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Scale to measure the attitudes of respondents regarding livestock based technological services provided by University

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Abstract
The present study was done to develop the attitude scale to measure the attitude of respondents regarding livestock based technological services provided by University. After editing 89 statements following the criteria outlined by Edwards (1969), a total of 78 statements were prepared and sent to 80 experts with with specialization in extension education to critically evaluate the statements for relevancy. Based on the feedback received from the judges, a total of 39 statements were selected based on their relevancy weightage and were then subjected to item analysis by presenting them to 36 dairy farmers participating in a dairy training program held at the University. From this process, 25 statements with 't' values greater than 1.75 were selected for inclusion in the final scale to evaluate reliability and validity. The split-half reliability was determined using the Spearman-Brown Prophecy Formula, yielding a value of 0.872. The internal consistency of the attitude scale was assessed using Cronbach's alpha, which was calculated to be 0.956. The validity of the attitude scale was established through content validity. The reliability and validity of the scale demonstrate its accuracy and consistency. With appropriate modifications, this scale can be utilized to measure farmers' attitudes in regions beyond the study area in the future.

Keywords: Attitude, livestock services, reliability, scale, validity

Introduction
Livestock sector plays an important role in Indian economy. India is a leading country in the livestock population with 535.78 million of total livestock population. (20th Livestock Census, DAHDF, 2019) [1]. Livestock farming is an ancient occupation in Punjab. Punjab has 25.31 lakh cows and 40.16 lakh buffaloes. Punjab produces a total of 14.30 million tons of milk annually, with a per capita milk availability of 1,283 grams per day (20th Livestock Census-2019, Punjab).
Guru Angad Dev Veterinary and Animal Sciences University (GADVASU) was founded in 2006, aims to promote livestock production, health, and disease prevention through a combined strategy that includes teaching, research, and extension programs at its main campus at Ludhiana and several outreach centres throughout the state. The university has started a number of livestock-based technology services to help end users learn and transfer innovations. It is essential to have a good understanding about the role of livestock based technological interventions and services provided by the University. So, in order to assess the attitude of respondents towards University led livestock based technological services the present attitude scale was developed.

Research Methodology
The 'Likert' method of summated rating (Likert, 1932) [5] was used to measure dairy farmers' attitudes towards Livestock Based Technological Services provided by the University. The procedures for computing and standardizing the scale are discussed and presented in the following sections.

Collection of statements
A selection of items and statements intended to assess attitudes of respondents toward livestock based technological services provided by University was gathered with guidance

from committee members. A preliminary list of 89 statements was compiled with consideration for their relevance to the study area.

Relevancy of statements by experts

After reviewing and editing 89 statements based on the criteria outlined by Edwards (1969) [3], a set of 78 statements were sent to 80 experts with specialization in extension education to critically evaluate the statements for relevancy and give responses on a three point continuum indicating 'most relevant, relevant, and not relevant' with scores of 3, 2, and 1, respectively. Compilation of the list of extension education experts from all over India was done. Experts from esteemed institutions including the Indian Veterinary Research Institute (IVRI), the National Dairy Research Institute (NDRI), and various State Veterinary and Agricultural Universities were selected for the research. These experts were given the opportunity to suggest any required modifications, additions, or removals.

Selection of statements

Out of 80 experts only 31 responded in a time span of 45 days (response rate: 38.75%). A respondent's attitude score was calculated by adding the scores of all items. As a result, each respondent's total score was calculated. Mean score for each statement was calculated. Statements having mean score >0.75 were selected.

Item analysis

An interview schedule containing 39 statements was devised and converted to Punjabi language. This interview schedule was then employed to gather feedback from 36 dairy farmers participating in a dairy training program held at the University. The farmers were asked to give the responses on a three point continuum indicating 'most relevant, relevant, and not relevant' with scores of 3, 2, and 1, respectively. The total score was calculated, ranging from '39' to '117', and arranged in descending order. Item analysis was performed on 25 percent of respondents with highest total score and 25 percent of respondents with lowest total score. Item analysis (assessment of individual statements) was conducted using these two groupings as criteria. The ratio was determined by comparing the
responses from high and low groups to individual statements. A critical ratio evaluates how effectively a particular statement differentiates between high and low groups of subjects for that statement.

$$t = \frac{X_H - X_L}{\sqrt{\frac{S^2_H}{n_H} + \frac{S^2_L}{n_L}}}$$

Where, XH = the mean score on a given statement for the high group, XL = the mean score on the same statement for the low group, S^2H = the variance of the distribution of responses of the high group to the statement, S^2L = the variance of the distribution of responses of the low group to the statement, nH = number of subjects in the high group, nL = number of subjects in the low group.

For each statement, the 't' value (critical ratio) was calculated, which is a measure of how well a given statement distinguishes between high and low groups of subjects (Edwards, 1954). The calculated 't' values were found to be distributed between 1.00 and 9.00 (Table 1). The final consideration was given to statements with 't' values of 1.75 and higher (p<0.05). Total 25 statements were incorporated in final interview schedule. Table 2 showed the final format of the attitude scale on livestock based technological services provided by University.

Validity and Reliability

All the attitude statements underwent testing for validity and reliability. To evaluate reliability, the split-half method was employed in this study. Scores were divided into two halves based on odd and even numbered statements and administered to 40 respondents. The correlation between the two sets of scores (r) was used for comparison. The Spearman-Brown Prophecy Formula (also known as the Spearman-Brown Prediction Formula) was utilized to calculate the reliability of the complete test. It is formulated as follows:

$$R = \frac{2r}{1+r}$$

Where, R = Reliability of full test, r = Correlation between two half tests

Cronbach's alpha was determined to assess the test's internal consistency using the following formula:

$$\alpha = \frac{N \times c}{v + (N-1) \times c}$$

Where, N = Number of items, c = Average covariance between item-pairs, v = Average variance

The reliability of a measure is evaluated through the resulting reliability coefficient, which ranges from 0 to 1. A value of 0 indicates that the test or scale items are entirely unrelated (i.e., they lack correlation or shared covariance), while a value approaching 1 suggests that the items exhibit high covariance. As the number of items in a test increases, the coefficient moves closer to 1 if the items are strongly related. In essence, a higher reliability coefficient indicates greater shared covariance among items, suggesting they are likely measuring the same underlying concept. A Cronbach's alpha of 0.70 or higher is considered acceptable, 0.80 or higher is deemed better, and 0.90 or higher is regarded as excellent. Cronbach's alpha can be applied to assess the reliability of instruments for both binary (dichotomous) data and larger-scale datasets (Sharma, 2016) [6].

Content validity of attitude scale

Content validity, which assesses the representativeness and adequacy of a measuring instrument's content, was utilized to validate the attitude scale. This validation involved developing a comprehensive list of test items representing the entire spectrum of livestock-based technological services of University, such as Pashu Palan Mela, training programs, regional melas, and awareness camps. The list was prepared in consultation with experts knowledgeable about university-led livestock technological services. It was assumed that the score from the attitude scale in this study accurately measured what it was designed to assess.

Table 1: Statements of item analysis by farmers of non-sample area

Sr. No.		Statements	't' value
1.	+	The University/outreach centres training programs provide the needful information regarding improved livestock practices	5.292*
2.	-	Lack of follow-up by the University/KVK/RRTC after completion of the training programs.	4.583*
3.	-	It is difficult to retain too much information provided during training programs of the University in short period	1.528
4.	+	Conducting exposure visit to farms/departments during training organized by University and its outreach centres provide practical know-how to the trainees	2.393*
5.	+	Regional trainings organized by the University/outreach centres enable trainees to adopt new practices and technologies at local level	2.828*
6.	+	The University Pashu Palan Mela (PPM) are beneficial to have glimpses of variety of technologies at a single place	4.583*
7.	+	The University Pashu Palan Mela (PPM) helps in providing the technical inputs developed by University experts	4.556*
8.	+	Participating in University Pashu Palan Mela (PPM), visitors gain social recognition and have the opportunity to meet with other progressive farmers	4.583*
9.	+	Livestock related information are exhibited by different departments in the University Mela is very useful to the visitors	1.528
10.	+	The University/outreach centres Animal Welfare Camps (AWCs) are beneficial to the farmers in awareness about proper management of diseases and First-Aid at village level	3.416*
11.	+	In University/outreach centres Animal Welfare Camps, farmers are made aware of the recommended animal health practices	4.583*
12.	+	Farmer's associations under the aegis of GADAVSU provide a single window platform for information and acquaint with the latest research interventions to the farmers	1.000
13.	+	Being the main technical mentor, farmer associations of University helps the farmers to raise their voices at different platforms	1.426
14.	+	The University farmer-scientist-interface enables the scientist to address the issues of a specific problems of the individual farmer	1.528
15.	+	Camps organized by University/KVK/RRTC helps in easy dissemination of knowledge and technical inputs developed by University.	2.049*
16.	+	Interventions provided in Village adoption program helps in improving the productive, reproductive performance of the livestock	9.000*
17.	+	University Facebook page (Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana & Gadvasu Pashu Palan Sandesh) enables farmers to learn about the latest technologies of University	3.862*
18.	+	WhatsApp groups created by GADVASU leads to greater social cohesion and improved social relationships among farmers	1.583
19.	+	WhatsApp groups created by University or its outreach centres are fastest way to exchange information among group members	3.862*
20.	+	University You tube channel (GADVASU extension services) provides latest information to farmers in shortest possible time	3.862*
21.	+	University Facebook and YouTube channels are more farmer friendly as they provide information in local language	3.989*
22.	-	The use of University mobile applications by illiterate farmers is challenging	4.245*
23.	+	Using the dedicated University/outreach centres Farmer helpline number, any query of farmer can be answered over the phone.	3.862*
24.		T.V and radio talks of GADVASU experts are useful for knowledge dissemination to livestock farmers	1.393
25.		T.V and radio talks of GADVASU experts reach the unreached farmers	1.426
26.	+	University/KVK/RRTC websites are helpful to farmers to get the latest updates	4.583*
27.	+	Use of University/outreach centre's ICT tools enhances transfer of technology and adoption	2.049*
28.	+	University Mobile app (PPTAK) provides the farmers an open platform to link with the experts where they can ask any questions related to dairy farming	1.528
29.	+	Vet MOOCs (Massive Open Online Courses) developed by GADVASU is an online learning platform which educate the farmers with the latest information	1.426
30.	+	Farmers can easily access a variety of recent information by contacting the farmer helpline number of University	1.000
31.	+	By receiving livestock-based information through University/outreach centres ICT services, famers are able to save their time	1.930*
32.	+	Farmer's feedback is fast through University/outreach centres ICTs tools and applications than traditional methods	2.646*
33.	+	GADVASU Services App covers all the services offered by University. It is highly recommended for farmers to be in touch with Veterinary University	1.000
34.	-	Information through University/outreach centres ICT tool is not as effective as face-to-face extension	4.438*
35.	+	Farmers benefit from the sale of University publications/literature because it provides them with the most recent reliable information and raises awareness.	3.862*
36.	+	University Value-added products like milk cake, burfi, ghee, egg pickle etc are sold to consumers, to create awareness about value addition of livestock products	0.607
37.	+	The production parameters such as daily milk yield, peak yield, and animal lactation length are improved by University mineral mixture feeding	3.862*
38.	+	Uromin lick provided by University enhances the milk production by restoring nutrient deficiency	3.211*
39.	+	Sale of bypass fat of University increases milk yield and fat percentage	1.528

Table 2: Statements selected for inclusion in the final scale

Sr. No.		Statements	't' value	HUF	UF	N	F	HF
1.	+	The University/outreach centres training programs provide the needful information regarding improved livestock practices	5.292*					
2.	-	Lack of follow-up by the University/KVK/RRTC after completion of the training programs.	4.583*					
3.	+	Conducting exposure visit to farms/departments during training organized by University and its outreach centres provide practical know-how to the trainees	2.393*					
4.	+	Regional trainings organized by the University/outreach centres enable trainees to adopt new practices and technologies at local level	2.828*					
5.	+	The University Pashu Palan Mela (PPM) are beneficial to have glimpses of variety of technologies at a single place	4.583*					
6.	+	The University Pashu Palan Mela (PPM) helps in providing the technical inputs developed by University experts	4.556*					
7.	+	Participating in University Pashu Palan Mela (PPM), visitors gain social recognition and have the opportunity to meet with other progressive farmers	4.583*					
8.	+	The University/outreach centres Animal Welfare Camps (AWCs) are beneficial to the farmers in awareness about proper management of diseases and First-Aid at village level	3.416*					
9.	+	In University/outreach centres Animal Welfare Camps, farmers are made aware of the recommended animal health practices	4.583*					
10.	+	Camps organized by University/KVK/RRTC helps in easy dissemination of knowledge and technical inputs developed by University.	2.049*					
11.	+	Interventions provided in Village adoption program helps in improving the productive, reproductive performance of the livestock	9.000*					
12.	+	University Facebook page (Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana & Gadvasu Pashu Palan Sandesh) enables farmers to learn about the latest technologies of University	3.862*					
13.	+	WhatsApp groups created by University or its outreach centres are fastest way to exchange information among group members	3.862*					
14.	+	University You tube channel (GADVASU extension services) provides latest information to farmers in shortest possible time	3.862*					
15.	+	University Facebook and YouTube channels are more farmer friendly as they provide information in local language	3.989*					
16.	-	The use of University mobile applications by illiterate farmers is challenging	4.245*					
17.	+	Using the dedicated University/outreach centres Farmer helpline number, any query of farmers can be answered over the phone.	3.862*					
18.	+	University/KVK/RRTC websites are helpful to farmers to get the latest updates	4.583*					
19.	+	Use of University/outreach centre's ICT tools enhances transfer of technology and adoption	2.049*					
20.	+	By receiving livestock-based information through University/outreach centres ICT services, famers are able to save their time	1.930*					
21.	+	Farmer's feedback is fast through University/outreach centres ICTs tools and applications than traditional methods	2.646*					
22.	-	Information through University/outreach centres ICT tool is not as effective as face-to-face extension	4.438*					
23.	+	Farmers benefit from the sale of University publications/literature because it provides them with the most recent reliable information and raises awareness.	3.862*					
24.	+	The production parameters such as daily milk yield, peak yield, and animal lactation length are improved by University mineral mixture feeding	3.862*					
25.	+	Uromin lick provided by University enhances the milk production by restoring nutrient deficiency	3.211*					

HUF: Highly unfavourable, **UF:** Unfavourable, **N:** Neutral, **F:** Favourable, **HF:** Highly favourable

Results and Discussion

Selection of item for attitude scale

The responses were gathered for 39 items based on 36 dairy farmers' attitude statements about livestock based technological services. The dairy farmers were asked to give the responses on a three point continuum indicating 'most relevant, relevant, and not relevant' with scores of 3, 2, and 1, respectively. The total score was calculated, ranging from '39' to '117', and arranged in descending order. Item analysis was performed on 25 percent of respondents with highest total score and 25 percent of respondents with lowest total score. Item analysis (assessment of individual statements) was conducted using these two groupings as criteria. For each statement, the 't' value (critical ratio) was calculated, which is a measure of how well a given statement distinguishes between high and low groups of subjects. The calculated 't' values were found to be distributed between 1.00 and 9.00 (Table 1). The final consideration was given to statements with 't' values of 1.75 and higher ($p<0.05$). Total 25 statements were incorporated in final interview schedule. Table 2 showed the final format of the attitude scale on livestock based technological services provided by University.

Reliability of the attitude scale

The accuracy or precision of a measuring instrument is referred to as reliability (Kerlinger 1964) [4]. The ability of an instrument to measure consistently is concerned with reliability, which is independent of the validity of an instrument (Tavakol *et al.*, 2008) [7]. The split half method is used to measure reliability in this study. The coefficient of correlation between forms was found to be (r) 0.774. The test's reliability is determined by this correlation coefficient. These coefficients undervalue the reliability of full-length measures, which provide a larger sample of the content domain and produce a wider range of scores, both of which

increase reliability estimates. As a result, the above coefficient must be corrected to give the overall measure's stepped-up reliability or the full length test's reliability (R). Therefore, the Spearman Brown Prophecy Formula (also referred to as the Spearman-Brown Prediction Formula) was employed. It's a formula that relates a test's psychometric reliability to its length, and it's been used by psychometricians to predict a test's reliability after changing its length. The value of R was found to be 0.872.

Internal consistency of the attitude scale

According to Yu (2001) [8], the Cronbach Alpha Coefficient, Kuder Richardson (KR) Formula, or Spilt half Reliability Coefficient can be used to compute and examine internal consistency within a single test. Cronbach Alpha is preferred over the other two for a variety of reasons, including the fact that it can be used with binary and large-scale data. KR, on the other hand, can only be used with dichotomously scored data. Second, spilt-half can be thought of as a one-test alternative to alternate form and test-retest, both of which require two tests. By dividing the items into two subsets, a single test is treated as two tests in split-half. The correlation between the two subsets is used to calculate reliability. As a result, the reliability coefficient may differ from one group to the next. Cronbach Alpha, on the other hand, is the average of all possible split-half coefficients computed using the Rulon method (Crocker and Algina, 1986) [2]. The internal consistency of the scale was calculated using Cronbach's alpha in this study, and the value was calculated to be 0.956, indicating that the attitude scale was internally consistent. At the 1% level of significance, all of the coefficients were found to be significant. As a result, the attitude scale that was created was extremely stable and reliable.

Content validity

The content validity of the scale was tested. The content validity is the representative or sampling adequacy of the content, the substance, the matter and the topics of a measuring instrument. As the content of the scale thoroughly covered the entire cosmos of livestock based technological services provided by University through literature and expert opinion, it was assumed that present scale satisfies the content validity. Thus, scale value difference for all the statements has a high discriminating value and it seems reasonable to accept the scale as a valid measurement.

Final scale

The instrument (final scale) was selected to include 25 attitude statements representing various aspects of livestock based technological services of University such as Pashu Plan Mela, regional mela, training programs, awareness camps etc.

Conclusion

The scale will be used to assess respondents' attitude beyond the present study area in the future. The scale items are simple and easy to comprehend, making the scale user-friendly and convenient to utilize.

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Conflict of interest/Competing interests

The author declare no conflicts of interest

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