Title
REFERENCE MANUAL ON TEACHING SKILLS FOR AGRICULTURE IN HIGHER EDUCATION INSTITUTIONS


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This manual has been produced with the financial assistance of the European Union. The contents therein are the sole responsibility of Kenyatta University and the partners implementing the project and can under no circumstances be regarded as reflecting the position of the European Union.
PREFACE

The purpose of this manual is to present the best practices in teaching agriculture courses at university level. The manual has input from diverse backgrounds and experiences of instructors of agriculture in East and Southern Africa, Italy and Germany. It was motivated by the need to ensure that university students get wholesome quality training to excel in their chosen careers and are able to compete internationally. The manual is highly recommended for all instructors of Agriculture and related courses.

INTRODUCTION

Agriculture is the major economic activity in East and Southern Africa (ESA). Millions of the region’s inhabitants depend on farming to support their livelihoods, most at small scale level, farming less than 5 acres of land. Concerted efforts have been made to improve farm productivity and benefits to agricultural sector stakeholders. However, the full potential of the agricultural sector has not been realized due to myriad constraints that include degraded natural resource base, lack of microfinance, inadequate policy support, weak institutional capacity, among others. In addition to supplying adequate food, the sector is expected to generate employment opportunities while ensuring sustainable management of the environment.

Higher education institutions are critical to the success of efforts being made to sustainably increase productivity of the agricultural sector in ESA. To maximize benefits, the sector needs to be more competitive in global trade and markets. This goal can be achieved faster if better trained manpower is available. However, resource constraints have adversely affected the ability of higher education institutions in the region to offer high quality training and deliver the expected high quality manpower. There is therefore need to put in place interventions to strengthen the quality of teaching highly qualified human resources.

Towards developing effective interventions to improve teaching skills, curriculum development and the engagement of management units in universities, the EDULINK Project FED/2013/320-148 facilitated the development of this reference handbook to be used as a resource by lecturers and instructors in higher education institutions. The materials have been contributed by instructors in universities in Kenya, Uganda and Zimbabwe with further input from project collaborators from Italy and Germany.

ACRONYMS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>MDG</td>
<td>Millennium Development Goals</td>
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<td>ESA</td>
<td>East and Southern African</td>
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<td>HEIs</td>
<td>Higher Education Institutions</td>
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<td>CAADP</td>
<td>Comprehensive Africa Agriculture Development Programme</td>
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<td>Moodle</td>
<td>Modular object oriented dynamic learning environment</td>
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<td>ODeL</td>
<td>Open, Distance and e-Learning</td>
</tr>
</tbody>
</table>
# Contents

Title .......................................................................................................................... ii

Contributors ............................................................................................................ ii

This manual has been produced with the financial assistance of the European Union. The contents therein are the sole responsibility of Kenyatta University and the partners implementing the project and can under no circumstances be regarded as reflecting the position of the European Union ........ ii

PREFACE .................................................................................................................. iii

INTRODUCTION ....................................................................................................... iii

CHAPTER 1 ................................................................................................................. 2

CONTEXT OF TEACHING AGRICULTURE ............................................................ 2

CHAPTER 2 ................................................................................................................. 4

PREPARING TO TEACH ........................................................................................... 4

Interpreting the curriculum ..................................................................................... 4

Developing the course outline ............................................................................... 5

Developing content ............................................................................................... 5

Sourcing of information ......................................................................................... 6

CHAPTER 3 ............................................................................................................... 8

DELIVERING A SUCCESSFUL CLASSROOM SESSION ........................................ 8

Prepare well for the class ....................................................................................... 8

Develop proper time management skills ............................................................... 8

Create a conducive teaching/learning environment ............................................. 8

Checking the entry level of the learners ............................................................... 8

Self evaluation ...................................................................................................... 9

Interactivity in class ............................................................................................. 9

CHAPTER 4 ............................................................................................................... 11

TEACHING PRACTICAL CLASSES ...................................................................... 11

Definition of practical .......................................................................................... 11

Approaches to facilitate practical training ............................................................ 11

Designing appropriate practicals .......................................................................... 11

Scheduling/ timing practicals ............................................................................... 12

Safety and other considerations during practicals ............................................... 12

Managing large numbers of students .................................................................. 13

CHAPTER 5 .............................................................................................................. 15

FIELD TRIPS, INTERNSHIPS AND SEMINARS ..................................................... 15

Field trips .............................................................................................................. 15
CHAPTER 6

INTEGRATION OF ICT IN TEACHING AND LEARNING

Definition of ICTs ................................................................. 20
Terminology ........................................................................ 20
  • E-learning ....................................................................... 20
  • Blended learning .............................................................. 20
  • Learner-centered learning environment .............................. 20

ISSUES IN INTEGRATION OF ICT IN EDUCATION ................ 20
Benefits of integrating ICT in teaching agricultural sciences .......... 21
ICT tools which can be used in agriculture teaching and learning .......... 21
Phases in the successful integration of ICTs in teaching .................. 22
Factors hindering integration of ICT in teaching and learning .......... 22

CHAPTER 6

TEACHING AGRICULTURE THROUGH OPEN, DISTANCE AND E-LEARNING (ODEL) ......................................................... 24
Introduction ........................................................................... 24
Open learning ......................................................................... 24
Distance learning .................................................................... 24
E-learning ............................................................................... 24
Benefits .................................................................................. 24
The objectives of ODeL in teaching of agriculture include ................. 25
Basic principles of ODeL .......................................................... 25
Problems and possible solutions ............................................... 25

CHAPTER 7

BUILDING COMPETENCIES FOR RESEARCH .......................... 27
INTRODUCTION ....................................................................... 27
Creating Effective Research Assignments ........................................................................... 28

CHAPTER 8: .......................................................................................................................... 30

ASSESSMENTS AND THE EXAMINATION PROCESS ......................................................... 30

Introduction ....................................................................................................................... 30

CONSTITUENT OF EXAMINATION ..................................................................................... 30

Pre-instruction evaluation ................................................................................................. 31

Formative Evaluation ....................................................................................................... 31

Summative Evaluation ...................................................................................................... 32

Principles of Instructional evaluation ............................................................................... 32

Examinations and Grading .............................................................................................. 33

CHAPTER 9: .......................................................................................................................... 35

BUILDING COMPETENCIES FOR ENTREPRENEURSHIP IN AGRICULTURE

GRADUATES ......................................................................................................................... 35

Introduction ....................................................................................................................... 35

Strategies for developing entrepreneurship skills ......................................................... 35

CONCLUSION ..................................................................................................................... 39

APPENDICES ....................................................................................................................... 40

Appendix 1: QUALITIES OF AN EFFECTIVE INSTRUCTOR .............................................. 40

APPENDIX 2: EXAMPLE OF A DETAILED COURSE OUTLINE ......................................... 41

Appendix 3: Academic Supervisor assessment form ....................................................... 43

Appendix 4: Student-lecturer evaluation form ................................................................. 44
CHAPTER 1

CONTEXT OF TEACHING AGRICULTURE

Agriculture is the key pillar for economic development contributing the largest proportion to the Gross Domestic Product of many sub-Saharan Africa countries. The sector is important in ensuring food and nutrition security, providing income, employment, and supporting other economic sectors such as energy, transport, industries, education among others. The achievement of several millennium development goals depends on attaining targets for the agricultural sector.

Fruit and vegetables, fisheries and livestock products, among other agricultural produce provide nutrition and food security, reduce malnutrition and poverty thus contributing to Millennium Development Goal No.1 (MDG1). Better health outcomes for children and mothers (MDG4 and MDG5) are assured where the agricultural sector thrives, while strengthened immune systems will reduce the costs and burden of treating infectious diseases (MDG6). Compared to other enterprises, agriculture creates more and better opportunities for commercialization through domestic and export markets, hence will provide more employment opportunities and better economic returns which improve livelihoods, especially for women and youth. Thus agriculture is core to increasing access to education (MDG2), health (MDG4, MDG5) and providing opportunities for women and youth, thus promoting gender equality and empowerment (MDG3). The increasing health consciousness globally will continue to increase demand for high quality agricultural produce. It is therefore important that agricultural value chain actors be enabled to seize the market opportunities.

Several factors constrain production and limit the potential in agribusiness. Insect pests and diseases, scarcity of high quality planting materials, poor/inappropriate farming practices, poor post-harvest management and inability to produce and market competitive products of the required quality standards, are major constraints. The lack of adapted quality planting materials in many crop varieties has constrained expansion of orchards and capacity of processors. Pest infestations reduce revenues and profits of smallholder growers and traders, and cause increasingly high production costs to local and export markets. Due to lack of knowledge on appropriate agronomic practices, quality of produce from many African countries is often lower than that of their counterparts in developed countries.

The foregoing demonstrates a need for interventions to develop, adapt, disseminate and demonstrate proven technologies that promote sustainable production and profitable agribusiness. This necessitates implementation of high quality training programmes that produce highly qualified human resource personnel to support the agricultural sectors.
However, the sector is performing sub-optimally and significantly below potential. A consequence of the underperformance is malnutrition and hunger, which undermines human health and ability to lead productive lives. Improving food security, nutrition and incomes in Africa’s largely agrarian economies are the interlinked goals of the CAADP\(^1\) initiative endorsed by the African Union in 2003. The persistent underperformance of African agriculture has been attributed to diverse factors, among them adverse climate change, low input use, and unattractive market conditions.

An important aspect that hitherto has not been explored is the contribution, or lack thereof, of agricultural higher education institutions in the weak performance of the sector. As the major suppliers of trained manpower for the agricultural sector, the state of agricultural Higher Education Institutions (HEIs) in the region, and the effectiveness of their training programmes, is an important area for intervention. Therefore, efforts to improve agricultural productivity oriented towards ensuring food security and reducing malnutrition, need to integrate research and training programmes amongst other key areas. The CAADP strategic framework Pillar IV (improving agriculture research, technology dissemination and adoption) suggests key roles for African HEIs. Interventions are all the more important taking into consideration the increasing youthful population that seems to be less attracted to careers in agriculture (CTA 2014), (RUFORUM). However in EU, more youth moving to agriculture and are progressing well to achieve its 2020 target.

Universities teaching agriculture have a mandate to conduct research and provide credible solutions to existing problems. Therefore, training in Higher Education Institutions should be geared toward producing quality graduates. The key quality indicators are

- Comprehensive theoretical knowledge in area of specialization
- Possess high practical knowledge and skills
- Ability to transfer knowledge and skills
- Good people management and interpersonal skills
- Independent thinking and problem solving skills

This manual is intended to enhance skills for teaching in agriculture to ensure development of high quality scientists, researchers, extension officers, high qualified growers, managers among others.

References

1. Achieving the millennium development goals in Africa. Recommendations of the MGD Africa Steering Group (June 2008)
3. Profiling Higher Education Institutions (Case Study from Eastern and Southern Africa), CTA and RUFORUM
4. Key Data on Higher Education in Europe

CHAPTER 2  
PREPARING TO TEACH

The starting point is to have a good quality curriculum and to ensure the instructor assigned a particular course has the necessary competence.

Interpreting the curriculum

The curriculum should be interpreted to ensure the learning experience achieves the required objectives. Learning is ideally organized to develop learners’ competence in the subject area, confidence, and importantly to develop learners’ capacity to contribute to societal development and become responsible citizens. As much as possible the teaching should allow for interdisciplinary learning and opportunities for self development.

The curriculum needs to be interpreted correctly for effective teaching. The instructor needs to familiarize him or herself with the University calendar and the course description as well as the institutions policies, which may impact teaching of the particular course. For example, a course that requires a field trip has to be conducted in a way that complies with institutional policy on trips including transport logistics and finances.

It is also imperative that one identifies and understands the goals and objectives that a curriculum seeks to address. Using the curriculum and the described course content, the instructor should develop a detailed course outline factoring in issues such as the number of learners taking the course; the teaching resources required versus those available for teaching the course, including and technical personnel for practicals and other learning activities. The topics should be organized from simple (known) to complex (unknown) to build a strong foundation for ensuing concepts. Difficult concepts should be aided with relevant examples based on students’ experiences so that they can be understood.

KCU 800: Biometry

Importance of biostatistics; hypotheses; comparison of populations and samples; variables, graphs and frequency distribution, measures of central tendency, and dispersion, commonly used distributions, statistical estimation and decision theory; computer applications and analysis of experimental data; completely randomized designs, lattice designs, latin square designs and split plot experiments; factorial experiments; variation in factor and level number. Correlation and regression theory; distribution: chi-square and binomial; non-parametric tests; tests of significance.
Example of course description. This is used to develop the course outline. Contents of the course should be discussed among the instructor in order to avoid overlaps and create better synergy.

**Developing the course outline**

The course outline is meant to establish a schedule for the course being taught. It should include the goals to be achieved through the course, the learning objectives and the expected learning outcomes. It should be developed in line with the university calendar to ensure harmony. The calendar indicates appropriate timing within the semester for continuous assessment activities as well as end of semester examinations.

At commencement of the semester, the instructor should bring to the attention of the class and discuss the details of the course outline. At this stage it is necessary that the instructor informs the class how the class will be conducted (theory, practical, seminar, term/semester paper, field trips, etc.) together with timing. The outline also provides details of how and when assessment will be done.

An important feature of the course outline is to provide guidance on additional reference / reading materials that the students should refer to. It is important that reading materials provided be: relevant, state of art, accessible to students preferably in institutional library or online and in adequate copies. If material is to be accessed online students should be given the specific web address, not just the name of the document to access. If students are required to read a specific section or chapter the instructor may want to make a few copies to share with students.

**Developing content**

- The course description provides guidelines but the instructor has to determine the specific material to be presented to the learners. This calls for critical thinking and continuous assessment to ensure material is relevant, updated, interesting and appropriate for the learning level.

- Content should be developed taking into consideration the topics and the order in which they will be sequentially presented to the students. The sequence of the topics should be in such a way that the ideas build on each other.

- Chose topics that support the learning objectives. Reasonable scope for coverage should be determined to ensure that the learners get enough time to understand and practice the skills taught.
Example of a course outline. See full example Appendix 1.

**Sourcing of information**

Information for developing course content can be from online sources, Text books, Journals and own research. The instructor should ensure that the information is up to date and relevant. Utilizing information that is locally contextualized may help the learners to better understand the lesson and identify opportunities for applying the knowledge acquired. The instructor should survey a wide range of existing literature to ensure learners are provided with comprehensive and detailed content.

**Consultation time**

The instructor should set aside time to consult with their learners. The hours and location where the instructor will be available for the students should be made known to the
learners early enough and preferably at commencement of the course. The time and
venue chosen should be favorable for both the instructor and learners. In addition,
the lecturer should allow the learners know his/her contacts (E-mail, phone number)
for easy access. Ideally, the instructor should develop a web page where the learners
can access this information.
CHAPTER 3
DELIVERING A SUCCESSFUL CLASSROOM SESSION

Teaching is a complex process that requires proper organization. The following will assist in effective teaching.

*Prepare well for the class*
This usually will inspire students’ confidence in their instructor and sets the pace for the lesson. A well prepared instructor is focused and utilizes time allocated more efficiently. Preparation also enables the instructor to anticipate questions and be ready with appropriate responses. The perception that the instructor is knowledgeable and prepared builds learners confidence and interest in the course. See Appendix 2: (Qualities of an effective instructor).

*Develop proper time management skills.*
Always begin the lessons on time to encourage the learners to attend classes on time and end promptly while ensuring good coverage of the lesson. This enables good and unrushed coverage of the content, while at the same time imparting important lessons to the learners regarding time management.

*Create a conducive teaching/learning environment*
This includes ensuring proper lighting, ventilation and proper arrangement of teaching resources, among other actions. The environment should be calm and noise within the class or in the surrounding should be completely minimized. Activities close to the learning room that can distract learners should be minimized. As a result, learners will be comfortable throughout the learning process. Within the class environment it is necessary to ensure order, e.g. have rules on conduct with mobile phones that can disturb class or rules to restrict disruptive movement once class has commenced. If it is a large class and some students are seated far away, the instructor may want to modulate their voice, use large font sizes or use amplifying equipment to ensure everyone can hear and see. It is good practice to confirm with the learners seated furthest that they can hear and see.

*Checking the entry level of the learners*
It is quite possible that learners in the course are not at the same level of knowledge at commencement. This is especially common for learners in the first year of university.

The knowledge level and skills tends to level out as students complete year one and progress to other years. The instructor should assess to determine the entry knowledge level and put in place measures to improve for segments of the class where gaps may be identified.

A recommended practice is to prepare information sheets (questionnaires) that students could fill in during the first lesson. In addition to assessing their knowledge levels, the instructor can also obtain information on learner’s expectations at the beginning of the course. The instructor could also administer a test that helps to determine what learners know.
If such an exam is to be administered it is important that learners be made aware with adequate notice, otherwise they may resent the instructor and the course.

Self evaluation
This is a professional activity that allows the instructor to evaluate themselves so they can become better teachers. This can be achieved through self-monitoring, video recording of teaching sessions and feedback from students via questionnaires or interviews. Data from institutional quality oversight offices may also be helpful in indicating how learners assess the instructor.

Interactivity in class
It is important for the instructor to be interested in each member of the class. Calling students by name boosts their sense of belonging, builds bonds between lecturers and students, and shows instructor has interest in the student. This acts as a motivator, resulting in the learners striving to do better. Although this may not be possible where classes are large, effort should be made to familiarize with as many learners names, interests etc, as possible. Where possible, giving individual attention to learners will allow instructor to understand the pace at which learners are progressing so as to attend to those that may need specific attention. The instructor should ensure the class is interactive by allowing controlled discussions, question and answer sessions. This is important so as to encourage critical and creative thinking among the learners. It also boosts their self confidence and improves verbal communication. The instructor should ensure discussions are focused and guided to remain within bounds of the current course. Maintain interest of learners through use of humour, tone variation, use of relevant interesting examples and proper use of gestures.

The chapter has discussed the interrelationship between the curriculum and the course outline. It underscores the importance of being able to interpret the curriculum before embarking on designing the course. Aspects that are paramount in ensuring successful teaching and learning were also highlighted.

Self Assessment activity 1

1. As an instructor, reflect on your school days. Who is that teacher (s) you still regard highly? What is it that you liked about the teacher (s)? How did this influence who you are today?
2. Describe yourself as an instructor. What is it that your students like /dislike about you? What are your weaknesses? What are you doing about it?
3. Go over your course outline. If you were asked to improve this course outline, what changes would you make? Why?
4. Identify your areas of strength and weaknesses. Work towards improvement and take note of students’ and peer evaluations for this end of semester. Keep on improving yourself, remember learning is a lifelong process.

References
2. Why do Agriculture Faculties Fail to Attract the Best Students? 2011. ASTI – FARA/IPFRI
CHAPTER 4
TEACHING PRACTICAL CLASSES

Definition of practical
The purpose of practical class is to provide an opportunity for the students to learn by doing. The instructor should spend minimal time on theory other than introducing the learners to the session. The instructor can spend some time demonstrating / illustrating; most of the time should be left for learners to carry out hands on procedures. Practicals are an absolutely essential component of teaching most agriculture courses. They should be assigned more time and resources as compared to theory classes. However, the lack of appropriate facilities and high cost of setting up practical training has affected the quality and frequency of practical classes offered. A common complaint among agriculture students is that practicals are lacking or inadequate, if not inappropriate.

Approaches to facilitate practical training
a) Maximize use of existing facilities: labs, research farms, green houses, orchards for field visits and observational experiences.
b) Practical teaching can be integrated to ongoing research projects, but with caution to ensure safety of learners and without interfering with research activities.
c) Establish a dedicated teaching farm with:
   • A multi-purpose technology demonstration area for crops, livestock, machinery, etc.
   • A crop museum and botanical garden with crops for exhibition and sourcing samples for laboratory work.
   • A dedicated field site where students will try out various technologies, crop varieties and practices.
   • A green house to be used exclusively for practical work by students.
   • Small scale facilities for irrigation
   • Establishing facilities for housing and of animals and poultry.
d) Partnership with private sector stakeholders who own facilities that could be used by students for learning and research purposes.
e) Motivate students to take interest in practicals by assessing practical reports and having the scores count as part of course assessment.

Designing appropriate practicals
When designing a practical class the instructor should keep in mind the objectives of the course.
• The experiments should be in line with theory learned so as to maximize synergy and ensure the theory and practical effort are well synchronized and reinforce each other to achieve the desired outcome.
• The input of technical and other support staff is crucial and should be considered in design of practicals to ensure they are feasible and successful. The close involvement of all personnel supporting practical learning is an
important aspect of success as they guide the learners in carrying out the practical.

- Learners should be encouraged to consult with technical personnel during and after the practical to enhance learning. The instructor should ensure the technicians are well briefed and adequately understand the principles and methods to effectively support the session. The briefing should happen several days before the intended practical session.
- The workload for each session should be manageable within the provided time.
- The activity expected to be done by students should be commensurate with resources (equipment, space, materials, technical personnel) provided/available.

**Scheduling/timing practicals**

- The practicals are most effective when done after a lecture / theory on a particular topic in order to marry theory with practice.
- The instructor should provide a brief introduction to each practical class and describe the relationship to the relevant section of the theory already learned.
- As much as possible learners should be informed beforehand the nature of the practical lesson and any preparation including prior reading that may be necessary to maximize value of the practical.

**Safety and other considerations during practicals**

- Students should be provided with health and safety guidelines before commencement of practicals.
- The instructor for the course or an experienced technician must be in charge of a practical class at all times.
- Safe working procedures for each practical must be outlined in relation to risk assessments carried out for different practicals. These procedures should be incorporated in the practical instructions and schedules.
- Instructors and technicians should carefully monitor all activities in line with specified protocols for each practical.
- The person in charge of each practical session should determine the student-demonstrators’ ratios in light of anticipated hazards for each practical to ensure adequate student supervision.

**To note**

- If the practicals involve handling farm animals students should be assisted by a trained animal handler.
- Practicals involving use of farm machinery and implements should be closely supervised by trained personnel to minimise accidents.
- For students with special needs (health, religious, cultural, etc) the instructor should consider having them sign declaration forms to give consent to certain practical learning procedures.
Managing large numbers of students
Large classes have the advantage of diversity while at the same time posing a concern of how to organize effective practicals such that all the students participate effectively.

- Since practicals are intended to help each learner gain hands on skills, dividing the class into smaller manageable groups may be necessary to ensure there is enough space and required equipment.
- If a class is to be split into groups, precautions should be taken to ensure each group gets the same quality of learning and experience. If different groups of students are to be handled by different persons it is necessary to ensure all persons go through the same preparation and can practice before the actual practical lesson.

Conducting a practical session
- Develop guidelines for each practical lesson with clearly stated:
  - lesson objectives,
  - student activities,
  - materials and equipment to be used
  - procedures during the lesson.
- Always evaluate each lesson (both formative and summative evaluations) and keep on improving your practical lesson delivery.
- Use appropriate demonstration techniques and remember students are unique individuals therefore strive to meet every student’s needs.
- Give tasks that are challenging but achievable to allow all learners to enjoy a sense of achievement.

Practical demonstrators
Demonstrators support the instructors and technicians in guiding the students perform the practical tasks and procedures. Demonstrators are especially necessary for assisting in large classes. Ideally demonstrators should be graduates who have already studied and excelled in that course.

- Demonstrators must be at the venue at least 30 minutes before the practical commences in order to make final preparations and to confirm the functionality of all equipment and tools.
- Demonstrators should always wear safety and protective clothing in line with particular practical considerations.
- Demonstrators should work closely with the person in-charge to guide students in all procedures, including observing health and safety precautions.

Attendance registers
- Registration encourages students to attend and participate in practical lessons and reinforces the importance of practical as a component of the learning process. This ensures the resources, time and effort spent on preparation of the practical lesson are well utilized.
- Attendance should be considered when awarding marks for practical reports.
• Students should be required to sign attendance registers for practical session.

Assessing the practical classes
Assessment will enable the instructor to determine whether the learning objective has been achieved and where necessary to take remedial action.

• Students should be encouraged to keep laboratory/field handbooks/diaries where they record all practical activities undertaken and results or outcomes of experiments.
• Students should present these to the instructor for assessment.
• The instructor may also include questions derived from practical classes in tests.

To note
Practical tests or exercises, be they individual or group help assessment of the development of psychomotor skills. Remember students have different learning styles, i.e. kinesthetic, audio, visual etc. As the instructor, give all your students an equal opportunity to develop or realize their strengths and capabilities thus motivating them all to do their best. At the end of it all, they will all succeed (theory test + practical test + oral presentations = pass!) By so doing you will have catered for all your students’ needs.

This chapter has discussed the importance of practicals in an agriculture curriculum. Higher education institutions in Africa are usually bedeviled with challenges in effectively providing practicals to students due to poor instructional methods. This chapter has proffered suggestions on dealing with some of these challenges.

References
CHAPTER 5
FIELD TRIPS, INTERNSHIPS AND SEMINARS

The learning experience can be significantly enriched by inclusion of field trips, internships and seminars.

Field trips
These are usually academic visits to Agro-based industries, commercial farms, Non-governmental organizations, research organizations among others. Field visits are intended to expose the learners to environments where what they learn is practiced and applied and thus are invaluable in enhancing the learning experience. This provides learners with unique experiences that may not be acquired in the class or laboratory. Well planned field trips provide students with first-hand experience related to the topic or concept taught during lectures. Field trips require proper planning for success. The aspects to be considered for successful planning can be grouped into three phases:

- Planning
- Execution
- Post execution.

Planning phase
This phase involves two major components: administration and instruction. **Administration** involves all of the steps taken by the instructor to organize the logistics. This includes notifying the faculty/school administration, seeking permission from the institution to host the visit and organizing the schedule of activities.

**Instruction** to learners is critical in preparing students for a field trip. This can be done through discussion of the purpose of the trip in relation to the course being taught. It is aimed at informing learners on what to expect during the field trip through methods such as showing photographs, drawings, or a videotape of the site to be visited.

- Rules to guide on issues of safety and expected behavior should be reviewed and made clear to learners.
- Briefing notes can be distributed to learners prior to departure on the trip.
- A discussion with the students on how to ask good open ended questions is often necessary.

To note
It is also helpful to notify other teachers of the absence of the learners for other lessons for the duration of the trip so that they can arrange a make-up on missed lectures.
Execution Phase
This phase comprises of the trip activity itself. Two important components need to be addressed during this stage: the role of the student and the role of the teacher.

The students’ role:
Most importantly attending the field trips and paying close attention to all instructions. As such students should:

- understand the objectives of the field trip and go through the program prior to the material day.
- take notes, be observant and attentive
- Engage the guide/demonstrator at the institution in relevant discussions and questions.

To note:
- Open exploration may not be appropriate in all locations, e.g. students may not be allowed to roam freely in a manufacturing plant.
- Time should ideally be allowed to view items or photos in the visitor area prior to the guided tour. This allows students to get comfortable with their surroundings, and can better focus on the topics to be learned.

This is followed by a guided tour for the whole class. During the tour, the teacher can point out specific items that relate to the educational goals of the trip. At this point, learners should be given an opportunity to ask any questions. The learners can be provided with specific instructions on observations to make on which they will be required to develop a report.

The instructors’ role:
- Monitoring and management of student behavior and learning progress. Where necessary, corrective action or adjustments should be made as students move from one stage of the trip to the next to ensure learning objectives are achieved. This should be done politely while observing courtesy to the hosts and other participants.
- During field trips, instructors should act more as facilitators rather than directors. The person hosting the visit should take charge in explaining and guiding the learners. The instructor should introduce the host to the learners to confer the necessary authority to conduct the learning exercise.
- The facilitator can play a greater role in stimulating discussion between learners and the host.
- At the end of the visit the instructor should nominate one student to give a vote of thanks. The student should have been identified and advised prior to the visit.
The Post Execution Phase / Post-Field Trip Activities
A post trip activity should be designed to assess whether the intended outcome was achieved

- Students can be organized into groups and assigned an activity such as writing a report based on the trip that can be shared in the class and the learners should be encouraged to use creativity in their presentation.
- It should happen soonest possibly after the learners get back from the field trip.
- The teacher should then link all the learning activities to the curriculum and evaluate the reports.

To note
- Part of the student assessment on the field trip should be the identification of problems and opportunities at the company/institution visited and suggest possible solutions. This will test students’ critical thinking and problem solving skills.
- Thank you letters should be written to the organizations/persons who facilitated and hosted the trip or contributed to the trip’s success.

Internships
Internships are an integral part of agricultural training. Universities have adopted supervised internships as part of their training in order for learners to benefit from work experience. Internships promote self-discovery and self discipline from the dynamic application of education and other learning opportunities. Students get the opportunity to enhance their abilities to set goals and outline plans to achieve them, communicate, think critically and reflect on their observations in order to develop professional skills.

They also get the opportunity to develop and strengthen competencies such as; decision making, problem solving, taking initiative, leadership, teamwork, communication, creativity and critical thinking skills. Importantly, internships provide learners with opportunity to interact with potential employers, gain exposure to actual working environments and learn independently of their university-based instructors.

The objectives are numerous and may include:
1. Identify and practice competencies that are necessary to be a successful professional in their area of specialization.
2. Develop professional attitudes and appropriate behavior.
3. Systematically self monitor, reflect on and evaluate performance and achievement considering career development goals.
4. Enhance technical skills and knowledge in an applied agricultural setting.

Features of successful university internship programs;
- Are anchored in the curriculum as part of the learning process.
- Are adequately resourced and facilitated to ensure success.
c) Are included in assessment and grading of the learning process, hence motivates the learners to take the experience seriously.

d) Allows opportunity for students to learn how to complete and submit a formal application for the internship and in some cases, identify and propose a training site.

e) Students enter into an agreement with the university and the employer specifying the training objectives and proposed activities to be achieved during the period of the internship.

f) The students submit periodical written reports, fill in time sheets and complete self evaluation reports.

g) The supervisor at the place of internship should provide the students with “on the job instruction” and submit a final written report to the university.

h) Student may also be tasked to complete a mini-research project based at the work station in order to assist in solving real work related problems at the assigned company.

i) Assignment of a lecturer to make supervisory visits to the internship site and complete a final evaluation of the students performance.

Please see:
Appendix 3: Example of a Lecturer assessment form during student visit

Seminars

A seminar is platform that students to present outputs from structured research activities or assignments formally. It is an interactive process that allows learners to obtain feedback from participants. Seminars can be a powerful approach to reinforce learning as well as providing learners with opportunity to learn from one another. At undergraduate level they can be optional but should be encouraged as students’ progress toward the final year.

To note:

- 3rd years could participate through listening and asking questions while 4th years are making presentations or vice versa.
- At Postgraduate level, this should be a mandatory and integral part of training and form part of the evaluation process. Topics can be shared amongst members of the class such that each individual or cluster/group of students address a unique topic. The learners may be required to research on the topic assigned and prepare to make presentation to the rest of the class on a specific time.

Important elements for success in seminars are to:

- inform the learners early of the requirement for a seminar,
- guide learners in selecting a relevant topic to present on,
- assist learners to obtain relevant reference materials,
- equip learners with presentation skills on how to prepare the presentation, e.g. making power point slides, posters e.t.c
• inform learners how the seminar will be assessed
• listen and help learners to build confidence before, during and after the seminar.

To be more objective in assessing the presentations the instructor may invite one or more colleagues to listen during the seminar.

Other activities that enrich the learning experience

Games
Games provide an exciting learning experience. The important thing is choosing appropriate games for the appropriate topic. This allows learners to have fun while learning.

To note: This needs ingenuity and creativity.


Self assessment Activity

1. Plan a field trip for your students. Outline your activities, students’ tasks and the tour guide’s tasks. After this planning, put away your draft document for 2 days. Revisit the plan and evaluate it. What were omissions, strengths and areas of improvements in the document? Does this help you appreciate the value of advance planning and revising the initial plan before presenting to students?

2. Plan 2 games for use in your lessons. How did students react to this new approach? How did you feel about it yourself? Make an honest evaluation of this lesson (s).

Agriculture being a practical subject demands that students learn more by observing and doing. This chapter has thus outlined beneficial learning activities that can be used to enrich and broaden students’ learning experiences.
Definition of ICTs
Information and communication technologies (ICTs) are a diverse set of technological tools and resources used for creating, storing, managing and communicating information. For educational purposes, ICTs can be used to support teaching and learning as well as research activities. ICT originally was applied to serve as a means of improving efficiency in the educational process. This chapter will deal with ways and importance of integrating ICT in agriculture teaching.

The use of ICT in the classroom is very important and can significantly enhance the quality of teaching and learning. The rate at which ICT’s are being developed is rapid; agriculture training and research needs to keep up the pace with changes in technological applications. Therefore studying the opportunities and obstacles to the use of ICT in agricultural education may assist educators to overcome these barriers and become successful technology adopters in the future.

Terminology
Several terminologies including ICT, Information Technology (IT), Communication Technology are interchangeably used to refer to technologies which are used for collecting, storing, editing and exchanging information in various forms.

- **E-learning** uses a network for course delivery, interaction and/or facilitation. Web-based learning is a subset of e-learning which uses specialized software e.g. moodle, blackboard etc.
- **Blended learning**: refers to learning models that combines the face-to-face classroom practice with e-learning solutions.
- **Learner-centered learning environment**: is a learning environment that pays attention to knowledge, skills, attitudes, and beliefs that learners bring with them to the learning process. Here, it means students personal engagement to the learning task using the computer and or the internet connection.

** ISSUES IN INTEGRATION OF ICT IN EDUCATION **
Training in agriculture needs to recognize the potential of ICT in widening access to education. However, despite the efforts and the strategies in place, there are several challenges to full realization of the benefits of ICT in teaching.
- In many universities, there are still very few agricultural courses on the e-learning platforms either for full time or blended learning.
• A general concern has been limited access to internet connections, but this is increasingly being resolved in most countries.
• Some academic staff either lack the necessary IT skills or are uncomfortable experimenting with use of ICT.
• In some institutions, computers, network infrastructures and connections are far less than the population of enrolled students and existing demands.
• Specific to ODeL programmes, some students lack skills in use of ICT, which limits their adoption and use of technology for learning.

To effectively utilize ICTs, lecturers need to develop the competencies necessary to use computers and the internet as a teaching tool. Many university academic staff still lack the required skill to match the technology (e.g. Social media) with innovative pedagogies that benefit the learning process.

**Benefits of integrating ICT in teaching agricultural sciences**

• Makes agriculture teaching and learning more interesting and deepens understanding.
• Makes teaching more student-centered, i.e. shifts the focus of activity from the teacher to the learners. These methods include:
  o **active learning**, students solve problems formulate and, answer questions, discuss, explain, debate, or brainstorm.
  o **cooperative learning**, students work in teams on problems and projects under conditions that assure both positive interdependence and individual accountability.
  o **inductive teaching and learning**, students are first presented with challenges (questions or problems) and learn the course material in the context of addressing the challenges.
• Helps teachers to better organize their teaching.
• Demonstrates essential but difficult-to-perform experiments at low cost e.g. simulation, you-tube etc, thus improving memory retention.
• To disseminate content more effectively with less variation.
• Enables regular updating of teaching material with new knowledge.
• Enhances virtual interactivity between learners/instructors in different geographical locations.

**ICT tools which can be used in agriculture teaching and learning**

• Tools for data capture, e.g. Camera, datalogger, global positioning system, etc.
• Multimedia software for simulation,
• Publishing and presentation tools,
• Digital recording equipment,
• Computer projection technology,
• Computer-controlled microscope
• Multimedia Personal Computer (MPC), laptop, notebook
• CDs & DVDs, digital video, camera
• Internet – emails, browsers, website, search engines
• Computer aided instruction
• Computer mediated video/ audio conferencing
- Videoconferencing
- Digital libraries, e-books and electronic publications
- Microsoft publishing newsletter, poster, brochures

**Phases in the successful integration of ICTs in teaching**

Successful integration of ICTs in learning needs to be done systematically to enhance adoption. Important phases are:

1) The establishment of **infrastructure** e.g. Internet, computers, cameras, projectors, appropriate software, library and skilled personnel.
2) Identifying the training needs of technical staff, instructors, support staff among others. These groups need to see the advantages of ICT in their work so they can be motivated to work together in integrating it in teaching.
3) Promoting wide adoption of ICTs in teaching and learning. This can be through non-monetary and monetary motivation, policy changes etc.
4) Evaluating the use of ICTs in teaching and learning activities to satisfy the different and unique target groups in higher education.

**To note**

The goal is to integrate the different elements of ICTs to deliver high quality teaching and learning.

**Factors hindering integration of ICT in teaching and learning**

Integrating ICT into teaching and learning is complex and confounded by several challenges. These include:

- Lack of confidence due to inadequate skills and the uncertainty of using new unfamiliar equipment and software.
- Resistance to change
- Lecturers’ use and opinion of ICT compared to traditional teaching methods.
- Lack of technical support to foster lecturer confidence in use of ICT
- Lack of adequate facilities

**Possible Solutions**

- Adequate training to
  - Keep up with technology changes
  - Keep up with the level of learners
  - Improve efficiency and productivity
- Adequate modern facilities
- Continuous demonstration the benefits of ICT integration in teaching and learning
- Address the fears through creating an enabling environment for staff to interact with ICT tools.

With ICT, teachers/instructors are no longer seen as “the transmitters of knowledge” but rather “the facilitators” of the learning process. Digital tools can expand learning performance beyond the reproduction of facts and concepts.
harness the potential of ICT in enhancing learning, the role of the learner needs to change from a passive to an active participant. This will require the instructor to rethink the learning activities, through exploration of how interactions are managed and facilitated, and a choice of the right tool for each pedagogical task.

**Question**

What other challenges in your institution hinder integration of ICT in training and what are some of the possible solutions?

**Summary**

The role of ICTs in higher education institutions in the 21st century cannot be overemphasized. ICT is one of the basic skills that a graduate is expected to possess. The integration of ICT in the teaching and learning process has been discussed in the foregoing as an enabler for the teaching and learning process and for developing skills such as independent learning in studies.

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CHAPTER 6
TEACHING AGRICULTURE THROUGH OPEN, DISTANCE AND E-LEARNING (ODeL)

Introduction
Education is going through a rapid transformation with learning needs expanding and the number of learners getting multiplied. New ways of knowledge transfer and exchange are being developed and as a result educational institutions, mainly universities, are striving to adapt to these new changes in terms of their functions as well as functioning. Over the last two decades, there has been a sudden surge in the interest placed on Open and Distance Education mode as an alternative for formal mode of education. As a result, many Open or Virtual Universities are seen to be established in several countries.

Open learning
This is a method of studying at a convenient place other than the formal institutional setting, using specifically written course materials, with the support of a tutor who provides guidance on a regular basis and helps students progress through their courses successfully. Occasionally, attendance at the University is necessary for practical work or supervised assessment. It usually provides an ideal way to study for those who have difficulties in attending classes regularly, perhaps due to employment commitments, a young family, long travelling distances, disability, among others.

Distance learning
Distance learning is a way of learning remotely without being in regular face-to-face contact with a teacher/instructor in the classroom. It often occurs when there is a separation between the instructor and the student, usually due to geographical or time concerns that prevent the student from attending an on-campus course. Often, electronic means are used to bridge this gap and distribute educational material though distance learning programs using printed and mailed materials.

E-learning
This is the use of computers in education either to provide programs that deliver instruction, or to facilitate communication between learner and tutor, or to enable students to have access to remote sources of information. E-learning has established its relevance and efficiency across the globe.

Benefits
Distance mode of learning is able to benefit the following through its unique characteristic of providing education to those who cannot opt for regular mode of education.
- ODeL is flexible in nature and able to cater for the needs of working people who cannot attend class continuously, adult learners especially, women, those who
could not get opportunity earlier in life and those who belong to socially and economically disadvantageous sections of the society.

- ODeL is less costly and provides opportunity to young people who are interested in agriculture courses yet are limited by resources to attend college.
- ODeL also allows professionals in other fields who are interested in agriculture to enroll without much interruption of their normal work schedules.
- ODeL is capable of advancing and disseminating knowledge for learning by a diversity of means and modes.
- ODeL provides opportunities for higher education to a large segment of the population.
- ODeL also allows for development of new programs in remote areas without having to move professors

The objectives of ODeL in teaching of agriculture include

- To promote entrepreneurial skills for self employment,
- To offer continuing professional education,
- To offer developmental extension education
- To offer Agricultural Education to special groups of rural people in general, and school dropouts, small and marginal farmers and women in particular,
- To provide innovative, open system of education by using distance learning and teaching methods supported and enabled by modern Information Communication Technology (ICT), and
- To orient the courses that would provide for developmental needs of the individuals, institutions / organizations and the country.

Basic principles of ODeL

- Bridge the geographical distance between teacher&learner, learner&learner, learner &study material and learner &institution.
- Study material is prepared in a manner that allows self-study.
- Barriers to learning removed (economical, flexibility of learning)
- Quality education provided in a cost effective way.
- Learning materials accessible through the ICT platforms, regional centres etc.
- Provide practicals through collaboration with other institutions.
- Seek innovative ways of exposing learners to various alternative ways e.g. simulations.

Problems and possible solutions

1. Nature of the study material;
The learners may be interacting with new material which will be challenging for them to interpret correctly. This can be addressed through designing activities that takes care of the learners needs regardless of their location.

2. Lack of constant communication with the instructor;
This can potentially lead to dropping out of learners due to lack of motivation. This can be solved through proper monitoring of the process of learning.

3. Lack of social interaction with other learners;
this is an important component of learning from the diverse nature of the different learners. This can be addressed through utilization of technology to provide platforms for the learners to have discussions such as videoconferencing and chatting.

4. **Students being deficient of technological skill;**
   this is especially a concern faced by adult learners. They should be given basic training of ICT to enable them participate fully in the course.

5. **Organizing practical classes;**
   Since students spend more time off campus where labs and facilities for practicals are available the instructor has to put in place specific measures to address gaps emanating from lack of practical classes.

**Question**

What other problems are encountered during practical classes and what are their possible solutions?

**SUMMARY**

This chapter has explored the pros and cons of open, distance and e-learning as other modes of learning for students who are unable to enroll for conventional programmes. The chapter has also highlighted the additional efforts for both lecturer and student for the open and distance learning to be effective.
CHAPTER 7
BUILDING COMPETENCIES FOR RESEARCH

INTRODUCTION
Most agricultural careers entail research and reporting aspects. It is therefore necessary that learners acquire these skills, at least at the basic level while they are under instruction. Developing research competencies is necessary as enquiry is at the foundation of innovation. Most instructors want students to know how to conduct quality research and write good papers from the research projects they undertake.

Arising from this demand, many degree programs now have introductory courses with content that addresses these research and writing basics. However, the assumption that students learn everything they need in one course is incorrect. All teachers need to regularly revisit this content so the students can develop competent research and writing abilities.

Instructors role
1. Show students how research in the particular areas of specialization differs from more general approaches. This may require accompanying the students to the field station, helping them develop surveys, getting librarians to work with them on drafts, and showing them how to design experiments.

2. Give the student previous work to examine. Exposing learners to work done by previous students, allows them the opportunity to get an idea of what is expected of them. In addition, the learners are able to critique the papers. Then instructors can make clear what worked in those papers and where students fell short. Instructors need to provide positive models that show what students are capable of and that clarify their expectations from their learners.

3. Have learners evaluate and defend their sources. The instructors should ensure that the students recognize and appreciate the importance of work done by scientists quoted in their list of references. This can be done through students explaining during their oral presentation why some sources are considered credible. In doing so, students often learn what other works that person has published or how he or she is viewed in their field of expertise. This also allows students see connections among their sources.

4. Set aside time for peer review. Peer review (or peer editing) is valuable so as to edit draft publications before submission. This can be done through groups that can work together editing each other’s work.
5. **Make them write multiple drafts.** It should not be assumed that students develop proper writing skills through a single exercise. Learners will mostly get the value of a writing process by doing a draft revision and rewriting. A research project write up only becomes perfect after several reviews.

**Librarians help with research:**
New students in the university usually have minimal experience using an academic library for research work considering the innumerable online and print resources currently available. Therefore, finding information that is relevant to their research becomes an overwhelming task. Some of the problems faced by learners include:

- Minimal exposure to scholarly writing; difficulty understanding the complex language used in scholarly journals as opposed to that in magazine articles and blogs.
- Minimal experience with reference books, especially with subject-specific reference works contributing to poor retrieval skills.
- Minimal experience in reading and comprehension of documented writing such as academic papers and thesis.
- Difficulty in issuing search engines with well chosen and formulated key terms that are specific to their research work.
- Difficulty determining which items in a results list will best meet their needs.
- Unwillingness to invest time in learning to do library research when they believe they can find something on the Web.
- Difficulty in arranging citations once credible information has been acquired.

The library faculty can work with faculty in Agriculture to help students overcome these obstacles through:

- Giving guidance about relevant resources available in library.
- Preparing a general resource guide available online for agriculture students.
- Meet with students (or groups of students) for follow-up appointments to work on their projects.
- Work with students at the reference desk.
- Guide the students on proper referencing skills

**Creating Effective Research Assignments**
Well-designed research assignments are an excellent teaching tool. These aid in developing the students’ research skills, critical thinking abilities and subject knowledge. In planning for the research assignments, ensure that you;

- **Clearly state what students are expected to learn from the assignment.** Tie the assignment to stated course objectives. Students who understand how an assignment enhances their knowledge will be more motivated to do quality work.
- **Assess your students’ research skills and knowledge.** Ask them to give evidence of material used for their write-up such as references of Journal articles.
- **Request a library instruction session.** Librarians can teach students how to locate, evaluate and cite information resources, etc.
To note

- The learners should also be:
  - Taught on how to set up proper field research such as layout of plots
  - Exposed to good laboratory skills relevant to their research work.
  - Guided on how to analyze data
  - Taught how to write a good report.
  - Supported in publishing scientific papers from their research.

Research is an important component of teaching and learning. This chapter has discussed the need to inculcate research skills in students as a way of improving their academic writing and presentation of ideas.
CHAPTER 8:
ASSESSMENTS AND THE EXAMINATION PROCESS

Introduction

Examinations at university are a totally different experience from examinations at lower levels of education. The learner has to take responsibility for their own learning and preparation, as opposed to lower levels where teachers probably train learners for the exam situation with mock exams, revision sheets, homework exercises and so on. The exams at university generally aim to test how well learners understand the subject area. Lecturers are often more interested in whether students can apply the knowledge learners have gained rather than in how many facts have been learned.

CONSTITUENT OF EXAMINATION

Assessment is an integral component of the teaching and learning process. Students learn through the assessment activities and the feedback provided. Assessment tasks should be hinged to the learning outcomes which should be precise.

Assessment should consider following questions:

- Why are learners being assessed?
- What is being assessed?
- How is it being assessed?

The objectives of assessment are to:

- Gauge learners understanding of content taught;
- Test the application of content;
- Appraise the various higher order thinking skills, that is, analysis, synthesis, application and evaluation;
• Determine learners’ readiness to progress to the next level of learning.

To be effective, assessment should be timely, preferably after completing a specified component of the course. The feedback to students should also be expedited and detailed. A marking guide can be availed to students to enable them to assess their performance against the expectations. In addition to the assessment by the lecturer, students can be encouraged to conduct peer and self-assessment progressively.

According to Bloom (1956) an effective assessment process should encompass the following components:

i) knowledge,
ii) comprehension,
iii) application,
iv) analysis,
v) synthesis, and
vi) evaluation

There are three phases of evaluation:

Pre-instruction evaluation
This takes place before instruction to determine the starting point on an instructional program (what has previously been referred to as entry level knowledge). It identifies need, prerequisite skills and causes of learning difficulties and helps to place students in learning groups.

Formative Evaluation
Formative evaluation consists of those techniques of a formal and informal nature that are used during the period of instruction. They include Continuous assessment tests, Semester papers, practical reports, essays among others.

It is conducted during the curriculum development process for the additional purpose of providing information that can be used to form a better finished product. Thus formative evaluation takes place at a number of intermediate points during curriculum development process and is useful for;

• Situation analysis
• Formulation of objectives
• Setting the curriculum project
• Programme building
• Piloting the new programme
• Improving the new programme

Role of formative evaluation
i. To diagnose students difficulties in learning
ii. To take remedial action during the course of instruction, which is usually pupil oriented
iii. Re-examination and consequent revision of the approach to teaching the subject.
iv. It is also used to provide assessment of curriculum quality.
v. Formative evaluation contributes to students’ achievement in the final examination.

**Summative Evaluation**
Summative evaluation is the assessment that takes place at the end of a course. A final examination (post-test) is used for the summative evaluation of instruction. Its major purpose is to find out whether the students have mastered the preceding instruction.

**Role of summative evaluation**

i. Guiding the curriculum planner and the teacher in assessing the extent to which implementation has been successful
ii. Giving a basis for future decision making and planning
iii. Providing a basis for future modification/curriculum change in relation to strategies and methodology of curriculum implementation

**Principles of Instructional evaluation**

**Consistency with objectives**
An effective evaluation programme should test the ability of the student both theoretical, practical and attitudinal behaviours implied by the objectives.

**Validity and reliability**
- **Validity** - A good evaluation instrument (whether theoretical or practical) should measure what the evaluator intends it to measure
- **Reliability** - refers to the concept that the pupil or candidate should perform consistently on a test under similar conditions at different times

**Continuity of evaluation**
Evaluation should not only be carried out at the end of the learning process. The recommended practice is to conduct evaluation as the learning process progresses as follows:

i. Initial behaviour pretest (pre-assessment) - helps instructor to know the academic background and performance of students in class
ii. Continuous evaluation during teaching - as per institutional policy
iii. End of programme evaluation - done at the end of the course

**Comprehensiveness**
- Implies that all the objectives of the curriculum must be evaluated - objective, cognitive, recall and all other domains.
- Since there are many things and variables to be tested in instructional evaluation a wide range of instruments must be employed.
i. Essay questions  
ii. Short answer questions  
iii. Objective test items  
   - multiple choice  
   - supply item  
iv. less formal approaches like use of interviews, questionnaires and assessment of personal and social adjustment.

At the beginning of the semester, learners should be informed about dates which all the examinations will take place and the time when they should get feedback. This helps the students to plan well for their semester.

Examinations and Grading  
Evaluating students' work fairly and consistently requires regular written work and examinations. It is especially important to provide students with a measure of progress throughout the semester, and not merely at the end. To this end, members of faculty are encouraged to give mid-term as well as final examinations. All written work should be returned to students with comments as soon as possible.

- All examinations should be carefully prepared and announced in advance. Faculty are responsible for accurate assessment of the mastery of course content.
- A student's performance should be evaluated solely on an academic basis; opinions and conduct not relevant to academic standards should not be involved.
- Final examinations should be given at the end of the semester, during the last scheduled class session.
- If a student misses a scheduled examination, the institutions policy regarding this should be applied fully.

Guidelines to setting good examinations

Grading  
Grades are an important measure of academic progress, and students need evidence of where they stand throughout the semester. Current practice in most universities is for grades to be submitted electronically in most universities. Therefore prior training and careful entry of marks is essential. The instructor should be aware of the grading system in the university.

- The instructor should enter only one grade for every student. Grades should be submitted soonerest possible because the students are entitled to prompt reporting of grades.
- Exam violation; if the instructor notes an exam violation, gather all relevant evidence. You are required to report all violations to the relevant authority. Then university policy should be applied accordingly for any examination irregularity.
• All unsatisfactory grades from one academic year must be remediated before a student begins the next academic year.

In this chapter the role of assessment in the teaching and learning process has been presented. The chapter has also highlighted the types, principles and methods of assessment in agriculture curriculum.

Note

It is necessary for learners to also provide an assessment of the instructor, facilities and the learning environment, which helps to improve the quality of classroom teaching and accountability. The learners should be given a tool to collect information regarding the course, the instructors, the learning environment and other learning activities. This will give important feedback for identifying possible gaps and providing credible solutions.

Several factors should be considered during this evaluation;

1. Timeliness; the tool should be issued early in the semester. At a time when the learners have had the introductory classes.
2. Appropriateness of tool to be used; the questionnaire, interview, focus group discussion or any other tool chosen should give the required feedback. It should be precise and structured to give quality information.
3. Remedial action; this should be done promptly to allow the learners to have a better learning experience.

See Appendix 4: Example of student-lecturer assessment form
CHAPTER 9:

BUILDING COMPETENCIES FOR ENTREPRENEURSHIP IN AGRICULTURE GRADUATES

Introduction

Considering that opportunities for formal employment may not be available for every person, graduates are encouraged to seek alternative opportunities and preferably to be “job creators” rather than “job seekers”. Venturing into entrepreneurship has been recognized as one of the most viable options for earning a livelihood, after completing studies. It is therefore necessary that graduates with competencies and skills for entrepreneurship be developed. Some universities have developed specific courses to develop entrepreneurship skills as a way of preparing students for self employment.

Entrepreneurship is defined as “the process by which individuals recognize economic opportunities and create value from it both to themselves and the society (Baran and Velickaite, 2008)”. Isiorhovoja (2011) considers an entrepreneur as someone who recognizes economic opportunities and creates economic values for himself/herself and the society at large. While some entrepreneurship skills are probably heritable, most people can be taught to become entrepreneurs.

One constraint in agriculture teaching is that lecturers, though competent in their subject areas, are often not prepared to instill entrepreneurial tendencies to their students. This chapter presents suggestions on possible actions and strategies for influencing graduates to more positively view self employment and start developing skills towards this direction.

Strategies for developing entrepreneurship skills

1. Learner should be provided with facilities for learning and acquisition of sufficient skills in different facets of agriculture. Entrepreneurship foundation consists of four pillars namely: Business ideas, resource availability, motivation and hard work and knowledge, skills and experience (Luyayi et al., 2014). The current agriculture programmes in most universities are quite strong in imparting technical knowledge, skills and experience which to some extent would be useful for business development and management. Demonstrations and practical learning plots where the learners are exposed to various agricultural practices can enhance their interest and positive view of agriculture enterprises.

2. Learners should be helped/guided to identify an area of agricultural enterprise that they are passionate about, and in which business acumen can be developed. Passion for a given area of agriculture is a good indicator of potential generation of business ideas that can be followed upon.
3. Teachers/lecturers / instructors should influence students towards a change of attitude from waiting upon others to self-dependence and generation opportunities for others upon graduation. An example is the BSc. Environmental Horticulture and Landscaping programme at JKUAT where emphasis on entrepreneurship / self employment upon graduation is bearing fruit.

4. The students should be constantly reminded how the different skills they are acquiring during studies can be converted into business enterprises. Instructors should aim to deliberately incorporate entrepreneurial skills development thought into their courses so that the students can over time acquire entrepreneurial potential. Trainers should identify possible businesses that graduates could engage in using the knowledge gained in particular courses. For example, during an entomology course students can be made aware that they can start businesses in insect rearing for studies, silviculture, bee keeping for honey and pollination services, insect identification, silk worms, etc. To do this successfully instructors need to be aware of appropriate examples and case studies of similar successful agro enterprises, at the appropriate scale that the students can identify with. This would provide role models for graduates to follow.

5. **Field trips** should be organized regularly to relevant enterprises to ensure regular mutual interactive session of students with successful agricultural entrepreneurs. This will expose students to real business scenarios and facilitate exchange of knowledge on important aspects of agribusiness which they could utilize to further develop their business ideas. Such visits can be built into regular learning activities and would require more strategic choice of places to be visited during learning trips and field visits.

6. **Entrepreneurs talks** can be organized with invited guests to give talks to students on development of entrepreneurship, business management and other relevant skills. A mix of various types of agro entrepreneurs would need to be identified and brought into contact with the students as they progress along their studies. While individual lecturers would be responsible for identifying a suitable invitee, the logistics may require resources, and therefore the strategy requires close coordination with department heads.

7. **Students industry/ field attachment and internships** can be strategically planned to bring them into contact with agricultural entrepreneurs in the area of their individual passion and interest. Since not all students will readily have identified their area of interest, preference in allocation of internship opportunity can be given to those who have show interest in entrepreneurship and already identified their area of passion.

8. **Training through real business context** whereby the focus for graduate training should facilitate immediate application of knowledge. For example, in a course at JKUAT students are asked to develop businesses ideas and they are assessed based on the plausibility of the ideas, rather than a written examination. Since business ideas take time to refine, to be useful, such a challenge should be allocated more time along the semester. As an extension of this, learners can be supported with some finances to act as seed money to
start testing their ideas. For example, at Kenyatta University, students with business ideas have participated in the Students Training on Entrepreneurial Promotion Program (STEP), an initiative in partnership with Leuphana University, Germany, and others, which aims at promoting entrepreneurial/business knowledge, attitude and skills to students and academic staff as an effort towards job creation and poverty eradication. The initial stages of the program include selection of participants who must be students in their final year of study, training of the participants by highly qualified trainers on relevant entrepreneurial/business skills, and finally, disbursement of a loan of 100 USD to the participants to engage in small scale businesses, which they will repay at the end of the training after running their businesses (http://www.ku.ac.ke/industrypartn/index.php/programs/step). This approach gives students a practical experience within a safe environment to attempt entrepreneurship. As another example, students at Wagenigen University in the Netherlands are often given a real consultancy problem for which they seek solutions. Such tasks offer an opportunity for the learners to exercise critical thinking and analytical skills.

9. **Agribusiness coaching careers:** according to the University of Maryland Extension, just like sports coaches, agricultural entrepreneurship requires professional coaching to succeed. Graduates can be supported to develop careers as coaches with the task of guiding farmers in developing successful, sustainable agricultural ventures.

10. **Boot camps and contests:** Learners can be encouraged and motivated to be innovative through boot camps and contests where learners are challenged to come up with innovative business ideas and the best are recognized with awards and possibly linked to potential investors and mentors.

11. **Agri-business innovation and incubation hubs** – Agri-business innovation and incubation centers can play a major role in identifying and nurturing business ideas from agriculture students. JKUAT has a Sorghum value chain incubation and development center while the Chandaria Business Innovations and Incubation Center at Kenyatta University (http://www.ku.ac.ke/chandaria-biic/) has numerous agribusiness ideas from students under incubation.

Conclusion

There are unlimited opportunities for creation of new jobs through entrepreneurship in agriculture. As a matter of fact, most entrepreneurship opportunities in agriculture are often taken up by non agriculture graduates who then employ agriculture graduates. This indicates training of agriculture graduates needs re-orienting to stop producing servants but rather develop business developers in who will influence the future of agricultural entrepreneurship.
References


CONCLUSION

- This document is intended to be a comprehensive reference manual that will improve the skills of instructors and the learning experience of students in agriculture higher education institutions in East and Southern Africa, but may be applicable in regions with similar conditions. The purpose of this manual is to produce graduates with the necessary skills and competencies requisite of the 21st century job market.

- The paucity of resources and facilities in higher education institutions in the ESA region, is a reality that is common elsewhere in Africa and developing parts of the world. This handbook has been written with that context in mind. Some sections of the manual have suggestions on how to teach effectively with minimal resources.

- The content of this reference manual has been shaped by the experiences of authors in different countries and at different universities. While we expect the contributions by practitioners from different institutions has enriched the manual, it nevertheless may not comprehensively address all aspects of agriculture teaching in the diverse geographical and socioeconomical contexts. The authors welcome suggestions on improvements in future revised editions.

- The authors hope that this work will contribute to the continuing transformation of agriculture teaching and research in higher education institutions, foremost in East and Southern Africa, and elsewhere in the world. Aluta continua.
APPENDICES

Appendix 1: QUALITIES OF AN EFFECTIVE INSTRUCTOR

Teaching is an art and a science which should be taken seriously and effort made to effectively deliver instruction. Some individuals are born teachers while others need put more effort in developing the desired qualities to be effective. Traits of the instructor impact greatly on students’ learning and willingness to learn. Some of these positive traits include:

- Prepared for class - This is seen in the flow of subject content, methodologies used, time management or punctuality and full utilization of lesson time. on-task,

- Positive attitude towards teaching and students - instructor is optimistic, communicates well with students, motivates students through praise recognition for good work and at the same time punishes bad behavior. The instructor is available for students when needed.

- Has high expectations for all students - expects all students to succeed and does not set limits for them. Sets high standards for students and motivates them to do their best.

- Creative in teaching - The instructor is resourceful, inventive and plans varied ways to present or deliver lessons for the benefit of the students. In addition, the instructor employs stimuli variation and is enthusiastic about their work.

- Fair treatment of students - treats all students fairly without bias or favour. Allows all students equal opportunities and privileges

- Approachable by all students - connects with students personally, share experiences with them and take interest in their lives (share their joys and sorrows, successes and failures!)

- Cultivates a sense of belonging - makes students feel welcome and comfortable in the lecture room, calls them by name and

- Has respect for students, is forgiving and does not begrudge students-respects students’ privacy e.g. when returning marked work or giving feedback, not embarrassing students and letting bygones be bygones. Understands that a forgiving attitudes helps reach out to difficult students

- Admits mistakes – Accepts corrections from students, e.g. in cases of wrong calculation of marks, apologizes to mistakenly accused students.

Instructors should make effort to adopt these qualities as they help in the creation of a conducive teaching learning environment.
### APPENDIX 2: EXAMPLE OF A DETAILED COURSE OUTLINE

**CHINHOYI UNIVERSITY OF TECHNOLOGY**  
SCHOOL OF AGRICULTURAL SCIENCES TECHNOLOGY  
DEPARTMENT OF CROP SCIENCE AND POST HARVEST TECHNOLOGY

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Biology of Plant Pests and Pathogens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Code</td>
<td>CUCS 213</td>
</tr>
<tr>
<td>Degree Level</td>
<td>2.1</td>
</tr>
<tr>
<td>Notional Hours</td>
<td>Notional Hours: 120 hours.</td>
</tr>
<tr>
<td></td>
<td>Contact hours: 48 hours lectures (4 hours/week * 12 weeks) plus 24 hours practicals/tutorials/field trips (4 hours every other week * 6 weeks).</td>
</tr>
<tr>
<td></td>
<td>Non contact hours: Directed and non-directed self learning 30 hours per semester (2 hours/week * 15 weeks)</td>
</tr>
<tr>
<td></td>
<td>Assessment: assignments, tests, reports, examinations: 18 hours per semester</td>
</tr>
<tr>
<td>Credits</td>
<td>12</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>CUCS123; CUCS122</td>
</tr>
<tr>
<td>Options (Compulsory or Electives)</td>
<td>Compulsory</td>
</tr>
<tr>
<td>Semester Offered</td>
<td>1</td>
</tr>
<tr>
<td>Course Aims</td>
<td>The course aims to develop students into professionals with theoretical and practical skills in:</td>
</tr>
<tr>
<td></td>
<td>1. identification of key pests and disease causing micro-organisms of plants,</td>
</tr>
<tr>
<td></td>
<td>2. description of the biology and ecology of pests and diseases</td>
</tr>
<tr>
<td></td>
<td>3. potential economic damage caused by insect pests</td>
</tr>
<tr>
<td>Specific Learning Outcomes</td>
<td>After successfully completing this course the student should be able to:</td>
</tr>
<tr>
<td></td>
<td>1. Define agricultural pests, pathogen and disease with examples,</td>
</tr>
<tr>
<td></td>
<td>2. Classify agricultural pests and disease causing organisms,</td>
</tr>
<tr>
<td></td>
<td>3. Describe insecticide resistance,</td>
</tr>
<tr>
<td></td>
<td>4. Describe damage caused by different pests and disease causing organisms on agricultural crops, and</td>
</tr>
<tr>
<td></td>
<td>5. Understand the biotic and abiotic factors influencing population dynamics of plant pathogens and pests.</td>
</tr>
<tr>
<td>Psychomotor/Practical Skills</td>
<td>Apply various technical and practical pests and diseases concepts in solving crop production problems related to insects, nematodes and diseases.</td>
</tr>
<tr>
<td>Course Content</td>
<td><strong>a) To include each topic to be covered.</strong></td>
</tr>
<tr>
<td>Methods of Facilitating Learning</td>
<td>This course will be facilitated through lectures, tutorials, group discussions and presentations, directed self-study, laboratory study, field visits, assignments</td>
</tr>
<tr>
<td>Assessment Strategies</td>
<td>Continuous Assessment will include; Two, one hour tests, three (3) assignments, a field visits and a term paper and laboratory reports. A minimum Final Mark of 50% is required to pass the course.</td>
</tr>
<tr>
<td>-----------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Quality Assurance Arrangements</td>
<td>Moderation of assessments will be conducted according to the CUT general rules and guidelines on moderation. Periodic syllabus review to keep abreast with advancing new knowledge shall be undertaken</td>
</tr>
</tbody>
</table>
| Student Support & Learning Resources | **Student Support**  
Access to the lecturer for consultations  
Online access to course material on central server, including online journal with assistance of the library. Information will be provided periodically on relevant text books, internet resources and other reading material  
**Prescribed Textbooks**  
### Appendix 3: Academic Supervisor assessment form

CHINHOYI UNIVERSITY OF TECHNOLOGY  
SCHOOL OF AGRICULTURAL SCIENCES AND TECHNOLOGY  
DEPARTMENT OF CROP SCIENCE AND POST HARVEST TECHNOLOGY

INDUSTRIAL ATTACHMENT ASSESSMENT FORM FOR ACADEMIC SUPERVISOR

STUDENT NAME: ............................................................................................................

REGISTRATION NUMBER:....................................................................................

PROGRAMME:............................................................................................................

DATE OF VISIT:........................................................................................................

NAME AND ADDRESS OF ORGANISATION TO WHICH THE STUDENT IS ATTACHED:

.................................................................................................................................

AREAS/SECTIONS COVERED BY THE STUDENT:
1.....................................................................................................................................
2.....................................................................................................................................

<table>
<thead>
<tr>
<th>ASPECTS TO BE ASSESSED</th>
<th>COMMENTS</th>
<th>ACTUAL SCORE</th>
<th>POSSIBLE SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theoretical knowledge (knowledge of the theoretical concepts of area of study)</td>
<td></td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>Practical performance (practical expertise; application of skills and knowledge on job)</td>
<td></td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>Log book: is it detailed, updated and signed</td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Initiativeness and innovation: What value has the student contributed to the company</td>
<td></td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>Professional growth / conduct</td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Description and Progress on research project</td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Total score</td>
<td></td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>

OVERALL COMMENTS:

NAME OF ASSESSOR: ....................................................................................................

SIGNATURE: .............................................  DATE: ...........................................
Appendix 4: Student-lecturer evaluation form