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Staying in Touch through Extension: An Analysis of Farmers' Use of Alternative Extension Information Products

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The U.S. farming industry is evolving quickly. It is therefore important that state Extension services be prepared to evolve as well. This study uses data collected in a 2007 survey of Ohio farmers to evaluate likelihood and frequency of use of various services offered by Extension as well as overall satisfaction with Extension services. Results indicate that tailoring of topics and communication methods to type of farm and/or farmer informational needs could improve the use of Extension resources. This implies that targeting of information products and methods may improve the performance of Extension education programs and customer satisfaction.

Key Words: communication methods, double hurdle model, Extension information demand, Extension satisfaction, value of information

JEL Classifications: Q10, Q12, Q16

Agricultural Extension programs at land-grant universities saw their beginnings in the late 19th century when a large portion of American families lived on farms. Their task was to distribute information and technology with the mission of increasing yields, decreasing costs, and ultimately enhancing welfare of rural populations (Knutson, 1986).

Just as with other sectors of the economy, the American farm sector has changed dramatically over time. Farm businesses today display a bimodal distribution, with many small and "lifestyle" farming businesses and a smaller number of much larger commercial businesses with relatively few between these extremes (Hoppe et al., 2007). Nationally, nearly 41% of farmers worked 200 or more days per year away from the farm in 2007 (National Agricultural Statistics Service (NASS), 2009). Farm operator ages range widely, with a mean age of 57.1 years for the United States (NASS, 2009). Likewise, the educational attainment of farm operators, and experiences derived from off-farm employment vary greatly. All of these things are likely to influence farmer information needs and delivery method preferences (see, for example, Ford and Babb, 1989; Jones, Batte, and Schnitkey, 1989; Schnitkey et al., 1992).

As the American agriculture sector continues to change, so too must Cooperative Extension programs change in order to retain their relevance to this diverse audience (Boehlje and

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King, 1998; Ilvento, 1997). McDowell (2001) posits that the political economy of farm and rural communities has had deleterious results for Extension programming and its goals. Specifically, farm-related issues like "disintermediation" (the elimination of more and more intermediate handlers in an agricultural good's life span, from field to table), opening of international agricultural markets, greater agricultural product differentiation, and increased grower productivity have drastically reshaped the needs of the farm industry. Similarly, changes in rural politics, economics, and infrastructure abound. Shifting economies, from rural to urban areas, the disrepair of rural infrastructure, and the transition of manufacturing industries overseas have all created a very different rural landscape than that in which the land-grant system and Extension programs were developed. Together, these changes in farm and rural communities have created uncertainty, redundancy, and, in some case, obsolescence for Extension programming.

With changing industry conditions come changing educational and research demands. For example, Tweeten and Amponsah (1996) argue that the shift to larger farming operations may provide a new role for Extension as an important tool for supporting and encouraging small farms. Similarly, as funding for agricultural research and Extension programs decline, Extension program efficiency becomes increasingly important (Ahearn, Yee, and Bottum, 2003; Dooley and Fulton, 1999; Martin, 2001; McDowell, 2001). This suggests that Extension educators should choose those methods of information delivery that maximize program efficiency and effectiveness (Jones et al., 2007). However, farmers vary systematically in their preference and frequency of use of alternative Extension delivery media (see, for example, Suvedi, Lapinski, and Campo, 2000), creating a set of distinct farmer audiences. This suggests that the choice of Extension delivery mechanism will vary with the type of farmer audience and with the farmer audience's distinct informational needs.

Of course, it is also likely that the delivery mechanism a farmer chooses will affect how satisfied she or he is with Extension programming; while famers may be very satisfied with their local Extension website, they may be less happy with the printed reports provided. Lohr and Park (2008) investigate how organic farmers rate Extension service effectiveness and find that, along with several demographic and farm management variables, use of private information sources is significant in predicting farmers' effectiveness scores. This provides grounds to consider how other information sources, namely, different Extension delivery mechanisms, may influence satisfaction with Extension.

The research reported herein will shed light on the issue of changing demands by farmers for various types of Extension information. We report results for a mailed survey of a full range of farm sizes and types, including both commercial operators and "lifestyle" farmers. We explore farmers' stated frequency of use of alternative forms of Extension educational materials. Specifically, a double hurdle modeling approach will be used: we first explore the characteristics that influence which Extension delivery mechanisms farmers choose to use; and secondly, for those farmers who indicated adoption of a delivery mechanism, we examine the factors that influence the frequency of use. We also evaluate farmers' satisfaction with Extension as an information provider and how this is impacted by farmer demographics, farm type, and information delivery preferences.

Data and Methods

This study is based on a mailed survey of 3,000 randomly selected farmers in Ohio, conducted from February to April 2007. The sample list was purchased from a private vendor.[1] Farm operators of all farm sizes were included in the sample, representing both large commercial farms and small "lifestyle" farms.

[1] The commercial vendor list is developed from subscribers to farm and rural publications, farmers who responded to their requalification efforts, surveys or questionnaires, farmers who attended the Farm Progress Show, or farmers who received payments from the United States Department of Agriculture. The list is regularly updated, is delivery point validated, and is periodically run through the Locatable Address Conversion and National Change of Address Systems.

A stratified random sampling process was employed, with larger farms (gross sales) oversampled to ensure adequate representation in the sample. A corrective weighting procedure was then applied in the calculation of all statistics to provide estimates that are representative of the population of Ohio farmers.[2]

Questionnaire design and administration followed best survey practices (Dillman, 2006). Of the 3,000 farmers contacted, 24 surveys were undeliverable. A total of 1,715 surveys were returned, 115 respondents refused to answer, and 260 were no longer farming or were deceased. A total of 116 surveys were excluded from the data analysis due to incomplete answers. The number of usable surveys for data analysis, therefore, totaled 1,224 resulting in a 41.4% response rate of eligible surveys.

The survey instrument consisted of several sections and was aimed at eliciting information regarding farmers' demand for agricultural information, with special focus on the use of Extension information products. A number of demographic and socio-economic measures were collected for respondents as well. The sample yielded results for several key measures that were comparable to the 2007 Ohio Census of Agriculture (NASS, 2009). The average farm size was 226 acres as compared with the Census estimate of 187 acres. Grain or oilseeds were the predominant crops. The typical farm earned 32.2% of gross sales from livestock and livestock products. Thirty-one percent of farms were classified as livestock specialty farms, with livestock accounting for more than 50% of gross sales. Fifty-nine percent of respondents were working off-farm (versus the Census estimate of 60.1%). Nearly two thirds were using the Internet (65.4%). On average, farmers were 57.3 years old (Census = 55.7) and had been farming for 29 years. Only 38.1% had obtained a college degree. About 87.4% were male, 95.6% were white, and 81.1% were married.

The analyses that follow are based on a series of seven questions that gauged the level of use of seven categories of Extension information products. These questions were asked only of those farmers who indicated that they were *familiar with the programs and services that Extension provides* (73.6%, $n = 901$). The seven categories were described as: Extension publications, Extension radio broadcast, Extension television (TV) broadcast, Extension website use, visits to an Extension office, called/spoke with an Extension educator, and attended an Extension meeting/workshop. Farmers were asked how frequently they had used the various Extension services in the past 3 years: *None* (0), *Less than once per year* (coded as 0.5), *once per year* (1), *twice per year* (2), *3–11 times per year* (7), *every month* (12), *and every week* (52).

Regression analysis of use of the various Extension products is used to provide a more complete understanding of these patterns. For any given information product, farmers will differ in their use of that product. Some will be unwilling to "adopt" a particular information delivery format. The deterministic and random factors that influence whether an individual will use a given information product may be different than those that influence how often an individual who does choose to adopt will use it. For this reason, we have implemented a two-stage hurdle model. Such a model allows us to account for differences in factors influencing the two decisions – whether to use an information product at all and how much to use it. The first stage model is estimated as a binomial Probit model, where the dependent variable reflects no use versus any level of usage of a particular Extension information product category. Explanatory variables include a number of demographic variables, information about the location of the farm business relative to the county Extension office and regional location within the state (southern or western region, as compared with the north-eastern region), and

[2] The sample was post-stratified by gross sales. Nine sales classes were identified, ranging from less than $2,500 to over $500,000 in annual sales. The weight factor for each sales category is calculated as the proportion of the farmers (based on the 2002 Census of Agriculture (NASS)) that is in each sales category divided by the proportion of the sample that is in this sales category. This determines if that sales category is over- or under-represented in the sample, and thus must be less- or more-heavily weighted in the statistical analysis.

farm characteristic variables, including gross sales and whether the farm was a livestock farm (sales from livestock accounting for 50% or more of total sales (Ahearn, 2008)). We also included five variables meant to capture how highly farmers value different types of information. These five variables – CROP_INFO, LIVESTOCK_INFO, BUSINESS_INFO, ENVIR_INFO, and HOME AND FAMILY_INFO – were determined using factor analysis on 31 questions, which asked farmers to rate the importance of different types of information on a scale from 1 to 7. For example, HOME AND FAMILY_INFO was formed from farmer ratings of the following topics: Food and Nutrition, Family Financial Management, Child Care, Family Life, Adult Development, Leadership, and Life Skills.

The second stage model is estimated conditional on adoption of the information product, and seeks to identify those factors that influence the level of use of the information product. The dependent variable is the use frequency per year (0.5–52) stated by the respondent for each information product category. Because use frequency must be positive for "adopters", and the response distribution also is truncated at 52 (weekly) uses per year, a Tobit estimator is used with lower and upper limits of 0.5 and 52, respectively. Explanatory variables in the second stage model include most of those from the stage one model, as well as access to the Internet and use of private consultants, both of which were considered factors that might influence total demand for Extension information and the form in which they prefer to receive information. We also reestimated our Tobit model under the premise of sample selection. In the first step, a Probit model is used to explain no use versus any level of usage of a particular Extension information product category, controlling for the effects of the explanatory variables. The Probit results are then used to test for the presence of sample selection effects in the second-step Tobit model (LIMDEP 9). Doing so, we find that the coefficient on the sample selection variable is highly insignificant (with p values close to unity). Consequently, we present the results of our Tobit model without selection correction. In both stages of analysis, the explanatory variables fall into one of three series: demographic characteristic (i.e., gender, region, etc.), farm characteristic (i.e., distance to an Extension office, farm type, use of private consultant), and information rating (i.e., perceived importance of the five information types).

Finally, we consider farmers' satisfaction with Extension services. Farmers were asked to indicate "overall how satisfied are you with the quality of services and programs provided by OSU [Ohio State University] Extension over the past three years?" Responses ranged from 1 = very dissatisfied to 7 = very satisfied. Because of the ordinal nature of the dependent variable, an ordered Probit model is used. However, the dependent variable display insufficient frequency in some cells to use the 1–7 scale, so we collapsed to a three-item scale for the dependent variable. Farmer responses were recoded as: 1–4 = dissatisfied or neutral (22.53%), 5 = slightly satisfied (27.41%), and 6–7 = satisfied (50.05%). Explanatory variables include the use frequency for the various Extension program delivery methods, in addition to demographic and business variables.

Results

Table 1 presents means and standard deviations for the dependent and explanatory variables for the models to be estimated. The Extension information product category with greatest adoption was printed publications, with nearly 95% reporting use. The least adopted information product category was the Extension website, with just less than 50% of farmers reporting use. For those farmers who had used these products, radio broadcasts were used most frequently, while meetings/workshops were used least frequently.[3] Tables 2 and 3 present the results of the first and second stage models, respectively. Table 2 also

[3] We do not imply that these frequency of use scales are directly comparable. Clearly, reading publications or listening to radio broadcasts are expected to have higher use frequencies for adopters than for Extension workshops. Still, for each we expect to see a distribution of use frequencies that vary with farm and farmer characteristics and information needs/preferences.

Table 1. Descriptive Statistics for Model Dependent and Explanatory Variables

	Mean	SD	Min	Max
Dependent Variables				
Adoption of Extension Publications	0.947	0.211	0	1
Adoption of Extension Radio Broadcasts	0.586	0.462	0	1
Adoption of Extension TV Broadcasts	0.507	0.469	0	1
Adoption of Extension Websites	0.498	0.469	0	1
Adoption of Extension Office Visits	0.895	0.287	0	1
Adoption of Call/Speaking with Extension Educators	0.746	0.408	0	1
Adoption of Extension Meetings/Workshops	0.671	0.441	0	1
Use Frequency of Extension Publications by Adopters	8.089	9.692	0.5	52
Use Frequency of Extension Radio Broadcasts by Adopters	11.136	16.461	0.5	52
Use Frequency of Extension TV Broadcasts by Adopters	7.350	13.605	0.5	52
Use Frequency of Extension Websites by Adopters	5.395	8.953	0.5	52
Use Frequency of Extension Office Visits by Adopters	4.135	5.819	0.5	52
Use Frequency of Call/Speaking with Extension Educators by Adopters	4.185	6.231	0.5	52
Use Frequency of Extension Meetings/Workshops by Adopters	2.622	4.564	0.5	52
Satisfaction with Extension	5.245	1.271	1	7
Explanatory Variables				
Gross Sales ($1,000)	61.7	153.3	2.5	1,500.0
Age	57.259	11.590	22	91
Years of Farming Experience	29.391	14.579	2	80
Gender (Female = 1)	0.126	0.311	0	1
Married (= 1)	0.811	0.367	0	1
Race (White = 1)	0.956	0.192	0	1
College Degree (= 1)	0.381	0.455	0	1
Distance to OSUE office	19.595	11.609	1	140
Internet Access (= 1)	0.654	0.446	0	1
Use Consultants (= 1)	0.255	0.408	0	1
Percent of Gross Sales from Livestock	32.247	37.733	0	100
Importance of Crop information	4.890	1.332	1	7
Importance of Livestock information	4.262	1.932	1	7
Importance of Business information	4.845	1.164	1	7
Importance of Environment information	4.788	1.139	1	7
Importance of Home and Family information	4.380	1.420	1	7
Western Region (= 1)	0.393	0.458	0	1
Southern Region (= 1)	0.362	0.451	0	1

includes the marginal effects estimates for the first stage models.

While farmers did vary in their usage of the seven information products, there were also similarities across information products. We begin by discussing the similarities: we identify variables that had similar effects across information types first for the collection of stage one models, and then for the collection of stage two models. To facilitate discussion, we use the following shorthand to refer to the different information product models: *Publication* will refer to the "Read an Extension Publication" model; "Listened to an Extension Radio Broadcast" (*Radio*); "Watched an Extension TV Broadcast" (*TV*); "Used an Extension Website" (*Web*); "Visited a County Office" (*Office*); "Called or Spoke with a County Educator" (*Spoke*); and "Attended an Extension Workshop" (*Workshop*).

Table 2. Farmers Adoption of Various Forms of Extension Information

	Read an Extension Publication		Listened to Radio Broadcast		Watch an Extension TV Broadcast		Used an Extension Website		Visited the County Office		Spoke with the County Educator		Extension Workshop	
Variable	Estimated Coefficient	SE	Estimated Coefficient	SE	Estimated Coefficient	SE	Estimated Coefficient	SE	Estimated Coefficient	SE	Estimated Coefficient	SE	Estimated Coefficient	SE
Intercept	3. 941***	0.849	0.913**	0.432	0.018	0.407	1.237***	0.413	1.289**	0.566	0.644	0.480	0.613	0.431
Age	−0.027***	0.008	−0.033***	0.005	−0.016***	0.005	−0.025***	0.005	0.000	0.007	−0.003	0.005	−0.011**	0.005
Years of Farming Exper.	0.013*	0.007	0.016***	0.004	0.021***	0.004	−0.003	0.004	−0.012**	0.005	−0.013***	0.004	0.010***	0.004
Gender (Female = 1)	0.572**	0.240	0.125	0.148	0.265*	0.144	0.618***	0.151	−0.067	0.220	0.175	0.157	0.642***	0.148
Married (= 1)	−0.631**	0.292	−0.466***	0.128	−0.353***	0.120	−0.059	0.123	−0.336*	0.190	0.113	0.132	0.254**	0.123
Race (White = 1)	0.168	0.419	−0.322	0.249	−0.032	0.226	−0.269	0.228	−0.096	0.318	−0.680**	0.307	−0.311	0.248
College Degree (= 1)	−0.040	0.174	−0.115	0.101	−0.114	0.096	0.368***	0.099	−0.107	0.142	0.184	0.113	0.247**	0.105
Gross Sales ($1,000)	4.7E-04	7.0E-04	−1.1E-04	2.9E-04	−6.2E-04	2.8E-04	2.7E-04	2.9E-04	2.8E-04	4.4E-04	7.7E-04*	4.6E-04	1.7 E 03***	5.3E-04
Distance to OSUE Office	−0.025***	0.006	0.001	0.004	−0.007*	0.004	−0.008**	0.004	−0.020***	0.005	−0.015***	0.004	−0.003	0.004
Livestock Farm (= 1)	0.130	0.196	0.230*	0.123	0.201*	0.118	−0.410***	0.122	0.611***	0.171	0.131	0.134	0.274**	0.126
Western Region	−0.388*	0.210	−0.068	0.118	0.159	0.114	−0.203*	0.115	0.114	0.146	−0.093	0.125	−0.299**	0.120
Southern Region	0.492	0.249	0.119	0.126	0.002	0.122	−0.027	0.123	0.725***	0.177	0.239*	0.138	0.296**	0.132
Crop_info	0.025	0.084	0.155**	0.052	0.035	0.051	0.007	0.051	0.181***	0.069	0.085	0.054	0.017	0.053
Livestock_info	−0.108*	0.057	0.035	0.029	0.014	0.028	0.046	0.029	−0.117***	0.040	0.051	0.032	0.024	0.030
Business_info	0.081	0.104	0.198***	0.059	0.082	0.058	0.240***	0.059	−0.007	0.086	0.376***	0.063	0.197***	0.060
Environment_ info	−0.020	0.081	−0.067	0.046	−0.071	0.044	−0.034	0.044	0.111*	0.063	−0.092**	0.049	−0.110**	0.046
Home and Family_info	−0.002	0.068	−0.039	0.037	0.098***	0.036	−0.089**	0.037	−0.021	0.051	−0.150***	0.041	−0.098***	0.038

Table 2. Continued

Variable	Read an Extension Publication		Listened to Radio Broadcast		Watch an Extension TV Broadcast		Used an Extension Website		Visited the County Office		Spoke with the County Educator		Extension Workshop	
	Estimated Coefficient	SE	Estimated Coefficient	SE	Estimated Coefficient	SE	Estimated Coefficient	SE	Estimated Coefficient	SE	Estimated Coefficient	SE	Estimated Coefficient	SE
N	901		901		901		901		901		901		901	
Model Chi-Squared	66.5***		171.3***		101.6***		139.0***		77.7***		152.9***		135.6***	
Correct Prediction %	96.7		69.3		54.1		65.0		91.9		84.2		81.6	
Correct Adopters %	99.9		90.9		59.8		78.0		99.9		97.4		96.7	
Correct Nonadopters %	0.0		22.4		48.0		47.8		0.0		15.3		17.9	
Change in Probabilities	Marginal Effects Estimates													
Age	−0.002		−0.013		−0.006		−0.010		0.000		−0.001		−0.004	
Years of Farming Exper.	0.001		0.006		0.008		−0.001		−0.002		−0.004		0.004	
Gender (Female = 1)	0.038		0.048		0.106		0.246		−0.010		0.052		0.224	
Married (= 1)	−0.030		−0.172		−0.139		−0.024		−0.042		0.035		0.092	
Race (White = 1)	0.013		−0.119		−0.013		−0.107		−0.013		−0.154		−0.100	
College Degree (= 1)	−0.003		−0.045		−0.046		0.146		−0.016		0.054		0.085	
Gross Sales ($1,000)	0.000		0.000		0.000		0.000		0.000		0.000		0.001	
Distance to OSUE Office	−0.002		0.001		−0.003		−0.003		−0.003		−0.005		−0.001	

Table 2. Continued

	Read an Extension Publication		Listened to Radio Broadcast		Watch an Extension TV Broadcast		Used an Extension Website		Visited the County Office		Spoke with the County Educator		Extension Workshop	
Variable	Estimated Coefficient	SE	Estimated Coefficient	SE	Estimated Coefficient	SE	Estimated Coefficient	SE	Estimated Coefficient	SE	Estimated Coefficient	SE	Estimated Coefficient	SE
Livestock Farm (= 1)	0.008		0.088		0.080		−0.162		0.075		0.038		0.093	
Western Region	−0.028		−0.027		0.063		−0.081		0.016		−0.028		−0.106	
Southern Region	0.030		0.046		0.001		−0.011		0.092		0.070		0.101	
Crop_info	0.002		0.060		0.014		0.003		0.026		0.026		0.006	
Livestock_info	−0.007		0.014		0.006		0.018		−0.017		0.015		0.008	
Business_info	0.005		0.077		0.033		0.096		−0.001		0.112		0.069	
Environment_ info	−0.001		−0.026		−0.029		−0.014		0.016		−0.027		−0.038	
Home and Family_info	0.000		−0.015		0.039		−0.035		−0.003		−0.045		−0.034	

*, **, *** indicate estimated parameters that are statistically different from zero at the 0.10, 0.05, and 0.01 probability levels, respectively.
SE is standard error.

Table 3. Farmers Frequency of Use of Various Forms of Extension Information[a]

	Read an Extension Publication		Listened to an Extension Radio Broadcast		Watch an Extension TV Broadcast		Used an Extension Website		Visited the County Office		Spoke with the County Educator		Attended an Extension Workshop	
Variable	Estimated Coefficient	SE	Estimated Coefficient	SE	Estimated Coefficient	SE	Estimated Coefficient	SE	Estimated Coefficient	SE	Estimated Coefficient	SE	Estimated Coefficient	SE
Intercept	−0.321	2.887	−23.575***	8.350	−0.195	7.587	−14.964***	4.416	−0.707	1.867	−4.481*	2.405	−8.152***	1.960
Age	−0.067*	0.037	0.085	0.113	0.093	0.100	−0.002	0.062	−0.059***	0.024	−0.011	0.028	−0.049**	0.024
Years of Farming Experience	0.077**	0.030	0.120	0.088	−0.010	0.079	0.112**	0.049	0.040**	0.020	0.006	0.024	0.042**	0.020
College Degree (= 1)	−0.767	0.789	−3.929**	1.893	−6.945***	2.024	3.389***	1.037	0.998**	0.495	0.695	0.595	1.266***	0.478
Gross Sales ($1,000)	0.005**	0.002	−0.005	0.005	−0.003	0.006	0.002	0.003	0.001	0.001	0.001	0.002	0.001	0.001
Distance to OSUE Office	0.035	0.031	−0.068	0.074	0.071	0.075	0.034	0.044	−0.006	0.020	−0.052**	0.026	−0.023	0.020
Internet (= 1)	0.754	0.834	4.699**	2.015	−0.091	2.025	5.620***	1.503	0.677	0.531	1.780***	0.651	0.572	0.530
Use Consultant (= 1)	−0.876	0.860	−0.330	1.980	1.173	2.070	1.782*	1.071	0.484	0.537	1.120*	0.649	−0.171	0.520
Livestock Specialist (= 1)	−0.732	0.962	6.869***	2.378	3.306	2.421	0.523	1.346	0.231	0.603	−0.932	0.728	0.466	0.601
Western Region	0.938	0.925	6.026***	2.286	3.000	2.377	0.377	1.305	0.498	0.606	−0.523	0.732	0.886	0.607
Southern Region	1.251	0.968	1.867	2.373	2.811	2.498	1.155	1.338	0.898	0.630	1.393*	0.755	1.550***	0.613
Crop_info	−0.176	0.429	0.458	1.079	0.266	1.050	−1.397**	0.640	−0.384	0.268	0.284	0.346	0.354	0.274
Livestock_info	0.797***	0.224	−0.291	0.565	0.289	0.565	0.379	0.308	0.246*	0.143	0.519***	0.174	0.353***	0.142
Business_info	1.447***	0.476	2.220*	1.238	−2.346*	1.249	2.123***	0.761	0.545*	0.288	0.740*	0.402	1.045***	0.318
Environment_info	0.024	0.365	1.272	0.991	−1.261	1.020	0.338	0.533	0.181	0.227	−0.024	0.304	0.476*	0.251
Home and Family_info	−0.382	0.295	0.303	0.776	2.660***	0.775	0.084	0.463	0.503***	0.180	−0.077	0.237	−0.368*	0.195
Sigma	10.274***	0.268	20.753***	0.751	17.697***	0.772	10.474***	0.393	6.259***	0.170	7.254***	0.221	5.591***	0.183
N	872		616		461		514		829		757		728	
Log Likelihood	−3028		−2167		−1451		−1564		−2417		−2127		−1725	
Log Likelihood, Restricted	−3063		−2189		−1471		−1594		−2452		−2156		−1777	
Model Chi Squared	69.11***		45.01***		41.26***		59.47***		68.53***		58.17***		104.30***	

*, **, *** indicate estimated parameters that are statistically different from zero at the 0.10, 0.05, and 0.01 probability levels, respectively.

[a] A tobit analysis is used with lower and upper limits of 0.5 and 52, respectively.

SE is standard error.

Stage One Models: Adoption

With the first stage models we sought to identify those factors that affected the likelihood that a farmer would adopt use of a certain Extension information product (Table 2). The seven models all provided good fits for the data: all the model Chi-squared statistics were significant ($p \leq 0.01$). The first stage models for *Publication, Office, Spoke,* and *Workshop* all exhibited good predictive capabilities, ranging as high as 96% of observations correctly predicted, although all models performed better in the prediction of adopters than predicting nonadopters.[4]

Comparing the first stage models for all seven information products, we found that several variables had relatively consistent effects across products. AGE coefficient estimates, for example, were significant ($p \leq 0.05$) and negatively signed in five of the seven models. The marginal effects of one additional year of age ranged between -0.2 percentage points (for *Publications*) and -1.3 percentage points (for *Radio*), implying that a 1-year increase in age decreased the probability that a farmer had used publications (radio) by 0.2 (1.3) percentage points. When we consider that the stage one models also control for YEARS OF FARMING EXPERIENCE, the negative age effect becomes especially interesting: it is not that older farmers are less likely to use Extension information products *because* they tend to be more experienced (and therefore less in need of information), but rather that older farmers tend to be less likely to use Extension resources *regardless* of their experience level.

Furthermore, while we would expect to find negative coefficient estimates on AGE for certain information products (like *Web*, for example), the negative effect came as a surprise in other models. For example, the relatively large, negative effect that AGE has on probability of radio use is surprising given that older farmers grew up in a period when radio was a relatively more important source of news and information than today. The consistent negative sign for this variable suggests that older farmers, with all else equal, typically have lower demand for external information.

Another interesting effect is associated with the FARMING EXPERIENCE variable. It is significant in all but the *Web* model. While this variable does not have a consistent effect in all models – it is positive in most models, but negative in the *Office* and *Spoke* models – its estimated impact does follow an interesting pattern. In models where AGE was significant (and negative), YEARS OF FARMING EXPERIENCE displays positive coefficient estimates. Thus, for two farmers of the same age, the one having farmed for more years will have a higher probability of using these information products.

The differential impact of age and experience is an interesting outcome, one that may be, at least partially, a feature of the sample which includes both "lifestyle" and commercial farmers. For example, for those farmers with less than $100,000 of gross sales, mean years of experience was significantly ($p \leq 0.01$) less than for those with more than $100,000 of sales. In fact, nearly 21% of the smaller farm group had fewer than 15 years experience, whereas only 5% of the larger farm group had fewer than 15 years experience. Although there was a statistically significant ($p \leq 0.05$) difference in age between the two groups, it was not as dramatic as the difference in years of experience between the two groups (mean age for the smaller group was only 1.5 years less than for the larger group). Thus, it seems that smaller farmers started farming much later in life than did larger farmers. This may suggest that the age-related impact on adoption of communication methods may be fairly consistent across farm size, but the experience effect may be largely impacted by smaller farmers possessing fewer years of experience.

We find a common effect associated with GENDER, as well. In the models where

[4] The prediction success percentages are those provided in the LIMDEP software. Predicted results for each observation are generated by substituting observation values into the estimated Probit equations, where index values greater than zero predict a dependent variable value of one (adoption) and those less than zero predict a value of zero (nonadoption). The predicted values are compared with the actual adoption or nonadoption responses of the respondent to measure correct and incorrect prediction.

GENDER is significant (*Publications, TV, Website*, and *Workshop*), being female (about 13% of our sample) has a positive effect on use. This effect is strongest in the *Web* model, where being female increases the probability of adoption by nearly 25 percentage points.

Being married seems to have the opposite effect. In all significant cases but one (*Workshop*), MARRIED decreases the likelihood of use of information products. Perhaps married farmers tend to rely more heavily on their spouses for advice and discussion. In the case of *Workshops*, however, married farmers are about 9 percentage points more likely to have attended a workshop than their unmarried counterparts. This may have to do with the social nature of workshops, an event that the couple often attends together.

Education level does not have a consistent effect across information products. Rather, COLLEGE DEGREE is significant in only two cases, *Web* and *Workshop*; in both cases, it carries a positive coefficient estimate. That more highly educated farmers are more likely to use the Internet is not surprising as there have been a number of studies that suggest greater usage of computers, Internet, and other high technology by those with more formal education (Batte, Jones, and Schnitkey, 1990; Putler and Zilberman, 1988; Schnitkey et al., 1992). The classroom-style learning environment of workshops may also be more appealing to farmers with more education.

DISTANCE to an Ohio State University Extension (OSUE) office was statistically significant and negatively signed in all but the *Radio* and *Workshop* models. While it is intuitive that increased distance to an OSUE office could decrease the likelihood of visiting the Extension office or reading a publication (if the respondent perceived that they must travel to the Extension office to retrieve the publication), it is noteworthy that this effect is also present for information products that are normally thought to overcome distance, like television broadcasts and web resources. In these latter cases, perhaps familiarity with Extension is itself a function of distance to the office and frequency of meeting Extension educators, and less familiar (more distant) farmers are less likely to watch Extension television reports or to use the Extension web site. It is also possible that farmers more distant from urban centers where the Extension offices are located may be less likely to have high speed Internet, and this may be a deterrent to using the Extension website.

The regional location of farms within the state is also significant in several models. Whenever significant (four of seven models), farm location in the southern region of the state increases the likelihood of adoption of information products as compared with north-eastern farmers. Although significant in fewer models, the variable indicating western farm location carries negative coefficient estimates. For instance, southern region farmers are 3.0 percentage points more likely to use Extension publications, 9.2 percentage points more likely to visit an Extension office, and 10.1 percentage points more likely to attend workshops than north-eastern region farmers. Western region farmers are 2.8 percentage points less likely to read Extension publications and 10.6% less likely to attend Extension workshops than north-eastern Ohio farmers. Because Extension services are not organized significantly differently in the different regions of the state, regional significances probably capture the effect of culture on Extension use. The southern, Appalachian region of the state is composed mainly of smaller farms, while the western region hosts larger, cash-grain farmers. The social culture of the southern region may also encourage use of workshops and face-to-face meetings. The north-eastern region is composed of a blend of these farm types, plus a greater urban influence. These agricultural and cultural differences are likely important in determining how farmers use Extension services.

The LIVESTOCK FARM variable (which takes a value of 1 if a farmer indicated greater than 50% of his or her sales from livestock) also exhibited consistent first stage effects across models. In all models where it is significant – except the *Web* model – the LIVESTOCK FARM estimated coefficient is positive. Thus, those farmers who have livestock farms were more likely to use radio, television, and workshops than their nonlivestock farmer counterparts. However, livestock farmers were 16 percentage

points less likely to use Extension websites, with all other variables constant.

Of the information rating variables, only BUSINESS_INFO and HOME AND FAMILY_INFO demonstrated any consistency of effect across stage one models. Estimates of the former variable's coefficients were positive whenever significant, indicating that farmers who more highly value business information are more likely to use Extension radio, websites, and workshops, and are more likely to have spoken to an Extension educator. It is conceivable that business-oriented farmers would tend to use Extension radio and websites more often because of the ever-changing nature of business information: accurate knowledge of prices requires that one consult information resources that are updated often. Similarly, Extension workshops often provide business information. That business-oriented farmers are more likely to have spoken with an Extension educator (in fact, very much more likely: a one-unit increase in rating score increases the probability of communication with an Extension educator by 11.2 percentage points) could be due to the personal nature of much business information. If a farmer is interested in business plan, financing, etc., he or she may feel the need to confer one-on-one with a consultant. Perhaps these business-conscious farmers are turning to Extension educators (specializing in consumer finance or agricultural economics, for example) for this information.

In contrast, farmers who more highly value HOME AND FAMILY information tended to be less likely to use Extension websites, educators, or workshops. They are, however, more likely to have viewed Extension television broadcasts. Extension television broadcasts often feature topics such as home gardening, nutrition, cooking, and home financial management, and thus television may be a highly valued source for people with these interests. Certainly, television broadcasts can be jointly viewed by operator and spouse or family, and consumer-oriented broadcasts may also have entertainment value.

Stage Two Models: Frequency of Use

The second stage models were estimated conditional on adoption of the named information products: coefficient estimates only apply for those farmers who indicated at least some use of that information product within the previous 3 years. Thus, n differs for each model, reaching a maximum of 872 observations for *Publications* and a minimum of 461 observations for *Web*. The model Chi-Squared statistics were significant ($p \leq 0.01$) for all models. Model results are reported in Table 3.

AGE exhibited consistent effects across models, as it did in the stage one models. For those farmers who had indicated some use in the first stage *Publications*, *Office,* and *Workshop* models, increased age was related to less frequent use of the product in the *Publications*, *Office,* and *Workshop* models. Thus, not only were older farmers less likely to adopt these Extension information sources, older farmers who did adopt use tended to use these less frequently.

The YEARS OF FARMING EXPERIENCE coefficient estimates are positive whenever significant in the second stage models. Thus, increased experience, with age and all other variables constant, is associated with increased frequency of use of Extension publications, websites, office visits, and workshops. Note that the AGE and YEARS OF FARMING EXPERIENCE variables produce differential effects in the *Publications*, *Office,* and *Workshop* models, just as they did in the stage one models. These results further confirm the presence of opposing effects of AGE and YEARS OF EXPERIENCE on Extension resource use, and again may be a feature of the full range of "lifestyle" and commercial farmers represented in our sample.

Having earned a college degree did not have consistent effects across information products. Conditioned on use of the product, those farmers with college degrees used Extension radio and television less often than their less-educated counterparts. They did, however, use Extension websites, office visits, and workshops more frequently. Perhaps the positive effects of COLLEGE DEGREE in the *Website* and *Workshop* models can again be attributed to the fact that those with college degrees are more familiar with Internet resources and classroom learning. However, the negative coefficient estimates in the *Radio* and *TV* models could imply

that more educated farmers find the material in these Extension resources subpar. This hypothesis warrants further study.

The coefficient estimates on the INTERNET variable (which equals 1 if a farmer has Internet access) are positive whenever significant. While it is unremarkable that farmers with Internet access use Extension websites more frequently (conditioned on adoption), it is interesting that the variable also carries positive effects in the *Radio* and *Spoke* models. This may imply that farmers who seek information from the Internet are ones who have a high demand for information in general, and thus search for information from a variety of sources.

Use of a private consultant also accompanied more frequent use of Extension websites and educator contact. It is noteworthy that while private consultants are often considered a substitute for Extension resources, these results indicate the opposite: CONSULTANT USE is never related with less frequent use of Extension resources, and in fact, is related with more frequent use in the *Web* and *Spoke* models. These findings are consistent with Lohr and Park (2008): increased use of private information sources does not discourage farmers from using public information resources.

Farm location in the southern region of the state also had relatively consistent effects across models. As in the first stage, SOUTHERN REGION farmers tended to use Extension resources more frequently than their north-eastern counterparts, giving higher frequency of use values in the *spoke* and *workshop* models. WESTERN REGION farmers who used Extension radio broadcasts also reported higher use frequencies than did their north-eastern region counterparts.

Of the information rating variables, LIVESTOCK_INFO and BUSINESS_INFO both tended to demonstrate positive effects across models. For farmers who had indicated some use, those who rated livestock information highly tended to use Extension publications, county offices, educators, and workshops more frequently. Similarly, farmers who more highly valued business information used Extension publications, radio, websites, county offices, educators, and workshops more frequently. The near-universal positive effects of these variables imply that farmers who value these types of information tend to use Extension resources in general more frequently. Given the quickly changing nature of both information types, it is not surprising that farmers with these interests tend to use many information products more frequently.

Factors Influencing Farmers' Satisfaction with Extension

In the previous sections, we observed different factors influencing use of Extension resources across the various methods of contact with Extension. This begs the question "Do these same factors influence farmer satisfaction with Extension, and do the various means of Extension communication influence farmer satisfaction?" We asked survey respondents to evaluate their satisfaction with Extension using a seven-item response scale ranging from 1 = very dissatisfied to 7 = very satisfied. Because of the ordinal nature of the dependent variable, an ordered Probit model is used. Because, there was insufficient variability in the dependent variable to use the 1–7 scale, we collapsed to a three-item scale for the dependent variable. Farmer responses to the satisfaction variable are reported in Table 4. Regression estimates are presented in Table 5.

The regression coefficient for MARRIED was significant ($p \leq 0.01$) and positively signed, indicating that married farmers were more likely to give higher satisfaction scores. With all else equal, married farmers were 9.0 percentage points less likely to give a *dissatisfied*

Table 4. Farmer Satisfaction with Extension

	Raw Scores		Aggregated Scores	
	Value	Percent	Value	Percent
Dissatisfied	1	1.89	0	22.53
	2	2.77		
	3	4.55		
	4	16.09		
Slightly Satisfied	5	27.41	1	27.41
	6	31.30	2	50.06
Satisfied	7	16.00		

Table 5. Factors Influencing Farmers Satisfaction with Extension[a]

Variable	Parameter Estimate	Standard Error		Marginal Effects Y = 0[b]		Marginal Effects Y = 1[b]		Marginal Effects Y = 2[b]	
Intercept	−0.9446	0.375	**						
Gross Sales ($1,000)	−0.0004	0.000		0.000		0.000		0.000	
Age	0.0034	0.004		−0.001		−0.001		0.001	
College Degree (= 1)	−0.0746	0.094		0.017		0.012		−0.030	
Years of Farming Experience	−0.0037	0.003		0.001		0.001		−0.001	
Gender (Female = 1)	0.0125	0.137		−0.003		−0.002		0.005	
Married (= 1)	0.3489	0.111	***	−0.090	***	−0.048	***	0.138	***
Race (White = 1)	0.0911	0.201		−0.022		−0.015		0.036	
Livestock Farm (= 1)	0.3071	0.111	***	−0.066	***	−0.055	**	0.122	***
Distance to OSUE Office	−0.0088	0.003	***	0.002	**	0.001	**	−0.004	***
Use Consultants (= 1)	−0.0026	0.100		0.001		0.000		−0.001	
Internet Access (= 1)	−0.2453	0.100	**	0.053	**	0.044	**	−0.097	**
Western Region (= 1)	0.5284	0.105	***	−0.120	***	−0.088	***	0.208	***
Southern Region (= 1)	0.2389	0.112	**	−0.051	**	−0.044	**	0.095	**
Importance of Crop Information	0.1247	0.046	***	−0.029	***	−0.021	**	0.050	***
Importance of Livestock Information	−0.0646	0.027	**	0.015	**	0.011	**	−0.026	
Importance of Business Information	−0.0763	0.054		0.018		0.013		−0.030	
Importance of Environment Information	0.1585	0.041	***	−0.036	***	−0.027	***	0.063	***
Importance of Home and Family Information	0.0223	0.034		−0.005		−0.004		0.009	
Frequency of Use of Extension Publications	0.0241	0.006	***	−0.006	***	−0.004	***	0.010	***
Frequency of Use of Extension Radio Reports	−0.0001	0.004		0.000		0.000		0.000	
Frequency of Use of Extension TV Reports	−0.0042	0.005		0.001		0.001		−0.002	
Frequency of Use of Extension Web Pages	0.0071	0.009		−0.002		−0.001		0.003	
Frequency of Visits to Extension Office	0.0569	0.016	***	−0.013	***	−0.010	***	0.023	***
Frequency of Calling/Speaking with Extension Educator	0.0340	0.017	**	−0.008	**	−0.006	*	0.014	**
Frequency of Attending Extension Meetings /Workshops	0.0604	0.025	**	−0.014	**	−0.010	**	0.024	**
Mu	1.0325	0.053	***						
N	901								
Log Likelihood Function	−832.1164								
Log Likelihood Function, Restricted	−934.2867								
Chi Squared	204.34		***						

*, **, *** indicate estimated parameters that are statistically different from zero at the 0.10, 0.05, and 0.01 probability levels, respectively.

[a] Farmers were asked to indicate "overall how satisfied are you with the quality of services and programs provided by Ohio State University Extension over the past three years?" Response ranged from 1 = very dissatisfied to 7 = very satisfied. This was recoded to three levels: 1–4 = dissatisfied (0), 5 = slightly satisfied (1) and 6–7 = satisfied (2).

[b] Marginal effects are computed at the means of all variables. Marginal effects for binary variables are computed as differences of probabilities for a one unit change (0–1).

rating, 4.8 percentage points less likely to give a *slightly satisfied* evaluation, and 13.8 percentage points more likely to give an evaluation of *satisfied*, all relative to their nonmarried counterparts. The LIVESTOCK FARM variable displayed a similar impact. Farmers with at least 50% of their income derived from livestock enterprises were 6.6 and 5.5 percentage points less likely to give *dissatisfied* and *slightly satisfied* evaluations, respectively, and were 12.2 percentage points more likely to give *satisfied* scores to Extension.

Distance from the farm to the Extension office was significant ($p \leq 0.01$) and yielded a negative coefficient estimate. Model estimates suggest that a 1-mile increase in DISTANCE results in a 0.2 and 0.1 percentage point increase in the probability of a *dissatisfied* or *slightly satisfied* evaluation, respectively, and a 0.4 percentage point decrease in the probability of a *satisfied* evaluation. Thus, those farmers located closer to the Extension office tend to give higher evaluations. Even though these marginal effects are all significant ($p \leq 0.05$), the magnitude of the effect is not large: a 10 mile increase in the round trip DISTANCE results in only a 2 percentage point increase in the probability of *dissatisfied*, and a 4 percentage point decrease in *satisfied*, scores.

Farmers who had Internet access also evaluated Extension more critically. With all else equal, INTERNET is associated with a 5.3 and 4.4 percentage point increase in the probability of a *dissatisfied* and *slightly satisfied* score for Extension, respectively, and a 9.7 percentage point decrease in probability of a *satisfied* score. This could be due to farmers' exposure to a much broader array of information products available on the Internet: Internet-using farmers may be evaluating Extension relative to the broad array of information products they access. Or there may be other systematic differences in the decision types or farmer characteristics of Internet-using farmers that are not captured in our model. We also observe differences in Extension evaluation for farmers located in various regions of the state. WESTERN and SOUTHERN region farmers are more likely than north-eastern region farmers to give *satisfied* evaluations of Extension, and are less likely to give *dissatisfied* and *slightly satisfied* evaluation scores.

The level of importance assigned by the farmer to various types of information also impacts satisfaction with Extension. With all else equal, those farmers who gave high importance scores to CROP and ENVIRONMENTAL information were less likely to give *dissatisfied* and *slightly satisfied* evaluation scores for Extension, and more likely to give scores of *satisfied*. On the other hand, those who gave higher importance scores for LIVESTOCK information were more likely to give *dissatisfied* and *slightly satisfied* evaluations for Extension.

The final set of variables analyzed consists of the frequency of use of Extension resources variables evaluated earlier in this article. The frequency of use variable values ranged from zero for farmers who had no contact with a given Extension resource during the past 3 years, to 52 for those who had weekly contact. Four of the seven contact frequency measures (EXTENSION PUBLICATIONS, VISITS TO THE EXTENSION OFFICE, CALLING/SPEAKING WITH THE EXTENSION EDUCATOR, and WORKSHOPS) were statistically significant. For all of these products, increased frequency of usage by farmers was associated with higher likelihood of an Extension evaluation of *satisfied*, and lower probabilities of *dissatisfied* or *slightly satisfied* evaluation scores.

It is instructive to note several variables do not influence satisfaction with Extension in this model. With all other variables controlled, satisfaction with Extension does not vary across the range of farm sizes or farmer ages, with level of formal education, or between farmers who use or don't use professional consultants. This allays some of the frequently mentioned concerns that large farmers are no longer satisfied with Extension, and that those who use professional consultants have substituted these for Extension.

Discussion and Conclusions

This study examines Ohio farmers' usage of a variety of Extension information products. Results of statistical models showed strong

association between a number of demographic and farm characteristic variables and the adoption and level of use of a variety of types of contact with Extension. Although there are several variables that similarly influence demand for various delivery methods, there are a number of key differences as well. Furthermore, our results also show some variables that, a priori, we thought would be important were not statistically significant in explaining Extension information product use.

Our sample included the full range of farm sizes, from very small, part-time "lifestyle" farms to the largest commercial farms. Information needs and value differ greatly between these two types of farmer. However, a key finding of our study is that farm size is not as important in determining Extension information usage as other variables. Farm size (gross sales) was statistically significant in only three of the adoption models, and the estimated marginal effect was relatively inconsequential in two of these. In the case of Extension meetings/workshops, a $100,000 increase in sales resulted in a 10 percentage point increase in the probability that a farmer had attended such meetings. In the second-stage models, farm size was a significant determinant of the level of usage in only one case – frequency of use of Extension publications – with larger farmers indicating a greater frequency of use of publications. Farm size was not a significant determinant of farmers' evaluations of satisfaction with Extension as an information provider.

Farmer age, by contrast, was found to be an important determinant of both adoption and usage levels for a number of delivery methods. Older farmers were less likely to use Extension publications, TV and radio broadcasts, the Extension website, and to attend Extension workshops. This was offset somewhat by years of farming experience. With age of farmer controlled for, farmers with more experience were more likely to use Extension publications, television, and radio broadcasts, or to attend Extension workshops. However they were less likely to visit the local Extension office or speak with the Extension educator.

That older farmers – with years of farming experience controlled – are often less likely to use Extension resources (and those who do use Extension tend to use it less frequently) is noteworthy. This may imply that Extension resources do not adequately address the concerns of older farmers: perhaps a stronger focus on retirement, estate planning, and farm transition planning, for example, could encourage older farmers to utilize Extension resources more frequently. By contrast, the positive effect associated with farming experience implies that less-experienced farmers are not capitalizing on the resources available to them. Thus, older farmers who have recently begun farming are least likely to use many Extension resources. This result is especially important for "lifestyle" famers, farmers who have often taken up farming later in life, possibly in retirement. Our results imply that this subset of Ohio farmers is not using Extension as much as other farmer groups. It is noteworthy that even though usage of Extension products differed with age, farmer satisfaction with Extension as an information provider did not differ with age.

Level of farmer education is often suggested to be an important determinant of information demand. We found mixed evidence on this effect in our study. The presence of a college degree was significant in the adoption model only for Extension website use and attendance of workshops – in both cases higher education increased adoption percentage. However, education was more important in determining the level of usage of information products. Conditioned on adoption of the delivery method, farmers with college degrees used the Extension office, website, and attended workshops more frequently, but used Extension television and radio broadcasts less frequently.

The significance of education level in the website models is an important result of our study: Extension websites were the least used resource (only 49.8% of respondents indicated some use of Extension websites), and those with college degrees were 15 percentage points more likely to have used an Extension website, and used these resource more frequently. In our sample, those without a degree were significantly ($p \leq 0.01$) less likely to have Internet access. This suggests that farmers with more formal education are using the Internet more

broadly, and Extension educators who wish to target this audience may find the Internet a useful communication medium. Educators may also have an opportunity to increase use of Extension websites by encouraging expanded Internet literacy and access, especially in more rural counties and targeting individuals with less formal education.

Another important finding is that farmers tend to favor different Extension information products depending on their information needs. For instance, those who gave higher importance scores for business information topics were more likely to adopt use of Extension radio broadcasts, Extension website, and to attend Extension workshops or to speak to an educator. Conditioned on adoption of a particular communication method, those who gave higher importance scores to business topics also indicated more frequent use of six of the seven Extension products – all but television broadcasts. This suggests that Extension educators need to carefully consider the topic and the characteristics of the likely audience when choosing the most appropriate method to communicate information.

Our finding regarding the effect of office location is also highly relevant today when many states are facing serious budget shortfalls. In response to these shortfalls, some are considering moving from county to regional Extension office locations. Our findings suggest that the distance from the farm to the Extension office is influential in the adoption and use of Extension products. Distance was significant in five of the seven adoption models. Not surprisingly, distance negatively impacted the likelihood of using Extension publications, visiting the Extension office, and having verbal communication with the Extension educator. More surprising, however, is that increased distance to the local office also decreased the likelihood of a farmer using Extension TV broadcasts and the Extension website. The latter two are not directly impacted by distance to the local office. However, this may suggest that nearby offices bread a familiarity with Extension that further encourages use of "distance" communication methods as well.

It is clear that Extension's audience remains diverse and that the range of information topics that are demanded is equally diverse. It is reassuring that many subgroups of farmers still value the information products offered by Extension. However, perhaps the greatest take-away message from this study is that Extension educators may have great opportunity to improve the effectiveness of their programs by better targeting audiences and topics to the communication methods that best fit each. Tailoring educational programs and delivery methods to their intended audience is likely to increase participation and frequency of use of the program.

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