during the weekdays in the selected schools. The entire activity of data collection was spread over three months. Two field assistants were involved to distribute and collect the research instruments in the sampled schools.

The data collection instruments were structured as follows:

1. Parent's Questionnaire (Appendix C)

   This structured questionnaire sought parents' opinions on the role of their children (agriculture students) in implementing the food security agenda.

   Part A: Bio data captured demographic characteristics such as residence (urban, suburban, rural), farming background and exposure to agriculture education.

   Part B: Opinions on skills use for food security focused on parents' assessment of how agricultural skills learned at school were applied at home.

   Sample question:

   > Rate how often your child applies the following skills at home: nursery practices, irrigation, livestock production, pest and disease control, soil and water conservation'.

   Themes covered: parental attitudes, frequency of skill application, perceived contribution to household food availability and suggestions for youth engagement in agriculture.

2. Agriculture Teachers' Interview Schedule (Appendix D)

   This semi-structured interview captured teachers' experiences and professional insights into how agricultural instruction contributes to food security.

   Part A: Background Information covered teacher experience, school type and student population.

   Part B & D: Instructional Methods and Skill Application explored teaching approaches, frequency of practical lessons and observed student engagement.

   Sample prompt:

   > 'Which instructional methods (e.g. demonstration, field visits, project-based learning) do you find most effective in building food production skills?'

   Themes covered: teaching methodology, curriculum emphasis, classroom constraints and student involvement in school-based food production.

3. Students' Focus Group Discussion Guide (Appendix E)

   The guide facilitated interactive discussions among agriculture students in groups of 8–12, each lasting approximately 100–120 minutes.

   Key thematic areas included:.

   Attitudes toward agriculture as a subject (e.g. 'Give three words that describe how you feel about learning agriculture').

Table 2. Reliability statistics.

	Cronbach's alpha	*N* of items
Teachers	0.698	16
Parents	0.676	14

Perceived relevance of agriculture education to household food security (e.g. 'How well does your agricultural education prepare you to produce food at home?').

Learning approaches and skills transfer (e.g. 'Which teaching approaches best help you develop practical skills for food production?').

To deepen reflection, Handouts A and B were used to prompt ranking exercises on the most and least important skills and learning strategies.

3.4.1. Instrument validation and reliability

The instruments were reviewed by three experts in agricultural education and curriculum studies to ensure content validity. A pilot test was conducted in two schools not included in the main study. The Cronbach's alpha coefficient for internal consistency was 0.84, indicating acceptable reliability. Focus group discussion data were audio-recorded and triangulated with questionnaire and interview data for credibility.

3.5. Reliability analysis

After the pilot test, reliability analysis was undertaken. Cronbach's alpha was calculated using SPSS version 24. Cronbach's alpha is the most common measure of internal consistency (reliability). It is most commonly used when one has multiple Likert questions in a survey/questionnaire that form a scale and wish to determine if the scale is reliable. The researcher devised questions in a questionnaire and an interview schedule with the intention of describing and exploring the stakeholders' perceptions on the role of the secondary school agriculture student in enhancing food security. Some questions were on a 5-point Likert scale from strongly agree to strongly disagree while others were on a 3- point Likert scale from disagree to agree.

The value of the alpha coefficient ranges from 0 to 1 and may be used to describe the reliability of factors extracted from dichotomous (that is, questions with two possible answers) and/or scales (i.e. rating scale: 1 = strongly disagree, to 5 = strongly agree and 1= all the time to 5 = never. A higher value shows a more reliable generated scale. Since, the alpha coefficients were all greater than 0.6, the conclusion is that the instruments had an acceptable reliability coefficient hence appropriate for the study. The result in Table 2 indicates that the Cronbach's alpha is 0.698 for teachers and 0.676 for parents which is a very high level of internal consistency for our scale with this specific sample.

3.6. Data analysis

A thorough examination of the instruments was done to detect anomalies and incomplete responses. Edited data was coded and fed into the computer for analysis using the Statistical Package for Social Sciences (SPSS) version twenty-four for Windows. Qualitative data was obtained, categorized into themes, analyzed through descriptive statistics and presented in tables and narrative form. The themes were: the agriculture student as a learner, an innovator, an informant, a trainer as well as an implementer of food security strategies and policies. A correlation analysis was further run to establish the relationship between the opinions of the respondents on the role of the secondary school agriculture student in enhancing food security.

4. Results and interpretation

4.1. Survey participation and representativeness

The overall response patterns across teachers, students and parents demonstrate a highly engaged sample, with most categories surpassing the recommended 60% threshold for representativeness (Fincham,

Table 3. The survey response rate.

Subject category	Expected sample	Actual sample	% Response rate
Public schools	132	60	46
Private schools	12	8	67
Agriculture teachers	148	111	75
Agriculture students	381	376	98
Parents/Guardians	381	323	85

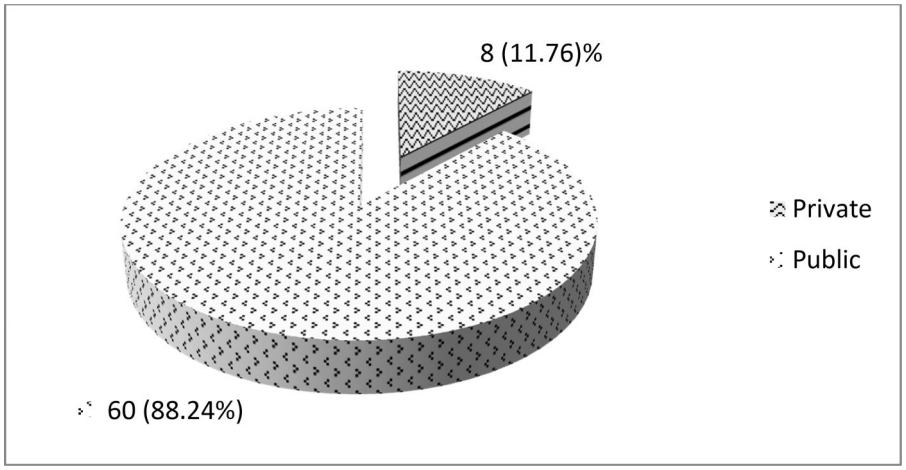

Figure 1. Percentage proportion of schools that participated in the study. $n = 68$.

2008). Table 3 shows that agriculture students (98%) and parents (85%) achieved very high participation, strengthening the reliability of perception data gathered from these groups. The public–private school variation reflects the larger population of public schools in the county.

Although some sampled schools did not participate due to scheduling changes, the researcher mitigated potential bias by reallocating respondents from demographically similar schools within the same locality. This strategic adjustment aligns with Draugalis and Plaza (2009), who notes that high usable response rates enhance representativeness and instrument validity.

4.2. School participation patterns

Of the 144 sampled schools, 68 participated (34.3% of all county schools). Public schools formed the majority (88.24%), mirroring their overall dominance in the region's education landscape. This distribution ensures that the findings reflect the typical agricultural learning environment in the county (Figure 1).

4.3. Characteristics of respondents

Understanding respondent characteristics clarifies the contextual factors shaping their opinions on agriculture and food security. The analysis below integrates teacher, student and parent biodata to highlight convergent patterns.

4.3.1. Agriculture teachers

The majority of participating teachers were from public schools (85.6%), consistent with the county's school composition. Their average duration teaching in the same station was fewer than five years (Table 4), suggesting relatively high mobility. Shorter tenures may limit deep community engagement but also expose teachers to diverse school contexts, potentially influencing their pedagogical approaches (Figure 2).

The distribution in Figure 3 shows that long-serving teachers (7–20 years) were few. This affects experiential relationships with communities; an important factor in community-based learning, which Schaps (2003) argues can enhance relevance and uptake of agricultural skills.

Table 4. Duration agriculture teachers had taught in their current school.

Descriptive statistics	
N	109
Mean	4.9
Mode	1.0
Std. deviation	3.9
Minimum	1.0
Maximum	20.0

Source: Primary field data.

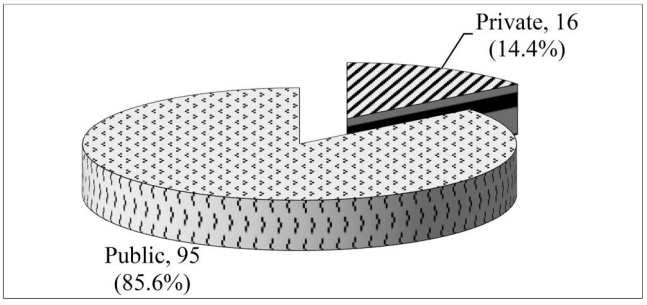

Figure 2. Percentage proportion of agriculture teachers who participated in the study. $n = 111$.

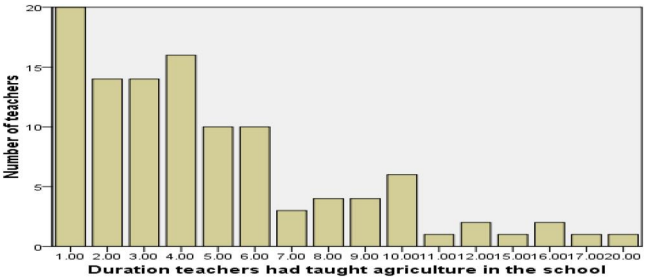

Figure 3. Graph of the number of teachers against the duration of stay in the school in years.

Table 5. Agriculture students' population per class.

	Descriptive statistics				
	N	Lowest	Highest	Mean	Std. deviation
Form one	106	5	290	57	42.31
Form two	107	8	119	42	22.40
Form three	105	4	95	32	17.58
Form four	106	1	100	29	19.37

4.3.2. Agriculture students

Class sizes varied widely (Table 5), with some form one classes ranging from 5 to 290 students. Such disparities imply unequal teacher–student interaction and differences in the capacity for hands-on learning. Larger classes may dilute practical exposure, affecting skill development for food security.

4.3.3. Parents and home contexts

Most parents (77.3%) resided in rural areas and 93.5% grew up on farms, suggesting they were well-positioned to observe and assess their children's agricultural practices. A majority (74.5%) also studied agriculture in secondary school, providing a shared knowledge base with their children (Figure 4).

A total of 302(93.5%) parents reported that indeed they were brought up on the farm whereas only 6.5% grew up in urban areas as indicated on Figure 5. This rural background reinforces the home as a potential site for practical application of school-based agricultural skills, consistent with Osongo (2014) and Njoroge and Orodho (2014), who highlight the centrality of rural households in Kenya's agricultural livelihood systems.

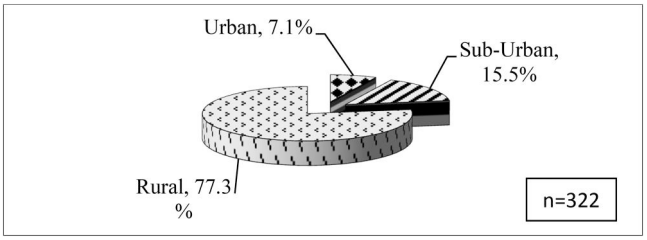

Figure 4. Parents' area of residence.

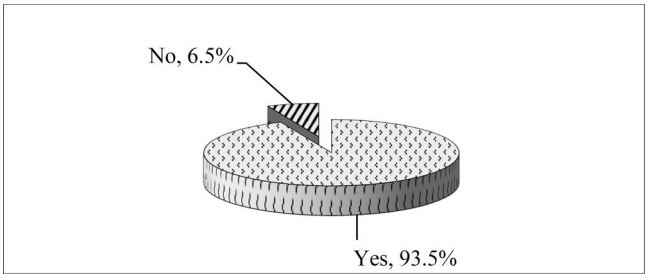

Figure 5. Proportion of parents who grew up in the farm. $n = 322$.

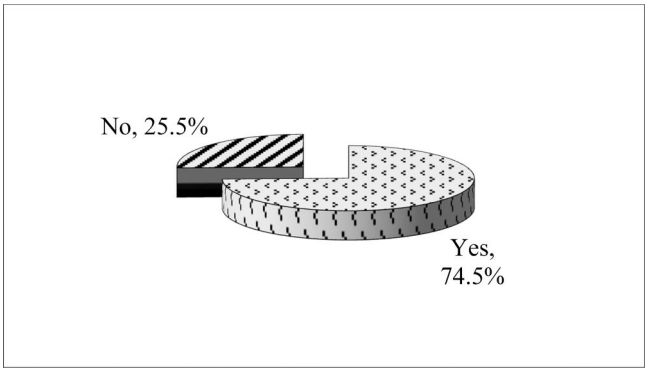

Figure 6. Parents' attendance at secondary schools that offered agriculture classes.

The study further sought to find out whether the same parents had attended a secondary school that offered agriculture as a subject. Their responses are shown in Figure 6.

The study observed that a total of 237(74.5%) parents had attended secondary schools that offered agriculture classes with only a very small proportion of 81(25.5%) parents reporting that the secondary schools they attended did not offer agriculture classes. This implies that the majority of the parents had an idea of what agriculture entailed. Such parents could further tell how the skills developed in their children could be applied to food security. This therefore would have translated to what they would have expected from their children.

4.4. Perceived roles of agriculture students in enhancing food security

Across stakeholder groups, five student roles emerged: learner, informant, implementer, innovator and trainer of trainers. Synthesizing these perceptions reveals hierarchies of recognition, role awareness and gaps in practice.

4.4.1. Students' self-perception of their roles

The study sought to establish the respondents' opinions on the role of the agriculture student in enhancing food security.

4.4.1.1. Students as learners. Most students (322 out of 376) saw themselves primarily as learners acquiring foundational knowledge. Their reflections (Excerpt 1, 2, 3) show that agricultural learning shapes future aspirations and readiness to apply skills in real-life settings. Students with no prior exposure to agriculture exhibited role-identity gaps, illustrating a disconnection between primary and secondary curricula.

> Excerpt 1: 'I had no idea of agriculture in secondary school because it is not done in primary school'. This excerpt implies that those who did not know that Agriculture was learnt in secondary school may equally not have known their roles as learners in enhancing food security and nutrition.
>
> Excerpt 2: 'I am likely to do agricultural engineering'.
>
> Excerpt 3: 'I intend to become my farm manager'.

The above two responses indicate that a good number of the agriculture students recognized their role as learners in enhancing food security even in their future careers.

4.4.1.2. Students as informants. All 376 students viewed themselves as informants capable of identifying gaps in instructional practices. Their requests for more demonstrations, technical experts and practical sessions signal a desire for experiential learning that aligns with constructivist educational principles.

> Excerpt 4: 'We need technical experts to come and demonstrate practices such as grafting, budding and hoof trimming. We may not afford to pay for tours and field trips all the time hence some miss out in such practices'.
>
> Excerpt 5: 'I think we need to have practical sessions on the school timetables in the form of double sessions. We also need to have a well-equipped agriculture laboratory. We do not need to wait until we are in form four to carry out agriculture projects'.

The responses in the above cases indicate that given a chance, agriculture students can contribute to food security policies by proposing areas of improvement to enhance food security and nutrition. This can be done through recommendations at the end of learning sessions as well as inviting them to present their project findings.

4.4.1.3. Students as implementers. A large proportion (342 students) believed they were applying learned skills, demonstrating agency through problem-solving (e.g. Excerpt 6 and 7). These examples highlight how school-based knowledge directly enhances household food security, particularly through improved postharvest management.

> Excerpt 6: 'We were taught how to fence our farms to prevent large animals from invading our crops'.
>
> Excerpt 7: 'My grandmother's granary has always been a habitat for rats…after being taught the qualities of a good food store, I made rat guards and sealed all the holes. For a year, we have not seen rats in the granary'.

4.4.1.4. Students as innovators and trainer of trainers. Students did not perceive themselves as innovators or trainers. This lack of role recognition suggests curricular or pedagogical gaps that limit student-led knowledge transfer and innovation roles critical for addressing emerging food security challenges.

4.4.2. Teachers' perceptions of student roles

Teachers perceived students more broadly than students perceived themselves.

Table 6. Relative amount of time spent on various class activities in an ideal forty minutes agriculture lesson.

Activity	*N*	Lowest	Highest	Mean	Std. Dev.
Teacher explaining to the whole class	108	10.00	80.00	35.2	16.9
Teachers giving notes	104	4.00	80.00	21.5	13.9
Whole class discussion	105	5.00	50.00	17.4	10.3
Students making their own notes	101	1.00	40.00	14.8	7.5
Students doing practical activities in small groups	100	1.00	40.00	15.2	8.8

Table 7. Agriculture teachers' opinions on the students' frequency of the use of the skills developed for food security.

			Most often		Often		Least often	
Agricultural practice	*N*	Median	*n*	%	*n*	%	*n*	%
Nursery practices	106	2	22	20.8	60	56.6	24	22.6
Ploughing	104	3	8	7.7	43	41.3	53	51.0
Irrigation	103	2	15	14.6	47	45.6	41	39.8
Soil and water conservation	105	2	22	21.0	55	52.4	28	26.7
Livestock producing e.g. poultry	106	2	19	17.9	38	35.8	49	46.2
Pest and disease control	106	2	16	15.1	54	50.9	36	34.0
Crop propagation e.g. budding	106	3	13	12.3	34	32.1	59	55.7

4.4.2.1. Students as learners. All teachers (100%) regarded students as learners. Table 6 confirms that instruction remains teacher-centered, dominated by explanations and note-giving, leaving limited time for practical activities. This mismatch between syllabus demands and instructional time constrains mastery of hands-on skills.

4.4.2.2. Students as innovators. Nearly half of teachers (43.2%) identified student innovation such as creative vegetable production in constrained spaces indicating potential for scaling youth-led solutions.

4.4.2.3. Student as trainers of trainers. Most teachers (97.2%) believed students could train peers and community members through Young Farmers' Clubs and academic events, suggesting teachers see students as change agents beyond the classroom.

4.4.2.4. Students as informants. Teachers (99.1%) acknowledged students as sources of policy-relevant feedback, especially through KCSE project reports that highlight pedagogical and content-related challenges (e.g. difficulty with agricultural economics topics).

4.4.2.5. Students as implementers. Teachers also recognized students' application of skills (Table 7). Skills like nursery establishment, soil conservation and irrigation were frequently applied, while practices requiring more resources (e.g. ploughing, grafting) were less common.

4.4.3. Parents' perceptions of student roles

Parents mainly saw their children as learners (90.1%) and implementers (32.8%).

4.4.3.1. Students as learners. Most parents valued agriculture as an elective subject and would support their children's selection of the subject (Figure 7), acknowledging its contribution to household livelihood and food security.

4.4.3.2. Students as implementers of food security. Parents reported frequent application of several skills such as livestock production and soil conservation (Table 8). These practices require minimal capital, explaining their prevalence. More complex or resource-intensive skills (e.g. budding, irrigation) were less frequently used.

4.4.3.3. Students as informants, trainers and innovators. Parents did not identify students as informants, trainers or innovators; possibly due to traditional expectations of schooling that emphasize learning and immediate application rather than broader leadership roles.

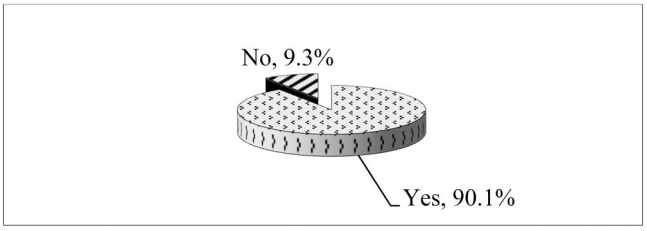

Figure 7. Percentage proportion of the parents' opinions that their children to do agriculture as an elective subject.

Table 8. Parents' opinions on the frequency of the use of the skills developed for food security.

			Most often		Often		Least often	
Practice	*N*	Median	*n*	%	*n*	%	*n*	%
Nursery practices	295	2	121	41.0	107	36.3	67	22.7
Ploughing	293	2	145	49.5	79	27.0	69	23.5
Irrigation	289	2	117	40.5	85	29.4	87	30.1
Soil and water conservation	299	1	152	51.5	94	31.9	49	16.6
Livestock production e.g. poultry and rabbitry	295	1	168	56.2	85	28.4	46	15.4
Pest and disease control	297	2	145	48.8	86	29.0	66	22.0
Crop propagation such as budding and grafting	297	3	121	41.0	107	36.3	67	22.7

Source: Field data.

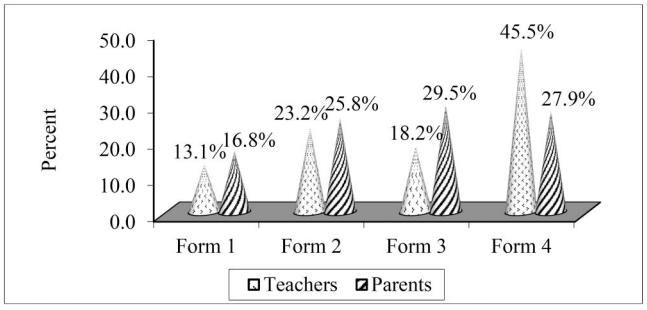

Figure 8. The level at which the students were very active in the use of the agricultural skills developed. $n = 111$ Teachers and 323 parents.

4.5. Alignment between teachers and parents

Both groups observed higher student activity in forms three and four (Figure 8), indicating cumulative learning effects and increased competence in later years.

4.6. Ways to improve practical agriculture for food security

Parents recommended several enhancements including modern farming technologies, innovations such as sack gardening, exposure through agricultural shows and better record-keeping skills. Community-level improvements included access to certified seeds, tax-free inputs, agroforestry, improved health services, transport infrastructure and free extension services. These suggestions highlight a desire for stronger integration between schools, households and broader agricultural systems.

4.7. Correlational analysis across stakeholder opinions

The researchers further established whether there is any correlation between the respondents' opinions on the role played by the agriculture students in enhancing household food security. Table 9 is a presentation of the summary of the respondents' opinions before carrying out the correlational analysis.

The analysis was conducted to determine the degree of association among the opinions of Agriculture Students, Agriculture teachers and Parents/Guardians regarding the role of agriculture students in enhancing household food security. The Pearson's correlation coefficients (r) and their corresponding p-values are presented in Table 10.

Table 9. Summary of the respondents' opinions on the role of the agriculture student in enhancing food security.

Theme	Agriculture students' opinions ($n = 376$)	Agriculture teachers' opinions ($n = 111$)	Parents'/guardians' opinions ($n = 323$)
The student as a learner	322 (85.6%)	111 (100%)	291 (90.7%)
The student as an innovator	0 (0%)	48 (43.2%)	0 (0%)
The student as an informant of policy	376 (100%)	110 (99.1%)	0 (0%)
The student as a trainer of trainers	0 (0%)	108 (97.2%)	0 (0%)
The student as an implementer of strategies and policies	342 (90.9 %)	106 (95.5%)	106 (32.8%)

Table 10. Correlational relationship between the respondents' opinions on the role of the secondary school agriculture student in enhancing household food security.

	Agriculture students	Agriculture teachers	Parents/guardians
Agriculture students	1.00 ($p = 1.000$)	0.62 ($p = 0.263$)	0.49 ($p = 0.403$)
Agriculture teachers	0.62 ($p = 0.263$)	1.00 ($p = 1.000$)	0.38 ($p = 0.533$)
Parents/Guardians	0.49 ($p = 0.403$)	0.38 ($p = 0.533$)	1.00 ($p = 1.000$)

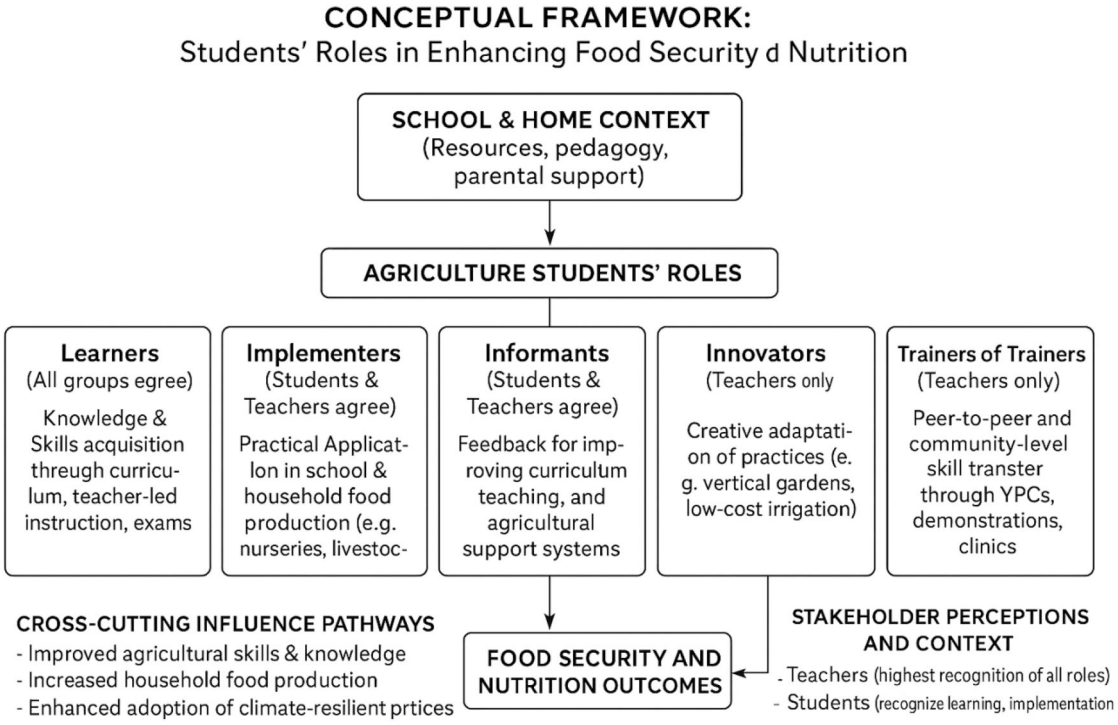

Figure 9. Perceived roles of agriculture students in enhancing food security and nutrition.

The correlations show moderate but non-significant positive relationships among students', teachers' and parents' perceptions of student roles. The highest alignment is between students and teachers ($r = 0.62$), likely reflecting shared engagement in the learning process. Weak correlations involving parents suggest differing expectations or limited visibility into school-based activities.

The lack of statistical significance is attributed to the small number of thematic variables ($n = 5$), reducing statistical power. Future studies should include more indicators or larger sample sizes (Figure 9).

4.8. A conceptual framework diagram summarizing the students' roles and relationships

5. Discussion

The study findings established that the parents, agriculture teachers and the learners themselves perceived that the agriculture students had a role to play as learners, innovators, informants of policy

development, trainer of trainers as well as implementers of agriculture policies and strategies. These observations are in tandem with those of Adom (2017), YPARD (2017) and Lohento and Ajilore (2015).

From the descriptive statistics, as innovators, the youth in school can be involved in the multi-stages of the food system production, processing, distribution and nutrition awareness. The study findings are supported by several national and international policies that engage youth innovation for food security and nutrition. These include the Kenya Youth Agribusiness Strategy (2017–2021), the Agricultural Sector Transformation and Growth Strategy (ASTGS 2019–2029) and the National Food and Nutrition Security Policy (NFNSP) which support capacity-building and inclusion of youth in decision-making, technology adoption and food system innovations (GoK, 2011).

As innovators, students can help introduce new technologies while also learning from traditional methods, holding the potential to offer the perfect fusion of new and traditional solutions to some of the world's biggest challenges. In a study (Njura et al., 2020), new technologies can be introduced through teaching secondary school agriculture in the psychomotor domain. The fusion of the traditional knowledge into the new one can effectively be done by engaging the students, the surrounding community, the agriculture teacher as well as extension officers in projects that can ultimately benefit all (Njura et al., 2020). Secondary school agriculture is therefore expected to develop knowledge and skills for learners so that they can fruitfully engage in practices that contribute to food security at the household level.

The current study recommends the importance of the creation and promotion of nutrition knowledge in secondary schools through the establishment, implementation and strengthening of young farmers' clubs for demonstrations on the production of nutrient-rich foods that promote nutrition and health. This will ultimately lead to the achievement of optimal nutritional health and active life for every individual in the school. In addition, the provision for the capacity of school management and teachers on early identification of health and nutrition problems and timely referral for appropriate action would be handy to enhance the promotion of innovation in crop production and utilization.

The study further established that stakeholders had the opinion that the youth in school had a role to play as a learner. These findings are supported by policies and programmes such as the Kenya Youth Development Policy (2019) the Kenya National Nutrition Action Plan (KNAP) 2018–2022 The Agricultural Sector Transformation & Growth Strategy (ASTGS, 2019–2029, the Home-Grown School Meals Programme (HGSMP) and the Food4Education.

Based on the opinion of the agriculture teachers on their students as learners, there is a clear indication that varied teaching methods such as discovery/problem-solving methods can improve innovation in the learning process. This has a positive attribute to the implementation of the food security agenda through the students as learners. Poor teaching methods such as spending most time giving notes and explaining rather than students discovering and participating in practical activities had a negative implication on gaining adequate skills in the learning process to enhance food security. The agriculture students can further enhance household food security through learning opportunities in school. This is evidenced by the opinions of the students in their groups, the agriculture teachers (100%) as well as the parents (90.1%). These findings are in tandem with those of MoALF (2017) in that nutrition education can be a long-term measure in addressing the challenges of malnutrition by fostering long-term healthy eating habits.

The food industry is highly diverse and comprises several important components. Each component adds distinct value to the whole food chain by improving sustainability and producing better products (FAO, 2019). In the context of the current study, secondary school students can be trained so that they can participate in the food chain. For instance, as learners, they can be trained in the food processing of fresh products into canned and packed goods. They can also be trained in advertising and marketing skills to inform others about the production and utilization of agricultural products.

As implementers of food security and nutrition policies and strategies, national programmes such as the Integrated Country Approach (ICA) which is a FAO initiative, opportunities for Youth in Africa (OYA) by FAO, United Nations Industrial Development Organization (UNIDO) and African Union (AU) support this role. The integrated approach adopted by FAO, UNIDO, and the AU to create quality on-and off-farm employment opportunities for African youth through improved skills, strengthened agricultural value chains and supportive institutions further strengthens this role. The 4K Clubs and Young Farmers

Clubs Education Supports the National Food and Nutrition Security Policy and School Meals and Nutrition Strategy enhancing food security and nutrition through its implementation agenda.

The study further established that the agriculture students had a role to play as informants of food security and nutrition policies. The findings are supported by 2022 FAO's Integrated Country Approach (ICA), the International Livestock Research Institute (ILRI), the YPARD, IFPRI and the Agriculture, Nutrition and Health Academy (ANH Academy). The Agriculture teachers for instance commented that students recommended in the KNEC agriculture project reports the need to reorganize the topics so that agricultural economics could be covered earlier in books two or three giving students humble time to revise the mathematical concepts that challenged them several times. This would also open students to more career paths related to agricultural economics which can be applied in food production hence its security.

The study further established that agriculture students were capable of being trainer of trainers. These findings are supported by programmes such the Farmer Business School (FBS), Food Forestry Training of Trainers, the FreshCrop, IFOAM & Biovision Africa Trust. For instance, in October 2020, IFOAM together with Biovision ran a regional ToToT in Nairobi for East African master trainers (IFOAM, 2020). From this pool, rural service providers often youth and students iimplement ecological organic agriculture models locally. A programme like the Eastern Africa Grain Council (EAGC) involves the trained youth to train smallholder farmer organizations and grain hubs (EAGC, 2024).

The participation of the student in school-community-based projects such as tree planting and involvement in food production in school clubs would help the students meet their roles as learners, innovators as well as implementers of the food security policies and strategies. This can be exemplified by lessons from FAO where the Developing Capacity for Strengthening Food Security and Nutrition in Selected Countries of the Caucasus and Central Asia project implements three different 'School Food and Nutrition Programme' linked to the Agricultural Sector pilots in Armenia, Kyrgyzstan and Tajikistan. The Organization's strategy is to link local farmers with school food and nutrition programmes to boost the local economy and encourage community involvement (FAO, 2020). In this regard, children learn how to grow healthy food while simultaneously learning about sustainable food cultivation.

Despite the various shocks to agricultural production, more can be done to address food security and nutrition at the lower level by involving learners at school. Schools can sustainably develop the skills of pupils and students accelerating the implementation of the food security and nutrition agenda. In this regard, governments will be able to feed its growing population by engaging the young generation which is the cohort of the targeted future farmers.

This study advocates that besides targeting the smallholder farmer, the government can benefit a lot in the implementation process by tapping the inbuilt talents of secondary school agriculture students. The inbuilt potential of the youth can be exploited if they are well engaged in agriculture. Farm Africa for example discovered that most pupils in Kenyan schools lacked access to training and education on farming and therefore were not being encouraged to perceive agriculture as a future career (FARM Africa, 2020). Therefore, Farm Africa initiated a project where students, as learners were shown how to grow high-value crops, keep livestock and market produce for global markets. The secondary school student can therefore learn with a mindset that there is a future career to venture into after school.

Results from the correlational relationships show some discrepancies in the stakeholders' opinions. The correlations suggest that while there is some positive alignment among the three groups, particularly between students and teachers, none of the relationships reached statistical significance. The limited sample size of only five themes reduces statistical power, which may explain the high p-value. The researcher therefore recommends additional themes for a larger data set in any other related study.

6. Conclusion

This study investigated stakeholder perceptions of the role of secondary school agriculture students in enhancing household food security, drawing on insights from students, agriculture teachers and parents/guardians. Across these groups, there was a shared recognition that agriculture students contribute meaningfully as learners, innovators, trainers of trainers, policy informants and implementers of food

security strategies. These perceptions demonstrate that secondary school agriculture education possesses untapped potential to strengthen Kenya's broader food and nutrition security agenda.

However, the study also revealed significant gaps most notably the absence of explicit policy frameworks guiding how students' knowledge, innovations and field-based insights can be systematically integrated into household, school-level and national food security initiatives. Without structured avenues for student participation in policy dialogue or community engagement, much of their potential remains underutilized.

The study further makes actionable recommendations for policy and curriculum development which include:

1. Institutionalizing student participation mechanisms
   This is by establishing formal platforms such as school agriculture councils, youth advisory committees, or county-level student agriculture forums through which agriculture students can articulate their views and contribute evidence to food security planning processes.
2. Strengthening curriculum alignment with food security priorities
   There is need to revise the secondary agriculture curriculum to embed practical competencies in climate-smart agriculture, household nutrition, agribusiness and community extension, ensuring students are better equipped to support household-level food systems.
3. Enhancing school–community linkages
   This can be achieved by developing structured community engagement programmes where students can apply agricultural skills in real household and community contexts, supported by teachers and extension officers.
4. Providing teacher professional development
   There is need to equip agriculture teachers with training on participatory pedagogy, innovation mentoring, and community extension approaches to better support students' roles as trainers, informants, and implementers.
5. Integrating student-generated data into local decision-making
   Counties and schools need to be encouraged to utilize student-led farm records, environmental assessments and community food security surveys to inform localized food and nutrition strategies.

7. Study limitations

This study was geographically limited to selected secondary schools within a specific region, which may constrain the generalizability of its findings to other counties with different socio-economic or agro-ecological contexts. Additionally, the study relied on self-reported perceptions, which may not fully capture the actual practices or constraints experienced by households and communities.

8. Directions for future research

Future studies should:

Examine the relationship between stakeholder perceptions and actual student engagement outcomes in food security interventions.

Expand the scope to include diverse counties and agro-ecological zones to improve representativeness.

Explore the longitudinal impact of agriculture education on graduates' roles in household and national food systems.

Identify additional emerging themes such as digital agriculture, climate adaptation skills and youth agripreneurship that influence students' capacity to contribute to food security.

Acknowledgements

The author wishes to acknowledge the immense support of the co-author for his contribution in developing this paper. She also acknowledges the Office of the County Director of Education Embu County and those of the

principals in secondary schools in the county for allowing for data collection. Further the author acknowledges the agriculture teachers and the students who participated in the interviews and the focus group discussions respectively. Further, the authors acknowledge the Chat GPT AI platform for helping in formatting of the entire manuscript.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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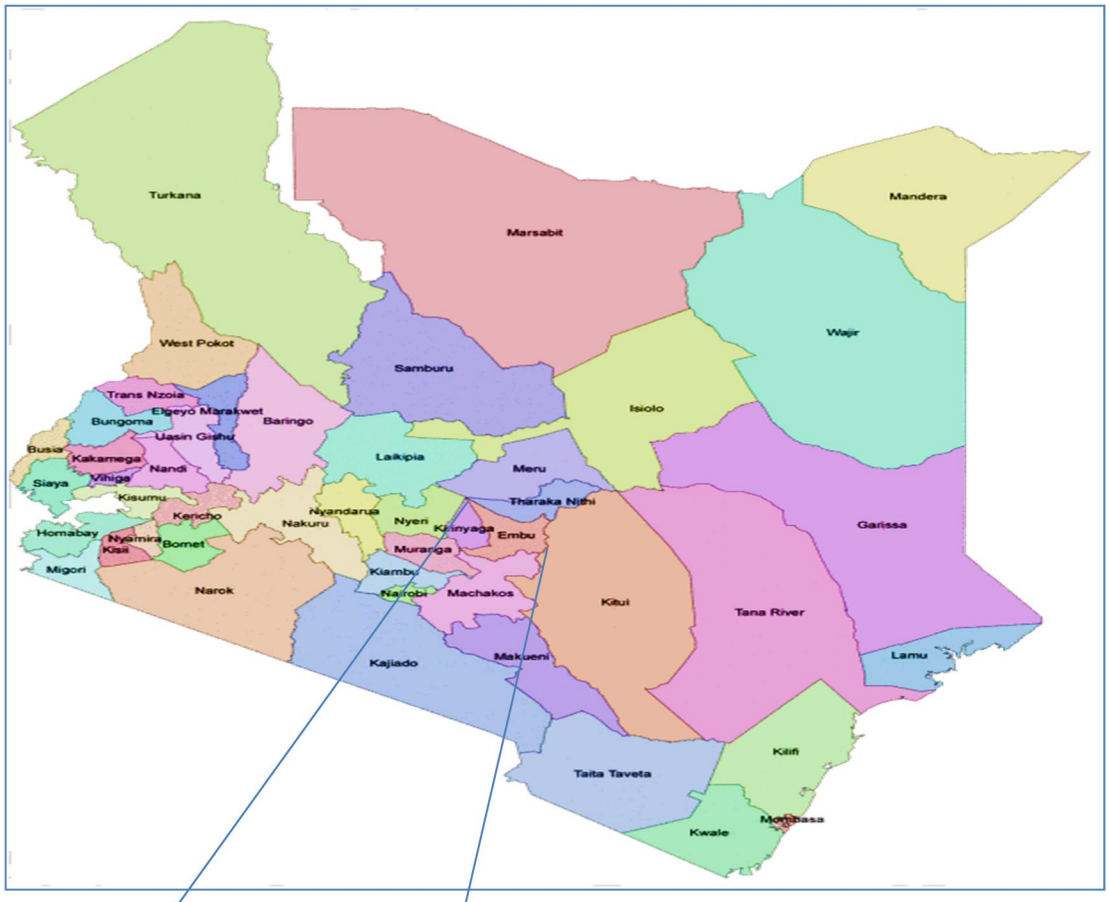
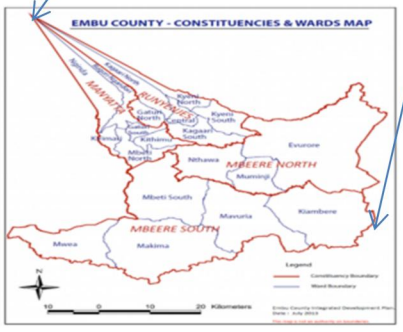
Appendix A. Map of Kenyan counties





Appendix B. Sample size determination

Table 3.1

Table for Determining Sample Size of a Known Population

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	346
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	354
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	191	1200	291	6000	361
45	40	170	118	400	196	1300	297	7000	364
50	44	180	123	420	201	1400	302	8000	367
55	48	190	127	440	205	1500	306	9000	368
60	52	200	132	460	210	1600	310	10000	370
65	56	210	136	480	214	1700	313	15000	375
70	59	220	140	500	217	1800	317	20000	377
75	63	230	144	550	226	1900	320	30000	379
80	66	240	148	600	234	2000	322	40000	380
85	70	250	152	650	242	2200	327	50000	381
90	73	260	155	700	248	2400	331	75000	382
95	76	270	159	750	254	2600	335	1000000	384

Note: N is Population Size; S is Sample Size *Source: Krejcie & Morgan, 1970*

Appendix B1. Sample size determination for a known population.

Population (N)	Sample (S)	Population (N)	Sample (S)	Population (N)	Sample (S)	Population (N)	Sample (S)
10	10	20	19	30	28	40	36
50	44	60	52	70	59	80	66
90	73	100	80	110	86	120	92
130	97	140	103	150	108	160	113
170	118	180	123	190	127	200	132
250	152	300	169	350	186	400	196
450	205	500	217	600	234	700	248
800	260	900	269	1000	278	2000	322
3000	341	4000	351	5000	357	10000	370
50000	381	100000	384	1000000+	384		

Source: Krejicie & Morgan (1970).

Appendix C. Parent's questionnaire

This questionnaire seeks your opinions on the role of the secondary agriculture student in implementing the food security agenda in Kenya. There is no right or wrong answer to each question. The information you give will be used to improve the teaching of agriculture in Kenyan secondary schools with the aim of improving food security. This information will be treated with absolute confidentiality then aggregated and summarized for inclusion in a research report.

Part A: Bio Data

1. How would you classify where you currently live (tick as appropriate)

Urban ☐
Sub-Urban ☐
Rural ☐

2. Did you grow up in a farm?

Yes ☐
No. ☐

3. Did you attend a secondary school that offered agriculture classes?

Yes ☐ No ☐

Part B: Opinions on the use of the skills developed for food security.

1. Given a chance to decide, would you choose your child to do agriculture as an elective subject?

Yes ☐
No ☐

b. If yes, state three reasons

……
……
……
……
…… ……

2. If your child already does agriculture, rate how often the skills developed are applied in the following practices. Use the scale of 1 = most often, 2= often and 3 = least often.

Practice	1	2	3
Nursery practices			
Ploughing			
Irrigation			
Soil and water conservation			
Livestock production e.g. poultry and rabbitry			
Pest and disease control			
Crop propagation such as budding and grafting.			
Any other			

3. If the child has reached form four, at what level was he/she very active in use of the skills?

Form 1…….
Form 2…….
Form 3…….
Form 4…….

4. In your own opinion, have the agricultural skills resulted into increased food security?
5. Suggest five ways that can be done to improve the level of participation of the youth in school to improve food security in your home through your child.

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Appendix D. Agriculture teachers' interview schedule (ATIS)

The following information seeks your opinions concerning the role of the secondary school agriculture student in implementing the food security agenda in Kenya. Please answer the questions to the best of your knowledge. Your opinions will be treated with maximum confidentiality.

Part A: Bio data.

1. Is your school private of public (tick?)

Private …… Public …….

2. For how long have you taught agriculture in this school…….
3. What is your estimated agriculture students' population per class?

Form one…… Form two…… Form three……. Form four…….

Part B: Opinions on the of the secondary school student in implementing the food security agenda.

1. Various teaching/instructional methods are employed in agriculture classes. Indicate the methods you personally employ in class and the percentage weekly use of each teaching approach identified.
   Teaching approach Percentage weekly use.
2. Estimate the percentage length of the teaching time spent on each of the methods listed. (Distribute the percentage so as to add up to 100%).
   Instructional method Percentage (%) Reason.
3. What are your opinions on percentage contribution of each of the teaching approach you employ to skills development for food security?

Teaching approach	Percentage contribution to skills development

Part D: Opinions on the Students' use of the skills developed in agriculture for food security.

1. Rate how often your students apply the skills developed in the following practices within the school. Use the scale of 1 = most often, 2= often and 3 = least often.

Practice	1	2	3
Nursery practices			
Ploughing			
Irrigation			
Soil and water conservation			
Livestock production e.g. poultry and rabbitry			
Pest and disease control			
Crop propagation such as budding and grafting.			
Any other			

2. At what level are the students very active in use of the skills?
   Form 1…… Form 2…… Form 3……Form 4…….
3. In your own opinion, has the agriculture student optimally employed the skills developed for food security within the school community?
4. Suggest five ways of improving the participation of the youth in school for improved food security around the school community.

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5. How would you rate the contribution of the agricultural skills developed on students in achieving the aspects of food security listed below?

Aspects of food security	Strongly agree (1)	Agree (2)	Disagree (3)	Strongly disagree (4)
There is enough food for an active, healthy life				
The food is readily available when needed				
The food available is nutritionally balanced in many households				
The food available is safe to consumers				
There is steady supply of food for households				
The food is economically acquired by households.				

Appendix E. Students' focus group discussion guide (SFGDG)

A. Introduction

This guide is designed for a discussion lasting approximately 100–120 minutes in length.

1. First, I would like you to sit in a circle around the room and introduce yourselves (FIRST NAME ONLY) and your class.

B. General opinions about agriculture as a subject

First, give me three words that describe your feelings about agriculture.

PROBE: What are the most positive things about learning agriculture?

PROBE: What are the most negative things about learning agriculture?

C. Preparing for learning agriculture.

I would like you to think back to when you first joined secondary school, think about what you were told or what you heard about agriculture as a vocational subject.

1. First of all, how knowledgeable were you joining secondary school about what to expect from the experience and the academic opportunities that would be available after studying agriculture?
2. Do you think that you had a pretty good idea of agriculture as a subject in secondary school?
3. And thinking about the advice you received when you attended the first agriculture lesson, what were you told?
4. What were the resources or people that you relied on for guidance and direction on how best to decide on choosing agriculture among other elective subjects, opportunities and challenges? Who gave you the best advice? (DIRECTED TO FORM THREE AND FORM FOUR STUDENTS).
   (PROBE IF NOT MENTIONED :) What about… Friends.
   Parents/family Teachers.
5. How well do you think your high school agricultural education prepares you to produce food at home?
6. How good of a job is your school doing at meeting your expectations in skills development for food security?

D. Agricultural teaching approaches employed in learning for food security.

a. What approaches do your agriculture teachers use that you think develop relevant skills for food security?
   PROBE: In what areas do they excel? PROBE: In what areas are they falling short?
b. Role of the skills developed for food security
   Since you joined Form One, you were taught many skills that can be applied in food production through the approaches employed; mention such areas.
c. What more can be done during the teaching so that you may sustainably produce food in your homes?

HANDOUT A

On this handout you will find a list of reasons people may have for learning agriculture. Please circle the three that you think are the MOST important for food production, and then I'd like to go around the room and talk about what you picked. Please only pick three. Second, please put an X next to the two that you think are the LEAST important.

1. Agricultural education will bring more career choices and a greater number of job opportunities in food industries.
2. Agricultural education will provide me with the knowledge, skills, capabilities, ethics, and values that are essential for food policy and its production.
3. Agricultural education will help me to be a more critical thinker, an innovator and problem-solver, better able to adapt in today's ever-changing society and economy in times of food insecurity.

4. Agricultural education will provide me with the specific skills and knowledge required in the field in which I hope to work.
5. Agricultural education will help me to gain more knowledge that will be helpful throughout life-both on and off the job to bring food on the table.

What did you pick and why?

b. When it comes to agriculture as a practical subject, are there some skills that are more critical for the longer term and others that matter more for the shorter term to necessitate food production?

On a scale from A to F, what grade would you assign your school on the job it has done in preparing you for food production? A is excellent, F is fail.

a. What are the intellectual skills that are most important to attain?

b. What are the practical skills that are most important to attain?

(HANDOUT B)

1. This handout lists a variety of specific approaches that may help you in developing skills for and participate more in implementing the food security agenda in Kenya. Please circle the two YOU think are the most critical for success in agriculture. Second, please put an X next to the one that you think is the LEAST important for skills development.
   a. Students should be attending internships for around two weeks in an agricultural based institution to improve on: their ability to solve problems and think analytically, time-management skills, independent and critical thinking/reasoning skills and strong work habits.
   b. Greater commitment to involving technical experts from agricultural institutions to teach and train the practical aspect of agriculture in secondary schools.
   c. Increased instruction sessions through creation of adequate time for practicals aimed at food security.
2. Thinking about the approaches that you think are most important, how good a job do you think your school is doing at preparing you to be successful and ensuring that you have the knowledge, skills, and experience needed for food production and security?

PROBE: In which areas does it fall short? Where does it need to improve?

3. I would like to go around the room and have each of you tell me what benefits you would get from the approaches preferred.

C. WRAP-UP

1. To wrap things up, I'd like to go around the room and have each person tell me what one or two things you will take away from this discussion today. It can be anything relating to any of the areas we discussed over the last one hour.
2. Thank you very much.