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Keegan D. Gay
University of Florida

Arthur Leal
University of Florida

Taylor K. Ruth
University of Florida

See next page for additional authors

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Data collected using survey methodology is readily used to provide insight into improving international agricultural and extension education programs. The evolution of survey technology has allowed educators access to a growing number of audiences; however, the escalating quantity of surveys contributes to greater survey fatigue. Utilizing multiple forms of response, such as Likert-type scales and visual analog scales, may relieve some symptoms of survey fatigue. The use of visual analog scales may allow respondents the ability to respond more freely to questions where fractional differences can hold a wealth of information. This study examined the possible advantages of utilizing visual analog scales rather than Likert-type scales in surveys. A Web-based survey was conducted with respondents randomly assigned to one of two treatments: comparison constructs in traditional Likert-type scale presentation form using radio buttons or comparison constructs with a Visual Analog Scale presentation. Results indicated responses from visual analog scales were similar to those on Likert-type scale questions. No significant additional time to complete the constructs was found; however, a significantly lower non-response rate existed for one construct using the Likert-type scale (10% compared to 32%). Seventy-five percent of the respondents given visual analog scales utilized the freedom to select increments between the restricted points of radio buttons.

Keywords

needs assessment, Visual Analog Scale, survey design, program evaluation

Erratum

A correction has been issued for this article. The DOI of the article was incorrect as published. The correct DOI is: 10.4148/2831-5960.1259. Link to Erratum: https://doi.org/10.4148/2831-5960.1466

Authors

Keegan D. Gay, Arthur Leal, Taylor K. Ruth, Alexa J. Lamm, and Joy N. Rumble

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Keegan D. Gay

Arthur Leal

Taylor K. Ruth

Alexa J. Lamm

Joy N. Rumble

University of Florida
Gainesville, FL
USA

Abstract

Data collected using survey methodology is readily used to provide insight into improving international agricultural and extension education programs. The evolution of survey technology has allowed educators access to a growing number of audiences; however, the escalating quantity of surveys contributes to greater survey fatigue. Utilizing multiple forms of response, such as Likert-type scales and visual analog scales, may relieve some symptoms of survey fatigue. The use of visual analog scales may allow respondents the ability to respond more freely to questions where fractional differences can hold a wealth of information. This study examined the possible advantages of utilizing visual analog scales rather than Likert-type scales in surveys. A Web-based survey was conducted with respondents randomly assigned to one of two treatments: comparison constructs in traditional Likert-type scale presentation form using radio buttons or comparison constructs with a Visual Analog Scale presentation. Results indicated responses from visual analog scales were similar to those on Likert-type scale questions. No significant additional time to complete the constructs was found; however, a significantly lower non-response rate existed for one construct using the Likert-type scale (10% compared to 32%). Seventy-five percent of the respondents given visual analog scales utilized the freedom to select increments between the restricted points of radio buttons.

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Introduction

The collection of information about client needs and satisfaction correlates directly to the success of international agricultural and extension education programs. Commonly, researchers utilize surveys to collect needs assessment and satisfaction data (Harder, Lamm, Ganpat, & Lindner, 2011) vital to the selection and development of programming in international agriculture and extension education settings (Lamm, Harder, Irani, Roberts, & Snyder, 2011; Malmsheimer & Germain, 2002). Surveys allow researchers to collect data from a relatively small group of individuals and generalize the findings to an entire population (Dillman, Smyth, & Christian, 2009). Surveys offer an established and effective mean of gathering data utilizing highly researched methods to increase the effectiveness of survey instruments. However, changes in technology and accessibility have had significant impacts on the distribution of surveys and the design of survey questions (Dillman et al., 2009).

Survey design intentionally tailors instruments to elicit high quantity and quality responses from participants (Dillman et al., 2009). Researchers utilize two basic formats when developing web-based surveys: open-ended and close-ended questions. Poorly designed questions threaten the accuracy of responses (Dillman et al., 2009). Open-ended questions allow participants to answer freely and with minimal limitations. However, open-ended questions require use of memory and greater effort to answer often resulting in more skipped questions versus close-ended questions (Ozuru, Briner, Kurby, & McNamara, 2013). In contrast, close-ended questions provide more familiarity and automatic retrieval for respondents, primarily because the answers are included as part of the question (Ozuru et al., 2013). In the course of measuring an individual's attitudes, close-ended questions utilize two basic scales of measurement: nominal and ordinal scales (Dillman et al., 2009; Spatz, 2008). Scales are not designed to determine respondents' "failure or success, strength or weaknesses…. [but to reveal] the degree to which an individual exhibits the characteristic of interest" (Ary, Jacobs, & Sorensen, 2010, p. 208).

While certain populations are identified with low survey response rates, the availability of surveys has changed the nature of collecting data (Adams & Umbach, 2012). The adoption of Web-based surveys has reduced the cost and technical knowledge needed to create surveys. As a result, online users endure exposure to survey pop-ups with almost every click of the mouse, and researchers are threatened by growing survey fatigue (Adams & Umbach, 2012). A study by Asiu, Antons, and Fultz (1998) found participants felt surveys have become overused. Additionally, time required to answer questions was identified as a key factor in survey completion, with the optimal completion time of approximately 13 minutes. The design of a survey contributes to the completion rate, with close-ended questions (i.e., Likert-type scales) requiring less time to answer than open-ended questions (Asiu et al., 1998).

The use of novel scales, such as visual analogue scales (VAS), presents the opportunity to decrease survey fatigue, allowing international agricultural and extension education professionals to collect survey data that is more reflective of the population (Dillman et al., 2009). Much of the research in international extension is currently conducted with traditional Likert-type scales which feature summated scales and single choice options (Al-Rimawi, 2003; Ganpat, Webster, & Narine, 2014; Kanté, Edwards, & Blackwell, 2013). A VAS allows the respondent to move a slider along

a line to match how they feel on a scale where a traditional Likert-type scale utilizes radio buttons. Data that more accurately reflects the population can help inform programing to better meet the needs of clientele (Malmsheimer & Germain, 2002). This study sought to compare VASs to traditional Likert-type scales in an effort to assess the viability of utilizing VASs in combination with, or in place of, Likert-type scales to more effectively gather information to assist in the identification of new programs that should be developed through needs assessments.

Operational Framework

Use of Likert-type Scales

One of the most common attitude scales used by researchers today is the Likert-type scale (Croasmun & Ostrom, 2011; Göb, McCollin, & Ramalhoto, 2007). Likert-type scales allow individuals to self-report a variety of attitudes and behaviors (Hartley & MacLean, 2006; Likert, 1932) and measure levels of agreement toward a particular topic in a series of statements (Göb et al., 2007). The use of Web-based surveys has resulted in the adoption of a radio button format for capturing respondents' answers to close-ended questions (Dillman et al., 2009). Researchers interested in measuring attitudes must consider the design of the Likert-type scale. The choice of using an ordinal or cardinal scale determines how the results will be interpreted (Göb et al., 2007).

Researchers commonly use either a five-point or seven-point Likert-type scale, as odd numbered scales provide the opportunity to have a neutral response and prevent response bias (Croasmun & Ostrom, 2011; Tanzo & Yusongco, 2014). The presence of negative answer options on Likert-type scales increases internal consistency (Croasmun & Ostrum, 2011). While Likert-type scales provide answer options within their design, respondents must still recall and distinguish subtle differences in past behaviors or attitudes, potentially contributing to low response rates (Hartley & MacLean, 2006). Yet, the ability of Likert-type scales to capture a wide range of response variance has contributed to its adoption among many researchers (Hartley & MacLean, 2006). The calculation of the Cronbach alpha coefficient can reduce internal consistency risks when using Likert-type scales and increase the strength of the survey design (Croasmun & Ostrum, 2011). Likert-type scales have been established as a reliable method of measuring attitude, but have also created the basis for the development of alternative methods.

Use of Visual Analog Scales

A VAS serves as another attitudinal scale that uses a close-ended question format (Dillman et al., 2009). This instrument has been especially useful in the medical field where self-reported health is vital in the treatment of patients (Torrance, Feeny, & Furlong, 2001). Respondents move a slider up and down, or side to side, on a scale or line to match their preference. The design of VASs can vary among each instrument, so careful considerations go into the design. Researchers must consider the length of lines, the use of scale marks, the presence of labels, the inclusion of labels on both ends of the scale, and the orientation of the line being either vertical or horizontal (Torrance et al., 2001) when considering use of VASs.

Automatic appearance of the slider on a VAS is another critical element in the scale design. The requirement to click on the scale to activate the instrument prevents answer influence and responses not reflective of respondents' views when skipping questions (Couper, Tourangeau, Conrad, & Singer, 2006). The inclusion or exclusion of well-defined endpoints also

affects the ability to compare responses; the exclusion would require respondents to determine the endpoints they believe are applicable (Torrance et al., 2001). Couper et al. (2006) found the use of a midpoint in VAS does not affect the overall mean of respondents' answers. However, the absence of a midpoint discourages its use when answering but requires more effort from respondents who feel the need to select the midpoint (Couper et al., 2006). Attrition may also present a problem if the VAS exceeds six-scale points (Torrance et al., 2001). Opinions vary on the responsiveness of VASs and the degree to which the design provides respondents the opportunity to report small changes in their response (Guyatt, Townsend, Berman, & Keller, 1987; Hasson & Arnetz, 2005). In practical settings, a standard would have to be established to determine the significance of marginal differences in responses (Guyatt et al., 1987).

Likert-type Scale and VAS Comparisons

Studies have commonly reported contradictory findings between Likert-type scales and VASs, where the context and setting affect the validity, reliability, and usefulness of each scale (Hasson & Arnetz, 2005). Celenza and Rogers (2011) determined VASs were a viable and acceptable alternative to Likert-type scales. Guyatt et al. (1987) conducted a study comparing a seven-point Likert-type scale and VAS in which respondents were trained on the use of the two instruments. The VAS instrument used only endpoint values. This study found training took longer for VASs than Likert-type scales. On average, respondents required 5-10 minutes of training for VASs, and sometimes required 15-20 minutes of training, while Likert-type scales took less than 5 minutes of training. However, all respondents were able to master the VAS (Guyatt et al., 1987). When compared to Likert-type scales, VASs produced comparable validity and similar responsiveness (Jaeschke, Singer, & Guyatt, 1990).

Hasson and Arnetz (2005) found similar results on VAS utilization with a strong correlation between single-question VASs and Likert-type scales. However, respondents in this study were more likely to select items in the middle of Likert-type scale constructs than VASs, which suggest end-aversion bias in Likert-type scales. Hasson and Arnetz's (2005) results indicated the two scales also displayed a strong correlation between criterion-related and construct-related validity as well as comparable reliability. While single-question Likert-type and VASs could be used interchangeably, a weaker correlation with multi-question Likert-type scales and single-question VASs was observed, and emphasized the lack of interchangeability between these two designs (Hasson & Arnetz, 2005). While both scales offer several benefits, the variation of scales in a single survey instrument have the potential to address known biases (Torrance et al., 2001).

Purpose and Objectives

The purpose of this study was to compare VASs to Likert-type scales to determine the viability of using VASs in need assessments and evaluation type research for international agricultural and extension education professionals. The following objectives guided this study:

1. Compare the responses delivered by Likert-type scales and VASs.
2. Compare the fatigue symptoms of respondents between Likert-type scales and VASs.
3. Describe the amount of freedom VASs allows respondents to use when reporting their answers.

Methods

A true experimental design was used for this study. Data were collected through a Web-based survey designed to gain an understanding of Extension agents' knowledge levels and needs related to critical issues and associated policies facing the agricultural and natural resources industry. The experiment for this study was incorporated into the survey with a control and intervention group used to compare respondents' use of traditional Likert-type scales to their use of VASs. The experiment was part of a larger questionnaire with two out of the 37 constructs manipulated for the purposes of this study. The control in this study used five-point Likert-type scales (see Figure 1) to collect data from the respondents. The intervention group replicated the same constructs as the control group with two of the scales changed from a Likert-type scale to a five-point VAS (see Figure 2). The first construct (Knowledge Construct) was designed using 12 items requesting respondents to identify their knowledge levels of specific policies on a scale with no true middle (*no knowledge* = 1, *a little knowledge* = 2, *some knowledge* = 3, *moderate knowledge* = 4, and *a lot of knowledge* = 5). The second construct (Sharing Construct), concerning how policies were shared with clients, requested respondents to identify their level of agreement or disagreement with four statements on a scale with a true middle (*strongly disagree*= 1, *disagree* = 2, *neither disagree nor disagree* = 3, *agree* = 4, *strongly agree* = 5).

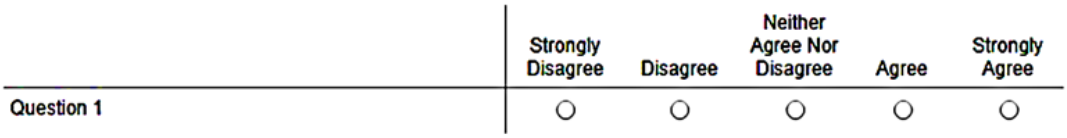

Figure 1. Example of a Likert-type scale.

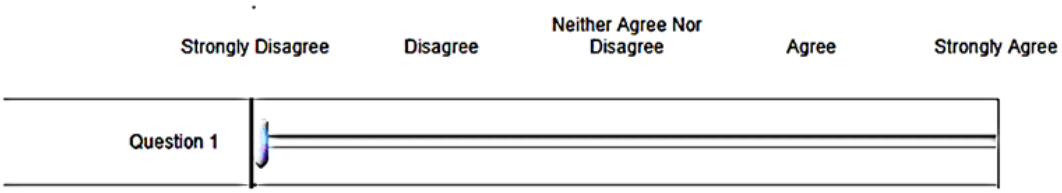

Figure 2. Example of a visual analog scale.

Three individuals with expertise in public opinion research, survey design, and extension education served on the panel of experts to ensure content and face validity of the survey instrument and integrated experiment. The panel included the Dean and Director for Extension at the University of Florida, a professor who specializes in survey research and experimental designs, and a professor who specializes in extension education.

The population for the study was Extension agents in the state of Florida (N = 350). The small population size and use of a Web-based survey allowed for a census to be collected and the questionnaire to be

distributed to the entire population of interest. Coverage and sampling errors, common in survey research, were avoided by using a census (Dillman et al., 2009). The tailored design method by Dillman et al. (2009) was used by researchers to collect the survey data. A pre-notice letter was emailed to all the Extension agents five days prior to the survey launch. The letter explained the intent of the original study (evaluating Extension agents' needs) and was signed by the Dean for Extension and Director for the Florida Cooperative Extension Service. The link to the survey was emailed to all Extension agents in mid-June. Four reminders were sent to recipients from the researchers. The first reminder was distributed seven days after the survey was opened, the second reminder was emailed nine days after that, and the third reminder was emailed 12 days after the second reminder due to a holiday weekend. The final notice was emailed to the recipients eight days later, a little over a month since the survey originally opened. The survey was closed within 24 hours of the final notification. It should be noted that between the first and second follow-up emails, a participant on the Extension agents' listserv sent an unauthorized reminder for the survey. However, this email did not include a link to the survey and there were no increases in response.

After closing the survey, 125 of the 350 Extension agents in Florida had adequately responded to the survey resulting in a 35.7% response rate. Demographics of respondents can be seen in Table 1. The majority of respondents were male (57.6%) and over the age of 50 (55.8%). The respondents' areas of expertise were mostly in horticulture (31.2%) and agriculture (28.8%). The distribution of years working in extension among respondents was fairly even. The exceptions were new professionals, who had worked in extension less than six years (27.7%) and professionals who had been employed between 21 and 25 years (7.6%).

For the experiment, respondents were evenly distributed into two groups (the control or treatment group) by the survey software to reduce the threat of experimental attrition and selection bias (Ary et al., 2010). The even distribution resulted in 58 respondents receiving the Likert-type scale only constructs and 68 respondents receiving the instrument with the VAS constructs. Data were analyzed using SPSS ® 21.0. Descriptive statistics were used to address the first objective by calculating means and standard deviations for the constructs manipulated in the control and treatment group. Independent *t*-tests were used to compare the mean and standard deviation of the Likert-type scale questions and the VAS questions.

Table 1

Demographics of Respondents

Characteristic	*n*	%
Sex		
Female	50	42.4
Male	68	57.6
Age		
20-29	12	10.0
30-39	22	18.3
40-49	19	15.8
50-59	48	40.0
60 -69	19	15.8
Programmatic Area		
Agriculture	36	28.8
Natural Resource	5	4.0
4- H Youth Development	15	12.0
Community Development	1	0.8
Family and Consumer Sciences	14	11.2
Horticulture	39	31.2
Sea Grant	6	4.8
Other	2	5.6
Years in Extension		
1-5	33	27.7
6-10	22	18.5
11-15	19	16.0
16-20	17	14.3
21-25	9	7.6
26 +	19	16.0

Objective 2 was addressed by analyzing the elapsed time for respondents to complete each construct. A timer, not viewable by the respondents, was incorporated into the survey. The timer reported the respondents' first click on an item within each construct (12 items for the knowledge construct and four items for the sharing construct) and the time until the last click. Responses from respondents who took longer than five minutes to submit an answer were discarded since these respondents likely stepped away from the computer skewing their response time. An independent *t*-test was used to compare time for both the control and intervention groups between the first click and the last click within each construct. Non-response was measured by counting the number of individual questions in the construct that were skipped by respondents (Likert-type scale or VAS), and an independent *t*-test was used to compare the two groups. Researchers measured attrition twice. The first measurement observed how many respondents in each group answered the knowledge construct but did not complete the remainder of the survey. The same measurements were taken again after the sharing construct. An independent *t*-test was

used to compare the control group to the intervention group for the first and second measurements of attrition.

Objective 3 looked at the freedom the VASs allowed respondents to use. Due to the lack of pre-existing literature on measuring the freedom offered by VASs, researchers employed special restrictions to ensure the respondent's intention to use this freedom. Only data resulting from the VAS slider being placed between X.3 and X.7 on the scale were analyzed (see Figure 3) to ensure the individuals counted were actively placing the slider in a position that would not be available on a Likert-type scale. Additionally, the decimal values were distant enough from a whole number to eliminate user error as the cause for the response. The percent of respondents utilizing this freedom in at least one question was calculated. Additionally, the percent of times respondents used this freedom in answering the questions of the construct was measured.

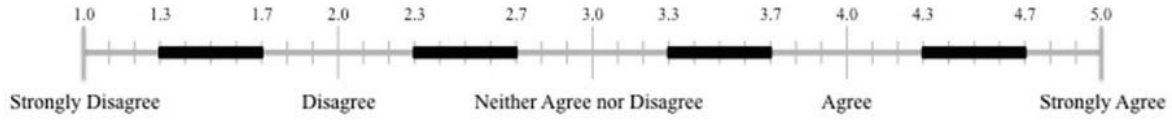

Figure 3. Numerical assignments of freedom.

Results

Comparison of Responses Delivered by Likert-type Scales and VASs

Respondents were asked to identify their level of knowledge on 11 policies/regulations on either a Likert-type scale or a VAS depending on treatment (see Table 2). Means were calculated for this categorical data to capture the nuance associated with the freedom allowed by a VAS for comparisons with the Likert-type responses. These means are not intended to describe the results for the question asked. Responses for both treatments were very similar overall. However, an independent *t*-test showed there was a significant difference in respondent answers for three questions in the knowledge construct. Respondents in the VAS treatment gave a higher mean score for Equipment Regulations, Fishing Rights, and Trucking Regulations. Mean difference for these three questions ranged from 0.49 to 0.66.

Table 2

Comparison of Knowledge Responses

Question	Likert-type *M (SD)*	VAS *M (SD)*	*Mean Difference*	*t*	*p-value*
Water Regulations	3.58 (1.13)	3.43 (1.09)	0.15	0.69	.494
Immigration Reform	2.18 (1.16)	2.07 (0.90)	0.11	0.50	.620
Food Safety Regulations	3.12 (1.33)	3.12 (1.18)	0.00	0.00	.997
Farm Bill	2.66 (1.09)	2.75 (0.78)	-0.09	-0.50	.615
Wildlife Regulations	2.57 (1.21)	2.71 (1.00)	-0.14	-0.60	.548
Fertilizer Regulations	3.54 (1.31)	3.75 (1.01)	-0.21	-0.96	.340
Farming Regulations	2.53 (1.27)	2.80 (0.97)	-0.27	-1.20	.233
Volunteer Screening	3.04 (1.30)	3.39 (1.21)	-0.35	-1.44	.153
Trucking Regulations	1.63 (0.82)	2.12 (1.02)	-0.49	-2.38	.020*
Equipment Regulations	1.90 (1.01)	2.41 (0.92)	-0.51	-2.48	.015*
Fishing Rights	1.65 (1.05)	2.31 (1.20)	-0.66	-2.59	.012*

Note. Scale is 1 = *No Knowledge,* 2 = *A Little Knowledge,* 3 = *Some Knowledge,* 4 = *Moderate Knowledge,* 5 = *A Lot of Knowledge.*
*$p < 0.05$.

Respondents indicated their level of agreement or disagreement with four statements surrounding how they decide to share information with their clientele on either a Likert-type scale or a VAS depending on their treatment (see Table 3). Results between the experimental group and control group were very similar and showed no significant differences when means were compared using an independent *t* test.

Table 3

Comparison of Sharing Responses

Question	Likert-type *M (SD)*	VAS *M (SD)*	*Mean Difference*	*t*	*p-value*
Share based on reliability of source	4.75 (0.47)	4.69 (0.41)	0.07	0.87	.388
Use multiple web sources to select information	3.96 (0.83)	3.99 (0.66)	-0.03	-0.22	.823
Select information based on collaboration with other extension agents	3.75 (0.95)	3.86 (0.81)	-0.12	-0.74	.459
Select information based on what other extension agents are sharing	3.55 (0.95)	3.68 (0.80)	-0.13	-0.82	.416

Note. Scale is 1 = *Strongly Disagree,* 2 = *Disagree,* 3 = *Neither Disagree nor Agree,* 4 = *Agree,* 5 = *Strongly Agree.*

Comparison of Respondent Fatigue Symptoms between Likert-type Scales and VASs

For each construct, time from first click until last click was collected, with mean times for each construct and treatment displayed in Table 4. Results between treatments were very similar, with no significant differences for either scale in each construct.

Table 4

Comparison of Time Elapsed in Seconds

Event	Likert *M (SD)*	VAS *M (SD)*	*Mean Difference*	*t*
1st Click Knowledge Construct	30.51 (142.27)	29.09 (110.55)	1.42	0.06
Last Click Knowledge Construct	60.05 (143.95)	60.55 (112.31)	-0.50	-0.02
1st Click Sharing Construct	10.56 (10.69)	10.81 (6.28)	-0.25	-0.17
Last Click Sharing Construct	23.72 (16.64)	28.52 (14.02)	-4.79	-1.78

Note: Knowledge Construct composed of 12 items without a true middle; Sharing construct composted of four items with a true middle.

In order to further measure fatigue, the number of respondents dropping out of the survey after the monitored questions was counted. There was no attrition among respondents assigned the Likert-type scale treatment and only one given the VAS treatment. Question non-response percentage and complete question non-response were determined for both constructs and within each treatment group (see Table 5). There was a significant difference between treatments. Those assigned VASs for the knowledge construct failed to complete an average of 32% of the questions while those assigned Likert-type scales only failed to complete 10% of the questions.

Table 5

Comparison of Percentage of Questions Not Completed

Construct	Likert-type *M (SD)*	VAS *M (SD)*	*Mean Difference*	*t*	*p-value*
Knowledge Construct	0.10 (0.26)	0.32 (0.31)	-0.22	-4.29	.000*
Sharing Construct	0.02 (0.10)	0.03 (0.11)	-0.01	-0.43	.667

Note. * $p < 0.05$.

Amount of Freedom VASs Allowed Respondents to Use

To determine the amount of *freedom* VASs allowed respondents to use, two measurements were calculated (see Table 6). The first measurement was the number of respondents per question who utilized the ability to place the slider between the

established labels. A response was assessed as being between the established labels for a typical Likert-type scale if the slider landed between the X.3 and X.7 space between the labels (see Figure 3).

For the knowledge construct, 70.6% of the respondents placed the slider between X.3 and X.7 indicating more freedom of use than a Likert-type scale provides. Similarly, 75% of respondents responded to at least one question in the sharing construct in the same manner. The second measure of freedom examined the percentage of questions per construct that respondents attempted to place the slider between X.3 and X.7, which is only available in the VAS. For the knowledge construct, participants used their freedom to place the slider between the labels 21.8% of the time, while they used their freedom to place the slider between the labels 14.5% of the time on the sharing construct.

Table 6

Percentage of Responses

Construct	*%*
Respondents Using Freedom at Least Once	
Knowledge Construct	70.6
Sharing Construct	75.0
Questions Answered Utilizing Freedom	
Knowledge Construct	21.8
Sharing Construct	14.5

Conclusions

The findings from this study shed light on the potential use of VASs compared to Likert-type scales when evaluating international agricultural or extension education programs. However, before interpreting the findings, it is important to recognize the limitations. First, a larger number of respondents might produce results more reflective of each scale's performance, including more accurate mean scores, which would better explain the observations in this study (Spatz, 2008). In addition, the respondents were limited to Extension agents, who may be more comfortable with both VASs and Likert-type scales than the average user. The Extension agents' level of familiarity with the scales may have altered the results. Lastly, using more than one construct to test each scale would also remove the possibility of the results found in this study to have occurred by chance.

As for the results, the mean scores were compared in the knowledge and sharing constructs to observe any differences between Likert-type scales and VASs. This study found VAS responses to three questions in the knowledge construct to have significantly different means (0.49 to 0.66 higher) when compared to corresponding responses in the Likert-type treatment. Given the scale of the mean differences, these results could possibly be attributed to the utilization of freedom by VAS respondents. No significant differences were observed in responses to the sharing construct. These results confirm Celenza and Rogers' (2011) study in which they found VASs to be as reliable and a valid alternative to Likert-type scales.

While Guyatt et al., (1987) initially reported a 5-10 minutes difference in

training between the two scales, this study found no significant time difference between respondents' first and last click with Likert-type scale constructs versus VAS constructs. However, the non-response to some questions for each construct might have contributed to the similarities in time per construct. This may be concluded as the construct with the least non-response (the share construct) also boasted the largest difference between treatment groups in time elapsed at last click. While the VAS might require slightly more effort, similar to Celenza and Rogers' (2011) study, respondents were still able to complete the questions.

Additionally, a significant difference was noted between the non-response in the intervention group (VAS) versus the control group (Likert-type scale) within the knowledge construct. Couper et al. (2006) found respondents were twice as likely to skip VASs, opposed to Likert-type scales. In this study, the higher non-response rate for the VAS was linked to the 12-question construct the respondents answered, but not the four-question construct. The non-response may be attributed to the number of questions in the construct and not necessarily to the scale used.

Often recognized for its ability to indicate slight differences in respondents' answers, this study looked at the use of freedom in the VAS. The use of freedom was referred to as slider positions on the VAS that would not typically be accessible using a Likert-type scale (X.3 to X.7). Given the option, respondents appeared to take advantage of the freedom in both the knowledge and share construct. These results amplify the ability to identify finer differences in responses when using the VAS (Celenza & Rogers, 2011). Additionally, respondents utilized freedom on 21.8% of the questions in the knowledge construct and on 14.5% of the questions in the share construct. The increase in use of the freedom in the knowledge construct might be attributed to having 12 questions compared to the four questions on the share construct.

Implications and Recommendations

The primary implication for this study was that VASs may be used in place of Likert-type scales when appropriate, such as when the response of the individual is important and the need for fractional differences in responses is desired. This might occur when extension administrators are assessing staff assignments to training opportunities or when Extension agents are considering the needs of volunteers or clientele. Should the scale permit, means can be performed, thus allowing VASs to replace Likert-type scales in order to provide a more varied response option without requiring excess cognitive demand.

VASs might also be useful when agricultural educators in the classroom wish to evaluate a course or specific exercise or when Extension agents wish to evaluate courses or seminars. The typical Likert-type scale forces a more positive or negative answer than the respondents may desire, but VASs would allow respondents the freedom to express fractional scores. Such an opportunity may successfully reduce the number of neutral responses from those wishing to avoid providing a negative answer or feeling that a more positive answer is undeserved. Additionally, the use of VASs may better convey the message to respondents that the information sought comprises input so vital that even fractional differences between responses is needed. The use of VASs, in these settings, could also easily allow respondents to indicate order of preference when asked to rank several different topics. Further research into the possible advantages of VASs for course

or educational event evaluations would be useful.

Utilizing VASs may also provide the possibility to limit personal bias in survey responses, especially in situation where negative input might jeopardize relationships that respondents wish to safeguard. VASs may be especially helpful when examining personal feelings such as students' relationships with mentors, advisors, or other students. Similarly, Extension agents may receive more honest responses to questions regarding personnel, evaluations of trainers, or other personal data.

Research into the learning curves associated with both VASs and Likert-type scales could prove useful when determining selection of scales to use with various audiences. For example, children may become confused if asked to utilize VASs because they may be uncomfortable with the concept of fractional worth. Similar information could also be helpful for educators needing to determine if secondary students respond positively to VASs or Extension agents working with laypersons who may have limited education.

Further research should attempt to compare Likert-type scales and VASs more thoroughly through a larger study with additional comparison questions and a larger number of respondents. The repeatability of VAS measurements should also be examined. Additional studies could also examine the possibility of using VASs to limit straight-line answers, and a study comparing answers longitudinally would help to determine if VASs are appropriate in identifying slight fluctuations in responses. This type of measurement might be beneficial when examining environmental quality issues or other topics where change appears slowly in small increments. A final recommendation is for research to identify the possible benefits of including a visual number along a VAS to indicate the exact position of the slider to respondent.

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