MAKERERE UNIVERSITY

POTENTIAL OF SCHOOL GARDENING AS A LABORATORY FOR DEVELOPING LIFE SKILLS IN AGRICULTURE IN PRIMARY SCHOOLS: A CASE STUDY OF SOROTI AND KAMULI DISTRICTS, UGANDA

By

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DECLARATION

I, Apolot Stella, declare that this thesis is my own original work and that it has never been presented to any University or other institution for the award of a degree.

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DEDICATION

To my dear husband Samuel and children Joanne, Arnold and Allan

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List of Acronyms

DEO	District Education Officer
DIS	District Inspector of Schools
FAO	Food and Agriculture Organization of the United States
FDG	Focus Group Discussion
GoU	Government of Uganda
MDGs	Millennium Development Goals
MoES	Ministry of Education and Sports
NARO	National Agricultural Research Organisation
NCDC	National Curriculum Development Centre
PLE	Primary Leaving Examination
PTA	Parents Teachers Association
PSA	Primary School Agriculture
SMC	School Management Committee
UNEB	Uganda National Examinations Board
UPE	Universal Primary Education
WFP	World Food Program

ABSTRACT

School curricula in Africa have been argued to be dominated by competitive academic subjects and prioritize terminal examinations over practical skills and contextualized learning. Although it has been argued that schools can serve as platforms for reaching rural communities with farming innovations through pupils, school gardening is often viewed simply as a labor-based activity that offers few learning opportunities to pupils engaged in it, a majority of whom leave school without employability skills. This study was conducted in two primary (elementary) schools in Uganda to determine the potential of school gardening in providing life skills in agriculture and mitigating short-term hunger in UPE schools. Data were collected for a period of four school terms equivalent to two cropping seasons using qualitative methods of FGDs, interviews, and observation. Findings showed that there was strong interest by pupils to willingly participate in school gardening activities and enhanced learning transfer of skills from the school garden to pupils' home gardens. The agricultural clubs offered the social energy that formed the foundation for learning technical aspects of agriculture in a more supportive environment of work and fun. School gardening had a number of benefits to pupils such as acquisition of knowledge and practical skills on crop production (life skills), food eaten by pupils and teachers and people oriented skills such as leadership, teamwork among others. It is recommended that the various education stakeholders and the communities be exposed and engaged to appreciate the processes and outcomes of school gardening as a learning laboratory and as a strategy for self-sustainability of school feeding programmes. Furthermore, the primary school agriculture curriculum in Uganda necessitates review to include the practical component in the school timetables.

CHAPTER ONE

INTRODUCTION

1.1 Background

School curricula in Africa are dominated by competitive academic subjects and prioritize terminal examinations over practical skills and contextualized learning (Vandenbosch, Hagmann, Momoh, &Ngwenya, 2002). This has led to education systems in Africa being rated as - short of life skills that link well with the needs of rural communities (Vandenbosch, *et al.*, 2002). Whereas agriculture is the most important source of livelihood in the rural communities, its requisite knowledge and skills are largely acquired through experience and not so much through the education system. This phenomenon creates disconnect challenges to the relevance of education in preparing the young people for better livelihood.

In Uganda, the government white paper on 'Education for national integration and development', recommended Universal Primary Education (UPE) programme and vocationalization of education through teaching of agriculture and other practical subjects (Government of Uganda, 1992). The UPE programme that was then introduced in 1997 faces a number of challenges including high dropout rates. Murphy (2003) estimated the dropout rate at primary school level at about 80%. Besides, less than 30% of the children who enroll in primary one complete primary seven yet most of these turn to farming as a source of livelihood (Kibwika, Okiror&Birungi-Kyazze, 2010). The new Primary School Agriculture (PSA) curriculum seeks to vocationalise the education system at primary school level as a response to the high UPE drop-out rates to enable the pupils gain some

transferable life skills in agriculture. However, five years after the introduction of the agriculture curriculum, it was still uncertain whether pupils actually made significant learning achievements in the subject and applied their school knowledge on home farms (Okiror, Kibwika, Matsiko&Oonyu, 2010). The concern is whether the education at primary level prepares pupils to earn better livelihood than their parents through agriculture.

Although it has been argued that schools can serve as platforms for reaching rural communities with farming innovations through pupils, in the case of Uganda, agriculture in schools is often viewed simply as a labor-based activity that offers few learning opportunities to pupils engaged in it, a majority of whom leave school without employability skills (Kibwika&Tibezinda, 1998). Learning agricultural production skills does not only benefit pupils after they dropout of schools, but it could also be of immediate benefit to them while in schools through school gardening. If properly applied, school gardening could enable the schools to produce food to partly cater for their school feeding programme. Lack of school feeding programme in the UPE schools has been identified as a major cause for school dropout. In this study, a school garden is *an agricultural plot around the school yard that lets educators to incorporate and sustain hands-on learning in a diversity of interdisciplinary standards - based lessons which connects pupils with their environment and local community food system* (researcher developed).

However, the National Curriculum Development Centre (NCDC) considers a school garden as *an out-door laboratory for teaching and learning of agriculture experientially and that it should have: experimental plots; nursery site; a livestock section; a crop museum; an*

*orchard and tree plantation (*NCDC, 2000*).* In this view school gardening presents great potential in providing life skills in agriculture and enabling the schools to be at least partly self - reliant in their school feeding programmes. The United Nations Food and Agricultural Organization (FAO, 2004) outlines several benefits of school gardening including: increasing the relevance and quality of education for rural and urban children through active learning and introduction of agriculture, nutrition knowledge to supplement school feeding programmes, life skills into the curriculum, providing school children with practical experience in food production and natural resource management as a source of innovation pupils can take and apply in their household gardens to the benefit of the whole family.

1.2 Problem Statement

Studies done so far on problems associated with practical teaching and learning of agriculture have been inclined to secondary school level of education and in relation to school dropouts' occupation (Ondia, 1995; Kibwika*et al* 2010). Several scholars are also of the view that primary school pupils can be an effective instrument for dissemination of agricultural information and practices in the community (Miiro&Orum, 2007; Okiror, *et al*., 2010) but they note that, this potential has not been fully exploited. Whereas school gardening has the potential to provide the much needed knowledge and life skills to the pupils, its uptake in UPE schools is largely dependent on the willingness and cooperation of various stakeholders including the pupils, teachers, parents, school management and the community at large.

Whereas most of the pupils who drop out at primary school level turn to farming as a source of livelihood (Kibwika, *et al.*, 2010), there is limited literature available on how to impart life skills in agriculture in primary schools. On the other hand, the extent to which the various stakeholders perceive and adopt school gardening as a laboratory for imparting life skills, attitude change towards agriculture as well as an opportunity for schools to produce food to provide meals at school is the issue of contention. Whether pupils can transfer and integrate the acquired skills from the school garden into their community livelihoods is another issue for investigation. This study therefore set out to test the potential of school gardening in developing life skills and attitude change towards agriculture among pupils and for primary schools to serve as centers for agricultural knowledge in communities in Kamuli and Soroti districts.

1.3 Objectives of the Study

General objective

The general objective of the study was to establish the prospects and challenges of using school gardening as a laboratory for developing life skills in agriculture in UPE schools.

The specific objectives of the study were:

- To establish the benefits of school gardening as a learning laboratory to enhance knowledge and skills in agriculture in primary schools.
- To assess whether agricultural clubs can motivate and inspire pupils to learn and practice agriculture.

- To assess the transfer of knowledge and skills acquired from school gardening activities to the pupils' homes.
- To establish the attitudes of the pupils, teachers, parents and the local community towards school gardening.

1.4 Justification of the Study

This study fits within the broader context of vocationalizing primary education in Uganda. Agriculture was introduced in primary education in 2000 with the intention of developing production skills among the pupils but its teaching remains largely theoretical. Most rural primary schools have adequate land to establish school gardens but this opportunity has not been utilized to impart production oriented skills in agriculture. Further, the primary schools cannot support the school feeding programmes despite having adequate land for farming. This study is therefore important to assess the relevance of school gardening as a laboratory for imparting practical agricultural skills and whether this intervention would support the school feeding programme to mitigate the effects of short-term hunger that pupils experience while at school.

Establishing the potential of school gardening in providing life skills in agriculture and supporting school feeding programmes in UPE schools may provide feedback to National Curriculum Development Centre (NCDC) on how to implement and strengthen the practical aspects of teaching agriculture subject in primary schools. It would also improve on the relationship between the various education stakeholders in terms of how to best plan for a more beneficial integration of productive agriculture and life skills at the primary level

education in Uganda, a practical demonstration as well as easy access to agricultural information and technologies for communities.

The findings of this study may be beneficial to the ministry of Education and Sports (MOES) to identify gaps in agriculture curricula and as well provide information for the National Agricultural Education Policy (NAEP). The goal of NAEP is "to enhance positive attitudes, knowledge and practices for sustainable agriculture through provision of quality formal and non-formal agricultural education and training at all levels and to all" (MOES, 2004, pg 12).

By highlighting the benefits of school gardening, the findings may also assist the decentralized local governments in Uganda to link school gardening activities to agriculture extension service within their localities. The constitution of Uganda (GoU, 1995:2) and the Local Government Act (GoU, 1997:2) give power to districts and sub county local governments to plan, budget and provide services to their populations. One outcome of the decentralization policies is the National Agricultural Advisory Services (NAADS) through the NAADS Act of 2001 which empowers farmers to demand and control extension services. School gardening would benefit from funding assistance by local governments if such activities are incorporated into local government development plans. Parents can particularly play an important role in demanding that some of the NAADS activities should be channeled to the education of their children or themselves through the participation of primary schools.

1.5 Limitations of the Study

Given the intensity of engagement, the time and financial requirements, the study was conducted in one region (Eastern Uganda) and in only two districts of Kamuli and Soroti. Within each district, only one school was targeted. The sample size of 200 pupils in total (100 per school) constituted from P3 – P6 was small for such reason as for easy follow-up (Home visits) limiting the study to only a few pupils. This certainly creates the limitation of coverage, and therefore this study can only be regarded as a case study. Whereas the principles derived from the findings can be applied widely, the evidence may limit the level of generalization.

1.6 Definition of Key words

For the purpose of this study, the following terms were operationally defined by the author as follows:

A school garden: An agricultural plot around the school yard that lets educators to incorporate and sustain hands-on learning in a diversity of interdisciplinary standards - based lessons which connects pupils with their environment and local community food system. It is a living laboratory where lessons are drawn from real-life experiences rather than textbook examples, allowing pupils to become active participants in the learning process.

School gardening: An instructional strategy that utilizes a garden as a teaching tool or learning laboratory for imparting agricultural knowledge and skills to school children.

Agricultural knowledge: An understanding of the basic agricultural concepts and practices used in crop production right from planting to storage.

Life skills: Formal or informal component of basic education that includes practical (agricultural) skills that can be turned into production and last a lifetime. Includes such skills as critical thinking, cooperation, community service, self-discipline and wise use of resources.

Pupils: Children enrolled in the primary school, particularly those in primary three to primary six (P3 – P6) classes.

Transfer of learning: Application of the agricultural knowledge and skills learnt by pupils at school to farming situations in their homes/home gardens.

Attitude: An expression of favor or disfavor towards a person, place, thing, or event

CHAPTER TWO

LITERATURE REVIEW

This chapter provides a general review of the literature related to school gardening. The chapter is divided into sections that include: (a) the meaning and concept of school gardening (b) theoretical background of school gardening (c) significance of school gardening (d) school gardening in Uganda (e) the influence of school gardening on basic education (f) contribution of school gardening on children's health, nutrition and food security and (g) influence of school gardening activities on families and communities.

2.1 The Meaning and Concept of School Gardening

The philosophy behind garden-based education is an amalgamation of the philosophies behind experiential education, ecological literacy, environmental awareness, and agricultural literacy. In other words, it involves teaching children through personal discovery in natural settings, where they learn ecological principles that govern all life, as well as develop a sense of connection with the land (Sealy, 2001) As far back as the seventeenth century, John Amos Comenius (1592–1670) believed that education should be universal, optimistic, practical, and innovative and should focus not only on school and family life but also on general social life. He stated "A school garden should be connected with every school, where children can have the opportunity for leisurely gazing upon trees, flowers and herbs, and are taught to appreciate them" (Weed, 1909, cited in Sealy, 2001). For the purpose of this study, *school gardening* is envisaged as an instructional strategy that utilizes a garden as a teaching tool/learning laboratory for imparting agricultural knowledge and life skills as well as providing food to primary school children. *A school garden* in this study is defined

as an agricultural plot around the school yard that helps the school to create and sustain hands-on learning which connects pupils with their environment and local or community food system (Researcher developed).

2.2 Theoretical Background of School Gardening

The application of the pedagogy within Garden Based Learning falls principally under one of the two frame works: Experiential education and or environmental education. In theoretical terms, School Gardening finds relevance in a number of contemporary educational theories (Desmond *et al*., 2003) including: Howard Gardner's (1983) theory on multiple intelligences, naturalist intelligence (Gardner, 1999), and Daniel Goldman's (1995) theory of emotional intelligence. Howard Gardener's theory of multiple intelligences and Daniel Goldman's conceptualization of emotional intelligence have contributed to the value of experiential education. Gardner (1999) claims that just as most children are ready to master language at an early age, so too are they predisposed to explore the world of nature. In a socio-ecological model of a child's outdoor landscape (Moore and Young, 1978), it is theorized that a child lives simultaneously in three interdependent realms of experience namely; the physiological environment of body/mind, the sociological environment of the interpersonal relations and cultural values as well as the physiographic landscape of spaces, objects, persons, natural and built elements. Development psychologists have tried to study children's relationship with nature and whether an innate sense of kinship with nature manifests itself by the time children reach a certain age (Tuan, 1978). However, Cobb (1969) indicated that middle childhood, approximately from 5 to 12 years of age is the period between the "*strivings of animal infancy and the storms of adolescence*". Cob also

identified this period as to when the “natural world is experienced in some highly evocative way”. Additionally, Tuan (1978) suggested that children have to be taught by adults about their natural environment, as “nature is an inarticulate teacher”. This is the reason why much of the activity in gardening is classified as environmental education.

2.3 Significance of School Gardening

Elsewhere around the world, garden-based-learning is an instructional strategy that is becoming a vibrant area of study (Desmond *et al*. 2003). The proponents of this teaching approach argue that whether it occurs under the definition of: environmental education, ecological literacy, agricultural literacy, or agricultural education, garden-based learning has the potential to contribute to basic education in both developed and developing world settings. The FAO (2004) identifies three broad objectives for school gardening as follows:

*“(1) Increasing the relevance and quality of education for rural and urban children through active learning, introduction of agriculture and nutrition knowledge and skills as well as life skills into the curriculum; (2) Providing school children with practical experiences in food production and natural resource management, which serve as a source of innovation they can take home to their families and apply in their own household gardens and farms;(3) Improving school children’s nutrition by supplementing school feeding programmes with a variety of fresh micronutrients and protein rich products and increasing children’s knowledge of nutrition, to the benefit of the whole family” (*pg 1 and 5*).*

In Sub-Saharan Africa, the arguments regarding the significance of school gardening have, however, generally been mixed. For example, it has been argued that, offering of practical

subjects like agriculture in basic education has been discouraging, mainly due to: the inability of school teachers to teach the practical aspects correctly; the negative attitudes of the rural populations that regard it a dead end; and the fact that the best basic education is a good general education (Okiror*et al* 2010). This view is supported by Riedmiller (2002) who identified the quality of school gardens as the single most important factor influencing the knowledge, skills and attitudes that pupils could gain from studying primary school agriculture. Bergmann (2003) argued that, although practical skills can enhance the relevance of education to rural life, general education should not be compromised by teaching such skills. However, Austin (1999) asserted otherwise that, content-based approaches to teaching – such as the examination driven teaching of agriculture - tend to make students passive as simple recipients of information without the practical involvement needed to encourage skill acquisition and transfer.

2.4 School Gardening in Uganda

In Uganda, following the recommendations of the Phelps-Stokes Commission of 1924, the colonial government recommended the teaching of biology at primary level to be accompanied with practical agriculture through school gardens (Ssekamwa, 1997). Many schools in Uganda have maintained school gardening as the only way of teaching agriculture, even when what takes place on them sometimes has nothing to do with classroom learning of the subject (Okiror *et al.*,2010). The Primary School Agriculture (PSA) curriculum prescribes that, a school garden is supposed to be an outdoor laboratory for the teaching and learning of agriculture; and should contain everything that teachers may need for teaching the pupils experientially. A school garden should therefore have:

experimental plots; nursery site; a livestock section; a crop museum; medicinal and spice plants plots; a fish pond; necessary farm structures; flower plots; beehives; orchard and tree plantation (NCDC, 2000, pg 10). Odurumuru, (1987) also argued that, the overall purpose of the school garden is to provide a wide range of learning experiences for pupils rather than simply making profits.

In light of the above and a bid to vocationalize the primary school curriculum, Uganda's Ministry of Education and Sports elevated agriculture into a stand alone subject at that level (NCDC, 2000). However, the quality of school gardens has remained an issue of major concern. This is because school gardening may simply be a labour-based activity that offers few learning opportunities to the pupils who engage in it, a majority of whom leave school without employability skills (Kibwika and Tibezinda, 1998).

2.5 Benefits of School Gardening as a Learning Laboratory

Basic education

Education is one of the most powerful instruments known for reducing poverty, inequality and for laying the basis for sustained economic growth (Bruns, Mingat & Rakotomalala, 2003). It is also asserted that, the prosperity of any nation depends on the extent to which its young people are prepared to engage in productive work (Kibwika*et al*., 2010). Primary education is the gateway to all higher levels of education that train scientists, teachers, doctors, and other highly skilled professionals that every country, no matter how small or poor, requires (Bruns, *et al*., 2003). The Dakar World Education Forum Goals also strive to; 1) Ensure that the learning needs of young people and adults are met through equitable access to appropriate learning and life skills programs. 2) Improve all aspects of the quality

of education and ensure excellence of all so that recognized and measurable learning outcomes are achieved by all, especially in literacy, numeracy and essential life skills.

While school gardening is an instructional strategy that utilizes a garden as a teaching tool, in many societies basic education is focused on developing academic (cognitive) skills, personal, moral and social development. It is also believed to provide vocational or subsistence training that allows the individual to provide food, clothing and shelter through employment or subsistence production (Desmond *et al*., 2003). However, the approach of basic education offered by the World Conference on Education for all (2000) presents another insight into the world of teaching and learning. It focuses on the philosophy of equal rights for all as stressed by the United Nations, taking into account the unique needs and culture of each community.

Teaching tool

Priscilla Logan, educational consultant and permaculture instructor from Santa Fe, New Mexico, identified four reasons for using gardens as a teaching method (Sealy, 2001): (1) High retention rate. When children work in gardens 90 percent of their experience is classified as hands-on. A study conducted by Bethel Learning Institute documented different student retention rates based on teaching method, with 11 percent retention for lectures, 75 percent for learning by doing, and 90 percent when students teach other students(2) Empowerment. A connection to the earth gives students a sense of achievement and motivation (3) Academics. Science, math, social studies, art, language, and many other subjects can be taught using nature as the learning laboratory, making these concepts more meaningful (4)Teamwork. Facilitating cooperation and communication in a real world

setting makes learning through teamwork possible; the class goal of a successful garden becomes more important than individual achievement. This is in agreement with Okiror*et al* (2010) conclusion that, application and/ or learning transfer of agriculture knowledge and skills depends on opportunities that are availed to pupils to practice at school and their homes. They argued that, both teachers and parents *ought* to offer supportive/ conducive (motivating) work environments for pupils to practice what they learn in classrooms. They also found out that, use of English language was a barrier in the communication of school knowledge to parents by the pupils. This led to their recommendation for the Primary School Agriculture (PSA) curriculum to be contextualized by revising it to incorporate use of local languages which are understandable to pupils and parents alike. Other studies have also shown gardening to have the potential to influence students in several positive ways. The hands-on and informal learning that occurs in these outdoor areas can be incorporated into all areas of the curriculum, fostering environmental awareness and increased interest in science (Haynes, et al., 2008). Blair (2009) also found out that, hands-on learning activities incorporated into subject matter are key components of experiential education in which environmental based education programs have been employed, emphasizing the development of lifelong learning skills, such as problem solving and critical thinking.

2.6 Influence of School Gardening on Children's Health, Nutrition and Food Security

Nutritional well-being requires access by all people at all times to *adequate food, health, education and social* care. The 1996 World Food Summit (WFS) held at FAO headquarters in Rome, and the World Food Summit: *five years later* (WFS:*fyl*) in 2002 reaffirmed the

right of everyone to have access to safe and nutritious food and to be free from hunger. Furthermore, the need to overcome hunger, poverty, and illiteracy is included in the first two Millennium Development Goals (FAO, 2004). School gardens have therefore been used to teach children about nutrition and how to make healthier food choices (Lineberger&Zajiceck, 2000). Okiror*et al* (2010) concluded that, school gardening not only leads to acquisition of knowledge and skills among pupils but also has potential to contribute to incomes and nutrition of rural households.

2.7 Influence of School Gardening Activities on Families and Communities

Hands-on involvement in children's designing, creating, caring for, and using school nature areas can help improve children's academic performance as well as instill the willingness and capacity to work for the communities of which they are a part (Bell, 2001). Bell also stated that teachers are gaining an appreciation for the potential of school ground projects that integrate disciplines, produce tangible outcomes and encourage children to build ties with their communities.

The Food and Agricultural Organisation's experience (FAO, 2004) has shown that, establishment of school gardens without the involvement of parents can create tensions within communities and that, school gardening and nutrition education have a greater impact that can be sustained longer if they are part of a programme involving the whole school and linked to activities which engage parents and the community. FAO (2004) also recommended that, it is essential to promote school gardens in the right context, i.e. as an applied activity with the potential for providing pupils with "life skills" and also increasing

their environmental awareness, especially in relation to the conservation of natural resources. Assisting in the creation of PTAs, where these do not exist, or supporting already established PTAs, is a constructive way to involve parents as partners in school-based gardening activities. Other good avenues for parents' effective involvement are through periodic visits to the school garden and through garden-related children's homework.

CHAPTER THREE

METHODOLOGY

This chapter describes the procedures and methods that were used to collect data and the tools for analysis and interpretation of results of the study. Specifically the chapter describes the study area, research design, process and procedure, target population, sampling strategies and sample size, data collection instruments and procedures, reliability and validity of the instruments and data analysis.

3.1 Description of the Study Area

The study was conducted in Soroti and Kamuli districts in Eastern Uganda. The two districts were purposively selected based on their relatively higher vulnerability to hunger, poverty incidences (Uganda Poverty Status Report, 2005) and being in two different cultural settings. The floods that occurred in Soroti and the neighboring districts also presented another dimension of vulnerability to food shortages in these areas. The Uganda humanitarian clusters report of 2007 indicated that, the unusually heavy rainfall that occurred in July 2007 to 2008 led to severe flooding and water-logging across many parts of eastern and northern Uganda, including the districts of Amuria, Bukedea, Kaberamaido, Katakwi, Kumi, and Soroti in the Teso sub-region. The most critical impact of the severity of flooding was in the Teso and Bugisu sub-regions. The flooding affected an already highly vulnerable area of Uganda in which the majority of households are dependent on subsistence agriculture.

3.2 Research Design

The study largely employed qualitative research using Case Study design applied in action research framework. The cases were the two schools. A case study was the most appropriate to explore questions of '*why'* and '*how'* (Yin, 2003) school gardening facilitated acquisition of life skills for primary school pupils, production of food for the school feeding programme and transferability of the knowledge and skills beyond the school. The qualitative approach was suitable for understanding relationships between the contexts in which school gardening is applied, mechanism – learning processes and outcome of school gardening. Qualitative techniques also helped in understanding the opinions of different stakeholders regarding school gardening. These opinions are constructed and may differ from one person to another depending on the context; therefore, a qualitative approach to exploring such issues was the most suitable (see Mason 2002, Onwilegbuzie& Leech 2007 and Silverman 2000).

Process and procedure

An elaborate research process and procedure was followed in setting up this study as illustrated below:

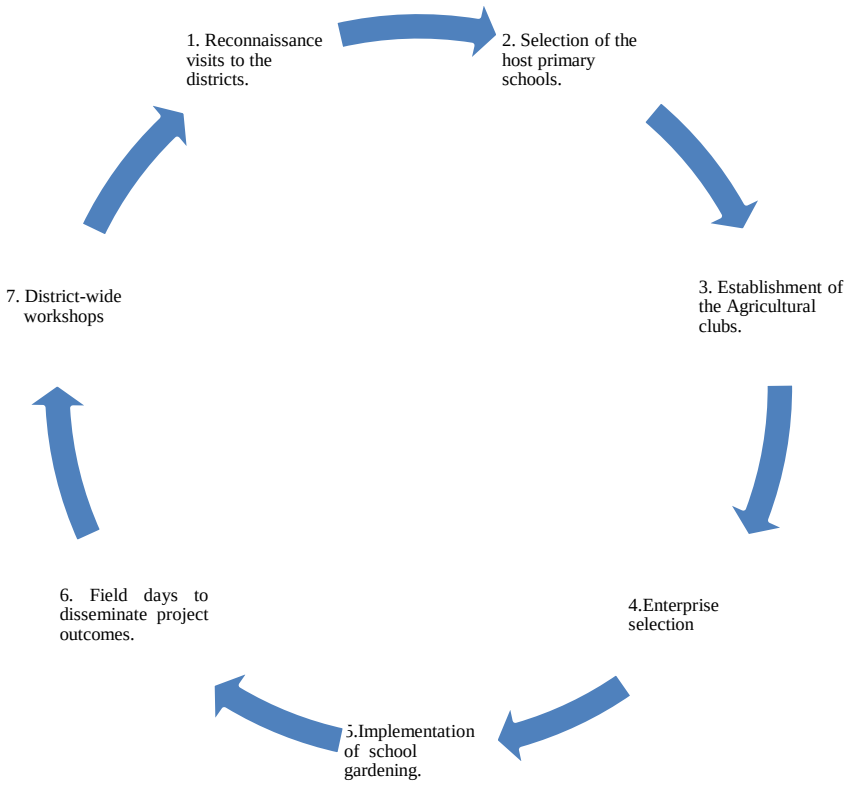


Figure 1: Research process and procedure (researcher developed)

3.3 Target population.

Sampling and Subject Selection

Teso and Busoga sub regions in Eastern Uganda were purposively selected. On one hand, the districts in the Teso sub region have particularly suffered from both human made ills such as insurgency, cattle rustling and natural calamities. Whereas, the districts in the Busoga region have been relatively stable. Soroti and Kamuli districts were selected based on their similar characteristics of higher vulnerability to floods and prolonged drought, higher hunger and poverty incidences rating (Uganda Poverty Status Report, 2005) and being in two different cultural settings to warrant comparison. Besides, these districts were among the districts in the country whose general performance in the Primary Leaving

Examinations (PLE) has nosed down over time for the worse (Oluka&Opolot Okurut, 2008). The choice of schools was based on such parameters as: availability of land for establishment of school gardens; ability of the school to serve as a learning centre for other schools in the area; commitment and enthusiasm of the school leadership.

The teaching of agriculture in Uganda schools was introduced by Alexander Mackay- a missionary as early as 1882. The Phelps-stoke's commission of 1924-25 recommended teaching of biology at primary level to be accompanied by practical agriculture through school gardens (Ssekamwa, 1997). School gardens in primary schools in the 1950s through 1980s, existed to supply food for pupils and teachers at school, experimental purposes of learning for instance how germination takes place among other agricultural practices. They were then ignored for reasons that ranged from negative attitude of pupils, teachers and parents, changing government policies including timetabling issues (DIS Soroti personal communication, 2010). This study therefore set out to test the potential of school gardening in developing life skills and attitude change towards agriculture among pupils and for primary schools to serve as centers for agricultural knowledge in communities in Kamuli and Soroti districts.

3.4 Sampling Strategies and Sample Size

The sampling strategies were based on the practicality of managing two schools over the many UPE schools and to maintain focus and specificity of the research for depth, distinction, complexity as well as understanding how these parameters work. Within each district, one rural UPE school had to satisfy the criteria that: there was land availability for

establishment of school gardens; ability of the school to serve as a learning centre for other schools in the area; commitment and enthusiasm of the school leadership. The choice of schools based on these criteria was recommended by the District Education Officers (DEO).

In each district, the DEO recommended two schools, which were visited by the researcher for on-spot assessment and verification. During the school visits the researcher discussed with the school Head teachers, agricultural teachers and other staff members to establish the interest and availability of land for establishment of school gardens. From this process, Tubur Primary School in Tubur Sub County, Soroti district and Nalango Primary School in Namwendwa Sub County, Kamuli district were selected as study sites. The two schools as well had a high pupil population of, 1,376 for Tubur and 1,248 for Nalango. The study therefore involved 200 pupils (100 pupils per school) constituted from primary three to primary six. The 200 pupils were self-selected by being members of the agricultural clubs. Membership to the clubs was voluntary and it is these that participated in the knowledge and skills acquisition in agriculture. The lower class pupils were exempted for being young to provide gardening labor and to demonstrate practice - based learning. On the other hand, primary seven pupils being candidates for Primary Leaving Examination were excluded to allow them concentrate for their examinations.

3.5 Data Collection Methods and Tools

Instruments and Procedures

The research upheld the confidentiality of the respondents' identity. Participants were as well informed of their rights as human research subjects. School gardening is a practical intervention aimed at enhancing learning to influence the behavior of the pupils and teachers

through mutual engagement, hence the action research framework provided the space for the researcher to engage with the pupils and teachers while generating data through processes of learning and reflection. The reflection aspects included interpreting experiences, activities and information to create new insights and agreement on future actions. This was done by soliciting different ideas and opinions from the pupils, teachers, school management committees and the parents' teachers associations in both schools. The information was generated for each objective using such methods as;

Objective 1: Interviews and observations administered to pupils, teachers and parents

Objective 2: Interviews, test-retest and observations administered to pupils (club members)

Objective 3: participant observation anchored in action research implemented with pupils

Objective 4: Focus group discussions administered to the teachers and parents (PTAs& SMCs)

Action research is a participatory and emancipatory process in that participants worked as a team progressively for problem solving and monitoring. This was fit for this research study since the establishment of school gardens was a process that involved progressive learning. The study was conducted in two seasons; season 1 (July – November, 2010) activities included:

1. Reconnaissance visits to the districts.
2. Selection of the host primary schools.
3. Establishment of the Agricultural clubs.
4. Selecting preferred projects/enterprises.
5. Implementation of the school gardening projects.
6. Field days to demonstrate and disseminate outcomes of the projects.

Season II (April - September, 2011) focused on:

1. Planting of the school gardens for second season of the study.
2. Assessment of the transfer of knowledge and skills acquired from school gardening activities to pupils homes and community at large.
3. Assessment of the sustainability of the school gardening programme after completion of the study
4. District-wide dissemination and stakeholder consultations for way forward.

With the purpose to triangulate, the following methods were used to collect data:

1. **In-depth interviews** administered to pupils with the help of teachers to assess knowledge retention.
2. **Test – retest** administered through theoretical agricultural tests for club members.
3. **Focus Group Discussions** conducted with the School Management Committees, Parent Teachers Association executives, school administrators and teachers as a follow-up to the individual interviews with the pupils. Focus Group Discussion was suitable because people often need to listen to other people's opinions to be able to articulate and create their own (Bogdan&Bicklen 2007). This method therefore helped in documenting the opinions, perceptions, beliefs and experiences of the various education stakeholders as well as exploring the pertinent issues emerging from the interviews. Such issues included: history of school gardening, major challenges to school gardening, various options for provision of food in schools and recommendations for future considerations.
4. **Participant Observation** of the practices learnt by the pupils, their behaviors as they participated in the school gardening activities, interactions between the pupils and

between the pupils and teachers, transferability of skills from the school garden to the home gardens. Data from interviews and observation was recorded on spot through field notes and video recording in order to document the process of analysis in detail.

3.6 Reliability and Validity of Data Collection Tools

Reliability

For purposes of consistency and dependability, raw data records in form of transcripts of conversations, interviews, observations, photographs and document studies was collected in a relatively unstructured manner. Detailed process of analysis was also documented. Different observers and raters that included teachers participated in field days. The necessary adjustments were also made in consultation with the academic supervisors during data collection process.

Content validity

In order to bridge between concepts and facts, the observations that helped the researcher see the garden and its benefits just as the subjects saw it, contributed to the content validity. The teachers, school administrators and parents were also consulted to provide relevant content to verify the claims and instruments used in the research and modifications were made prior to data collection**.** Their feelings and understanding of events in the study were as well sought. Data was triangulated in such a way that, evidence was deliberately sought from a wide range of different and/or independent sources such as other literature and peoples previous experiences in school gardening to identify patterns of convergence which eventually created evidence. The data was also fed back to the participants (pupils, teachers

and parents) for purposes of cross checking whether the findings were a reasonable account of their experience. Interviews and focus group discussion were administered to the same people to take note of the emerging data.

3.7 Data Analysis and Interpretation

Thematic analysis was applied to the qualitative data. The qualitative data were clustered in their respective themes based on content as described by Silverman (2001). The researcher read through the transcripts several times to find instances of skeletal themes and established relationships between these differing categories. This process allowed the researcher to categorize the interview content from different pupils based on recurring themes. The transcribed data was then analyzed to observe and select strong and recurring themes or topics (Rubin 1995). The processes of interviews from various pupils produced five major and recurring themes: enjoyment from participating in the garden, previous gardening experience, parental influence on school gardening experience, school influence on knowledge application, and classroom reinforcement for gardening and knowledge retention.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Background of the Respondents

The target population for this study was pupils that enrolled in Universal Primary School Education in Soroti and Kamuli Districts in Eastern Uganda. The pupils that participated in the study were selected from P.3-P.6 within Tubur and Nalango Primary Schools. The participating classes (P.3-P.6) were characterized by high pupil enrollment averaging to 180 pupils per class as compared to the Uganda national average primary school pupil- teacher ratio indicator of 49:1 (World Bank, 2012). Discussion with the school head teachers showed that, due to the high enrolment, pupils faced several challenges among which were poor sanitation facilities, inadequate and or lack of access to safe water at school, lack of midday meals and inadequate scholastic materials. Though these challenges existed, the pupils were taught based on national primary school curriculum (NCDC, 2010) which has five basic subjects namely Mathematics, English, Social Studies, Religious Education and Integrated Science where agriculture is an integral component. Given that agriculture was integrated into general science, detailed study of the school time tables for Nalongo and Tubur Primary indicated that no practical component of agriculture had been incorporated. This was indeed a dilemma given that both schools owned land where school gardens could be established to teach pupil practical agriculture and long life agricultural skills that could be used when these pupils left school.

4.2 School Gardening as a Strategy to Enhance Practical Learning in Schools

School gardening is not a new venture in Kamuli and Soroti Districts. School gardens existed in the 1950s till 1980s though for some reasons have been ignored in the recent past. Discussions with the DIS in Soroti district revealed various reasons as to why school gardens are not very popular among primary schools. Among the reasons are; negative attitude of pupils, teachers and parents towards school gardening, changing government policies including curriculum and timetabling that exclude agriculture practicals (DIS Soroti personal communication, 2010). It with this background that this study explores to rejuvenate school gardening as a learning laboratory using pupils as champions for transfer of knowledge learnt from school to parents and the community around the school. Prior to establishing the school gardens, the pupils formed agricultural clubs. The agricultural clubs were meant to motivate and inspire pupils to learn and practice agriculture and were later to become the centre for implementing the school gardening activities. Each school formed two agricultural clubs of 50 members each to provide space for pupils to engage into learning. Each club chose their preferred crop enterprise (*Table 1*) through which they would demonstrate to the others and the community the benefits of school gardening. Table 1 indicates the distribution of club members per class and choice of enterprises in each school.

Table 1: Distribution of club members per class in each school

School	**Project/enterprise**	**Club Members per class**								**Total**
		P.3		P.4		P.5		P.6		
		M	F	M	F	M	F	M	F	
Nalango P/S	Maize	6	7	5	7	7	6	9	3	**50**
	Cassava	6	6	6	7	5	7	7	6	**50**
Tubur P/S	Maize	6	7	6	7	6	6	6	6	**50**
	Beans	6	6	5	7	7	6	7	6	**50**
Total		**24**	**26**	**22**	**28**	**25**	**25**	**29**	**21**	**200**

As shown in table 1, pupils in Nalango selected maize and cassava as their major crop enterprises while Tubur pupils selected maize and beans. However, Nalango pupils identified soybeans for its high nutritive value which they eventually intercropped during the second season. The choice of crops matched very well with the major crops that were grown in the study districts. Four key players featured in the school gardening initiative and these included; pupils, teachers, researcher, SMC and PTA. While pupils managed all aspects that pertained to the school gardens, teachers and the researcher provided technical backstopping to enhance the use of the school garden as a learning platform.

4.3 Roles and responsibilities of the Actors

The different actors that performed various activities during school gardening included pupils, teachers, SMC, PTA and researcher. Each of these actors had different roles as stipulated in the sections that follow.

4.3.1 Role of Pupils

As earlier mentioned, the pupils were the primary actors in the school gardens and because of this, they played a number of roles and carried out various activities to promote school gardening as described below:

Establishment of pupils' leadership structures within the agricultural clubs

The pupils' leadership structures were formed to provide space for pupils to effectively participate in the establishment of school gardens. Pupils were therefore responsible for constituting an overall pupils' leadership committee and the specific agricultural club leadership to manage school gardening affairs and to report to the school administration. Table 2 shows the club executive membership in the different study schools.

Table 2: Agricultural club executive leadership by gender

Position	Tubur primary school		Nalango primary school	
	Girls	**Boys**	**Girls**	**Boys**
Overall Chairperson	✓			✓
Vice chairperson		✓	✓	
Chairperson beans club	✓			✓
Chairperson maize club		✓	✓	
Secretary	✓		✓	
Treasurer	✓			✓
Publicity		✓		
Mobilizer		✓		✓
Committee member		✓	✓	
Total	**4**	**5**	**4**	**4**

Table 2 shows the nine different leadership positions that were established within the agricultural clubs in Tubur and Nalango. The positions were arranged in an ascending order of prominence and the overall chairperson was the highest position in the hierarchy of the club leadership. Both girls and boys participated in the club leadership. In Tubur primary school, the girls took up the top most positions of club executive leadership (i.e. the positions of overall chairperson, chairperson beans club, secretary and treasurer) as compared to boys who took lower positions (vice chairperson, chairperson maize club, publicity secretary, mobilizer and committee member. In Nalango primary school, the positions were shared equally among the boys and girls. While the boys were elected for chairperson and treasurer, the girls were elected to vice chairperson and secretary. The other four (4) positions for the committee members were equally divided among girls and boys. The composition of club leadership demonstrates the concept of gender equity and potential, a desirable attribute for enhancing the visibility of both men and women in rural development (*Figure 2*).

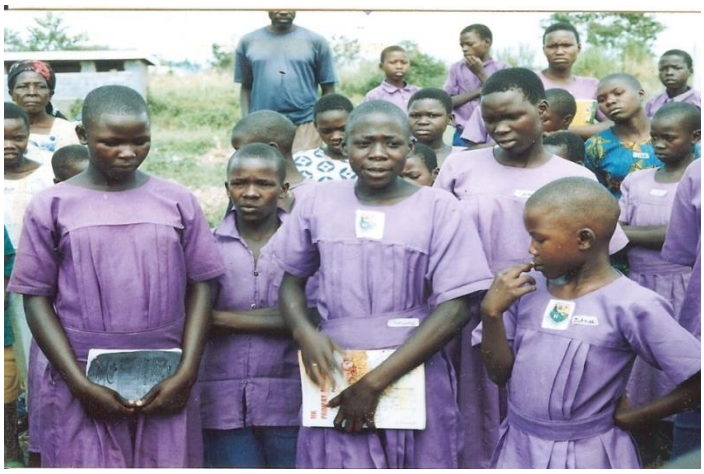


Plate 1: Executive club leaders of Tubur primary school L-R front row an executive *committee member, chairperson maize club, the overall chairperson and chairperson beans club pose with some of the PTA members back row*

Scaling out strategy to increase pupils' participation in school gardening

One of the objectives for the establishment of clubs was to test whether agricultural clubs would enable the pupils in their organized groups to transfer what they learnt to their homes. It was hoped that what the pupils learn in school gardens would in some way be transmitted to their homes and particularly to their parents. The agricultural clubs became a motivator for learning practical aspects of agriculture and leadership skills. Although the project target population was 200 pupils from P3 – P6, it was not possible to prevent other pupils including those from other classes from participating in agricultural clubs activities during the second season. The sense of belonging to an agricultural club and the teamwork spirit compelled pupils to join voluntarily. For example during the first season more, 34 pupils (7 boys and 27 girls) joined the clubs (*Table 3*) while more 46 pupils (18 boys and 28 girls) joined the clubs during the second season. Table 3 shows the number of pupils that joined the agricultural clubs voluntarily in both schools during the first season.

Table 3: Other interested pupils enrolled in agricultural clubs during the first season

School	Class	No. of pupils		
		Male	Female	Total
Nalango	P.6	1	2	3
	P.5	0	2	2
	P.4	2	10	12
	P.3	3	3	6
Total		**6**	**17**	**23**
	P.2	1	0	1
Tubur	P.6	0	1	1
	P.5	0	4	4
	P.4	0	1	1
	P.3	0	4	4
Total		**1**	**10**	**11**
Grand Total		**7**	**27**	**34**

Table 3 shows more interest to participate in school gardening by the lower class pupils (P2 – P3) in Tubur and mostly P4 pupils of Nalango. There were also more girls than boys who voluntarily joined the agricultural clubs during the first season. This could be attributed to the girls' traditional practice to take after their mothers who are producers and custodians of food in society. Observation made during school gardening activities such as during planting, fertilizer application and weeding depicted pupil's interest and commitment in school gardening. The pupils worked enthusiastically even when they were hungry and tired. Several pupils from Nalango had this to say about membership to the agricultural club:

"*I want to join the maize club because I want to know how maize is planted".*

"I *want to be able to teach my parents proper farming methods".*

"*I feel good being one of the school agriculture club members".*

"I just want to be in the club to know what the club members are doing".

During the garden work from time to time, the club members were able to explain to non-club members what they learnt in their respective clubs since each club participated in a different enterprise.

Choice of crop enterprises and selection criteria

School gardening activities hinged on the type of crop enterprise that was selected by each club. The pupils in both schools selected the crop enterprise that they wanted to establish in their school gardens. This step was very critical because it was the building block for creating pupils' interests in participating in the subsequent activities. Various enterprises were suggested by pupils and reasons for their selections given. Discussion with the pupils showed that the crops were primarily selected because of their various attributes as indicated in (*Table 4*). Table 4 reflects selection attributes that correlate with a particular crop.

Table 4: Choice of crop enterprises

S/N	School	Crop choice	Attributes
1	Tubur & Nalango	Maize(LONGE 4&5) LONGE 4 LONGE 5	Easy to cook and serve in a school environment Short maturity period (100-115 days) Drought tolerant variety High yielding and Quality Protein Maize (QPM)
2	Tubur	Beans (K132)	Short maturity period(80 days)
3	Nalango	Cassava(MM 96/4271)	Short maturity period (ready for peace meal harvesting at 8 months) Tolerant to prolonged drought Resistant to pests and diseases (*Brown streak*) as compared to the local varieties.
4	Nalango	Soybeans	High nutritive value and ease of management in the field

Table 4 indicates choice of crops with various attributes that ranged from; ease of cooking and serving in a school environment, short maturity period, high nutritive value and ease of

management in the field, high yielding, early maturity as well as tolerance to prolonged drought, pests and diseases. Soybeans were an additional enterprise implemented by Nalango club members and was planted during the second season by the maize agricultural club. Besides understanding the various crop attributes, the pupils then proposed the enterprises for the school gardening intervention in their respective schools as shown in *Table 5*. Table 5 shows the proposed enterprises and the number of pupils who thought that these were important.

Table 5: ***Proposed Crop Enterprises as suggested by Pupils***

Type of Crop Enterprise	**Proportion of Pupils Proposing the Crop Enterprise (%)**	
	Nalango n=100	**Tubur n=100**
Maize (LONGE 4&5)	78	80
Beans(K132)	30	70
Cassava(MM96/4271)	80	20
Soybeans NAMSOY 4M (LOTNAM/40/001/10B)	75	10

Results in table 5 shows the different proportions of pupils that selected the various crop enterprises. In Tubur primary school, over 70% of the majority of pupils selected maize and beans as the crops to plant in the school gardens. However, more than 75% of the pupils in Nalango Primary School preferred maize and cassava as their major crops. The other crop that the Nalango pupils selected was soybeans that was also preferred by 75% of the pupils. The crop with the highest proportion of pupils was eventually honored as the priority enterprise for school gardening. The types of crops selected eventually became the names of the agricultural clubs; viz, the Bean and Maize Clubs and the Maize and Cassava Clubs in Tubur and Nalango Primary Schools respectively. This exercise of enterprise selection facilitated pupils to exercise their rights and demonstrate their rational decision making while building consensus.

School garden site selection and considerations

The pupils were taken through some of the considerations on how to select a good site for the school garden. They learnt that the success of a school garden depended on its location and that, the far away plot would be difficult to monitor and protect from thieves and grazing animals. This they learnt through previous experience when Tubur for example had planted sweet potatoes with support from world vision. The garden was far from the school and that attracted thieves and stray animals. However, they also acknowledged that sometimes there would be no choice but to utilize available land or land allocated by the school administration for school gardening. The pupils in both schools considered the following in site selection for a school garden: (1) support by the school or community for the land to be used; (2) the slope in respect to dangers of soil erosion; (3) accessibility and security from thieves and livestock.

Practicing proper agronomic practices

Proper agronomic practices are pre-requisite for good crop production. So the pupils played a major role in implementing good crop husbandry practices on the established school gardens. Table 6 summarizes the different agronomic practices and the role that the children played.

Table 6: Pupil Participation in the Different Agronomic Practices for Selected Crop *Enterprises in Nalango and Tubur Primary Schools*

Practice	Pupil's role in the practice
Land preparation	Leveling and removing of tree stumps, large stones and anthills. Marking out the lay of plots and paths for the school garden.
Seed selection	Sorting of planting material (cassava cuttings)
Timely planting	Attending lessons on when it should be done.
Planting method/spacing	Row planting of the various school garden enterprises in their recommended spacing.
Fertilizer application	Application of DAP fertilizer at planting of maize and UREA fertilizer as top dressing between rows when maize was at knee height.
Weeding	Actual weeding (twice in a season).

Pupils in both schools actively participated in learning as well as applying the recommended agronomic practices of the various school garden enterprises. Before engaging in each of those practices, the pupils were briefed with the technical aspects related to the practices by the researcher. The main focus was particularly on the *how* and *when* it is done. It is important to note that both schools did not reflect practical agriculture lessons on their school time tables at the start of the research period. However, the implementation of school gardening was made possible because of the involvement of the SMCs, PTAs and school administrations as they mainstreamed school gardening in the school work plans.

4.3.2 Roles of the teachers and researcher

The teachers and researcher played supportive roles to enhance pupils' learning to link between theory and practice. The teachers that were selected as patrons for the agricultural clubs and the researcher guided pupils as they established their preferred agricultural enterprises. They also made follow up on pupils' knowledge acquisition and transfer

amongst themselves. The teachers and the researcher also followed up with pupils to ensure that they (pupils) did similar activities learnt from the school garden at home and or the community in which they lived. Table 7 indicates the roles teachers and the researcher played during school gardening programme.

Table 7: Role of teachers and researcher

Practice	Teachers and researcher role
Agriculture clubs activities	Providing technical backstopping (Club patrons) Overseeing the activities of the clubs.
School gardening activities	Teaching and practical guidance to pupils in respective crop enterprises. Drawing and managing school gardening time table with pupils. Guiding pupils in the establishment and management of the preferred agricultural enterprises.
Knowledge acquisition and transfer among pupils	Observing and monitoring visits to pupils'.

4.3.3 Role of SMC and PTA committees

The school management committees and parent teachers associations play oversight roles such as monitoring of performance of school projects, being accountable to government on use of school funds as well as managing pupils and teachers' welfare. Since these committees were responsible for the overall monitoring of UPE programme in primary schools, it was important to directly involve them in the school gardening activities. Agriculture as a theory subject was timetabled but practicals were not. The SMCs, PTAs and school administrations in both schools mainstreamed school gardening activities in their respective school work plans. This they did by way of deliberately finding time for the

practicals sometimes using the time for games. Table 8 specifies the role played by the SMC/PTA committees during school gardening.

Table 8: Role of SMC and PTA committees

Practice	SMC/PTA's role in practice
Land preparation	Offered oxen and supervised ploughing of land for school gardens.
Fencing of school gardens	Provided poles and fenced the school gardens.
Monitoring school gardens progress	Organized meetings with the schools administration to track school gardens progress.

The schematic diagram (*Figure 2*) shows a synthesis of how the different roles played by the various stakeholders enhanced the development of the school garden which later turned into a laboratory for pupils' learning and skills transfer.

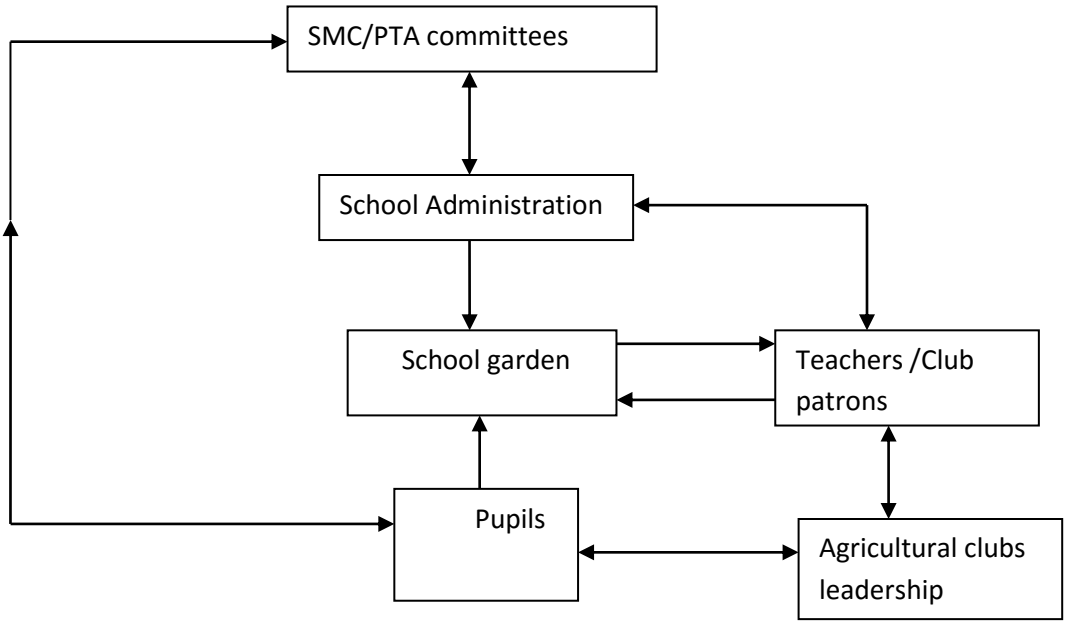


Figure 2: Linkages by the different actors in execution of school gardening roles

4.3.4 Role played by secondary actors

Besides the pupils, PTA, SMC, teachers and the researcher's roles in the school gardening programme, other players such as input dealers and the district leadership played complementary roles.

Role of input dealers

The role of the input dealers was to help in accessing the technological packages (information and improved varieties) for the respective crops. The organizations/seed companies that were contacted included; NARO, FICA SEEDS and NASECO. While the improved cassava variety (tolerant to *Brown Streak virus* (MM96/4271) was procured from NARO, the quality protein maize (QPM) LONGE 4 &5 and beans (K132) was procured from FICA Seeds –Uganda. The improved Soybeans variety (NAMSOY 4M) was procured from NASECO Seed Company Ltd. The research project procured and donated seed, hoes, barbed wire and strings in kind to both schools. The inputs were provided as a start-up support based on the needs of the schools particularly with regard to implementation of the school gardens. Such inputs were provided in kind to the pupils but under the supervision and custody of the school administration and agricultural teachers of both schools.

Role of local government structures (district leadership)

The local government administrative structures at sub county and district level had roles to play in school gardening. The local councils supported in mobilization of parents to participate in school gardening activities while the technical staff provided technical backstopping to the programme. In order to integrate school gardening in the school

programmes, the district agriculture officers in both districts were consulted during the production process and the respective sub county agriculture officers especially in Tubur, participated in the establishment and monitoring of the school gardens progress.

4.4 School gardening as a learning laboratory for pupils

School gardens were established in Tubur and Nalango Primary schools in Soroti and Kamuli districts respectively to enable pupils enhance their knowledge and skill in agriculture. The learning took place in the garden and engaged pupils at three levels namely; cognitive or knowledge gain, skills acquisition or psychomotor and attitude change or affective learning.

4.4.1 Cognitive learning (mental skills or knowledge)

The cognitive domain of learning as described by Bloom (1956) is one of the best known educational spheres of influence. The cognitive learning takes place at six levels namely: knowledge, comprehension, application, analysis, synthesis and evaluation. Discussions with pupils and evidence from the assessment tests indicated that, learning among the pupils took place mostly at the knowledge acquisition level.

Knowledge level assessment tests

Different tests were administered for different classes while the same class did the same test at different intervals in both schools (*appendices 2-5*). This exercise was intended to generate empirical evidence on knowledge level learning that had taken place. In both schools in the first test, over 60% of the pupils (club members) answered correctly the type

of questions related to what was learnt in class. However, a majority (70%) of the pupils failed questions related to practical production techniques of crops as indicated in Table 9. Results in table 9 reflect pupils' performance in practical and general questions learnt in class. The knowledge questions were questions such as names of crop varieties, spacing, among others while general questions were drawn from what pupils learnt from agriculture theory lessons in their respective classes.

Table 9: Pupils' performance in general and Practical questions

Class	Questions that pupils answered correctly	Questions that pupils failed
P6 n=50	In both schools, over 60% of the pupils in the **first test** answered correctly questions relating to: What was learnt in class (in theory lessons) and general knowledge related questions such as: what is a food path, natural food block, why seed selection, why a school garden e.t.c (Questions 1 – 9, 16 & 17).	In both schools, a majority(70%) of the pupils in the **first test** failed: • Questions related to technical production of crops) i.e common pests, diseases and varieties of cassava, beans and maize (Questions 10 – 15).
P5 n=50	What was learnt in class (in theory lessons) and general knowledge related questions e.g plant population, staple food crops grown in the area, intercropping, advantages of having a school garden (Questions 1-3,7-13)	• Questions related to technical production of crops e.g tools used, spacing of beans, maize, cassava, intercropping e.t.c (Questions 4-6,9 &11)
P4 n=50	What was learnt in class (in theory lessons and general knowledge related questions e.g.an activity a farmer does before planting, common crops grown in the area, reasons for growing those crops e.t.c. (Questions 1,2,5-9,11&12).	• Questions related to technical production of crops e.g. crop varieties of maize, beans, cassava, spacing of the said crops e.tc (Questions 3,4,10,13,14 &15)
P3 n=50	What was learnt in class (in theory lessons and general knowledge related questions e.g why do farmers grow crops, name garden tools e.t.c (Questions 1-4)	• Questions related to technical production of crops e.g spacing, varieties, pests, importance of having a school garden e.t.c (Questions 5-10)

See appendix 2-5

The pupils' performance as reflected in Table 9 can be attributed to the practical experiences pupils gained from school gardening activities verses class theories. These lessons (practical) enabled pupils to have hands on experience on various activities such as: names of crop varieties, spacing of selected crops, weeding, and physical monitoring of the growth of the crops in the school garden among other lessons. Through practice, they would also learn the rationale behind whatever they did practically. This was the nature of field-based learning. On several occasions, the teachers and sometimes the researcher would ask them to explain why they had to do things the way they did. At this point the teachers would provide the theoretical justifications and the consequences of not doing things the right way.

It is noteworthy that, in the subsequent tests (2nd and 3rd tests) a greater percentage of pupils got right both general and practical questions as reflected on the progressive performance in the subsequent section. Different tests were administered for different classes while the same class in both schools did the same test at different intervals. The schools were spatially separated by distance that pupils in one school had no chance to interact with those in another school. Table 10 presents the average scores in the various tests segregated by schools and gender.

Table 10: Pupils' Mean Scores (MS) out of 100%

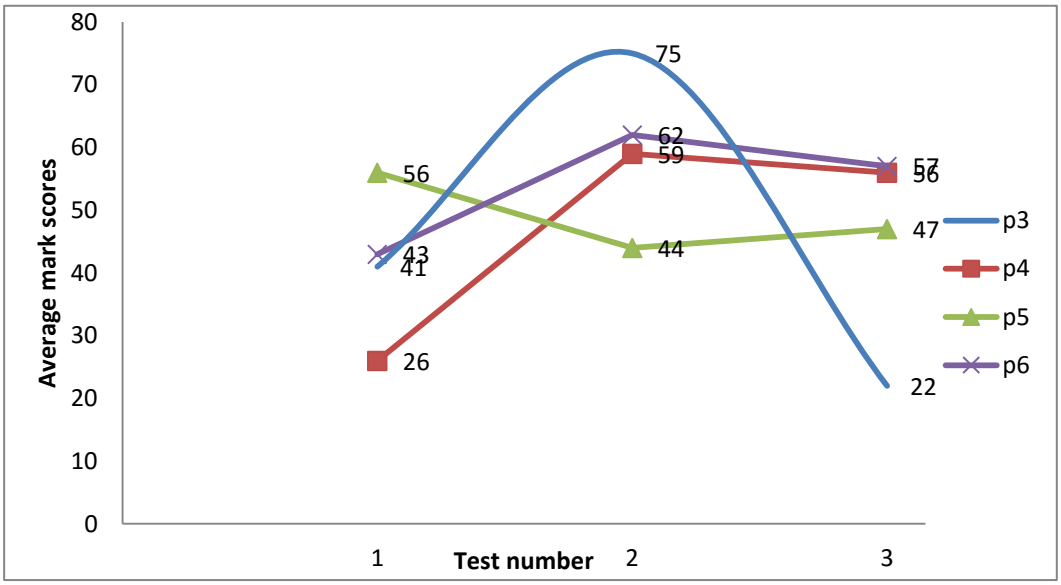
School	**Class**	**First Test MS**		**Second Test MS**		**Third Test MS**	
		Boys	Girls	Boys	Girls	Boys	Girls
Tubur	P3	46	20	61	25	67	53
	P4	22	18	38	41	47	35
	P5	52	19	39	17	62	38
	P6	35	52	46	46	56	60
Nalango	P3	32	34	74	67	18	28
	P4	29	34	65	61	41	50
	P5	33	39	47	52	32	33
	P6	43	45	73	69	60	58

Overall, the results indicate progressive improvement in performance (by scores) in both schools. The pupils' improved performance as they progressed in the three tests was attributed to accumulation of knowledge over time rather than the recall effect. If the period was long enough, it could be assumed that the recall had minimal effect. However, there was no control for recall. This in itself indicated knowledge gain in agriculture as an achievement by the pupils. The teachers in those schools too agreed that they noticed improvement in learning of the pupils through their participation in school gardening. The Tubur agriculture teacher for example said, "…..*the outdoor environment, and active engagement of pupils in school gardening activities enhanced their learning of agriculture which is an integral part of the science subject".*

However, comparison of the performance was made between the schools (Tubur and Nalango) and between genders, using a paired t-test. The marks used for comparison included all the three sets of marks (test 1, test 2 and test 3) obtained from all the classes p3, p4, p5 and p6. Results from a paired t-test indicate that the mean score from all the three tests and all the classes was 41.45 for Tubur and 46.54 for Nalango. The test showed no difference in the performance between the two schools (P-value 0.1557 and t-value 1.43). However, there was a significant difference between gender at 5% interval, with the males performing better than the females (P-value 0.0426 and t-value 2.045). Performance (cognitive) of the males averaged to 52.80 while for the females averaged to 46.96. Generally, there was better performance as the pupils progressed in the subsequent tests (*Figure 3*). Figure 3 illustrates the progressive performance of the pupils as they advance in classes. Performance in the first test was generally poorer than in the second and third

tests. This could be attributed to the effects of recall or memory in relation to the time lag and repetition of tests. The tests were given out three times in both schools. However, P5 performed poorly in the second test as indicated which could be attributed to the pupils' ability to comprehend knowledge.

Figure 3: Plot of average performance of pupils in the different tests



Key: P3:= Primary three, P4:= Primary four, P5:=Primary five**, P6**:=Primary six

A significant improvement in performance was observed in p.6. The paired t-test comparison showed no difference in performance between p.3 and P.4; P.3 and P.5; P 3 and P.6; P.4 and P.5. There was however a significant difference in performance between P.4 and P.6 and P.5 and P.6 (*Table 11*).

Table 11: Comparison in performance as pupils progressed in the level of study

Level of study	Average scores	P-value comparison pairs	P-values
Primary three (P.3)	43.75		
		P.3 and P.4	0.4628
		P.3 and P.5	0.1796
		P.3 and P.6	0.2045
Primary four (P.4)	40.08		
		P.4 and P.5	0.7369
		P.4 and P.6	0.0018
Primary five (P.5)	35.58		
		P.5 and P.6	0.0152
Primary six (P.6)	54.27		

Table 11 indicates better performance by primary six pupils in scores compared to other classes. This can be attributed to the level of understanding and ability to comprehend knowledge by the pupils in this class. It could also be attributed to the learning that took place during implementation of the school gardening activities. Primary six pupils' performance as compared to the lower primary pupils could also be explained by the fact that the lower primary pupils had difficulties in reading and writing in the English language. This is the reason why educationists such as Bukenya (2008) recommend use of local languages specifically for lower classes for learning to be beneficial.

Factors that influenced pupils' performance in the tests

In order to complement the cognitive learning assessment among the pupils, it was necessary to identify factors that contributed to the outcome of their performance in the tests. Follow-up interviews with the pupils were conducted specifically to explain their performance in the knowledge tests. Pupils that scored below 40% (UNEB pass mark) and those who scored above 80% (distinction or excellent) as an average for the three tests, were selected as respondents to the interviews. The reasons for their performance included ability to interpret questions, practical engagement in the school gardens, gender and class segregation. These are elaborated below.

Ability to interpret questions

Discussions with pupils who scored below 40% revealed that, they had problems interpreting the questions and spelling of the answers. In this case, the problem lay more towards the command of English language rather than content in agriculture. This was evidenced when these specific pupils (28%) i.e 28 out of the 99 who participated in all the three tests tended to provide the right answers to the same questions when translated into the local language and asked orally. Low scores in the tests therefore did not imply that these particular pupils did not learn as much. The teachers who supervised the pupils in the gardens noted that, more than half of the pupils who scored low in the tests tended to be more active with field/practical activities. The same pupils that were active during practical lessons could explain very well in their local languages the rationale behind what they were doing. The test-retest of theory together with practical work in the school gardens enabled pupils with time to master what was learnt through the school gardening engagement hence pupils were able to link theory to practice. Most of the pupils then in the subsequent tests got

the correct answers related to crop varieties, spacing, pests and diseases because it was easy for them to relate the questions to what was learnt and practiced from the school garden.

Practical engagement in the school gardens

Pupils, who scored above 80 %in the second and third tests, indicated that their knowledge had been enhanced by practical engagement in the school garden. This enabled them to internalize theory as they easily related it with practice in concurrence with Thorp and Townsend (2001) assertion that, "*school gardens are a fantastic and stimulating way to make classroom subjects more appealing and meaningful to students".*

In the first test, most of the pupils (65% in Nalango and 74% in Tubur) scored below average (40%) than in the subsequent tests mainly because they hadn't yet engaged in practical school garden activities. The pupils who excelled (scored above 80 percent on average) in the tests, tended to come from families that were carrying out some improved practices such as row planting and or using improved planting materials (seeds). Table 12 indicates the time lag between the tests.

Table 12: Agricultural tests timing/dates

School	First test	Second test	Third test
Tubur	16/7/2010	4/8/2010	25/5/2011
Nalango	3/8/2010	10/11/2010	26/5/2011

Gender appropriateness of the tool used to measure knowledge gain

Generally the girls in both schools demonstrated more enthusiasm in school gardening practical activities than the boys who performed better in the theoretical tests. To

substantiate this, both the general chairperson and chairperson of the beans club of Tubur scored 40% and 47% respectively during the first test. However, they actively participated and as well actively mobilized other club members to participate in the school garden activities. The girls were also good at answering questions posed during informal interactions at the garden than the boys, further indicating that they appreciated more what they did practically. In absence of a better way to measure learning, the researcher relied on the test results which was probably the best way to capture all forms of learning that might have taken place. It is difficult to imagine that those girls (general chairperson and chairperson of the beans club) did not learn as much.

Class segregation in relation to performance

The lower classes pupils (P3 & P4) performance in the tests was between 0% – 70%. However, those that failed the test i.e. scored 0%were more (38%) in Nalango than in Tubur (13%). In the upper primary the range was between (6% - 90%) in scores. This finding concurs with the findings of Oluka and Opolot (2008) who conducted a simple and quick test for primary three pupils in one urban and one rural school per district in the 32 schools of Busoga and Teso. The researchers observed difficulty among pupils in answering questions written on the chalk board. However, when the same questions were asked orally, there was an immediate and class-wide effort among pupils to respond to the same three questions. The researchers concluded that, the unease on the first part of the test reflected inability among pupils to read.

The upper primary pupils needed closer supervision and did not engage in garden work as willingly as those in lower primary. This was visible when the head teacher of Tubur

primary school one day *supervised primary six pupils with a stick while they were weeding school garden maize*. This was contrary to the lower primary classes who concentrated with less supervision. The upper primary pupils didn't take garden work seriously which could be attributed to the past experiences where agriculture in schools was used as a punishment. In Nalango primary school as well, the researcher happened to witness *pupils being given to weed the maize garden as punishment for coming to school late on the day of closure for term two 2010.*

4.4.2 Psychomotor learning (Skills acquisition, development and transfer) among pupils

This is the second domain of learning that Bloom (1956) and Harrow (1972) describe as skills that one acquires through physical movement and coordination. It includes various manual or physical, technical, social and interpersonal skills that a learner acquires in the process of learning. Development of these skills requires practice which is measured in terms of speed, precision, distance, procedures and techniques in execution. These skills are also acquired in different levels including; perception where the learner is able to use sensory signal, readiness to act mentally, imitate and try out to do something, habitual response to perform some activity with confidence and proficiency, performing without hesitation as well as adaptation to the activity.

The psychomotor skills that pupils acquired from school gardening included; physical, behavioral, social/interpersonal and technical skills as follows:

a) Physical, behavioral, social and interpersonal skills acquisition and development

Physical skill. Pupils were able to practice skills such as weeding, spraying of crops, identification of crop pests and diseases, handling of potentially dangerous chemicals. The pupils besides the practical implementation of the school garden activities took lead in showing and explaining the different practices to their parents, teachers and other stakeholders during the school field days.

Leadership. Pupils in both schools learnt leadership skills through their agricultural clubs. The pupils became innovative and organized various presentations that included speeches, dance, poems and songs during the school field days. The field days provided an opportunity for the pupils to apply leadership skill when they organized themselves to perform different roles during the field day.

Communication. The communication skill was evident among pupils of both schools. Pupils were able to mobilize and pass information amongst themselves for school gardening activities. They also organized and facilitated their meetings as well as drawing of the school garden management rosta during holidays. The pupils also exhibited confidence as they communicated about the value of agriculture and risks of hunger through songs, poems and drama during the school field days that brought various education stakeholders together

Independence and self-confidence. The pupils were able to set up their own home gardens using skills acquired from the school garden. This indicates transferability of the skills learnt beyond the learning environment. The ultimate benefit of their learning lies in what they can do with the knowledge rather than what they can say about what they learnt. Being able to replicate what they learnt at home suggests that the learning had transcended beyond the head to the hands and heart.

Assertiveness. A sign of self-confidence was exhibited when the pupils out rightly rejected to give their t-shirts to the school administration as some teachers had suggested. The 200 target pupils (club members) received t-shirts during the school gardening programme. The t-shirts were meant for motivation and identity in the various clubs. While the teachers thought the school would keep the t-shirts as school property, the pupils argued that the t-shirts were their hard earned asset through school gardening.

Teamwork. Gardening in school benefited pupils as they worked together. Most activities such as weeding were done within a short time – something that made them appreciate teamwork. The composition of the agricultural club members in the case-study schools included pupils from different classes and age groups, so the school gardening engagement encouraged pupils to develop friendly relationships across age groups which otherwise would be difficult in the absence of clubs. This gave children the opportunity to learn to work in groups with diverse characteristics and interests. To put this more clearly, one pupil remarked, *"being in the agricultural club helps you make more friends"*

Decision making. The pupils in both schools chose the crops to be grown in the school gardens and as well decided to name the clubs after the crops grown such as the maize or beans clubs. Change in expectations over time was as well evidence for acquisition of decision making skill among the pupils. After their decisions on preferred enterprises for the first season (mainly cassava, maize and beans), pupils during the second season of planting expressed interest in growing other food crops that were not originally decided upon at the onset of the school gardening programme. A primary six pupil of Tubur had this to say:"*I feel good about our school garden but we should include other food crops like cabbage so that we can mix it in the beans to give better flavour and nutrition".* Another Tubur primary

three pupil said…*the school should encourage growing of a variety of crops such as cassava, sunflower, cabbages and simsim. Simsim is especially good to mix in beans instead of using cooking oil that is expensive".*

The best moment of decision making came when pupils had to decide how to share the harvest they obtained from their school gardens. By consensus in both schools, pupils decided to use their harvest for their school feeding programme. This was inspite of the fact that not all pupils in the school had participated in the school gardens. This kind of selflessness may be extended beyond school as a primary three girl of Tubur on visiting her home garden affirmed," *I want my maize to provide food at home and not for sale"*.

b) Agronomic and post-harvest handling skills

It is important to note that, both the pupils and teachers of Tubur and Nalango primary schools indicated inadequate technical knowledge in agriculture. The teachers and pupils could not easily identify various fertilizers, the improved varieties of the selected crops for school gardening programme i.e. maize, beans, soybeans and cassava, their spacing, as well as other agronomic practices. This was evidenced when the teachers especially of Tubur primary school were as well *taking notes* during the practical activities at the school garden site. Among the technical skills that the pupils learnt included:

Land preparation. Pupils took part in learning how land preparation is done and site considerations. After the decision, ploughing and fencing of the land for school gardens to secure it from the grazing animals and trespassers by the parents, the pupils with teachers guidance learnt and ensured the following: (1) killed anthills, leveled the gardens by removing large stones, tree stumps and tall grasses, (2) laid out the school gardens by

marking out paths and plots. The aim was to maximize the use of the land allocated for school gardening.

Seed selection. After the pupils were taught the importance of seed selection, they learnt and actively got involved in seed selection and or sorting of planting material before the actual planting took place (*plate 2).*

Plate 2: Nalango pupils sorting cassava cuttings before planting

Planting. It is important to note that the pupils were taught the importance of timely planting (early in the season) in order to make full use of the early rains and also to harvest early. Pupils learnt how to use proper spacing for particular crop enterprises**.** Table 12 shows the different crops varieties and their recommended spacing that pupils learnt and participated in establishing or planting in the school gardens.

Table 13: Recommended spacing of the different op varieties/ enterprises established in school gardens

Crop/ enterprise	Variety	Recommended spacing
Maize	LONGE 4&5 (Nalongo)	75cm x 60 cm (two seeds per hole)
Beans	K 132	50cm x10 cm (two seeds per hole)
Cassava	MM96/4271	1m x 1m (two cuttings of 3-5nodes)
Soybeans	NAMSOY 4M	45cm x 25cm (one seed per hole)
	(LOTNAM/40/001/10B)	60cm x10 cm (two seeds per hole)

Although the pupils learnt and practiced row planting of crops in their school gardens, back at home their parents practiced broadcasting and or estimated the rows. One primary five girl of Nalango primary school commented," *planting in rows is a tedious exercise because*

at home we broadcast or guess the lines and spend less time". However the pupils together with their teachers acknowledged that planting in rows saved seed than broadcasting method.

Fertilizer application. The planting method used was result demonstration. The school garden was divided into two halves; one half was planted without fertilizer while the other half was planted with fertilizer. The purpose was to enable the pupils learn the difference and advantages of using fertilizers in agriculture. DAP fertilizer was applied during planting while UREA fertilizer was applied as top dressing when maize was at knee height in both schools.

Weeding. Pupils learnt reasons for weeding as: to have a clean crop garden; to avoid weeds competing with crops for light, water and other nutrients. They also learnt that its recommended to weed at the right time, right manner and right number of times according to the existing conditions subjected to the crop in the field. The pupils did the weeding of their crops practically as they put into practice weeding lessons learnt.

Pest and disease identification. Although the pupils did not know exactly the names of pests or diseases attacking their crops in the school gardens**,** Tubur primary school pupils recognized an attack on the leaves of the beans as they were being eaten up by insects they claimed they did not know. They also noticed an attack on their maize by the *maize stalk borer*. This prompted for practical lessons with the pupils while in the school garden such that they were taken through learning about some common pests and diseases that attack the specific crops planted as well as their control. Among the common pests of beans in the field were *aphids* and *leaf miners* that are controlled by spraying with the recommended insecticide. The maize crop was attacked by *stalk borer* (pest) while *maize streak viral*

disease and *head smut* were identified as common maize crop diseases. On the other hand, the pupils of Nalango primary school noticed disease attack on their cassava crop at the school garden though they were not able to name the disease. They were then taken through the practical lesson of how to identify some pests and diseases of cassava crop. The common pests of cassava included the *white fly* which also happens to be the vector for African cassava mosaic disease (ACMD) and the *mealy bug*. The important diseases of cassava crop include the famous *African cassava mosaic viral disease* and the *brown streak viral disease* which is becoming important of late. It is important to acknowledge that there was an attack of *brown streak disease* on the cassava garden at Nalango primary school. However, the disease did not affect the yield simply because the cassava streak tolerant variety (MM96/4271) sourced from the National Agricultural Research Organization (Namulonge) was planted.

***Pests and disease control*.** Among the most important pests and disease control measures that the pupils in both schools learnt were: use of improved varieties that are disease resistant/ tolerant, timely planting and spraying with the recommended insecticides. The pupils in both study schools were taken through practical lessons of pest and disease control. The activity of spraying was practically handled by the older boys in upper classes of primary five and six in both schools. Some pupils confessed having done this for the very first time as one primary six boy of Tubur commented during the process of spaying beans against the aphids and maize against the stalk borer , "*I give thanks to the school gardening programme because I have learnt how to mix the chemical and how to spray crops".*

Harvesting and postharvest handling

Signs of maturity**,** timely harvesting and harvesting methods are some of the important lessons that pupils in both study schools learnt. Harvesting of the mature crops was then done by the pupils themselves in both study schools.

***Storage*.** At this stage proper drying to attain the correct storage moisture content (usually 12% wet basis), threshing, winnowing and proper storage mechanisms were among the important activities that the pupils were taught and observed during the process of production. Pupils participated in storage activities (*plate 3*).

4.4.3 Affective learning (Attitude change) among pupils through participation in school gardening activities.

Plate 3: Tubur pupils organize maize from their school garden in the school store

Affective domain is the third classification of learning as described by Bloom (1956) and Krathwohl et al., (1973). This section includes the manner in which the learners develop in feelings and how they deal with things emotionally. It involves feelings, attitudes, values, appreciation, enthusiasm and motivation. Through the agricultural clubs, pupils became aware of the existence of improved agricultural technologies/varieties of which they confessed were not grown at their homes before. Researcher-pupils and teacher-pupils informal interactions during school gardening activities facilitated freedom for pupils to ask questions such as; *Why plant in rows*? *Why do we weed our crops*? *What pest/disease was affecting the beans*? Others wanted to know the *source of seed (varieties)* as well as *their advantages over the existing local varieties*.

Commitment that pupils in both schools demonstrated through their participation in school gardening activities portrayed ownership and value they attached to their school gardens as one pupil from Nalango primary school remarked, "*I feel happier being in the garden and to watch our crops grow".* This indicates a feeling of satisfaction and the use of the word "*our*" portrays a strong sense of ownership. Through a citation, one of the pupils (boy) of Tubur highlighted the essential categories of food types for good health and nutrition as follows: "*Invited guests, host head teacher, ladies and gentlemen. I am here to remind you about food classes that our bodies need for proper growth and development. They include; Proteins – to make our bodies grow well, Carbohydrates- to give us strength and Vitamins- to protect our bodies from diseases.* This indicated that pupils through their participation in school gardening were able to link food production with nutrition lessons which enhanced their attitude towards school gardening.

4.5 Pupils' Platforms for Transfer of Knowledge and Skills Acquired From School Gardening Activities to Their Homes

Monitoring of knowledge acquisition and skills transfer platforms among pupils was an important component of this research. Pupils were tracked for replication or traces of transfer of skills from the school gardens to homes. To facilitate transferability, starter seed packs were distributed to pupils who met the criterion of voluntary interest to try at home and availability of a piece of land at home. This activity was meant to measure the club members' motivation to try out what they learnt from the school garden at their homes. Seed amounting to half (1/2) kilogram per pupil was distributed to the identified club members.

Table 13 shows club members that received seed by gender.

Table 14: Distribution of starter seed packs (maize and beans) to Tubur agriculture club members

Class	**n=100**	**First season**		**Second season**		
		Boys	Girls	Boys	Girls	**Total**
P.6	n=25	1	0	8	5	**14**
P.5	n=25	0	1	6	4	**11**
P.4	n=25	2	4	3	6	**15**
P.3	n=25	1	4	4	6	**15**
Total		**4**	**9**	**21**	**21**	**55**

Table 13 above indicates the different pupils by gender who received maize and beans seed during the different seasons of the research process. A follow-up of those students who received seed indicated that a majority (69%) of the pupils applied some of the skills learnt from the school garden at their homes. Such skills included row planting, recommended spacing and timely weeding. However, 27% of the pupils broadcasted their seed as a common practice at home reasoning that planting in rows is tedious. The remaining 4% had not planted their seed by the time of the visit with the intention to plant in the next season.

The most common skill that pupils(55%) acquired and transferred was **row planting** and **spacing** for the recommended plant population. A visit to one of the pupils' (a primary three girl of Tubur) home garden revealed that, the young girl taught her grandmother how to plant maize in rows. Though the lines were not as straight as expected (*plate 4*), there was evidence of an acquired skill (row planting) and more so the positive attitude that the pupil exhibited.

Plate 4: Tubur Primary three pupil with her grandmother and aunt shows off her row planted maize home garden to the researcher

It's also important to note that some children had a different point of view concerning row planting as one pupil of Nalango primary school had this to say, "*planting in rows is a tedious exercise because at home we either broadcast or guess the line spacing".* This brings out the constraint of labour intensity. Whereas some of the recommended practices may be appreciated, adoption may be constrained by the labour it requires.

However, some of the parents interviewed, expressed optimistic views about the pupils' gardens. A mother who has two children (P5 and P6) both belonging to the maize club of Tubur primary school, had this to say," *my children taught me how to plant maize in rows, and for the first time I was able to get a yield of 10 bags (1,000kgs) of threshed maize from a piece of land where I used to get less yield (4-5 bags), thanks to the school garden programme for teaching my children better farming practices*". School gardening was also described by parents as a good avenue for their involvement in transforming food production cultures in their communities. The PTAs, SMCs and other community members that were involved in school gardening activities learnt and applied some of the agricultural knowledge and technologies from the school garden to their homes. By demonstrating different farming practices, they would influence their neigbours and other members of the community (beyond the schools). As evidence to this, one parent revealed;

"*when I learnt about the school gardening programme in Tubur, I decided to come around the school to actually see what was going on. I requested and was given some maize seed by the agriculture teacher because the variety being planted at school was new to me".*

The school therefore had become a centre of knowledge and technology transfer, which is also easily accessible by the community members. Such farmers demonstrate a new attitude

of being proactive to seek for information and technologies. Often farmers wait for information to reach them rather than them reaching out for information and technologies. This implies that, school gardening activities played a role in attitude change among both pupils and parents. One of the important forums that brought various education stakeholders together was the school field days.

School field days

A field day for the purpose of this study was a day that brought the various education stakeholders together including: the pupils, teachers, school administrators, parents, SMC, PTA, researchers as well as the neighboring community. During the field-day, pupils (club members) demonstrated to the stakeholders what they had done and learnt in their respective clubs. The pupils therefore prepared and communicated through a variety of approaches such as: speeches, songs, poems and dance which provided evidence for achieved objective of attitude change among pupils through participation in school gardening activities. The field days also revealed acquisition of some of the people-oriented skills that pupils acquired through their participation in the agricultural clubs such as team work, leadership, division of labor, planning skills among others.

4.6 Factors Influencing Knowledge Application and Transfer by Pupils

A number of factors that influenced knowledge application and transfer among pupils were identified during focus group discussions (FGDs) with the pupils, teachers and parents. The identified factors included both enabling and limiting knowledge application and transfer by pupils. Table 14 shows some of the factors influencing knowledge application and transfer.

Table 15: Factors influencing knowledge application and transfer by pupils

Enabling Factors	Limiting Factors
Teamwork among pupils	Time-tabling constraints (lack of agriculture practical lessons on school timetable)
Benefits accruing to pupils e.g. eating food they produce	Negative attitude of parents
	Inadequate agriculture skills among teachers
Availability of dedicated teachers	
Support from school administration	Agriculture used as punishment at school
Supportive parents (providing land and other inputs to pupils)	Changes in curriculum
Farming background of households	Household chores for pupils after school

Results in Table 14 indicated that the factors affecting knowledge application and transfer by pupils included enabling and limiting factors.

Enabling factors

- Teamwork. Pupils benefited from the motivation to work together in a group. This energized pupils to develop the urge to apply through peer influence.
- Benefits accruing to pupils. Realization of the benefits from school gardening by the pupils is very important to encourage them to share their experiences with other people. For example, eating of food generated from the school garden during school feeding days, was one of the factors that motivated pupils to relay what they learnt from school gardening to their parents.
- Availability of dedicated teachers. The teachers' commitment to guide and work with pupils during school gardening activities was one of the enabling factors for pupils' to apply what they learnt in real life situations.

- Supportive school administration. The allocation of time for school gardening activities by the school authorities facilitated pupils to practice what they theoretically learnt in class. The school administrators showed interest in promoting school gardening (*plate 5*).

Plate 5: Nalango head teacher together with one of the teachers (right) teach pupils how to space cassava at the school garden

The Nalango head teacher also affirmed support for the school gardening project during the school field day when he echoed that the school gardening project had come in time to consolidate the school's mission, "*to produce future citizens with functional life skills".*

- Supportive parents. Parents offered small plots of land to their children for the home gardens and this facilitated pupils in applying what they learnt from the school garden. Such skills included row planting, proper spacing of crops and weeding.

Limiting factors

- Time-tabling constraints. A case in point is that, in both schools (Tubur and Nalango) agriculture practical lessons did not appear on the school timetables. This could not allow teachers to freely take out pupils to participate in school gardening activities since it was not reflected on the school time tables.
- Attitude of parents. Some parents had negative attitude towards school gardening by way of associating it as being used by teachers for punishment (*plate 6*).

Plate 6: *Tubur primary school girls weeding maize in the school garden as a punishment for talking in class*

- Changes in school curriculum/ roll-out. Changes in school curriculum by the ministry of education have affected the learning of agriculture in primary schools. In Uganda, the primary school curriculum teacher's guide volume two (NCDC, 2001) accorded agriculture as a standalone subject. However, it was replaced by the current curriculum (NCDC, 2010) which integrates agriculture back into science an idea that was rejected during the development of the former curriculum. This implies that, when agriculture is being integrated into science other than as a standalone subject, it limits the value accorded to it as a subject.
- Other factors such as limited technical knowledge and skills among teachers, agriculture being used as a punishment at school (*Plate 6*); and household chores for pupils after school had a bearing on the teaching, learning and application of agricultural knowledge and skills at school and household level. This means, at school pupils do not get the right skills since teachers have limited knowledge and skills. When agriculture is used as a punishment, the pupils develop negative attitude towards agriculture both at school and at home. However, some teachers acknowledged learning better technologies from the school garden lessons as one Tubur teacher admittedly said," *I have learnt how to apply fertilizer and about some of the crop varieties(maize and beans) that I did not know before".*
- Lack of funding support for school gardening activities was highlighted as another challenge in both study schools which could affect school gardening activities in terms of their sustainability. However, discussions with the school administrators of Tubur primary school indicated that, there is funding support for school gardening under UPE funds but their insufficiency and delay in release was identified as a major factor for its

effectiveness. Besides, there were no records in both schools to show utilization of such funds for school gardening activities.

Production constraints

i. Unfavorable weather in terms of delay in rains, prolonged drought, pests and disease attack on school gardens crops was observed and reported by respondents to have greatly affected the yields from the school gardens.

ii. Production land for the school gardens remains a challenge even for the rural schools. In most cases the available school land is shared between the school and the teachers. In Nalango primary school particularly, the school gardening committee showed interest in planting various crops for the school but cited inadequate land because land was shared among the teachers who reside at school. The challenge here is how to avail some land for school gardening activities.

iii. The yields realized from the school gardens during the first season were inadequate to sustain food supply for the pupils and teachers for the whole school term. For example in Tubur primary school, the first season produce(350kgs of maize and 100 kgs of beans) was enough to be eaten twice (one meal for pupils & teachers and another during the school's annual general meeting). At Nalango, the first season's produce (385kgs of maize) was used to make porridge for pupils and lasted three weeks.

4.7 Challenges Experienced by Pupils while Sharing School Gardening Information with Parents

Through focus group discussions and interviews, parents and pupils were asked to identify some of the challenges they experienced while sharing their knowledge with other people at home. The major challenges identified by pupils through this process included:

- Age difference. Some parents did not want to learn from their children about agriculture, which they assumed to know better and have been practicing for a long time. Some parents disregarded the information passed to them by their children as one Tubur girl recalled, *"One day on my way to school, I met a parent (not my own) broad casting beans and as I stopped to share with him on how to plant in rows, he told me I was too young to teach him about agriculture".*
- Lack of time spent together by both parents and pupils at home. The pupils confessed fear of approaching parents especially when they are fatigued after a day's work.
- Information distortion during translation from English to the local language. Both English and local language were used at school to teach pupils during gardening lessons. However, some pupils could not adequately express themselves in English. The study acknowledged use of local languages specifically for lower classes (P3 &P4) for learning to be beneficial and as recommended by the education ministry (Bukenya, 2008). This concurs with other researchers who have similarly expressed concern about the negative effects of emphasizing European languages in delivering agricultural messages (Ozowa, 1997; Riedmiller, 2002).

On the other hand, the parents pointed cumbersomeness of the recommended procedures/ practices such as row planting as compared to broadcasting and poor access to the recommended technologies as their challenges. In summary, it can be inferred that children made an effort to transfer the knowledge and skills learnt to their families and the community at large despite the challenges named. This is in agreement with the recommendations made by (Miiro&Orum, 2007; Okiror, *et al*., 2010) that primary school pupils can effectively disseminate agricultural information and practices in the community.

4.8 Potential of school gardens as Food Banks for UPE schools

School gardens have the potential to support school feeding programmes in that, besides facilitating learning objectives, they can provide food that the school can depend on to avail midday meals to pupils. In both schools, the produce from school gardening activities was used to feed the entire school as a way of celebrating their achievements but also as a demonstration that school gardening can substantially contribute to the school feeding programme. Below is a more detailed description of the school feeding activities in each school.

Tubur primary school

One of the feeding days was held on 3/12/2010 which also happened to be closing day for third term. The head teacher noted high turn up of pupils (90%) during the third term closing day compared to second term when only 70% of the pupils reported for the term closure. He attributed this to the announcement made to the pupils that there would be food (lunch) for all the pupils on the last day of the term. The head teacher appreciated the outcome of school gardening (food) as he highlighted some of its benefits as:

Pupils acquire practical skills; commitment to learning as pupils are attracted to school; pupils are motivated to transfer the acquired skills to their parents at home; anticipated good performance; reduced absenteeism and school dropout caused by hunger; it also raises the enrollment and provides good nutrition and health for the pupils.

Interviews with some of the pupils on the feeding day gave the following responses: one primary three pupil said: "*the school should grow a variety of crops such as simsim, cassava, sunflower, cabbage among others. I do encourage specifically the growing of simsim so that it's used to mix with beans other than frying because cooking oil is expensive".* Another club member said, "*there is need for all the pupils to participate in the activities of the school garden and not only club members since when it comes to eating like today all of us are participating".* There was a general agreement by club members to share with all the pupils (the programme targeted only 100 constituted from P3 – P6) so as to attract active participation by all hence produce more food. One pupil identified the benefits of feeding at school as: "*when we (pupils) eat at school, we do not doze off in class hence greater concentration and therefore we attain good passes".*

Plate 7: Tubur teacher finds out how pupils feel as they enjoy(eat) food from their schools garden

Nalango primary school

Pupils together with the school administration preferred to utilize their first season maize to provide porridge as a midday meal to pupils. This arrangement lasted for an extensive period of three (3) weeks.

The school gardening programme also facilitated acquisition of improved varieties and practices for the parents and communities around the schools (*plate 8*).

4.9 Sustainability of school gardens and agricultural clubs after the research period.

It was essential to assess how the school gardening initiatives would continue to be managed by schools after the research period. This was also important for scaling out of the achievements of school gardening among the research schools and beyond.

Internal institutional support

Both schools set up mechanisms for the management of the school gardens. This served as an output of the school gardening research intervention. In Tubur primary school, two agriculture teachers were assigned with the full responsibility of managing and supervising the school gardens as well as the agriculture clubs. Each of the teachers was responsible for a different club/enterprise. Their other responsibility was to report the school gardens progress to the school administration, school management committee and the parent's teachers association. In contrast, Nalango primary school had a special committee comprised of six (6) teachers (2 female and 4 male) alongside the agriculture teachers who also took full responsibility of supervising the agriculture clubs and the enterprises. At Nalango, the school notice board reflected

Plate 8: Fresh cassava (12 months old) from the Nalango school garden that was packed for parents during the school field day

Plate 9: Nalango pupils enjoy eating porridge made from maize harvested in their school garden

the varieties of crops planted in the school gardens as well as master/mistress on duty (MOD) who as well was responsible for overseeing school gardens. The Nalango school administration took responsibility of the gardens unlike in Tubur primary school where school garden work was left entirely to the two agriculture teachers. The implication of the different kind of school gardening management structure in the two schools was that, in Tubur, school gardening activities were not possible without the said agriculture teachers. Such evidence for Tubur was that, *whenever the researcher was on follow-up visits, other teachers as well as the head teacher would straight away look for the agriculture teachers thus the researcher was often associated with the agriculture teachers for updates on school gardening progress.* In contrast, at Nalango all the teachers as well as the school administration were aware and could always report progress of the school gardening activities at any one time. The strategy adopted at Nalango ensures continuity of school gardening activities even in the absence of particular individuals.

Care of school gardens during non-school days/holidays

In both study schools, the executive members of the clubs set up a schedule for caring for the school gardens during holidays. The schedule was shared and agreed upon with pupils, teachers and parents. During the holidays, the main school garden activities were monitoring weed infestation, pest and disease outbreak, stray animals' invasion, thieves and other eventualities that could affect the school garden while both teachers and pupils were out on holidays.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

This study thought to establish the prospects and challenges of using school gardening as a laboratory for developing life skills in agriculture in UPE schools. The study had four specific objectives to: establish the benefits of school gardening as a learning laboratory to enhance knowledge and skills in agriculture in primary schools; assess whether agricultural clubs can motivate and inspire pupils to learn and practice agriculture; assess the transfer of knowledge and skills acquired from school gardening activities to the pupils' homes; and establish the attitudes of the pupils, teachers, parents and the local community towards school gardening. This chapter covers major findings, conclusions and recommendations as follows:

5.2 Major findings

The major findings of this study were categorized into four areas according to the study objectives:

1. Benefits of school gardening as a learning laboratory

School gardening is an effective way of enabling pupils to practice (learn by doing) agriculture while at school. The effectiveness of school gardening depends on the quality and quantity of guidance provided by teachers at school and the support given to pupils by their parents at home. The home gardens that pupils established at home helped improve on

the working relationship between pupils, teachers and parents in agricultural knowledge and skills acquisition.

2. Agricultural clubs as a motivation to learn and practice agriculture.

The agricultural clubs offered the social energy/collective interest in certain agricultural enterprises that formed the foundation for learning technical aspects of agriculture in a more supportive and friendly environment of work and fun. The agricultural clubs also served as a platform for pupils, teachers and the researcher to engage in learning of new agricultural skills in experiential manner.

3. Transfer of learning

Transfer of agricultural knowledge and skills to pupils' homes depended on **enabling factors** (teamwork spirit among pupils, benefits accruing to pupils such as eating the food they produce, availability of dedicated teachers, support from the school administration, support from parents and farming background of households) and **limiting factors** (time-tabling constraints i.e. lack of agriculture practical lessons on school time table, negative attitude of parents, inadequate agriculture skills among teachers, agriculture being used as a punishment at school, changes in curriculum and household chores for pupils after school). The home gardens provided an opportunity for joint learning between pupils, parents and other household and community members when pupils solicited for their support. The flow of information between pupils and parents was affected by age difference, lack of time spent together by both parents and pupils at home and information distortion during translation from English to the local language.

4. Attitudes of the pupils, teachers, parents and the local community towards school gardening.

The schools recognized the relevance and potential of school gardening as well as agricultural clubs by involving the pupils, teachers, school administration, school management committees (SMCs) and the parents' teachers associations (PTAs). The teachers on duty appreciated the additional role of overseeing the activities of school gardening, this portrayed their positive attitude towards school gardening. The involvement of SMC and PTA committees enabled them to mainstream school gardening in their respective school work plans from an informed point of view. However, poor cooperation between school administration, SMC/PTA committees and teachers was reported in Tubur as causing insecurity of the school gardens leading to tress passing and theft of produce.

5.3 Conclusions

1. The findings of the study showed that there was strong interest by pupils as they willingly participated in school gardening activities. Practical engagement in the school gardens enabled pupils with time to master and hence link theory to practice. The production cycle which the pupils were taken through and got involved in, enabled them to learn the technical aspects of production in a practical way (life skills). However, pupils require considerable supervision and support from the curriculum, teachers and parents in applying the acquired agricultural knowledge.
2. It can also be inferred that agricultural clubs approach can be an efficient tool for disseminating agricultural knowledge and technologies in the community (beyond the schools). This is because pupils through their agricultural clubs also learnt people-

oriented skills such as: leadership, independence, self- confidence, motivation, communication as well as teamwork which they were able to utilize during school field days and in their communities.

3. The study identified two sets of factors necessary for effective application and transfer of skills both at school and at household level. These are: *enabling* and *limiting***.** Follow up visits to encourage and advice pupils revealed that, the small home gardens approach demonstrated some benefits for both pupils and their parents by way of facilitating replication of the skills acquired as well as the introduction of improved seed for the households. Therefore, application and or learning transfer of agriculture knowledge and skills depends on available opportunities for pupils to practice at school and at their homes.
4. Cooperation among the various education stakeholders contributes to the sustainability of school gardening activities. Since parents were able to access agricultural technologies through schools, it can be concluded that, schools can became centres for agricultural knowledge and technologies for communities.

5.4 Recommendations

Based on the above conclusions, the following recommendations are suggested to enable schools contribute to better learning of pupils, school feeding programmes and use of pupils as sources of information to parents and or the community at large.

1. The primary school agriculture curriculum should be reviewed to include the practical component in the school timetables. However, the practice of using garden work as a punishment for wrong doing in schools, impacts negatively on attitudes eventually

developed by the learners on agriculture as a subject. The agriculture teachers should be given specialized training in agriculture and incentives in order for them to effectively teach the subject. Schools could also adopt test re-test approach as a way of measuring forms of learning that could have taken place among the learners.

2. The schools can engage some of the current members (pupils) of the agricultural clubs to become Trainers of Trainers (TOTs) to guide future processes of school gardening. However, the implementation of school gardening should ensure ownership of benefits by pupils for their motivation.
3. There is need for exposure and engagement of the various education stakeholders such as the district level administrators, school administrators, school management committees (SMC), parents' teachers associations (PTA) and the local communities to appreciate the processes and outcomes of school gardening as a learning laboratory and as a strategy for self-sustainability of school feeding programmes. Planning for scaling-up and sustainability of the positive aspects of school gardening is necessary.
4. Schools need to set up strong management strategies for the operationalization of school gardening. There is also need for schools to adopt diversified farming practices with greater acreages to sustain school feeding programmes throughout the school term. The schools can opt for short term annual crops such as horticultural and pulses as well as medium term staple food crops such as cassava and sweet potatoes. Cash crops could also be established to generate supplementary incomes for food diversity thus improved nutrition.
5. Since school gardening has a number of demonstrable benefits for rural households, funding support should be incorporated into school budgets to ensure continued

implementation of school gardening activities by school administrators as well as their supervision by district education inspectors. Policy makers in local governments should work through the existing local structures to ensure that school gardening proposals are included in their Sub county Development Plans.

6. This research examined the prospects and challenges of using school gardening as a laboratory for developing life skills in agriculture in UPE schools in Eastern Uganda only and particularly in Kamuli and Soroti districts. Differences may exist across regions and districts. Further research should therefore be carried out in other regions if the results are to be generalised.

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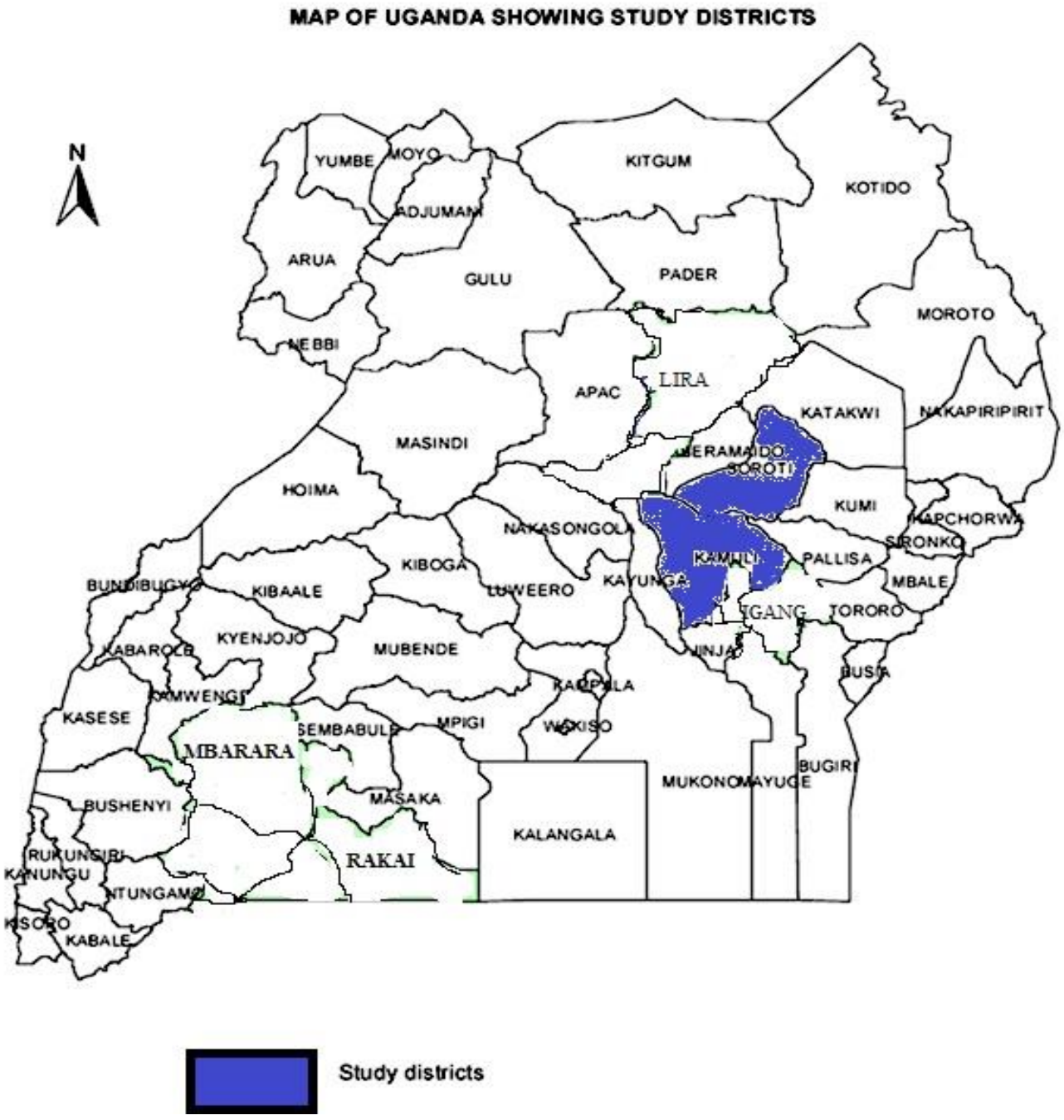
APPENDICES

Appendix 1: Map of Uganda showing study Districts



Appendix 2: Agriculture Test Questions for P.6 club members

1. What is a food path?
2. Mention any one natural food block.
3. Name the two staple food crops in your area.
4. How are the crops named above planted at home?
5. Why is seed selection important to farmers?
6. Describe any one factor one should consider when selecting a garden site.
7. Planting beans, cassava and maize in lines is better than broadcasting. Give any one reason as to why?
8. Mention any one disadvantage of over population of crops in a garden.
9. Name two measures used to control weeds in a maize and cassava garden.
10. Name any one common pest that affects:
    (a) Beans
    (b) Maize
    (c) Cassava
11. Name any one common disease that affects:
    (a) Beans
    (b) Maize
    (c) Cassava
12. Describe one way of caring for the following in the garden:
    (a) Beans
    (b) Maize
    (c) Cassava
13. Name two (2) varieties of maize known to you.
14. Name two (2) varieties of beans known to you.
15. Name two (2) varieties of cassava known to you.
16. Mention any two (2) advantages of having a school garden.
17. Who takes care of a school garden?

Appendix 3: Agriculture Test Questions for P.5 club members

1. What is plant population?
2. Name the two staple food crops in your area.
3. How are the crops named above planted at home?
4. What do crop farmers use when planting?
   (a) Beans
   (b) Maize
   (c) Cassava
5. How do crop farmers plant:
   a) Beans
   b) Maize
   c) Cassava
6. State any two advantages of proper spacing of crops.
7. What is inter-cropping?
8. Name any two advantages of inter-cropping to a farmer.
9. Mention any one disadvantage of inter-cropping.
10. Name any two tools used by farmers in Uganda.
11. Why do farmers prepare their gardens before planting?
12. Mention any two (2) advantages of having a school garden.
13. Who takes care of a school garden?

Appendix 4: Agriculture Test Questions for P.4 club members

1. Suggest one activity a farmer carries out before planting his or her crops.
2. Name the two (2) commonest crops grown in your area.
3. Identify one pest that can damage each of the two crops you have named above.
4. Name any two (2) varieties of the following crops
    a) Beans
    b) Maize
    c) Cassava
5. Give three (3) reasons why people grow crops.
6. Name the two staple food crops in your area.
7. How are the crops named above planted at home?
8. Suggest any one way farmers can care for their crops
9. Explain the methods of growing crops known to you
10. Mention the way farmers space their crops
11. Name two (2) ways farmers keep their crops for future use
12. Suggest one importance of storing crops
13. What is the spacing for
    a) Beans
    b) Maize
    c) Cassava
14. Mention any two (2) advantages of having a school garden.
15. Who takes care of a school garden?

Appendix 5: Agriculture Test Questions for P.3 club members

1. Why do farmers grow crops?
2. Name any two (2) types of crops grown in your area.
3. List down any garden tools you know.
4. Name the two staple food crops in your area.
5. How are the crops named above planted at home?
6. What is the spacing for:
    a) Beans
    b) Maize
    c) Cassava
7. Name the varieties of the following crops:
    a) Beans
    b) Maize
    c) Cassava
8. Name any two(2) pests that destroy:

a) Beans

b) Maize

c) Cassava

9. Mention any two (2) advantages of having a school garden.
10. Who takes care of a school garden?

Appendix 6: Stakeholders perceptions of school gardening as an option for food provision in UPE schools in Kamuli and Soroti districts, Uganda

Focus Group Discussions with the respondents

A. School Management Committees (SMC) and Parents Teachers Associations (PTA)

1) What is your role as PTA/ SMC member in the school?
2) Please share some history about school gardens that you know of?
3) Are you aware of the school gardening programme in Nalango/Tubur primary school?
4) How did you get to know about the school garden progarmme in your area?
5) What is your opinion/attitude about the idea of a school garden as a parent?
6) How has the school garden in your area benefited you as a parent/ community?
7) Do you have a child in this school?
8) If yes, what has your child said to you about the school garden?

B. School Administrators and Teachers

1) Please share some history about school gardens that you know of?
2) What is your opinion/attitude about the idea of a school garden as a teacher?
3) How has the school garden in your school benefited you as a teacher?
4) How does your teaching subject relate with the school garden?
5) What internal institutional support is in place for the school garden? (Exploring the administrative support such as care of the school garden during holidays and sustainability).
6) What is your assessment of skills and knowledge acquired by the pupils to home gardens and community at large?
7) What are some of the factors affecting the knowledge application by pupils?
8) What challenges/constraints have you encountered during the production process of the school garden?
9) What ways have you employed to minimize these challenges and constraints?

Appendix 7: Nalango field day song

Chorus

Oh Nalango Agricultural club

We are really happy to receive you

Oh, special thanks to MakerereUniversity

And bravo! the faculty of agriculture.

1. You've taught us how to plough, how to sow and how to weed

Really Dorcas and Stella you've done a great deal

May God bless you. Chorus……..

2. You've tirelessly given us support

Materially we cannot tell it all

In the fight against short- term hunger,

You've done it for us, may God bless you. Chorus…….

3. You've groomed us into useful citizens

You've paved a way to our development.

A hungry man is an angry man

You've added joy to our stay in school

Appendix 8: Tubur field day song

We appreciate the agriculture officials for the good services rendered to Tubur x 2

With their leader, the Dean of the faculty to teach us to produce short-term crops x 2

Oh for sure, we are requesting the agriculture officials to educate our parents x2

On agricultural productive skills, so as to fight poverty, marasmas and kwashiorkor

Bye-bye visitors we all wish you, a safe journey home x2

Appendix 9: Tubur field day poem

Hunger, what a killer you are!

You make us feel stomach ache, become thin and eventually die.

What a killer you are!

For we do not have strength, strength to dig for you, only the rich can do it.

What a killer you are!

In every house you want to be there, asking every child, woman and man to give them something.

How deadly you are!

After contracting you, no medical doctor can cure you, except you, yourself.

The poor ones only wait to die.

Appendix 10: Pupils' scores in progressive tests

School	class	Scores for first test										Scores for second test										Scores for third test								
		0-20		21-40		41-60		61-80		>80		0-20		21-40		41-60		61-80		>80		0-20		21-40		41-60		61-80		>80
		No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No
Tubur	P3	8	33	9	38	2	8	2	8	3	13	7	39	3	17	4	22	2	11	2	11	0	0	5	21	8	33	9	38	2
	P4	14	61	4	17	5	22	0	0	0	0	3	18	6	35	5	29	2	12	1	6	1	10	3	30	2	20	4	40	0
	P5	11	41	9	33	0	0	2	7	5	19	9	56	3	19	3	19	0	0	1	6	0	0	7	44	3	19	4	25	2
	P6	5	21	7	29	7	29	5	21	0	0	1	6	6	35	8	47	2	12	0	0	0	0	0	0	7	58	5	42	0
	Total	**38**	**156**	**29**	**117**	**14**	**59**	**9**	**36**	**8**	**32**	**20**	**119**	**18**	**106**	**20**	**117**	**6**	**35**	**4**	**23**	**1**	**10**	**15**	**95**	**20**	**130**	**22**	**145**	**4**
Nalango	P3	14	54	4	15	1	4	3	12	4	15	2	8	4	17	3	13	6	25	9	37	11	55	5	25	2	10	2	10	0
	P4	9	36	6	24	5	20	5	20	0	0	1	3	8	21	7	18	10	26	12	32	0	0	6	25	16	67	2	8	0
	P5	8	32	6	24	5	20	6	24	0	0	0	0	4	14	19	68	5	18	0	0	3	13	14	61	6	26	0	0	0
	P6	1	3	13	43	16	53	0	0	0	0	0	0	1	4	1	4	22	85	2	7	1	5	1	5	11	52	8	38	0
	Total	**32**	**125**	**29**	**106**	**27**	**97**	**14**	**56**	**4**	**15**	**3**	**11**	**17**	**56**	**30**	**103**	**43**	**154**	**23**	**76**	**15**	**73**	**26**	**116**	**35**	**155**	**12**	**56**	**0**

Source: Primary data