



Contextual Determinants of Learning Behaviour Differentials amongst Host-farmers of University-Student Outreach in Uganda

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ABSTRACT

In Sub-Saharan Africa, a knowledge void still exists on two contextual questions of university-community outreach: 1) how social demographics differences are related to farmer learning behaviour towards student outreach, and 2) how student outreach models compare with public and non-public extension services. A cross-section survey was used to obtain data from a sample of 283 respondents purposively selected from previous hosts of student outreach of Gulu University in Uganda. Results from Kruskal-Wallis method revealed that there were significant differences among host-farmers with respect to farmstead distance to the university for knowledge sharing ($\chi^2(2) = 8.5$; $P < 0.05$) and giving feedback ($\chi^2(2) = 7.6$; $P < 0.05$). Regarding the experience of participating in outreach program, significant differences among host-farmers were found in seeking information ($\chi^2(2) = 12.3$; $P < 0.01$); knowledge sharing ($\chi^2(2) = 10.4$; $P < 0.01$); seeking feedback ($\chi^2(2) = 16.4$; $P < 0.01$) and giving feedback ($\chi^2(2) = 8.1$; $P < 0.05$). Further, Friedman test results showed that host-farmers perceived the university-student outreach to be superior and significantly different from public and non-public agricultural extension. We conclude that university outreach is a useful service to farmer. However, its success in facilitating farmer learning is dependent on farmstead distance to the university and farmers' level of experience of participating in university activities. We recommend more logistical support from governments to university outreach programs so that outreach services can efficiently complement public and non-public interventions in delivering community-based training and learning approaches.

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Introduction

In developing countries, university-community linkages are largely underdeveloped (Sherrard, 2016). It has been reported that the aims of many universities most especially in Sub-Saharan Africa, are quite disconnected from the local development

needs (Blackie, 2016). This has been attributed to the fact that these universities experience diminished public funding for which the fiscal allocation is meant to simultaneously cater for the core functions including teaching, training, research and community outreach (Larsen, 2016). In the face

of existing financial squeeze, community outreach has been least prioritized by universities in the planning and budgeting processes. This is well-evidenced in a host of scholarly work that often refer to community outreach as a relegated third mission of the university (Tefera, 2013; Muriisa, 2014). Inevitably, as suggested in Preece (2013), outreach activities in universities have remained marginal, barely contributing to community development. Quite a lot of researched work in terms of knowledge, technologies and innovations have been shelved within universities and are hardly exploited to facilitate learning in communities. Of particular importance, universities need to take into account the contextual factors in their target communities of outreach service provision. Key among these contextual factors are socio-demographics and alternative development interventions. Such a responsive community outreach is likely to more effectively contribute to bridging the development gap in communities where such universities are located (Cloete and Maassen, 2015).

In recent times, and following good lessons learnt on community outreach from other universities, for instance, EARTH University in Costa Rica, rolling out student-oriented outreach models in African universities has gained prominence (Sherrard, 2016). For example, many South African universities are currently running service learning programs for enhanced community outreach (Preece, 2013). Elsewhere in Africa, agricultural-leaning universities are also implementing student-focused outreach models. A case in point, Egerton University in Kenya runs a farm attachment program (as form of community outreach) for student experiential learning which supports farmer learning (Mungai and Njuguna, 2016). In Uganda, student outreach services are well known in two universities. For example, Makerere University runs a student attachment program, in which undergraduate students train smallholder farmers for purposes of developing their capacities in farming business (Opolot *et al.*, 2018). At Gulu University (the focus of current study), in what is known as the

Student-Centered Outreach (SCO), students are attached to farmsteads for both own experiential learning and provision of advisory services to host-farmers (Kalule *et al.*, 2016).

Conversely, recent research on university student outreach has concentrated on the influence of these outreach programs on entrepreneurial competences of host-communities (Opolot *et al.*, 2018; Mukembo, 2017). Other studies have merely explored the role of resistance, stereotyping and gender-bias (Roberts and Edwards, 2017) and description of processes for student attachment (Sherrard and Alvarado, 2017) with limited focus on the underlying contextual determinants of learning behaviour differentials. In the SCO, there has been claims of social environment factors limiting ultimate student-farmer interaction for learning (Roberts and Edwards, 2017). Yet, there is still little attention paid to analyzing how the differences in farmer socio-demographics are related to farm-level learning behaviour, an issue that calls for further investigation. In addition, a research gap still exists on how the student-to-farmer university outreach compares with alternative agricultural development interventions namely public and non-public agricultural extension. This study therefore assesses the role of socio-demographic differentials for learning behaviour among host-farmers of university-student outreach. It also compares farmers' perceptions of university student outreach to both public and non-public agricultural extension services using Gulu University (GU) in Uganda as a case. The results of the differences in farmers learning behaviour attributable to socio-demographic characteristics are important for segmented targeting of outreach services to host-communities in enhancing more even impact. In addition, comparative results on university outreach with public and non-public extension services can be insightful to policy brokers in lobbying for a more supportive policy environment for university outreach programs.

Design of Student-Centered Outreach at Gulu University

In the original design of the SCO, undergraduate students of agriculture were being attached to farmsteads situated within the 10km radius from the University campus (Odongo *et al.*, 2017). However, the reorganization of this SCO following the introduction of graduate programs in the Faculty of Agriculture and Environment led to diversification of community attachment approaches. In the study of Kalule and Ongeng (2016), it was articulated that in addition to the SCO described above, graduate students, upon completion of the first year of their masters study programs, are attached to farmers' organizations including associations and producer groups for a period of 2 -3 months. The core features of the SCO (as explained by Kalule *et al.*, 2016) include: 1) students interact with farmers to facilitate learning; 2) farmers participate in problem communication and knowledge sharing with students; 3) students transmitting identified farming problems to the faculty; and 4) students transmit researched solutions to the community. In this outreach set up, it can be imagined that long term success and linkages in the SCO would most likely depend on adequate student-farmer engagement in information seeking, knowledge sharing, seeking and giving feedback on experiences, farming practices and technical knowledge.

Theoretical Framing

University outreach is associated with enhanced farmer learning and behavioural change through fostering student-farmer interactions. Farmer learning models therefore provide a strong basis for application to the context of university outreach programs whose main purpose is to support learning in farming communities. This study therefore, adapted and modified the learning behavior model advanced by Edmondson (1999). The model explains that learning behaviour comprises of four tenets: seeking information, knowledge sharing, seeking feedback and speaking about concerns (also

known as giving feedback). However, how these occur in the context of university outreach remains unclear. It has been argued that in order to be able to learn and adapt (Karubanga *et al.*, 2016), farmers seek to acquire complete, high quality and timely information related to their crops and livestock throughout the year (Kumar *et al.*, 2018). Learning in relation to university outreach refers to a dynamic behavioural process of interaction and exchange among people (Kozlowski and Bell, 2007). For instance, Karubanga *et al.* (2017) and Kirkpatrick and Johns (2003) point out that farmers' learning may involve interpersonal practices of seeking and sharing information either amongst the farmers or between the farmers and other stakeholders such as extension agents. These processes enable learners to compare new information with their experiences, creating new solutions for more efficiency and effectiveness (Carmeli *et al.*, 2009).

In particular, information seeking refers to an individual way and manner of gathering and sourcing for information for personal use, knowledge updating and development (Igwe, 2012). Seeking information through university outreach is useful for farmers to overcome their inadequacies in knowledge of certain basic practices that may include technical, managerial and marketing (Owolade and Kayode, 2012). University outreach is further known for enhancing knowledge and experience sharing among students and farmers which also involve donating and collecting knowledge thereby facilitating farmer learning (Kamarudin *et al.*, 2015). Lastly, the learning loop is only complete, if there is giving and receiving feedback from the source of knowledge (Hamilton, 2010). For instance, Milestad *et al.* (2010) point out the relevance of feedback for farmer learning where they reasoned that feedback enhances the adaptive capacity of the farmers in a given learning situation. They further explained that feedback construes new or revised interpretations of farmers' experiences and in effect changes these farmers' attitudes for decision making and behaviour for production.

Previous research has demonstrated that farmers' acquisition of information and knowledge is connected to social demographic characteristics of the farmers (Acheampong *et al.*, 2017). For instance, key among the social demographics that are likely to affect farmer learning behaviour are: sex, age and education status. Besides, there are also some factors which are peculiar to the context of student-to-farmer University outreach that are also worth testing. These include among others: participation in farm-labour sharing, experience of hosting students on the farm and farmstead distance to the university. Therefore, this study hypothesized as follows:

H1: Host-farmers of university student outreach are significantly different in learning behaviour for socio-demographic factors

H2: Host-farmers of students of university outreach are significantly different in learning behaviour in terms of a) level of experience of hosting students on their farms; and b) farmstead distance to the university

Another key assumption in this study is that farmers are confronted with different sources of information but with varying levels of efficiency in service delivery. Extant literature has shown that farming households experience underservice from public agricultural extension. Seemingly, alternative development interventions, for instance, university outreach would help to address the service gap. It is presumed that comparative perceptions on facilitating farm-level learning amongst farmers differs between university-student outreach and other development interventions of agricultural extension service and thus, this study hypothesized as shown below:

H3: Farmers' perceptions of own learning behaviour in the student-to-farmer university outreach is significantly different from that of public and non-public agricultural extension services

Methodology

Research Design

A cross-sectional survey was conducted on a sample purposively selected from previous host-farmers of the Student-Centered Outreach (SCO) program of Gulu University. In the SCO, students are meant to commute to and from the farmsteads, at least once in every two weeks for a period of not less than a year. Selected farmers had previously received students onto farms during the period of 2007 to 2016. Study participants were drawn from neighbouring districts of Gulu and Omoro in Northern Uganda. Besides, these two districts are in close proximity to Gulu University. The location of Gulu University is largely rural in nature and as such, there are many farming households in the neighbourhood of the University campus, a factor that has enabled ease of reach of farming households. In this study area, apart from university outreach, common development interventions for farmer agricultural extension service include: the public agricultural extension service, non-governmental organization (NGO) extension and the farmer-to-farmer extension.

Literature shows that there are two common paradigms that guide the choice of research design in social sciences and these are positivism and constructivism. In the positivist approach, the research argument is based on widely accepted principles (knowledge or theories about human behaviour) and normally, the research process ends with deductive reasoning guided by rules and laws (Creswell, 2014; Saunders *et al.*, 2012). For the constructivist approach, the research inquiry involves moving from 'specific to general phenomenon' using inductive reasoning, allowing to gain a subjective sense of the environment in which study participants live (Trochim 2006). As such, the positivists start with theory and use quantitative data for making inferences while constructivists start with observation through qualitative data collection with concurrent analysis resulting into inductive reasoning (theorizing). In this study, the pragmatism approach as articulated by Creswell (2014) was preferred. Pragmatism transcends the positivist and

constructivist approaches and allows the researchers to combine the quantitative and qualitative research methods. The pragmatism approach was found necessary for this study for two reasons: 1) theory testing to deductively provide evidence to either support or refute the research hypotheses derived from studying literature; and 2) gather qualitative information for detailed explanation of issues underlying positive perception of the university-student outreach as compared to public and non-public agricultural extension among program participants.

A sample of 283 respondents was computed following the sample size estimation method suggested by Krejcie and Morgan (1970). Subsequently, a purposive and multi-stage sampling approach was used to arrive at the final study participants. The reason for purposive sampling was to target only the program participants of university-student outreach for making deductions. First, respondents were selected from the sub counties of Paicho and Bungatira (Gulu District) and Koro and Bobi (Omoro District). In each sub county, farmer groups that had received students were identified for sampling. Subsequently, a list of farmers from each group was used to systematically sample respondents. To ensure representativeness, proportional sampling was used to distribute the sample between the selected districts. Up to 65% of SCO program participants come from Gulu District, possibly, because of the closeness of this district to Gulu University. As such, 181 participants representing 64% (Paicho = 94 and Bungatira = 87) were respectively sampled from Gulu District. That meant that 102 representing 36% (Koro = 61 and Bobi = 41) were sampled from Omoro District.

Data and Data Sources

Data were collected using semi-structured questionnaire. The questionnaire captured both Likert scale data as well as qualitative information that allowed respondents freedom of expression. Initially, the questionnaire was pretested to assess its

validity and reliability. Pretesting of the questionnaire was done in Lakwana Sub County (Omoro District), which neighbours the study area on a sample of 33 respondents. Results from the pretested questionnaire were then used to reword questions and/or items for improved consistency and clarity of questions to respondents. Construct reliability (CR) was used to check for measurement reliability of the construct of farmer learning behaviour. The CR index was 0.93, which was above the minimum threshold value of 0.7 and thus, satisfying the condition of measurement validity. A key section in the questionnaire captured responses on farmers' learning behaviour. This construct comprised of four indicators and these were: seeking information, knowledge sharing, seeking feedback and giving feedback to the service provider. Each of these four indicators was measured using four items, adapted and modified from Edmondson (1999) to suit the context of the student-to-farmer university outreach. The same indicators and items were repeated for each of the three other sources of farmer agricultural extension service namely public extension service, NGO extension and farmer-to-farmer extension. In all, a total of 64 items were used to measure farmers' learning behaviour. A sample item from the domain of information seeking read as follows: "I seek information on farming practices from university students". All items were rated on a 5-point Likert scale (1-5, where 1 = not at all and 5 = always).

Social demographic factors used in this study include: sex of the household head (captured as female = 1 and male = 2) and education status of household head (no-formal education = 1; primary education = 2 and post-primary education = 3). Other variables include: age of household head in years, participation in rotational farm-labour sharing in the community (if participant = 1; otherwise = 2, experience of hosting students on the farm (number of times the farmer had received student since inception of university outreach). Lastly, farmstead distance to the University was captured in km.

Data Analysis

Data were entered, processed and transformed in the computer statistical package of SPSS. Means and standard deviations were computed from Likert scale data on the indicators of farmer learning behaviour. Preceding testing for statistical differences in this study, correlation analysis was done to assess the possibility of multicollinearity. Given that correlates between seeking information, knowledge sharing, seeking feedback and giving feedback ranged from .69 to .77 (see appendix, Table 1), it suggested a risk of multicollinearity as explained by Hamilton (2006). As such parametric methods were unsuitable for making inferences and thus, non-parametric methods namely Kruskal-Wallis, Friedman and Wilcoxon signed-rank tests were preferred for subsequent analysis. Effect sizes were also computed manually following the method suggested by Field (2009). Effect size were calculated as follows:

$$\frac{Z}{\sqrt{N}}$$

where Z is the statistic that tests for significance of differences from Wilcoxon signed-rank test and $\sqrt{N}$ is the square root of sample size. The study also adapted Cohen (1988) criteria for evaluation of effect sizes (ρ). This criteria explains that the magnitudes of such effect sizes are considered small, if $\rho \leq 0.1$. These effect sizes are medium in size, if $\rho \leq .3$ and they are large, if $\rho \geq .5$. Lastly, the statistical findings were corroborated with qualitative information collected from some respondents in order to enhance the validity of study results.

Results and discussion

Socio-demographic differences in farmer learning towards student outreach

Results of differences in farmer learning behavior towards student outreach are presented in Table 1. The results show that respondents were significantly

different in learning behaviour with respect to experience of hosting students.

The differences were detected in seeking information ($\chi^2 (2) = 12.3$; $P < 0.01$); knowledge sharing ($\chi^2 (2) = 10.4$; $P < 0.01$); seeking feedback ($\chi^2 (2) = 16.4$; $P < 0.01$) and giving feedback ($\chi^2 (2) = 8.1$; $P < 0.05$). These results supported the hypothesis (H_{2a}) that farmers' learning behaviour was significantly different for the level of farmers' experience of hosting University outreach students. There was also significant differences in farmstead distance to the university for knowledge sharing ($\chi^2 (2) = 8.5$; $P < 0.05$) and giving feedback ($\chi^2 (2) = 7.6$; $P < 0.05$). These findings supported the hypothesis (H_{2b}) on existence of significant differences in farmstead distance to the University for the behaviours of knowledge sharing and giving feedback.

However, hypothesis (H_{2b}) was not supported in respect of seeking information and seeking feedback, for which no significant differences were found. Participation in farm-labour sharing was only significantly different for knowledge sharing ($\chi^2 (1) = 4.7$; $P < 0.05$) and was not statistically significant in any of seeking information, seeking feedback and giving feedback. However, for the variables of sex, age and education status of the household head, there was no significant differences across the four indicators of farmers' learning behaviour, and thus, hypothesis (H_1) was not supported. This implied that the three variables were independent of farmers' learning behaviour.

A comparison of short-distance and medium-distance farmers revealed that significant differences were only in giving feedback ($\chi^2 (1) = 3.9$; $P < 0.05$). For the other three indicators of farmers' learning behaviour, no significant differences were found. Still, there was no significant differences across the four indicators of learning behaviour between medium and long-distance farmers. Thus, the effect size in the comparison of short and medium-distance as well as the medium to long-distance farmers, which ranged

Table 1. Socio-demographic differences for farmer learning behaviour

Variables	N	Kruskal-Wallis Test for Group Differences							
		Seeking Information		Knowledge Sharing		Seeking feedback		Giving feedback	
		MR	χ^2	MR	χ^2	MR	χ^2	MR	χ^2
Sex of household head									
Male	154	139.2		141.1		147.0		141.0	
Female	129	145.3	0.4	143.1	0.0	136.0	1.3	143.2	0.0
Farm-labour sharing									
Participant farmer	195	139.4		135.0		135.9		136.2	
Non-participant farmer	88	147.9	0.7	157.6	4.7*	155.5	3.5	155.0	3.3
Age of household head									
≤ 30 years	69	148.2		142.5		153.2		141.2	
> 30 – 50 years	123	139.5	0.5	142.2	0.1	136.1	2.0	144.7	0.3
> 50 years	91	140.7		141.3		141.6		139.0	
Education of household head									
Pre-primary education	27	129.5		133.6		124.1		116.8	
Primary education	160	146.1	3.8	143.2	1.8	146.2	0.3	148.4	1.2
Post-primary education	96	138.7		142.3		140.1		138.4	
Farmstead dist. to the University									
Short distance (≤ 10 km)	142	153.4		154.4		149.9		153.3	
Medium dist. (>10 - ≤ 20 km)	81	130.8	5.6	137.6	8.5*	142.8	4.9	139.0	7.6*
Long distance (> 20 km)	60	130.2		118.7		122.3		119.2	
Experience of hosting students									
Low (≤ 3 times)	203	132.3		133.9		131.5		133.9	
Medium (4 – 6 times)	57	158.4	12.3**	152.3	10.4**	156.5	16.4**	157.0	8.1*
High (> 6 times)	23	187.2		188.2		198.5		176.3	

* & ** means significant at $P < 0.01$ & $P < 0.05$ respectively**Table 2.** Post hoc tests for pairwise comparisons

Pairwise Comparisons	Farmers' learning Behaviour (N = 283)							
	Seeking Information		Knowledge Sharing		Seeking feedback		Giving feedback	
	χ^2	ρ	χ^2	ρ	χ^2	ρ	χ^2	ρ
Farmstead distance to the University								
Short (≤ 10 km) & Medium (>10 - ≤ 20 km)	1.6	0.1	0.5	0.0	2.2	0.1	3.9*	0.3
Medium (>10 - ≤ 20 km) & Long (> 20 km)	0.0	0.0	1.8	0.2	2.6	0.2	2.1	0.2
Short (≤ 10 km) & Long (> 20 km)	3.5	0.2	8.3**	0.6	4.5*	0.3	7.4**	0.5
Experience of hosting university students								
Low (≤ 3 times) & Medium (4 – 6 times)	3.6	0.2	4.4*	0.3	2.3	0.1	4.8**	0.3
Medium (4 – 6 times) & High (> 6 times)	1.0	0.1	6.0*	0.7	3.5	0.4	3.1	0.3
Low (≤ 2 times) & High (> 4 times)	5.5*	0.4	13.3**	0.9	9.1**	0.6	8.8**	0.6

* & ** means significant at $P < 0.01$ & $P < 0.05$ respectively**Table 3.** Comparison of university student outreach to public and non-public agricultural extension services

Farmers' Sources	Means (SD); n= 283			
	Information seeking	Knowledge Sharing	Feedback seeking	Giving feedback
Student Outreach	3.91 (0.99)	3.99 (0.92)	3.94 (1.01)	4.02 (0.92)
Public Ext. Service	2.49 (1.15)	2.54 (1.14)	2.46 (1.16)	2.44 (1.14)
NGO Ext. Service	3.30 (1.04)	3.36 (1.02)	3.31 (1.06)	3.39 (1.08)
F2F Ext. Service	3.11 (1.23)	3.21 (1.24)	3.12 (1.23)	3.15 (1.21)

from 0.0 to 0.3, were all small as affirmed by Cohen (1988). The effect sizes between short-distance and long-distance were above small criterion; seeking information ($\rho = 0.2$), seeking feedback ($\rho = 0.3$). Large effect sizes were detected in giving feedback ($\rho = 0.5$) and knowledge sharing ($\rho = 0.6$). In the case of knowledge sharing, the result implied that the differences in short and long-distances from the university amongst farmers accounted for 60% variation in farmers' knowledge sharing with students.

Results of post hoc analysis for the variables, which had three comparison groups and exhibited significant differences in at least two indicators of learning behaviour are presented in Table 2. For example, farmstead distance to the university, the results show that farmers within short-distance radius from the university ($\leq 10\text{km}$) performed better in three indicators of learning behaviour compared to those located in long-distance to the university ($>20\text{km}$). Thus, farmsteads within short distance to the University were significantly different from long-distance farmsteads in knowledge sharing ($\chi^2(1) = 8.3$; $P < 0.01$), feedback seeking ($\chi^2(1) = 4.5$; $P < 0.05$) and giving feedback ($\chi^2(1) = 7.4$; $P < 0.01$).

Regarding the experience of hosting university outreach students, significant differences were found across the four indicators of farmers' learning behaviour between low and high number of times of hosting students. The results were as follows: seeking information ($\chi^2(1) = 5.5$; $P < 0.05$), knowledge sharing ($\chi^2(1) = 13.3$; $P < 0.01$), seeking feedback ($\chi^2(1) = 9.1$; $P < 0.01$) and giving feedback ($\chi^2(1) = 8.8$; $P < 0.01$).

There was also significant differences between low and medium experience of hosting students for knowledge sharing ($\chi^2(1) = 4.4$; $P < 0.05$) and giving feedback ($\chi^2(1) = 4.8$; $P < 0.01$). The comparison between medium and high, the significant differences were only found in knowledge sharing ($\chi^2(1) = 6.0$; $P < 0.05$). The effect sizes were biggest in the comparison between

low experience and high experience. These effect sizes ranged from medium ($\rho = 0.4$ in information seeking) to large ($\rho = 0.6, 0.6$ and 0.9 in seeking feedback, giving feedback and knowledge sharing respectively). For knowledge sharing, as a case, the results meant that the difference in low and high experience of hosting students amongst farmers accounts for 90% of the variation in the learning behaviour of knowledge sharing.

Elsewhere, studies have shown that farmers in close proximity to knowledge institutions, for instance, universities and research institutions, and knowledge sharing platforms have a relative advantage in accessing information and knowledge, and tend to exhibit better learning (Mashavave *et al.*, 2013). It is likely that farmsteads that are closer to the university are regularly reached by students because of ease of commuting to and from these farmsteads. It is also imaginable that long-experience farmers could have realized the value of participating in student outreach activities. In turn, these farmers could have been more encouraged to exhibit positive learning behaviour towards student outreach. These results support earlier findings that have suggested that host-communities tend to have positive perceptions towards student outreach because these communities assume that students possess valuable knowledge (Shuda and Kearns-Sixsmith, 2009).

Comparison of student-to-farmer university outreach to other farmer extension services

Results in Table 3 reveal that the student-to-farmer university outreach was rated highest amongst the four domains of farmer learning behaviour. Results from Likert scale data indicate that with respect to university student outreach, farmers rated least information seeking ($M = 3.91$; $SD = 0.99$) while the highest rated indicator was giving feedback ($M = 4.02$; $SD = 0.92$). Farmers rated lowest the four domains of learning behaviour with respect to public extension service, ranging from giving feedback ($M = 2.44$; $SD = 1.14$) to knowledge sharing ($M = 2.54$;

SD = 1.14). NGO extension service was rated second highest from information seeking ($M = 3.30$; $SD = 1.04$) to giving feedback ($M = 3.39$; $SD = 1.08$). The second lowest rated service provider was farmer extension whose rating ranged from information seeking ($M = 3.11$; $SD = 1.23$) to giving feedback ($M = 3.15$; $SD = 1.21$).

A follow-up with tests on differences in farmer learning behaviour between the student outreach and other service providers are presented in Table 4. Friedman test results showed that information seeking ($\chi^2(3) = 180.38$; $P < 0.01$); knowledge sharing ($\chi^2(3) = 170.91$; $P < 0.01$), feedback seeking ($\chi^2(3) = 186.62$; $P < 0.01$) and giving feedback ($\chi^2(3) = 190.68$; $P < 0.01$) were significantly different across the four sources of farmers' information. Post hoc analysis, in which Wilcoxon signed-rank tests were conducted with a Bonferroni correction applied, resulted in a significance level set at $p = 0.0125$. Accordingly, there was a statistically significant reduction in information seeking from student outreach to public extension service ($Z = -12.81$; $P < 0.0125$), NGO extension service ($Z = -7.12$; $P < 0.0125$) and farmer extension ($Z = -7.38$; $P < 0.0125$). Accordingly, these results supported the hypothesis (H_3) that farmers' perceptions of own learning behaviour in the student-to-farmer university outreach is significantly different from that of public and non-public agricultural extension services.

Regarding the knowledge sharing, there was significant differences in favour of the student outreach when compared to public extension ($Z = -12.60$; $P < 0.0125$), NGO extension ($Z = -7.24$; $P < 0.0125$), and farmer extension ($Z = -7.40$; $P < 0.0125$). A similar pattern of significant differences was also found for seeking feedback and giving feedback when student outreach was compared with other three service providers examined in this study. There was also significant differences in favour of NGO extension compared to public extension for seeking information ($Z = -8.75$; $P < 0.0125$), knowledge sharing ($Z = -8.71$; $P < 0.0125$), seeking feedback ($Z = -9.14$; $P < 0.0125$)

and giving feedback ($Z = -9.54$; $P < 0.0125$). Surprisingly, when NGO extension was compared to farmers' extension, significant differences were only found in giving feedback ($Z = -2.88$; $P < 0.0125$) and for other three indicators, there was no statistical differences. Lastly, the respondents rated farmer extension better than public extension with significant differences found in seeking information ($Z = -5.80$; $P < 0.0125$), knowledge sharing ($Z = -5.93$; $P < 0.0125$), seeking feedback ($Z = -5.84$; $P < 0.0125$) and giving feedback ($Z = -6.35$; $P < 0.0125$).

A further examination of the triggers of superior rating of student outreach for farmer learning behaviour revealed more frequent student-farmer contacts compared to public and non-public extension service. These farmers also reported that they expected better knowledge from students compared to their peers. In most cases, the respondents expressed preference of student-to-farmer outreach to public extension service, as some farmers articulated below:

"... the students are more frequent and are easier to access compared to government workers...", farmer, Boke Village, Bungatira Sub county, November 2017.

"... I think students are studying and always reach us with adequate knowledge, and are easier to access too. Government workers, provide free inputs but do not come down to individual farmers to guide us on the use of such inputs...", farmer, Holly-Rosary village, Laroo Sub County, November 2017

The lower rating of NGO extension was attributed to downscaling of services to farmers. That aside, much as these farmers recognized that peer farmers (farmer-to-farmer extension) were more accessible, they still preferred university outreach as articulated by some respondents below:

"... NGOs give information on managing village saving and loan associations. However, of late they have not been coming to us...", farmer, Kalam-Omida, Bobi Sub County. December, 2017.

Table 4. Friedman and Wilcoxon signed-rank tests for differences

Tests/ Comparisons	Information Seeking		Knowledge Sharing		Feedback Seeking		Giving Feedback	
Friedman Test								
Chi-Square/ $\chi^2(3)$	180.38**		170.91**		186.62**		190.68**	
Wilcoxon Signed-Rank Test	Z-Val.	p	Z-Val.	p	Z-Val.	p	Z-Val.	p
Student Outreach – Public Extension	-12.81*	-.76	-12.60*	-.75	-13.04*	-.77	-12.94*	-.77
Student Outreach – NGO Extension	-7.12*	-.42	-7.24*	-.43	-7.23*	-.43	-7.02*	-.42
Student Outreach – Farmer Extension	-7.38*	-.44	-7.40*	-.44	-7.67*	-.46	-8.31*	-.49
NGO Extension. – Public Extension	-8.75*	-.52	-8.71*	-.52	-9.14*	-.54	-9.54*	-.57
Public Extension – Farmer Extension	-5.80*	-.34	-5.93*	-.35	-5.84*	-.35	-6.35*	-.38
NGO Extension – Farmer Extension	-2.08	-.12	-1.67	-.10	-2.18	-.13	-2.88*	-.17

* Significantly different at $P = 0.0125$ (after Bonferroni adjustment for multiple comparisons); ** Difference within the farmers' learning behaviour was significant ($P=0.01$)

“... peer farmers only give knowledge learnt from other sources. But university students have been taught and have more new knowledge to share compared to peer farmers”, farmer, Boke Village, Bungatira Sub county, November 2017.

“... peer farmers are more close to me and provide knowledge on a daily basis University students, however, have always given us first-hand knowledge on farming”, farmer, Holly-Rosary, Laroo Division, November 2017.

Conversely, effect sizes were equally interesting. In the comparison of student outreach to public extension service, the effect sizes were as follows: knowledge sharing (-.75), information seeking (-.76), feedback seeking (-.77) and giving feedback (-.77). This meant that the differences between student outreach and public extension service explained the variation in farmers' learning behaviour ranging from 75% up to 77%. In the comparisons between student outreach and NGO extension, the effect sizes ranged from .42 – .43 while between student outreach and farmer-to-farmer extension, the effects ranged from .44 to .49. Surprising findings were detected in the comparisons of NGO extension service and farmer-to-farmer extension, in which effect sizes were small (.10 – .17). However, the effects in the comparison of NGO and public extension were larger than medium sizes (.52 – .57).

The findings corroborated with previous studies, which have reported inadequacies in linkages between farmers on one hand, and on the other hand,

public extension systems and research (Sewell *et al.*, 2017; Klerx *et al.*, 2017). Surprisingly, NGO agricultural extension service did not significantly differ from the farmer-to-farmer extension. This could be because most structures of farmer-to-farmer extension have been established by the NGOs themselves, and as such, farmers find little differences between the two forms of service. The high rating of student outreach had connection to frequent student visits to farms and expected knowledge quality. This finding is in support of the studies which have reported that frequent contacts between extension agents and farmers' influences farmers' information seeking and learning (Goud and Ram, 2018; Dambazau *et al.* 2015). In relation to farmer extension, respondents acknowledged that their peers were equally easily accessible and were useful in the learning process, a finding in support of results in Karubanga *et al.* (2017).

Conclusion and Recommendations

It has been established that farmstead distance to the university and the length of experience of hosting university students significantly influenced farmer learning behaviour towards student outreach. Farmers within short-distance from the university are better at seeking information, knowledge sharing, seeking and giving feedback in the student-to-farmer university outreach. Similarly, farmers with long experience of participating in student outreach are better than their counterparts at

interacting with students for seeking information, knowledge sharing, seeking feedback and giving feedback. This study also demonstrated that the student-to-farmer university outreach is a valuable service to host communities. It has been shown that student outreach services have a relative advantage at influencing farmer learning behaviour in areas that are proximal to the university compared to public agricultural extension, NGO extension and farmer-to-farmer extension. However, it is also evident that the comparative advantage of student outreach services over public extension service is because these farmers experience more contacts with students, a fact that can be attributed to the rural nature of Gulu University location.

This study contributes by enriching the literature on farmers' learning behaviour. The four domains of farmers' learning namely information seeking, knowledge sharing, feedback seeking and giving feedback have been applied to assess how social demographic differences are related to farmer learning behaviour towards student outreach. Further, these concepts have been used to compare farmers' perceptions of the student-to-farmer university outreach with public and non-public extension service. From a managerial perspective, it has been shown that university student outreach to farmers brings more meaningful impact and lasting learning relationships with the community when three conditions are met. The conditions are: 1) frequent student visits to the farming households; 2) students exhibiting sound knowledge quality; and 3) nearness of farmsteads to the university. Thus, student outreach models can be exploited to complement public and non-public extension approaches in supporting farm-level learning and innovation. This is more likely to succeed with rural-based universities whose campuses tend to be in close proximity to farming households.

A potential limitation in this study is that all data were obtained from previous hosts of agricultural students of Gulu University during university outreach. This gave no room for comparison of participants and non-participant farmers of

university outreach. The implication of this scenario is that the insights of non-program participants were not available in the comparison of the various farmers' information sources. Nevertheless, the results are still relevant for application in contexts of student oriented outreach services.

We therefore recommend better logistical support to university outreach programs so as to improve delivery of community outreach and complement existing public extension systems. For more impact, it is also recommended that universities take a lead in facilitating farmers' learning spaces that bring together extension service providers, private sector actors and financial service providers which ensures complementarity of services. Future research should evaluate the role of human and financial resources in supporting student-centered outreach to facilitate farmers' learning for innovation in Uganda and elsewhere in the world. In addition, studies should further examine how farmers' motivational and social factors influence farmers' active participation and gaining from the student-centered outreach.

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Appendix

Table 1. Correlations between farmers' learning behaviour and social demographics

Variable	Correlates (N = 283)									
	1	2	3	4	5	6	7	8	9	10
1. Seeking information	-									
2. Knowledge sharing	.73**	-								
3. Seeking feedback	.75**	.76**	-							
4. Giving feedback	.69**	.77**	.75**	-						
5. Sex	.02	.01	-.06	.01	-					
6. Farm-labour sharing	.07	.14*	.11	.12	-.01	-				
7. Age	-.04	-.05	-.06	-.05	.12	.09	-			
8. Education	.03	.05	.04	.04	-.36**	.16**	-.28**	-		
9. Farmstead distance	-.11	-.13*	-.10	-.14*	-.05	-.22**	-.02	-.07	-	
10. Experience of hosting students	.19**	.16**	.22**	.15*	.01	.00	.11	.04	-.12	-

* & ** means significant at $P < 0.01$ & $P < 0.05$ respectively