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Research Article

Development of cognitive learning scale to test the knowledge level of farmers on organic livestock farming

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Abstract

In the current study, 246 questions were first created with the intention of encouraging thinking rather than rote memorizing to assess farmers' level of knowledge regarding organic livestock farming. It was created in a way that would allow knowledgeable farmers to be distinguished from those who were not. To determine the item difficulty index and item discrimination index, the respondents' scores were subjected to item analysis. Thirty three items in all, with discriminating indices ranging from 0.30 to 0.55 and difficulty indices between 30 and 80, were chosen for the final selection. Using the test-retest method and split-half method, the generated knowledge test's reliability was evaluated. At the 1% level of significance, the test-retest coefficient of correlation value of 0.85 was determined to be significant. The designed farmers' knowledge test scale on organic livestock farming was determined to be very reliable and useful for measurement.

Keywords: Farmers, Knowledge, Learning scale, Organic livestock farming

Highlights

- Difficulty index and discrimination index of each item were analysed.
- Reliability test showed a correlation coefficient of 0.85, significant at 1% level.
- A total of 33 items (statements) were finally selected for the Knowledge test of Organic livestock farming scale.

INTRODUCTION

Organic farming has gained importance worldwide, in view of increased environmental awareness, consumer preferences as well as sustainability of farm resources (Subrahmanyeswari & Chander, 2008). Organic livestock farming means raising livestock on organic feed (*i.e.* pastures cultivated without the use of fertilizers or pesticides), have access to pasture or outside, along with the restricted usage of antibiotics and hormones (Oruganti, 2011). Organic livestock farming is a holistic farming approach in many ways. It allows farmers to work in a safe socio-economic environment. For the development of organic livestock farming, it is important to ensure the confidence of the consumers in organic products by realising the self-created demands to a high degree (Sundrum, 2001). To effectively share information about organic livestock farming, it's essential to evaluate farmers' understanding of this practice and address any knowledge gaps. Initially 25 items were selected based on its content validity to develop a knowledge test on organic farming techniques mainly on organic manures and pesticides (Priyadarshni et al., 2020). Consequently, the objective of this study is to develop a tool for creating a cognitive learning scale that accurately predicts farmer's knowledge levels in this area. A scale containing 18 items was developed to measure the knowledge of marginal farmers on organic farming (Goswami & Das, 2020).

MATERIALS AND METHODS

The various stages involved in construction of a cognitive learning scale to test the knowledge level for organic livestock farming are outlined below-

Collection of items: The knowledge test consisted of questions known as items. These items were gathered from various sources, including literature, field extension agents, subject matter experts in animal and agricultural sciences, and the researcher's personal experiences. The questions aimed to assess the farmers' understanding of organic livestock farming.

Initial selection of items: The items were chosen with the intention that they shouldn't rely on memorized information and should require some level of analytical thinking (Goswami et al., 2012; Biswas et al., 2017). The questions were formulated on a dichotomous scale.

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A prior study conducted by Goswami et al. (2011) described the creation of a comparable scale assessing the knowledge level of duck farmers regarding duck farming. Additionally, Dhargupta et al. (2008) carried out a similar investigation focused on creating a cognitive learning scale to evaluate the knowledge level about health status.

RESULTS

Preliminary administration of test: A total of 60 farmers were selected from Kolkata during the period of July to September 2024. Each farmer received a score of 1 for a correct answer and 0 for an incorrect one. The aggregate number of correct answers recorded by all respondents amounted to 246. After tallying the scores from each farmer, the results were organized in descending order. The 60 respondents were categorized into 6 groups (G1…G6) with 10 individuals in each group. The top four groups with the highest scores and the bottom four groups with the lowest scores were chosen for calculating the item difficulty index and item discrimination index.

Item analysis: Item analysis of a test provides two types of information- item difficulty index, which speaks about the difficulty level of an item and item discrimination index, which indicates how well the item discriminates in agreement with the test of the scale (Guilford, 1954).

Item difficulty index: The difficulty index was defined as the proportions of respondents of Kolkata giving correct answers to that item. This was calculated using the formula:

$$P_i = \frac{n_i}{N_i} \times 100$$

Where,
P_i= Difficulty index in the percentage of the i^{th} item
n_i= Number of farmers of Kolkata giving the correct answer to the i^{th} item
N_i = Total number of farmers to whom the i^{th} item was administered (60 numbers in this research)

Item discrimination index: The discrimination index may be defined as the measure of capability of the item to differentiate the well-informed respondents and the less informed respondents. The following formula was used for calculation of this index.

$$E_{1/3} = \frac{(S_1 + S_2) - (S_5 + S_6)}{N/_3}$$

Where,
S1, S2, S5 and S6 were the frequencies of correct answers in G1, G2, G5 and G6 groups respectively and N=Total number of respondents in the sample of the item analysis.

Selection of items for the test: The final format of the knowledge test was prepared after considering the values of item difficulty and item discrimination indices. In the present study, the items with an item difficulty index ranging from 30 to 80 and a discrimination index ranging from 0.30-0.55 were selected to be included in the final list of knowledge tests. The procedure followed was in line with the learning scale developed by Nanda et al. (2022) on the knowledge level of veterinary students on ICT. The items following both the criteria (Ray & Mondal, 2005) mentioned above were taken into consideration. The number of total selected items was 33, and the items with the item difficulty index and item discriminatory index are shown in Table 1.

Scoring method: The summing up of scores for correct replies over all the items of a particular respondent indicates his/her knowledge about organic livestock farming. The range of scores was from 0 to 33.

Reliability by Test-Retest method: This method was also employed for calculation of reliability of the prepared knowledge scale. The prepared 33 items were subjected to the 30 respondents other than the respondents used for preparation of the scale. The same questions were again subjected to the same respondents after 15 days. The coefficient of correlation (*r*) was calculated between the two sets of results, and it was found to be 0.85, which was significant at 1% level of significance.

Reliability by Split-Half method: All the 33 items were arranged randomly and divided into two halves of 16 and 17 items. The two sets were administered to 30 farmers other than the farmers taken for preparation of the scale. The coefficient of correlation (*r*) between two sets of scores was found out to be 0.88, which was significant at 1% level of significance. The reliability coefficient thus obtained, indicated the "internal consistency" of the knowledge test developed for this study was high.

Content validity of the knowledge test: Proper care was taken to include items from the entire universe relevant to the knowledge of organic livestock farming for the

Table 1. Item difficulty index and item discrimination index of the finally selected items

Sl. No.	Items	Correct	Incorrect	Difficulty Index	Discrimination Index
1.	Do you know that Organic livestock farming prohibits the use of synthetic pesticides and fertilizer?	YesNo	10	78.33	0.4
	Role of Animals in organic farming systems-	Correct	Incorrect		
2.	Unutilized agricultural areas	1	0	70.00	0.30
3.	Diversity with different species	1	0	78.3	0.35
4.	Used for draught purposes	1	0	70.00	0.40
	What are the characteristics of an ideal organic livestock farm?	Correct	Incorrect		
5.	Geographically located near market outlets	1	0	56.66	0.50
6.	Can genetically modified organisms be used in organic livestock farming?	Yes No	0 1	36.66	0.35
7.	Have you heard the name of Organic dairy farming?	Yes No	1 0	70.00	0.55
	How organic milk can be produced?	Correct	Incorrect		
8.	Animal over 6 months of age that have access to pasture	1	0	70.00	0.50
9.	A proper herd health programme should be there	1	0	60.00	0.40
10.	Are non-natural feed additives and supplements recommended in organic dairy farming?	Yes No	0 1	45.00	0.40
11.	What is the recommended to provider cows with daily access to pasture, paddocks or runways in an organic dairy operation?	All day Any other	1 0	65.00	0.55
12.	How do some producers can accelerate the breakdown of manure before field application in organic dairy farming?	Composting Any other	1 0	78.33	0.55
13.	What are the recommended space requirements for dairy cows per animal?	6 m^2 Any other	1 0	80.00	0.40
14.	Frequent use of antibiotics is a common measure for disease management in organic dairy farming?	Yes No	0 1	51.66	0.30
15.	For feeding calves up to the age of 12 weeks, what proportion of the overall ration should be whole organic milk	At least 51% Any other	1 0	76.66	0.30
	Why is pasture rotation important for organic goat farming?	Correct	Incorrect		
16.	To use chemical dewormer	0	1	38.33	0.40
17.	Which of the following physical identification methods is required by organic health standards for physical identification?	Tattooing Any other	1 0	70.00	0.55

Cont. Table 1.

Table 1., Cont. ...

Sl. No.	Items	Correct	Incorrect	Difficulty Index	Discrimination Index
18.	Do you know that Trim feet often, once in every six weeks?	Yes No	1 0	66.66	0.35
	How long does it generally take for the conventional farm follow organic standards and then only it will fall into the category of certification?	Correct	Incorrect		
19.	Less than 1 year	0	1	40.00	0.35
20.	1 year	1	0	45.00	0.35
21.	More than 1 year	0	1	35.00	0.30
22.	What is the ratio of male of female goat during breeding?	1:20 Any other	1 0	66.66	0.45
	Bloat disease of goat can be treated by the Following ways-	Correct	Incorrect		
23.	Let the animal walk	1	0	78.33	0.40
	What are the benefits of Organic pig farming?	Correct	Incorrect		
24.	Establish business monopoly	1	0	71.66	0.45
	Proper nutrition for organic pigs-	Correct	Incorrect		
25.	Forages (grass, alfalfa)	1	0	80.00	0.50
	Organic pig housing should have following requirements:	Correct	Incorrect		
26.	Outdoor access year around	1	0	78.33	0.45
	What steps you should take to maintaining certification in organic pig farms-	Correct	Incorrect		
27.	Transparency in farming practices	1	0	73.33	0.35
	What is the importance of Organic Sheep Farming-	Correct	Incorrect		
28.	Maintaining closed flocks and herds	1	0	75.00	0.30
	Followings are the sheep breeds for organic farming-	Correct	Incorrect		
29.	Afrikaner	1	0	68.33	0.45
30.	Damara	1	0	68.33	0.30
	What is the source of stock in organic sheep farming?	Correct	Incorrect		
31.	Replacements	1	0	71.66	0.30
	Followings points are to be considered during construction of proper housing for organic rabbit farming-	Correct	Incorrect		
32.	Sufficient ventilation and heating	1	0	78.33	0.30
	Followings are the steps that keep rabbit healthy in the summer season-	Correct	Incorrect		
33.	Careful about feeding	1	0	76.66	0.50

farmers. The items were collected from different relevant literature, specialists, and various other sources. Thus, it was assumed that the measurement was done as intended.

The study was designed to analyse the knowledge level of the respondents on organic livestock production in order to establish a scale. Item analysis gave us with the item difficulty index which reflects the difficulty level of an item, and the item discrimination index which indicates how well the item discriminates in agreement with the test of the scale (Guliford, 1954 ; Biswas et al., 2017). The result revealed that only 33 out of 246 items were significant in terms of difficulty index and discrimination index, and these items were further found valid and reliable for the creation of the knowledge scale on organic livestock farming. This suggests that these 33 selected issues are considered less difficult to comprehend and answer and have the ability to separate the well-informed respondents and less-informed respondents.

This knowledge test scale comprising all the claims would aid the researcher and concerned department in the identification of less-informed respondents' areas, and the socio-economic growth of the livestock farmers. The knowledge exam which has been produced can be used internationally to identify the knowledge level of the farmers on organic animal production. To achieve the right results, this scale can be adjusted based on the test locations.

Conflict of interest: Authors have no conflict of interest in this study.

Author's contribution: BP: Conducted the research; AG: Conception and design and supervision; SMN: Performed drafting of the manuscript and data analysis.

Data availability statement: All the data supporting the research findings have been presented in the paper. The corresponding author is willing to provide the raw data upon reasonable request.

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