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RESEARCH ARTICLE

Relationship between Competence and Use of Information and Communication Technologies (ICTs) in Classroom Instruction by Secondary School Agriculture Teachers in Nyamira County, Kenya

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Abstract

Research studies in the past decade have shown that ICTs are effective means for widening educational opportunities. However, their use in classroom instruction by most agriculture teachers is limited. The purpose of this study was to determine the relationship between competence and use of ICTs in classroom instruction by secondary school agriculture teachers in Nyamira County, Kenya. Descriptive survey design was adopted in this study. The target population comprised 215 secondary school agriculture teachers from the five Sub-counties of Nyamira County. Proportionate to size, stratified random sampling was used to obtain a sample size of 120 respondents. A semi-structured questionnaire was used for data collection. The instrument was evaluated by two research experts in the Department of Agricultural Education and Extension of Egerton University for its content and face validity and was pilot tested in south Gucha Sub-county of Kisii County for reliability. The reliability coefficient of the instrument was found to be $\alpha = 0.77$ which was above the 0.70 threshold acceptable reliability. Descriptive and inferential statistics (Pearson's Product Moment Correlation) were used for data analysis. Statistical Package for Social Sciences (SPSS) version 20 was used in analysing data and all tests were computed at $\alpha=0.05$. The study established a significant relationship between teachers' ICT competence and the use of ICTs in classroom instruction ($r=0.52$; $p<0.05$). The study recommends that the Ministry of Education and school administrators should provide ICT resources to schools, provide training opportunities and support to teachers for effective use of ICTs in classroom instruction.

Introduction

The rapid growth in Information Communication Technologies (ICTs) has brought remarkable changes in the twenty-first century, and also affected the demands of modern societies (Amenyedzi, Lartey & Dzomeku, 2011; Buabeng-Andoh, 2012). ICTs transforms the teaching and learning process from a dull teacher-dominated activity to an exciting learner-centred process which nurtures confidence, initiative and mental skills (Osodo, Chisikwa & Ongati, 2010). Kubiatko (2010) noted that, ICTs if used appropriately can support students' collaboration, stimulate higher cognitive skills and deepen teaching and learning process. Integrating ICTs in teaching and learning secondary school agriculture is therefore required in improving the quality of instruction.

ICTs provide the opportunity to gather, store, retrieve, process, analyze, and transmit information (Tezci, 2010). It is not a single technology, but combination of hardware, software, multimedia, and delivery systems (Avwiri, 2011). Today, ICTs in education encompasses a great range of rapidly evolving technologies such as desktop, notebook,

and handheld computers, digital cameras, local area networking, Bluetooth, the Internet, the World Wide Web and DVDs; and applications such as word processors, spreadsheets, tutorials, simulations, email, digital libraries, computer-mediated conferencing, video conferencing etc. (Mishra, Sharma & Tripathi, 2010). For many people, books and journals are no longer the first or primary source of information or learning.

Where ICT has become a regular part of the classroom experience, there is evidence of positive impact on learning and student performance. The visual nature of some technologies, particularly animations, simulations and moving imagery, engage learners and enhance conceptual understanding (Eskrootchi & Oskrochi, 2010). The use of simulation software offers opportunities to investigate problem or difficult areas which are impossible to create in classrooms – or are often too dangerous. Simulations and animations allow students to see events that would otherwise be invisible because they happened too quickly, too slowly or were not readily observable. Students can also access authentic data on the internet and use its facilities to collaborate with professional scientists.

A study by Lau and Sim (2008) in Malaysia observed that up to 75% of teachers agreed that use of ICTs would make them more effective in teaching. According to Agbulu and Ademu (2010), ICTs makes learning more student centred, encourage cooperative learning and stimulate increased teacher/student interaction. Because of its importance in education, many African countries have initiated various projects in schools so as to integrate ICT use in teaching and learning processes (Hennessy, Harrison & Wamatoke, 2010). However, most schools have not made effective use of technology (Hennessy *et al.*, 2010; Kiptalam & Rodrigues, 2010; Miima, Ondigi & Mavisi (2013)). This low use is attributed to a number of factors as defined by Rogers (2000). They include availability of ICT resources and teachers ICT competence among others.

According to Osodo, Chisikwa and Ongati (2010), using up-to-date hardware and software resources is a key feature to diffusion of technology. Infrastructure is more than a question of availability, but also about access. A study by Yildrim (2007) found that access to technological resources is one of the effective ways to teachers' pedagogical use of ICTs in teaching. Agbulu and Ademu (2010) noted that the poor choices of hardware and software and lack of consideration of what is suitable for classroom teaching are problems facing many teachers. In another study to explore factors that influence classroom use of ICT in Sub-Saharan Africa, Hennessy *et al*. (2010), noted that introducing technology into schools is largely dependent upon the availability and accessibility of ICT resources. It was observed that schools are increasingly being equipped with various ICT resources for teaching, learning and administrative purposes; connectivity is improving but still their use remain low.

Computer competence is defined as being able to handle a wide range of computer applications for various purposes (Van Braak *et al*., 2004). In order to achieve high levels of teacher competence in ICTs, there is a need to provide effective training if teachers are to implement ICTs in their teaching (Buebeng-Andoh, 2012; Tasir, Abour, Halim, & Harum, 2012). If training is inadequate or inappropriate, then teachers will not be sufficiently prepared, and perhaps not sufficiently confident, to make full use of technology in classroom.

A study by Miima, Ondigi and Mavisi (2013) in Kakamega County found out that Kiswahili language teachers (99%) do not use ICTs in teaching and learning process. The 1% only used CDs and DVDs to revise the selected Kiswahili set books. Teachers cited lack of competence as one of the major impediment to ICT integration. They felt that more information and training about ICT integration was necessary since their computer skills were low. Similarly, another study by Agbulu and Ademu (2010) in Nigerian schools, found out that teachers were not knowledgeable in the use of ICTs for teaching and therefore the level of utilization of ICTs in secondary schools was very low. The low ICT competence level of teachers was also echoed by a study by Buebeng-Andoh (2012) who indicated that teachers' lack of knowledge and skills was the second most inhibiting factor to the use of computers in schools. However, Tasir *et al*. (2012) revealed that Malaysian teachers have a high level of ICT competency. This means that these teachers are able to use most ICT tools for classroom instruction. Limited literature had been found on ICT competence of secondary school agriculture teachers in Kenya and specifically in Nyamira County. This study therefore aimed at filling this gap.

In Kenya, the objectives of teaching agriculture in secondary schools are set out in the syllabus: to promote interest in agriculture as an industry and create awareness of opportunities existing in agriculture and related sectors; to demonstrate that farming is a dignified and profitable occupation; to enhance skills needed in carrying out agricultural practices; to develop self-reliance, resourcefulness and problem solving abilities in agriculture; to develop occupational outlook in agriculture; to enable schools to take an active part in national development through agricultural activities; and to promote agricultural activities which enhance environmental conservation (Republic of Kenya Ministry of Education, 2002). The objectives are multi-dimensional in nature, so for their achievement multiple methods and resources should be used in an integrated fashion. At present, resources and facilities for teaching and learning agriculture are either inadequate or not available in most Kenyan secondary schools. This makes teachers to strain in delivering the agriculture content. Meanwhile schools are increasingly acquiring ICT resources which can be used as alternative sources for teaching and learning agriculture. However, the competence of agriculture teachers to use these technologies is not well documented in the available literature, hence the need for this study.

The purpose of the study was to determine the relationship between secondary school agriculture teachers' competence and the use of ICTs in classroom instruction in Nyamira County, Kenya. The objective of the study was to determine the relationship between agriculture teachers' ICT competence and the use of ICTs in classroom instruction in Nyamira County

The following null hypothesis derived from the objective guided the study:

Ho_1 There is no statistically significant relationship between agriculture teachers' ICT competence and the use of ICTs in classroom instruction in Nyamira County.

The findings of this study intend to inform all the educational stakeholders on the relationships between teachers' ICT competence and the use of ICTs in classroom instruction. By understanding the influence of this factor, problems surrounding ICT integration in teaching and learning may be overcome by the stakeholders adopting strategies that might address them. As a result of this study, agriculture teachers may be influenced towards the use of ICTs in improving classroom delivery. The findings of this study will also encourage other potential scholars and researchers with an interest to study other related aspects in this field of ICT integration in classroom instruction.

Materials and Methods

The study adopted a descriptive survey design. Gay (1983) defines descriptive research as a process of collecting data in order to test hypotheses or to answer questions concerning the current status of the subjects of the study. It was a survey as it was a self-report study which required the collection of quantifiable information from the sample (Mugenda & Mugenda, (2003). This design was deemed appropriate for the study because it enabled the researcher to determine the relationship between ICT competence and use of ICTs in classroom instruction by agriculture teachers and also enabled the researcher to reach as many respondents as possible within a short time.

The study was carried out in Nyamira County of Kenya. The County is located in the former Nyanza Province and has five Sub-counties: Nyamira South, Nyamira North, Manga, Borabu and Masaba. According to the Ministry of Education, Nyamira County (2013), the County has 168 secondary schools with 215 agriculture teachers distributed in the various Sub-counties of Nyamira County. The 215 teachers thus constituted the population of the study.

Proportionate stratified random sampling technique was used to select a sample of agriculture teachers as the respondents of the study. A list of all agriculture teachers with there contact numbers was obtained from the County education office. Then, the teachers were proportionately stratified according to Sub-counties to have a fair representation from each sub-county. From each stratum (Sub-county), the desired sample size of 16 to 30 was randomly selected to attain a sample size of 120 agriculture teachers (Table 1). This sample was adequate as Kathuri and Pals (1993) recommend 100 subjects as ideal for a survey research in social sciences. The extra 20 were necessary to take care of attrition and any refusal to complete the questionnaire. To proportionately select the representative sample, the following formula was used:

$n_h=N_h/N \times n$

Where,

n_h= the sample size from stratum h

N_h= population size for stratum h

N= total population size

n= total sample size

Table 1

Proportionate sample size and Number of Agriculture Teachers in Nyamira County

Sub-county	Population	Sample
Nyamira North	50	28
Nyamira South	47	26
Manga	29	16
Borabu	36	20
Masaba	53	30
Total	215	120

Source: Nyamira County Education Office

To successfully achieve the purpose and objective of this study, a semi-structured questionnaire, developed by the researcher was used to collect the data. The questionnaire consisted of three sections. The first section focused on teachers' age, gender, teaching experience, professional qualification, and ICT experience. The second and third sections investigated agriculture teachers' ICT competence and the use of ICTs to conduct classroom tasks by agriculture teachers respectively. The questionnaire was availed to two research experts in the department of

Agricultural Education and Extension of Egerton University to determine its face and content validity. The research experts ascertained whether the items in the questionnaire captured the intended information in accordance with the objectives and hypothesis of the study. The suggestions made were used to modify the instrument. A pilot study was conducted before the actual administration of the questionnaire to establish its reliability. A total of 30 agriculture teachers were used from secondary schools in Gucha Sub-county of Kisii County. The Sub-county was considered relevant for this study because of its proximity to Nyamira County and for the purpose of obtaining an independent group of respondents who were not supposed to take part in the main study. Cronbach's alpha reliability coefficient of each item of the questionnaire was computed after the pilot study. According to Moore and Benbasat, (1991), the reliability levels are acceptable values for Cronbach's alpha when equal to 0.7 or greater. For the instrument used in this study, a Cronbach's alpha reliability coefficient of 0.77 was obtained and this was above the threshold of acceptable reliability.

The researcher obtained an introductory letter from the Graduate School of Egerton University. This facilitated the acquisition of a research permit from the National Council for Science and Technology before proceeding to gather data for the study. On the ground authorization and support were sought from the County Education Office of Nyamira County where a list of all agriculture teachers in their respective Sub-counties with their phone numbers was obtained. Respondents for the study were contacted early by phone calls to inform them the purpose of the study and the day the researcher was expected to present questionnaires to them. Questionnaires were delivered by the researcher to all respondents in their respective schools. On arrival, the researcher sought permission from the school administrations before handing the questionnaires to the respondents. The researcher was available throughout the filling of the questionnaire to explain issues unclear to the respondent and to collect the completed questionnaires.

The Statistical Package for Social Sciences (SPSS) version 20 for windows software was used to analyse data. All the completed questionnaires were reviewed for any errors out of which the best 100 questionnaires were selected for this study. Data obtained from these questionnaires were then entered into SPSS for analysis. Descriptive and inferential statistics were used for data analysis. Descriptive statistics were used to summarize the mass of properties using frequencies, percentages and means. The hypothesis (**Ho_1**) was analyzed using Pearson's Product Moment Correlation (PPMC). PPMC was preferred because it shows whether there exists a linear relationship between each dependent variable and the dependent variable in this study. The hypothesis was tested at α=0.05 significance level.

Results and Discussions

Data was gathered in order to complete the objective of the study which stated*: to determine the relationship between agriculture teachers' ICT competence and use of ICTs in classroom instruction, in Nyamira County*. The study investigated competence of agriculture teachers, frequency of use of various ICTs to conduct classroom tasks and the relationship between teachers' ICT competence and use of ICTs to conduct classroom tasks.

Agriculture Teachers' Level of ICT Competence

The respondents were asked to rate their level of competence computer applications listed, on a 5-point scale (1=cannot use, 2= low, 3= moderate, 4= high, 5= very high). The percentage distributions of the teachers' responses were as shown in Table 2.

Table 2
Level of Teacher's Competence in the Use of ICT Resources

	Level of ICT competence (% of Teachers)					
ICT resources	**1**	**2**	**3**	**4**	**5**	**Total**
Word processing	7	9	40	26	18	**100**
Spreadsheet	10	26	37	14	13	**100**
Presentation	18	29	24	17	12	**100**
Database	20	34	27	11	9	**100**
Search engine	12	15	25	17	31	**100**
Communication	8	13	22	23	34	**100**

The results in Table 2 show teachers' responses across were almost evenly distributed across the 5 competence levels. With respect to word processing, the highest percentage of teachers (40%) felt that they had "Moderate" competence while a significant 26% felt that their competence was "high". Similarly, 37% of the teachers reported "moderate" and another 26% reporting "low" competence in spreadsheets applications. On the other hand, the

highest percentage of teachers, (29% and 34%) reported "low" competence in the application of presentation and databases respectively. On a positive front, 31% and 34% of the teachers felt that their competence in search engine and communication respectively was very high.

Adopting the scoring strategy assigned to the competence levels, the means for the teachers' level of competence in the various ICT applications were as shown in Table 3. The results revealed that the means ranged from 3.62 (highest) to 2.57 (lowest). The highest means was related to teachers' competence in communication applications such as e-mail while the lowest means was related to their competence in databases. The high mean score of competence in communication followed by that of search engines may be attributed to frequent use of e-mail for communication given that due to the growth in communication technology, e-mail is fast replacing most of other formal communication methods thus frequently used by not only teachers but equally by learners. Search engines are frequently used to search information on the internet thus enhancing teachers' competence in the same. In addition, the relatively high mean on word processing may also be attributed to frequent use of this Microsoft Office application as the main interface for typesetting printed works.

Table 3

Means of Teachers' Level of Competence in ICT Applications

ICT Applications	N	Mean	Std. Deviation
Word processing (e.g. Ms word)	100	3.39	1.100
Spreadsheet (e.g. Ms Excel)	100	2.94	1.153
Presentation (e.g. Ms PowerPoint)	100	2.76	1.272
Database (e.g. Ms Access)	100	2.57	1.183
Search engines (e.g. Internet/www)	100	3.40	1.378
Communication (e.g. E-mail)	100	3.62	1.293

Generally, the means indicate that teachers' level of competence ranged from low to moderate, with very slim prospects of moving to high competence in applications such as communication. The findings of this study agree with that of Agbulu and Ademu (2010) in Nigeria which revealed that agriculture teachers did not have deep knowledge in the use of ICTs in teaching. This led to low level utilization of ICTs in teaching-learning process. Komis (2008) stated that, a majority of the teachers felt that application of the word processor was much easier, and more useful to their lesson planning and teaching, than other ICT software resources. In the same way, search engines were a source of information that could be useful in teaching, quizzing and even planning lessons, therefore many of the teachers applied themselves to improve their skills in this two areas. Schibeci *et al.* (2008) stated that, in moving towards complete ICT integration in the teaching process, teachers often use the word processors and search engines much more than other data bases. They therefore develop more confidence and skill in manoeuvring these applications than others.

Frequency of Use of ICT Resources by Agriculture Teachers to Conduct Classroom Tasks

To determine the level of use of the ICT resources in classroom instruction, respondents were asked to rate the frequency with which they applied ICT resources to conduct various classroom tasks. The teachers were asked to rate the frequency of use based on a 5-point scale. Teachers' responses were analyzed quantitatively using frequencies and percentages.

Table 4

Frequency of Teachers' Use of ICT Resources to Conduct Classroom Tasks

Tasks	Frequency					Total
	Never used at all	*Less than 5 times a term*	*Once a week*	*Two or more times a week*	*Daily*	
1. Creating quizzes	33%	32%	16%	14%	5%	**100**
2. Creating power point presentations	58%	20%	12%	6%	4%	**100**
3. Downloading video clips/ animations	45%	25%	17%	10%	3%	**100**
4. Sending/ receiving e-mails	47%	19%	15%	11%	8%	**100**
5. Receiving subject association on-line resources	48%	22%	8%	9%	13%	**100**
6. Maintaining subject records	27%	23%	12%	21%	17%	**100**
7. Preparing content for class	33%	17%	16%	18%	16%	**100**
8. Preparing worksheets/handouts	47%	11%	15%	13%	14%	**100**

The percentages in Table 4 show that the largest percentage of teachers who used ICTs to perform various classroom tasks on a daily basis did so in preparing worksheets/handouts (17%), maintaining subject records (16%), preparing content for class (14%) and receiving subject association on-line resources (13%). The findings also show that more than half of the teachers (58%) never used ICTs in creating power point presentations which is the main interface for classroom curriculum delivery. By and large, most teachers either had never used the ICTs to conduct the classroom tasks covered by this study or used them less frequently as can be read from percentages in the columns with the response categories of "Never used at all" and used "Less than 5 times a term"

Further analysis involved determining the means of teachers' use of ICTs to conduct the various classroom tasks shown in Table 4. In order to determine the means, a scoring strategy was adopted for teachers' responses as follows: never used at all = 0, less than 5 times a week =1, once a week =2, two or more times a week =3 and daily =4. The scores for the use of ICTs in conducting the different tasks were added together to obtain a composite score for the use of ICT in classroom instruction. The means for teachers' frequency of use of ICT resources to conduct classroom tasks were as shown in Table 5.

Table 5

Means for Teachers' Frequency of Use of ICT Resources to Conduct Classroom Tasks

Tasks	N	Mean	Std. Deviation
1. Maintaining subject records	100	1.78	1.474
2. Preparing content for class	100	1.67	1.491
3. Preparing worksheets/handouts	100	1.37	1.516
4. Creating quizzes	100	1.26	1.203
5. Receiving subject association on-line resources	100	1.17	1.443
6. Sending/ receiving e-mails	100	1.15	1.335
7. Downloading video clips/ animations	100	1.01	1.141
8. Creating power point presentations	100	.78	1.124

Considering the means of frequency of teachers' use of ICTs in performing the tasks, the figures in Table 5 show that the highest mean of 1.78 was in relation to maintaining subject records which still fell below the "Once a week" frequency of use. On the other hand, using the ICTs to create power point presentations had the lowest mean of frequency of use with a mean value of 0.78 that equally fell below the "less than 5 times a week" frequency of use, indicating that it was almost never used in performing classroom tasks yet it is the single most import aspect of ICT integration in classroom instruction. Zakopaulous (2005) stated that whereas ICT resources are available for the use of teaching, and indeed come with many advantages and benefits that could make teaching much easier and less challenging; many factors come into play when applying the resources and thereby making use of them. Many schools do not experience the benefits of ICT resources because teachers are hindered by several factors from making use of them.

Hypothesis (Ho_1) Testing

The hypothesis for the study stated: *There is no statistically significant relationship between secondary school agriculture teachers' ICT competence and their use of ICTs in classroom instruction.* The teacher's scores for the level of competence in the various ICT applications were added together to obtain a composite score for teachers' ICT competence. This composite score and that of teachers' frequency of use of ICT resources to conduct classroom tasks were used to compute the Pearson's Product Moment Correlation to determine the nature and magnitude of the relationship between the two variables. The results were as shown in Table 6.

Table 6

Relationship between Agriculture Teachers' ICT Competence and their Use of ICTs in Classroom Instruction

		Teachers' Use of ICTs in Classroom Instruction	Teachers' Competence in ICT applications
Teachers' Use of ICTs in Classroom Instruction	Pearson Correlation	1	.521**
	Sig. (2-tailed)		.000
	N	97	97
Teachers' Competence in ICT applications	Pearson Correlation	.521**	1
	Sig. (2-tailed)	.000	
	N	97	100

***. Correlation is significant at the 0.01 level (2-tailed).*

The correlation analysis revealed that there was a significant, positive correlation between Secondary school Agriculture teachers' ICT competence and their use of ICTs in classroom instruction ($r=0.52$; $p<0.05$). The correlation was of moderate strength, indicating that agriculture teachers' use of ICTs in classroom instruction was associated with their levels of competence in the use of ICT applications. Therefore, based on this result, the null hypothesis which stated that: *There is no statistically significant relationship between secondary school agriculture teachers' ICT competence and their use of ICTs in classroom instruction,* was rejected. Higgins (2010) indicated that as teachers received training and help in accessing knowledge and proper application of ICT, the more committed and interested they become to employ ICT in their teaching activities. This is also true for cases of teachers engaged in teaching practical curriculum subjects like agriculture (Knobloch *et al.,* 2003). Proper training and increased competence in handling ICTs increases the level of use significantly.

Conclusion and Recommendation

Based on the results of this study, the following conclusion was reached:
There is a significant relationship between secondary school agriculture teachers' ICT competence and their use if ICTs in classroom instruction. When agriculture teachers are competent in manipulating the ICT applications, they become more confident in the use of ICTs and make more use of the same in classroom instruction.

Recommendation

School administrators should provide internal training to enhance teachers' competence in the use of ICTs and to increase their experience in the use of ICT. This is important because exposure to various ICT applications consistently increases agriculture teachers' competency and confidence in using ICTs.

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