Original Research Article

Evaluating the Effectiveness of a Digital Knowledge Pack in improving Agricultural Experiential Learning: The Case Study of Egerton University's Students, Kenya

Abstract

One of the roles of higher education is to produce competent professionals with high employability skills. Learning by doing commonly known as Experiential Learning (EL), is an approach to learning that helps students acquire competences needed in the job markets. Field attachment including Farm Attachment Programme (FAP) of Egerton University (EU) is known to provide opportunities for EL. However, the effectiveness of this approach to learning is dependent on possession of prior knowledge and EL abilities including ability to; willingly get actively involved in the learning experiences, reflect, analyze, solve problems, make decisions in addition making continuity arrangements for innovations/projects initiated. This study aimed at evaluating the effectiveness of a designed Digital Knowledge Pack (DKP) to improve the levels of ELAs among the students of EU. The DKP design attributes under evaluation were the DKP; weekly structure, implementation enablement, students' portfolio and resources. The specific objectives of the study were to(i) characterize EU students on FAP (ii) determine the levels obtained on ELAs with each DKP innovation design attribute (iii) determine the effects obtained on ELAs with each DKP innovation design attribute iv) evaluate the extent to which the use of a DKP improved ELA levels among the students. The study employed Participatory Action Research Design (PAR) by first allowing a sample of 30 students to proceed on FAP for three weeks and then introducing a designed DKP toolkit in the fourth week of attachment. The levels of ELAs among students were determined before and after the introduction of the DKP using a rating continuum scale of 1-5. The results showed that the DKP weekly structure had a significant (F (10,29) =8.49, P=.001 effect on the students' ELAs and accounted for 72% of the variation in ELAs. The effect of the DKP student's portfolio on ELAs was also significant (F (9,29) = 6.95, P =.001) at 95% confidence level and accounted for 74% of the variation in ELA levels. DKP implementation enablement and DKP resource attribute had significant [(F (3,26) 87.410, P<.0001) and (F (16,29) =2.86, P =.03) respectively], effects (64.9% and 50.6%) on ELAs respectively. Further analysis revealed that multicollinearity existed in the DKP attribute variables. This was resolved by conducting Principal Component Analysis (PCA) of the DKP design variables. A scree plot showed a one component solution that explained 91.18% of variance in the ELA index regression model. The component Eigenvalue was 3.647 and therefore the four DKP attributes could be explained by one component variable referred to in this study as DKP innovation Design (DID) attribute. The results showed that using a DKP significantly improved the ELA levels from M=2.63, SD=0.52 to M=4.07, SD=0.13. The 95% confidence interval of the mean was 1.356 [1.005, 1.706]. In conclusion the study showed that the use of a DKP innovation toolkit improved experiential learning abilities among Egerton University students. The higher levels of abilities allowed students to gain more competences (knowledge, skills and attitudes) from their farm experiences thus improving the students' employability skills.

Keywords: [Digital Knowledge Pack, Farm attachment Programme, Egerton University, Agricultural Experiential learning]

1. INTRODUCTION

One of the roles of higher institutions of learning is that of forming professionals who are competent for the job markets. According to [1], experiential learning is a learning approach proven to provide the competencies required by students. Field attachment including FAP of EU in Kenya provides opportunities for experiential learning. However; experiential learning does not just happen but requires students to possess ELAS; willingness of students to get actively involved in the learning experience, ability to reflect, analyze, solve problems and make decisions [2] and for the purpose of this study make continuity arrangements for the initiated projects or innovations. Field Attachment Programme is a session when students go out for real-life working experiences to familiarize themselves, with the working environment in their areas of specialization. Over the years, attachment for students undertaking agricultural related training at EU, has focused on government parastatals and agri-based companies without engagement with the farmer, contrary to other countries like Zimbabwe [3]. Yet, attachment on farms provides students with an opportunity to learn and utilize theoretical knowledge acquired in class, understand the opportunities and challenges that a farmer deals with and propose mitigation approaches to some of the challenges. This is the reason EU initiated FAP for its students to give opportunities for experiential learning from farm experiences. The FAP is designed, in such a way that, students are attached to the same farm(s), continuously at least for three consecutive years. Each cohort of students builds and follows-up on recommendations of the previous group. The first cohort of students focus on making a general appraisal of the farm. The students at EU work with the farmers with the backstopping of the project coordinators, lecturers and existing extension officers in synthesizing the report and proposing appropriate recommendations to the farmers. Concurrently, the student is nurtured as an analytical observer to be part of the solution that provides coordinated knowledge

Experiential learning refers to learning through “reflection on doing” [4]. It is an example of unguided or minimally guided instructional approach that is very popular and intuitively appealing [1]. However, minimally guided instruction is less effective and less efficient than instructional approaches that place a strong emphasis on guidance of students in the learning process [5]. The minimal guidance approach in experiential learning begins to recede only when learners have sufficiently high prior knowledge in their field of experience, to provide "internal" guidance [6]. [2] posits that effectiveness of experiential learning is dependent on possession of four abilities namely; willingness to be actively involved in the learning process, ability to reflect on learnt experiences, possessing analytical skills, ability to make decisions and solve problems. Experiential learning has been studied widely and ELA levels among Egerton University students on FAP have been found to be low [7]. Literature review has shown that knowledge can be packaged digitally to ensure it is accurately, promptly and reliably provided to students during FAP. Further, studies on field attachment programme posits that using a student portfolio during attachment can encourage students to have a meaningful reflection on what they do. Effectiveness in learning is modelled by theories of learning that states that learning takes place from known to unknown, from simple to complex and from concrete to abstract content. These theories are important considerations when packaging knowledge for use by students.

[8] posited that, there is need to provide students on FAP with adequate, prompt and accurate knowledge and points out the four mostly used source f knowledge among the students during FAP. First, the internet which, according to students is not localized to the needs of the host farmers. Moreover, searching for unstructured knowledge is expensive as students must use internet bundles which are costly. In addition, some students are hosted by farmers in remote areas where there is poor internet connectivity. Secondly, the lecture notes and books which must be carried by students for references during FAP. These sources are very bulky and the students may not carry adequate references to help them solve problems and make decisions for the challenges encountered during FAP. The third source of knowledge during FAP is faculty members at the university. Students have however reported inaccessibility of the lecturers when they need them. Finally, the agricultural officers are the fourth source of knowledge. Unfortunately, students have reported that these officers are too busy not available for consultation [9]. According to [10], providing knowledge in digital formats can resolve the issue of students carrying bulky text books and lecture notes for use during FAP. Digital packaging of knowledge can also help to structure the knowledge and incorporate a searching mechanism thus improving promptness in knowledge accessibility. Packaged knowledge can be used anywhere including remote areas with poor internet connectivity. No evaluation has been done to evaluate the effectiveness of using a designed

DKP to improve the levels of ELAs. The purpose of this study was therefore to evaluate the effectiveness of DKP innovation in improving the levels of ELAs among students of EU. The DKP design attributes were operationalized as: DKP weekly structure, DKP students' portfolio, DKP implementation enablement and DKP resources attributes. Specific objectives of the study included: (1) To determine the levels obtained on ELAs with each DKP innovation design attribute (ii) To determine the effects obtained on ELAs with each DKP innovation design attribute iii) To evaluate the extent to which the use of a DKP innovation design improved the ELAs. Searching for ways to improve students' ELAs is of great significance. The willingness of students to get actively involved in the learning experiences, the ability to reflect, analyze, solve problems, make decisions and make continuity arrangements for any innovation/projects initiated, helps the students to acquire necessary competences (knowledge, skills and attitudes) from the learning experiences. Eventually the competences acquired becomes the employability skills that improves the quality of professionals graduating from universities.

2. METHODOLOGY

2.1 Research Design

The Participatory Action Research (PAR) was employed in this research. It is defined as an approach in which the action researcher and a client collaborate in the diagnosis of a problem and in the development of a solution [11], This is in contrast with other research designs in which disinterested researchers emphasize on re- productivity of findings [12]. PAR entails four phases namely; diagnostic, planning, action and evaluation [13]. In this study, the diagnostic phase was executed by allowing students to proceed for their FAP for the first three weeks. This was followed by a workshop to get feedback from the students about their experiences in the host farms. Another purpose of the workshop was to train students on use of DKP toolkit. A Focus Group Discussion was organized and students asked to narrate their FAP experiences. A baseline survey questionnaire was administered to collect data. The data was analyzed and results used to inform the design of the DKP toolkit and to determine the ELA levels before introducing the DKP. The challenges and gaps coming out from students' narrations were addressed as much as possible. According to [1] effectiveness of experiential learning is also dependent on the level of prior agricultural knowledge among students. The challenges and provision of knowledge resources were considered during the design of the DKP. The Action phase entailed allowing students to download the DKP app in their laptops after the training and allowing them to conduct their FAP in the remaining five weeks as guided in the DKP. To allow for real time interactions during FAP and to address challenges encountered while using the DKP, an online google group was created where students would post their DKP documents and ask questions. On completion of FAP, which lasted for eight weeks, students were evaluated to determine its effectiveness of using the DKP to improve the students' levels of ELAs.

The action phase of the study was conducted among students hosted by farmers in Njoro ward in Nakuru county. The ward was selected due to its proximity to Egerton University. Most farmers around the university had participated in the FAP programme and therefore understood how the programme worked. Furthermore, proximity to the university enabled students to operate from their usual residences in cases where the host farmers were not able to accommodate the students. Njoro ward covers an area of 124.46 sq km and comprises *Mukungugu, Subuku, Migaa* and *Njoro* Sub–Locations of Nakuru County. This study targeted a population of 600 farmers and students who had participated in the FAP since the programme's inception in 2014. A sample size of 30 students was purposively selected based on their innovativeness to participate in the study, according to [14] people can be classified into five categories depending on the rate at which they adopt innovations. These categories are innovators, early adopters, early majority, late majority and laggards. It was important to work with the students that exhibited the traits of "innovators" because of the short duration of the FAP i.e., 8 weeks. The innovators were able to go through the training on use of DKP and effectively use the DKP in the remaining five weeks of attachment. This may not have been possible with the laggards. The number 30 was chosen to manage the costs of buying the digital packs toolkits. In addition, action research is better managed when dealing with small numbers. All the 30 students who used the DKP toolkit during FAP became the subjects of the study. Four instruments were used to collect data namely; Baseline survey questionnaire, focus group discussion topic guides, google groups observation proforma and a DKP evaluation structured questionnaire. Piloting of the instruments were done and a reliability coefficient of r= 0.70 was obtained. The validity of the DKP toolkit was determined by experts in the Department of Agricultural Education and Extension of EU.

The framework shown in Figure 1 was used to conceptualize the study. The vulnerability context of the students was the need for prompt accurate knowledge by students on FAP. The independent variables were the DKP design attributes while the dependent variables entailed the improvement of the ELAs among the students defined as: the levels of willingness to get actively involved in the learning experiences and the abilities to reflect, analyze, solve problems and make decisions during the learning experiences in addition to ability to make continuity arrangements for the innovations or projects initiated by the students in the host farms.

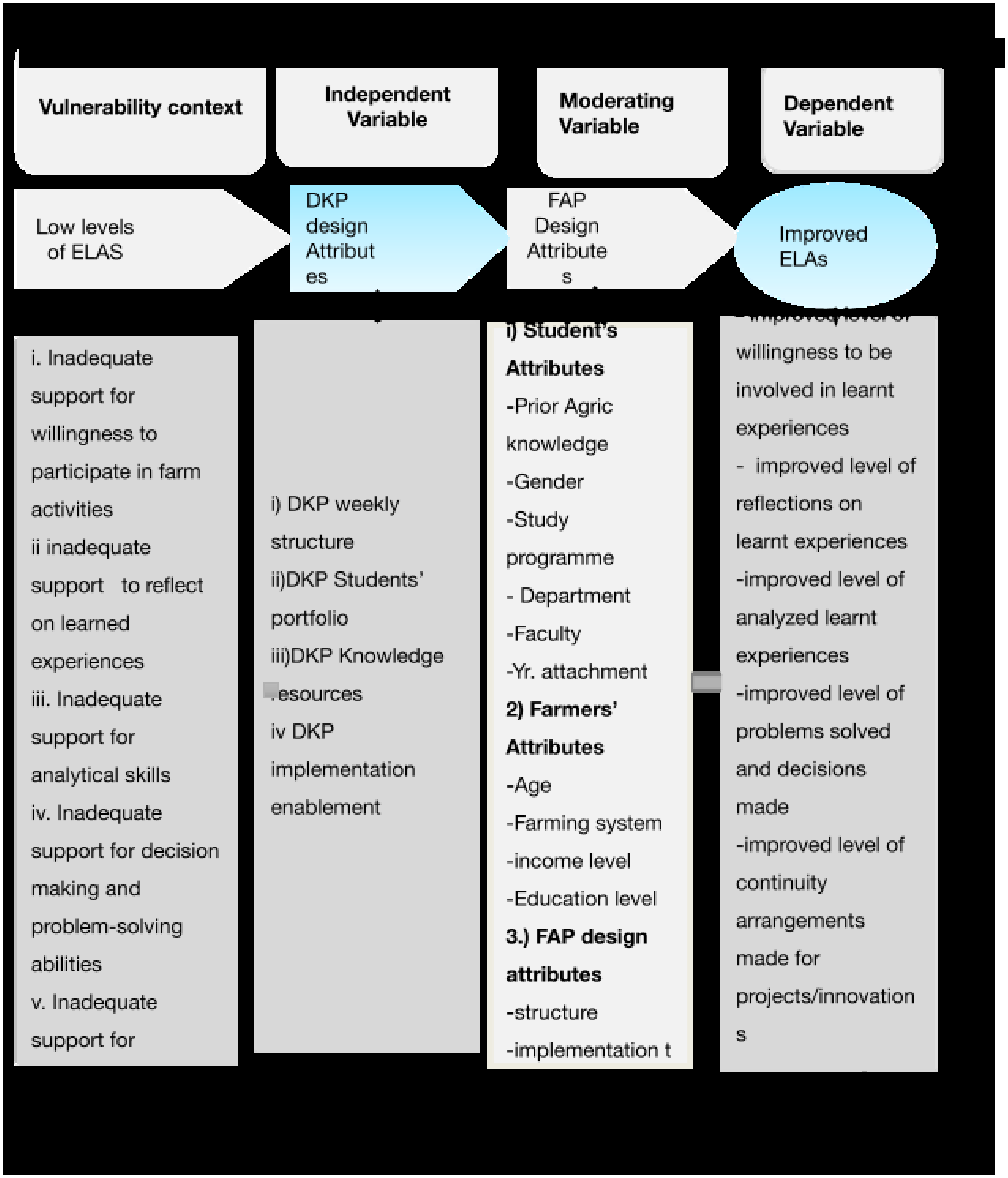

Fig. 1: The effect of DKP design attributes On ELAs

2.2 Data collection and analysis

Face to face and online administration of evaluation questionnaires methods were used to administer the instruments for data collection. A research license was obtained from the (National Commission of Science, Technology and Innovation (NACOSTI). Data was collected by putting students in groups of five and allowing them to narrate their experiences on their host farms in the first three weeks of attachment. Data was analyzed at two stages. First, before the introduction of DKP to determine the level of ELAs among the students and after using the DKP to evaluate its effectiveness in improving ELA levels among students. In Specific terms, the analysis aimed at determining the levels obtained with each DKP design attribute and establish the size effects of the attributes on ELAs. Students were asked to rate the DKP design attributes based on the extent to which the attributes affected their ELAs. The means were obtained from a 5 -point continuum scale ratings on ELAs with a minimum of one and a maximum of five. Measures of central tendencies specifically the means were used to estimate the levels of experiential learning among students. ANOVA was used to determine the significance ($P \leq .05$) of the variations in ELAs obtained with each FAP design attributes. The indicators used to measure ELAs which were adopted from [1] and included; willingness to get actively involved in the learning experiences in the host farm and ability to; reflect, analyze, solve problems, make decisions and make continuity arrangement for the projects/ innovations initiated on the host farms by the students. The effect sizes of the DKP design attributes on ELAs were determined using the General Linear Model and the effects estimated using partial Eta squared at 5% level of significance.

3. RESULTS AND DISCUSSION

3.1Students' Demographics

To characterize the students on FAP, their demographics data were collected and analyzed. A total of 30 students participated in the action phase of the study. Figure 2 shows percentage distribution of the students according to gender. Eighty-three (83%) percent of the student's population that participated in the action phase of the study were males while 17 % were females. The overall percentage representation of the female students in FAP was generally low. It is important to note here that the only criteria used to select participants was their eagerness to get actively and digitally involved in the study.

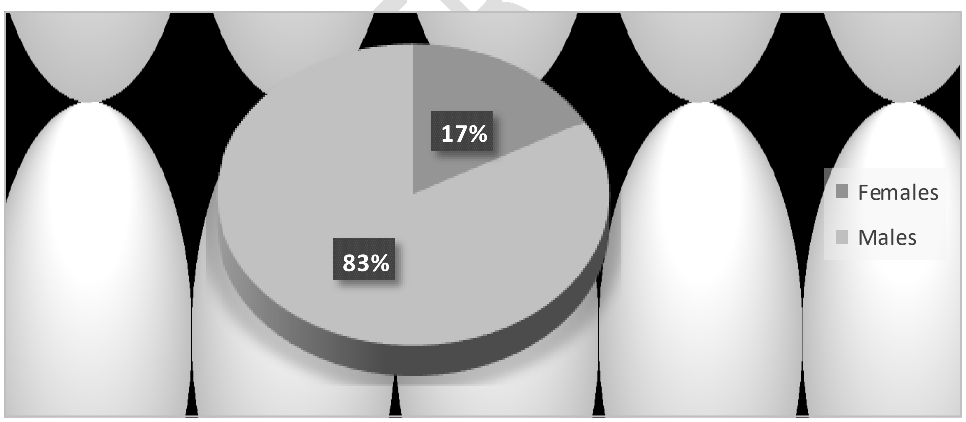

Fig. 2. Students' distribution by gender

In this study student's selection was based on the speed at which the students responded to particular tasks posted on the student's whats app group. According to [14] theory of adoption of an innovation, learners can be categorized as: innovators, early majority, late majority and laggards. it may be concluded that the females were not as eager as the males to engage in new innovative tasks. While that argument may be true, there were other factors that may have affected the low representation of the female students in this study; First, majority of the farmers preferred male to female students. Secondly, the overall representation of the female students in FAP was generally low. A number of thinkers who engage with gender theories and issues related to women and technology like; Donna Haraway, Sadie Plant, Julie Wosk, Sally L. Hacker, Evelyn Fox Keller, Janet Abbate, Thelma Estrin, and Thomas J. Misa, among others [15] argue that women are discriminated against in the technology field and are not given the same opportunities as men. This is a problem in the world today [16] because everyone should be treated equally and not judged based on their gender. It is unfair for someone to be overlooked and not give the same opportunities to showcase their skills. This finding suggests that support and encouragement are the two most important aspects that can influence women participation in computing /digital world. In order for women to be more receptive to the field the environment must become a more welcoming place by their male counterparts [17].

The students were requested to indicate the type of digital devices that were accessible to them during FAP. This was important because the digital toolkit (DKP) was designed to work with a device that would display the packaged content. The results shown in Figure 3 revealed that majority (63.3%) had access to a smart phone and a small (10%) percentage said they had access to computers via cybers in the nearby the shopping centers.

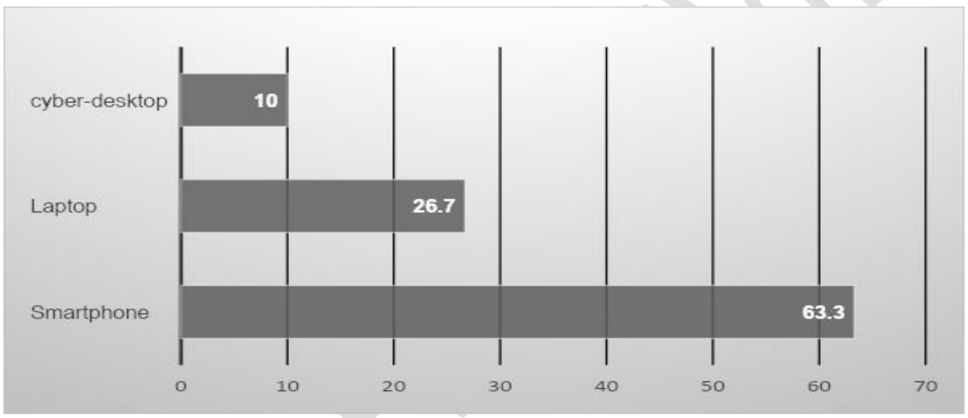

Fig. 3. Distribution of students based on type digital devices accessible during FAP

The other demographic characteristic of the students was the academic departments where students were drawn from at the university. The results shown in Figure 4 revealed that that majority (63.3%) of the students were drawn from the department of agribusiness and Agricultural Economics. 23.3% of the students were drawn from the department of Horticulture, Crops and Soils (CHS) while 13.3% were drawn from the department of Agricultural education and extension. The selection was done on basis of students' eagerness to be innovative.

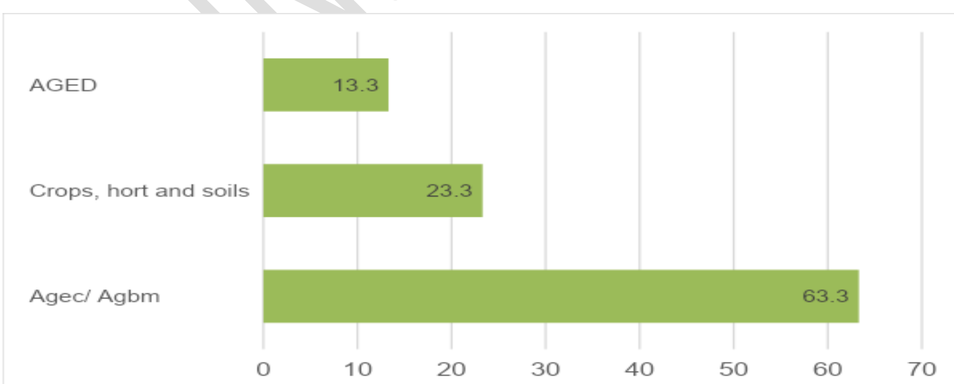

Fig. 4. Distribution of students by their academic departments at the university

Most innovators are associated with business careers and a good example is Steve Jobs who developed many jobs by making good business out of his innovative ideas. It is no wonder that majority of the respondents in this study were drawn from department of agribusiness and economics [18]. The students were asked to state their sources of knowledge during FAP. The results shown in Figure 5 indicated that majority (70%) of the students used internet as their source of knowledge. The results revealed that the least utilized source of knowledge were Faculty members, the lecturers.

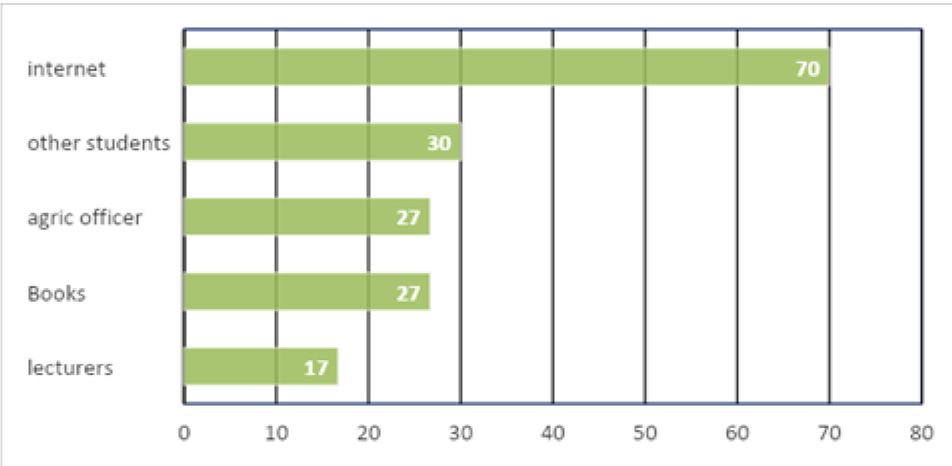

Fig.5. Percent distribution of students according to the sources of knowledge used during FAP

The students were then asked to narrate the challenges they encountered with the sources of knowledge available to them. The results are shown in Figure 6. Majority (79.3%) of the students said that they could not access relevant text books during FAP as the host farms were located far from library facilities. They also added that the books were bulky and it was not possible to carry them to the host farms.65% of the students reported that there was poor internet connectivity in their farms and could not access the knowledge they needed online. Either they were not able to access the internet due to high cost of internet bundles or the internet signals were poor. Some of the sources of knowledge presented some challenges. For instance, the printed sources e.g., textbooks had static photographs that could not demonstrate certain skills like would audio-visual sources.

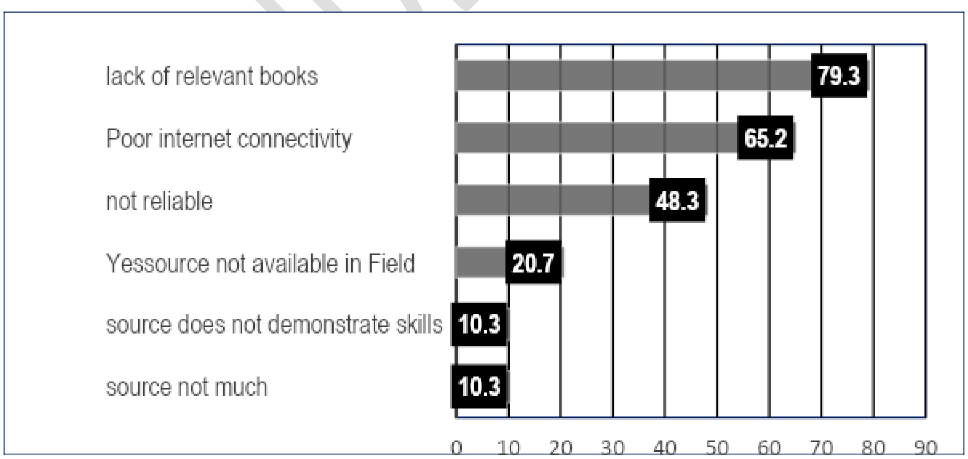

Fig. 6. Percent distribution of students according to challenges in using knowledge sources

Students were exposed to list various farm enterprises during FAP. In order to understand the type of prior knowledge required in order to effectively participate in the farm experiences, students were asked to qualitatively list the types of crops, livestock and economic activities in their host farms. This was done in a training workshop three weeks after reporting for FAP. Table 1 is a summary of types of crops, livestock and economic activities as listed by students

Table 1. List of farm enterprises in the host farms that students needed knowledge in

Crop knowledge	Livestock Knowledge	Knowledge on Economic/AGB	Agricultural Engineering Knowledge	Others
Maize	Dairy cattle	Marketing of Farm produce	Tractor operations	Excel App resources
Beans	-Friesian	Purchase of input supply	Farm Machinery	Power point App
Cabbages	-Ayrshire	Value additions of produce	Farm structures	
Potatoes	Sheep	Farm Management	Soil and water conservation	Statistical packages
Carrots	Goats	Farm records	Farm tools and equipment	
Garden peas	Poultry	Tractor operation	Water drainage	Video resources
Onions	Fish	Farm machinery	Water and Irrigation	

Active learning coordinates with the principles of constructivism which are, cognitive, meta-cognitive, evolving and affective in nature. Studies have shown that immediate results in construction of knowledge is not possible through active learning, the child goes through process of knowledge construction, knowledge recording and knowledge absorption. This process of knowledge construction is dependent on previous knowledge of the learner where the learner is self-aware of the process of cognition and can control and regulate it by themselves [29].

3.2 Students' levels of ELAs before and after introduction of DKP

Experiential learning ability indicator levels for the thirty students who participated in the action phase of this study were first determined. These indicators were taken from [2] and included; willingness to actively participate in the learning experiences, ability to reflect on learnt experiences, ability to analyze learning experiences, ability to solve problems and make decisions and finally ability to make continuity arrangements for initiated projects in the host farms. Relevant constructs were chosen to measure the experiential learning ability indicators. These constructs were carefully selected to measure each of the indicators of experiential learning abilities before and after the introduction of the DKP toolkit. The procedure followed in measuring the constructs has been discussed in the methodology section. The thirty students who participated in the action phase of this study were requested to rate the constructs selected to measure experiential learning ability indicators DKP in a continuum scale of 1-5. The results shown in Table 2 reveal that before introducing the DKP the average experiential learning ability for students on FAP was

(M=2.633, SD= 0524). However, after introducing the DKP, the experiential learning ability level among students was found to be high (M=4.07, SD=0.13). The DKP rating on ability to make a reflection on learned experiences was the highest (M=4.27, SD=0.58) while the rating on ability to analyze the learning was rated lowest (M=3.87, SD= 0.82)

Table 2. ELA indicator levels before and after introducing the DKP

	ELA Indicator to:	N	min	max	index	SD	Rating
ELA before DKP	Reflect	30	2	5	2.65	0.05	Low
	make decisions	30	1	5	2.59	0.13	Low
	make cont. arrangement	30	2	5	2.60	0.24	Low
	solve problems	30	2	5	2.61	0.30	Low
	Willingly get involved	30	2	5	2.70	0.14	Low
	make analysis	30	2	5	2.60	0.10	Low
	Overall, ELA index	30	1	5	2.63	0.52	Low
ELA after DKP	Reflect	30	3	5	4.27	0.58	High
	make decisions	30	2	5	4.20	0.89	High
	make cont. arrangt.	30	2	5	4.10	0.71	High
	solve problems	30	2	5	4.00	0.95	High
	Willingly get involved	30	3	5	3.97	0.76	Moderate
	make analysis	30	2	5	3.87	0.82	Moderate
	Overall, ELA index	30	2	5	4.07	0.13	High

3.3 Effects obtained on ELAs with each DKP Innovation design attributes

Students were asked to rate the DKP innovation design attributes in relation to enhancing improvement of experiential learning abilities. The DKP innovation design included; DKP weekly structure, DKP implementation enablement, DKP student's portfolio, and DKP resources.

3.3.1 Effects obtained on ELAs with DKP Weekly structure attributes

The scatter diagram in figure 7 shows the DKP experiential learning ability versus DKP Weekly Structure (DSW) indices. The graph revealed that there was a positive linear effect between the two variables. The students who rated their weekly structure high had higher levels of ELAs. The weekly structure was designed in such a way that there was a power point presentation at the beginning of every week to motivate the learners to engage in farm experiences in the week that followed. The presentations were found to have a positive and significant linear effect meaning that they helped to improve the willingness to get more actively involved in the learning experiences, they also improved abilities to: reflect, analyze, solve problems and make decisions about their farm learning experiences.

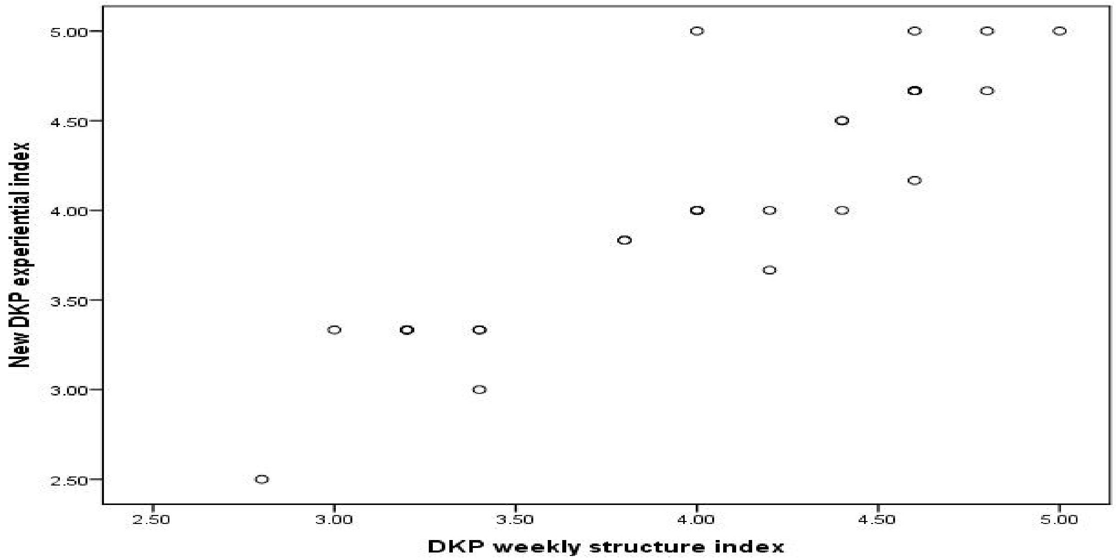

Fig. 7. Effect of DKP weekly Structure on Students' ELAs

The effect size was found to be significant *(F (10,19) =8.49, P= .00*). The value for R Squared was found to be equal to .817 (Adjusted R Squared = .721). This meant that the DWS contributed 72.1% of the Variation in the levels of ELA among the students. Some critics maintain that building the motivation necessary for students to learn without guardrails can be difficult, and that some students might be left behind as a result. Without enough motivation or interest in critical areas [19], it is argued that, unguided (lacking in motivation) students might fare poorly against their peers [20].

3.3.2 Effect obtained on ELAs with DKP students portfolio attributes

A second scatterplot diagram (figure 8) shows the effect of the DKP students' portfolio on the experiential learning ability. The results revealed a positive and linear effect between the two variables. The students were required to identify farm enterprises present in their host farms and record them in their portfolios. Further, they were expected to carry out job and task analysis and prepare daily jobsheets. These documents were then uploaded in the students' portfolios. The students were expected to reflect by recording their learning experiences in the DKP portfolios.

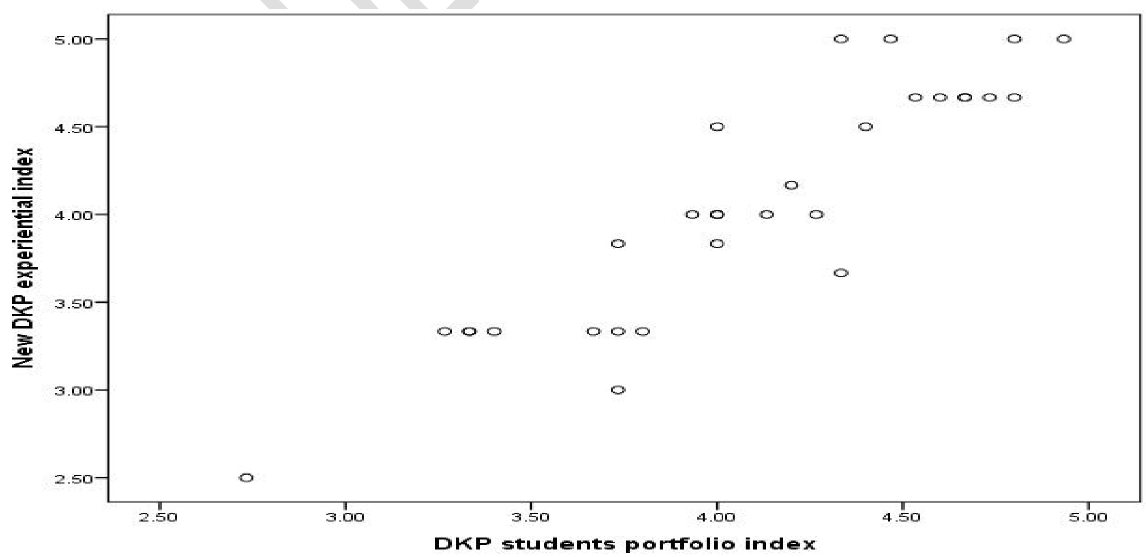

Fig. 8. Effect of DKP student's portfolio on students' ELA

The result depicted a positive and significant effect *(F (20,9) =5.32, P=.01)* between the student's portfolio and the students' experiential learning ability. The Value for a R Squared = .922 (Adjusted R Squared = .749) implying that the DKP student's portfolio contributed to about 74.9% of the variation observed in the ELA levels. It can therefore be concluded that activities involving identification of farm enterprises, job analysis, task analysis and jobsheet preparation improved the students' experiential learning ability i.e., the willingness of the students get actively involved in the farm experiences, the ability to be reflective and analytical, the ability to make decisions and solve problems in addition to the ability to make continuity arrangements for initiated projects/innovations. Reflective learning is the ability to reflect on one's actions in order to take a critical stance or attitude towards one's own practice and that of one's peers, engaging in a process of continuous adaptation and learning [22][23]. According to one definition, it involves "paying critical attention to the practical values and theories which inform everyday actions, by examining practice reflectively and reflexively. This leads to developmental insight" [24]. A key rationale for reflective practice is that experience alone does not necessarily lead to learning; deliberate reflection on experience is essential [25][26]. Reflective practice can be an important tool in practice-based professional learning settings where people learn from their own professional experiences, rather than from formal learning or knowledge transfer. It may be the most important source of personal professional development and improvement. It is also an important way to bring together theory and practice; through reflection a person is able to see and label forms of thought and theory within the context of his or her work [27]. A person who reflects throughout his or her practice is not just looking back on past actions and events, but is taking a conscious look at emotions, experiences, actions, and responses, and using that information to add to his or her existing knowledge base and reach a higher level of understanding [28].

3.3.3 Effects obtained on ELAs with DKP implementation enablement attributes

A scatter plot (Figure 9) was drawn to graphically represent the effect of the DKP implementation enablement on ELAs. The results showed that there was a positive and linear effect between the DKP implementation enablement and students' ELAs. The training workshop, the hyperlinks used to navigate the DKP and the online google groups used during the implementation of the DKP innovation helped to improve the students' ELAs.

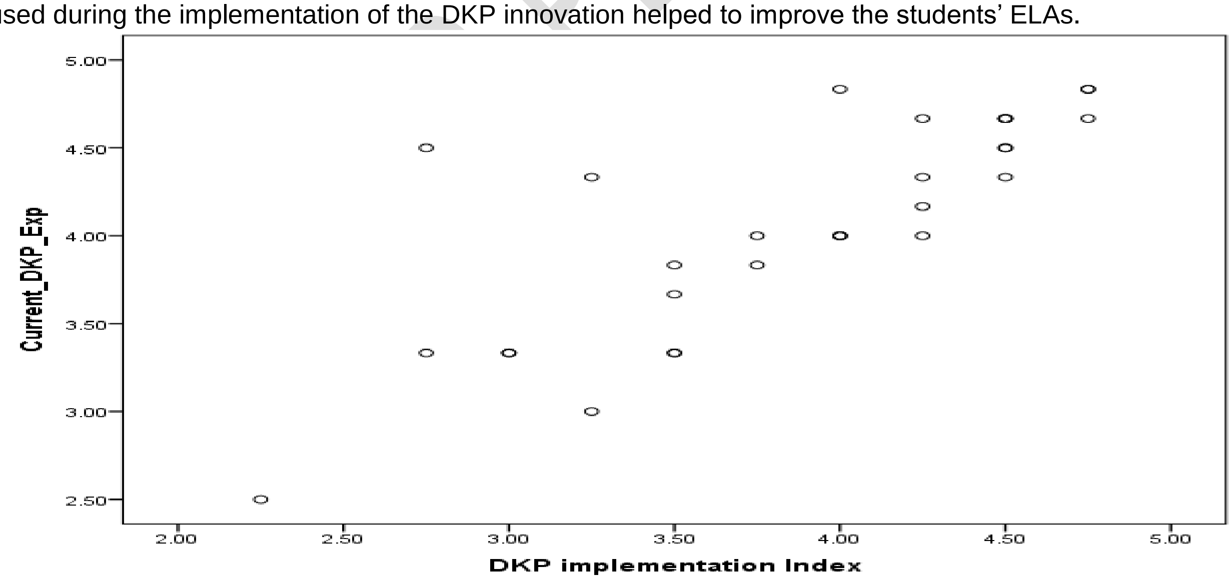

Fig. 9. Effect of DKP implementation Enablement on ELA among students on FAP

On running a general linear model to estimate the effect size by using the partial Eta squared, the results showed that there was a positive and significant *(F (20,9) =6.95, P=.01)* effect of DKP implementation enablement on the students' ELAs. The Value for R Squared was found to be equal to .758 (Adjusted R Squared = .649), implying that the DKP implementation enablement contributed to about 64.9% of the variation observed in the ELA levels. The training workshop, the online google groups and the hyperlinks embedded in the weekly structure documents to help in navigating resources packaged in the DKP helped to improve students' ELAs. In computing, a hyperlink, or simply a link, is a reference to data that the user can follow by clicking or tapping [30]. A hyperlink points to a whole document or to a specific element within a document. Hypertext is text with hyperlinks. The text that is linked from is called anchor text. A user following hyperlinks is said to navigate or browse the hypertext. The hyperlinks embedded in the weekly power points can therefore be said to have helped the students browse or navigate throughout the DKP attributes and thus having a significant effect on the students ELA levels.

3.3.4 Effects obtained on ELAs with DKP Resource attributes

To determine the effects obtained on ELAs with DKP resources, a scatterplot (Figure 10) was drawn. The results showed that utilizing the Packaged DKP resources during FAP, had a positive and linear effect on the students' ELAs. A general linear model was run to determine the partial Eta squared and estimate the effect size of DKP resources. The results further showed that the effect was significant ($F (9, 20) = 2.86$, $P= .03$). R Squared was found to be equal to .779 (Adjusted R Squared = .506). This means that the DKP Resources contributed about 50.6% of the variation observed in the students' ELAs.

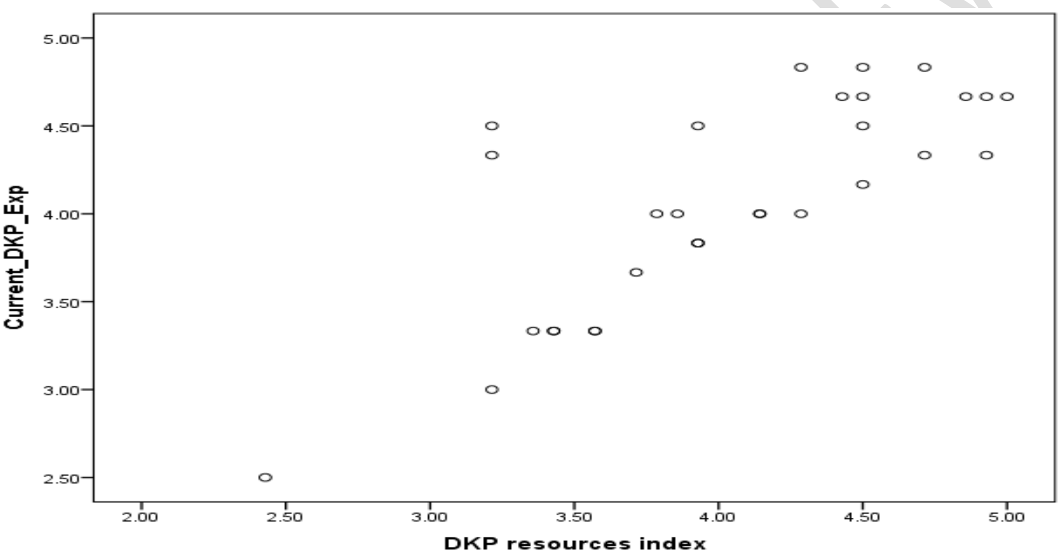

Fig. 10. Effect of DKP resources on Students' ELAs

The resources packaged for use by the student's included knowledge in; livestock, crop production, agribusiness/ economics and knowledge in agricultural engineering entailing; farm tools and equipment, tractor operations, farm machinery, and farm structures. Video resources that cut across all knowledge areas were added. The knowledge in livestock farming that was packaged in the DKP resource section included, zero grazing, livestock nutrition, diagnosis of livestock parasites and diseases, dairy farming management, poultry farming (emphasis was put on management of indigenous breeds of poultry), pig farming among others. Knowledge about crops entailed knowledge on; maize, beans, cabbages, carrots, onions, website links on how to identify crop pests and what registered products to use for each of the pests and diseases among other topics were packaged. Under agribusiness management there was knowledge on input supply, marketing of farm produce, farm management, record keeping, and value additions among other topics. In agricultural engineering, farm structures, tools and equipment were the main topics covered. Fam machinery was also added to the resource in agricultural engineering. Richard Ohmann argues that, adults ignorant of computers will soon be as restricted as those who today are unable to read. Software will become the language of the future, and the dominant intellectual asset of the human race, so that an understanding of software will be a primary component of literacy in the electronic age".[31]. Building onto this premise most of the resources were provided in multimedia digital formats including video resources

3.4 Use of DKP Innovation design and improvement of ELAs

To predict the effect of each DKP design attributes on improvement of experiential learning abilities, a stepwise Multiple Linear Regression was used to evaluate whether DKP weekly structure index (DWSi), DKP resources index (DRi), DKP student's portfolio index (DSPi) and DKP Implementation Index (DIMi) indices could predict students' Experiential learning ability index. The linear regression summary model revealed that the predictors i.e., constant, DKP weekly structure index, DKP resources index and DKP implementation enablement, all acting together, accounted for 90.4% (Adjusted R square, coefficient of determination=.904) of the variation in experiential learning ability index. However, individual variables were not significant in the overall regression model and this pointed to existence of multicollinearity among the DKP attributes. One way to resolve multicollinearity is by running a Principal Component Analysis (PCA). The first step was to check the assumptions of the principal component analysis by performing Kaiser-Meyer -Olkin measure of sampling adequacy analysis was performed and Bartlett's test of sphericity used to determine the significance of the coefficient matrix. In other words, to test whether it was appropriate to run the correlation matrix. The results in Table 3 showed a high significance (p=.001) level. The sampling adequacy was acceptable (KMO=.807) and Bartlett's test of sphericity demonstrated that correlations between the independent variables were large enough for PCA ($\chi2(6)$ =149.968, p=.000). The SPSS program sets KMO to .5 when the correlation matrix is identity matrix, avoiding the problem of carrying out divisions by zero.

Table 3 Kaiser-Meyer-Olkin Measure of Sampling Adequacy.

KMO and Bartlett's Test		0.807
Bartlett's Test of Sphericity	Approx. Chi-Square	149.968
	Do	6
	Sig.	.001

KMO values greater than 0.8 can be considered as a good indication that principal component analysis will be useful in analyzing the variable in question. This occurs when most zero-order correlations are positive. KMO values are less than 0.5 when most zero order correlations are negative. A scree plot, shown in Figure 11 was plotted to explore and give an estimate of the number of component solutions available in order to resolve the issue of multicollinearity. The results produced a one component solution to the multicollinearity problem encountered in the regression analysis.

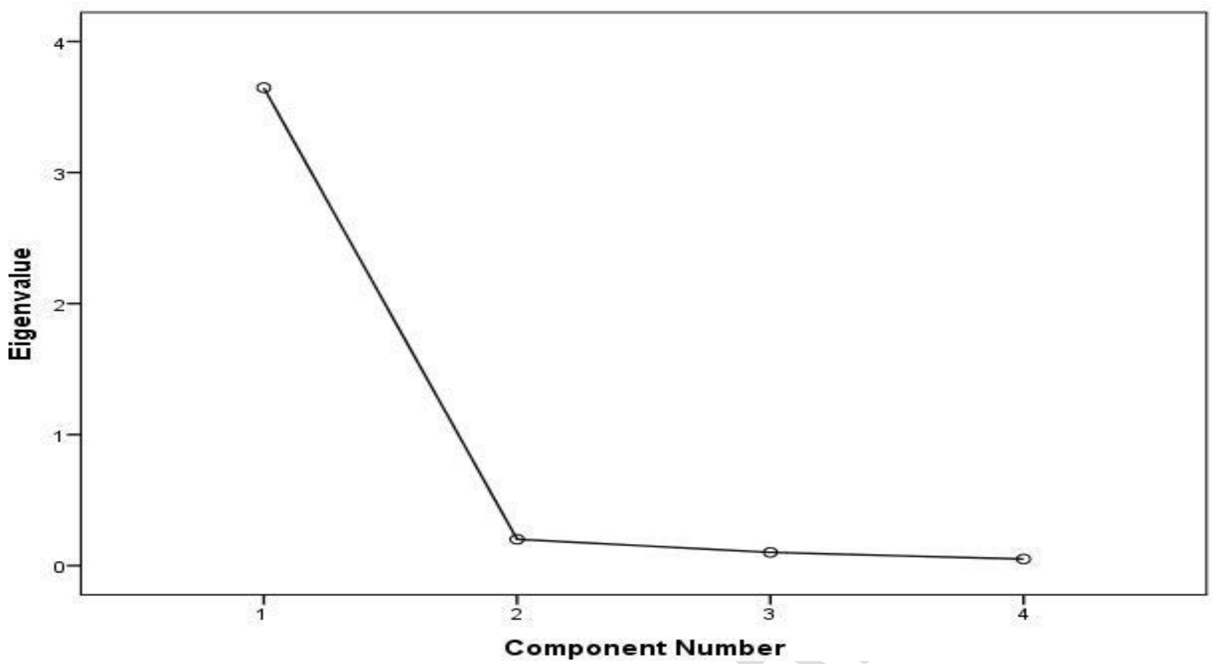

Fig. 11. **Screen plot showing the Eigenvalue against component number**

A PCA was run for the four independent variables. The results revealed there was a one component solution that explained 91.18% of variance in the regression model.; The component Eigenvalue was 3.647. Eigen value is a scalar associated with a given linear transformation of a vector space and having the property that there is some nonzero vector which when multiplied by the scalar is equal to the vector obtained by letting the transformation operate on the vector especially: a root of the characteristic equation of a matrix. Using SPSS, the Principal Component Analysis (PCA) method was used to analyze the correlation of the variances found in the independent variables by first producing the correlation matrix shown in Table 3. The results showed that there was a high correlation between all the independent variables. For instance, there was a high correlation between DKP resource index and DKP weekly structure index (.864). There was a high correlation between DKP implementation index and DKP resources index (.903). The correlation between the DKP resources index and DKP student's portfolio index was .854. A PCA was run for the four independent variables. The results revealed there was a one component solution that explained 91.18% of variance in the ELA regression model. The component Eigenvalue was 3.647. Eigen value is a scalar associated with a given linear transformation of a vector space and having the property that there is some nonzero vector which when multiplied by the scalar is equal to the vector obtained by letting the transformation operate on the vector especially a root of the characteristic equation of a matrix.

4. CONCLUSION

In conclusion, this study revealed that after using the DKP during FAP, the levels of ELAs among students on FAP improved from what has been documented in [7] from 2.63 to 4.07 measurements rated in a continuum scale of 1 to 5. All the attributes of the DKP including the DKP weekly structure, DKP student's portfolio, DKP implementation enablement and DKP resources were found to have a positive and significant effects on the levels of ELAs. However, multicollinearity was also detected among the independent variables. A scree plot drawn to show the number of principal components that could be used to explain the variations in the levels of ELAs revealed that there was a one component solution. A name (DKP Innovation Design Attribute-DIDi) was suggested to refer to the one component which included all the DKP design attributes studied including; DWS, DIMi, DSP and DR. The one component attribute explained 91% of the variation observed in the ELAs among Egerton University students on FAP, at 5% level of significance.

ETHICAL APPROVAL (WHERE EVER APPLICABLE

All authors hereby declare that the surveys have been approved by Egerton university board of graduate studies and performed in accordance with approved standards.

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DEFINITIONS, ACRONYMS, ABBREVIATIONS

DKP	Digital Knowledge Pack
FAP	Farm Attachment programme
EU	Egerton University
EL	Experiential Learning
ELA	Experiential learning Ability ELAs Experiential Learning Abilities DWS DKP weekly Structure
DIM	DKP implementation Enablement
DSP	DKP Students Portfolio
DR	DKP resources