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CONSTRUCTION OF KNOWLEDGE TEST FOR ANALYSING KNOWLEDGE LEVEL OF ECO-FRIENDLY CONSERVATION PRACTICES

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ABSTRACT

A test was constructed to measure the Knowledge level of farmer's eco-friendly conservation practices. The test was developed using scientific procedures including item collection through preliminary screening, item selection based on expert opinions, item analysis (difficulty index, discrimination index), testing reliability and validity of knowledge test and final administration to respondents. A total of 25 items were developed and sent to 67 experts in Agronomy, soil science and extension education for a relevancy test using a three-point continuum via Google form.Out of 25 items, 22 items were selected for item analysis based on the mean score. Selected items were administrated to 36 non respondents of Patan block of Jabalpur district, Madhya Pradesh for item analysis. Split-half technique was used for testing the reliability of the scale in which correlation coefficient (r) was found to be 0.80.

Keywords: *difficulty index, discrimination index, correlation coefficient, reliability*

INTRODUCTION

Madhya Pradesh is one of the richest repositories of biological diversity hotspots in the state- Satpura and Vindhyachal ranges. Madhya Pradesh is the 2nd largest state in the country in area. The key eco-friendly expertise's merit mentioning are organic farming, crop rotation and intercropping, rainwater harvesting, mulching, vermicomposting, contour farming, cover crops, intercropping, floating farming, integrated pest management which can be all collectively considered as eco-friendly farming.

The chemical detrimental effects of fertilizers in plants are reduction in germination,

retardation in seedling growth, scorching and increased susceptibility to diseases. Study with in the field of agriculture has recognized variety of environmental friendly technologies like eco-farming, eco-friendly nutrient management.

Three important goals of eco agriculture are: Enhance rural livelihoods, Conserve or enhance biodiversity and eco-system services, Develop more sustainable and productive agricultural system without polluting the soil, water and surrounding area. Eco-friendly farming combines some agricultural approaches like Integrated Pest Management, Integrated Nutrient Management, Integrated Weed Management, Soil, Water and Residue Management practices. (Mishra, 2013)

Natural resources are the items that exist freely in nature for human use and do not require mankind's action for their generation or production. Soil and water are the necessary natural resources that support life in all forms and are crucial for sustainable agricultural production. (Khandelwal, 2024)

Organic farming currently covers only 2.8 Mha or two per cent of India's net has sown area of 140 Mha. Natural farming is the fastest growing sustainable agricultural practice in India and has been adopted by around 800,000 farmers. Integrated Pest Management (IPM) has achieved a coverage area of 5 Mha after decades of sustained promotion. Crop rotation is the most popular SAPS in India, covering around 30 million hectares (Mha) of land and approximately 15 million farmers. Agro forestry, mainly popular among large cultivators, and rainwater harvesting have relatively high coverage - 25 Mha and 20-27 Mha, respectively.

Considering the growing importance of sustainable agriculture, it is essential to assess farmers' knowledge of eco-friendly conservation practices before designing effective extension interventions. A standardized knowledge test provides a scientific means to measure farmers' awareness and understanding of such practices. As highlighted by Bloom et al. (1956), knowledge is a fundamental component of educational activities, making the construction of a reliable and valid tool indispensable. The development of such a test follows systematic steps, including item collection, expert

validation, item analysis, and the assessment of reliability and validity. A well-constructed knowledge test not only quantifies farmers' knowledge but also helps in identifying specific gaps that need to be addressed through training and capacity-building programmes. Thus, the knowledge test becomes a vital instrument for promoting eco-friendly conservation practices in agriculture.

OBJECTIVE

To construct a knowledge test for analysing knowledge level of eco-friendly conservation practices.

METHODOLOGY

Locale of the study

To construct the knowledge test, a pilot survey was carried out in Patan village (22.53°N, 79.42°E) of Jabalpur district, Madhya Pradesh. A randomly selected group of 36 non-sample respondents participated in the pilot study, offering useful feedback for refining the test. Patan village was excluded from the final data collection. The finalized knowledge test was then administered to the selected respondents from two districts of Madhya Pradesh for quantitative analysis.

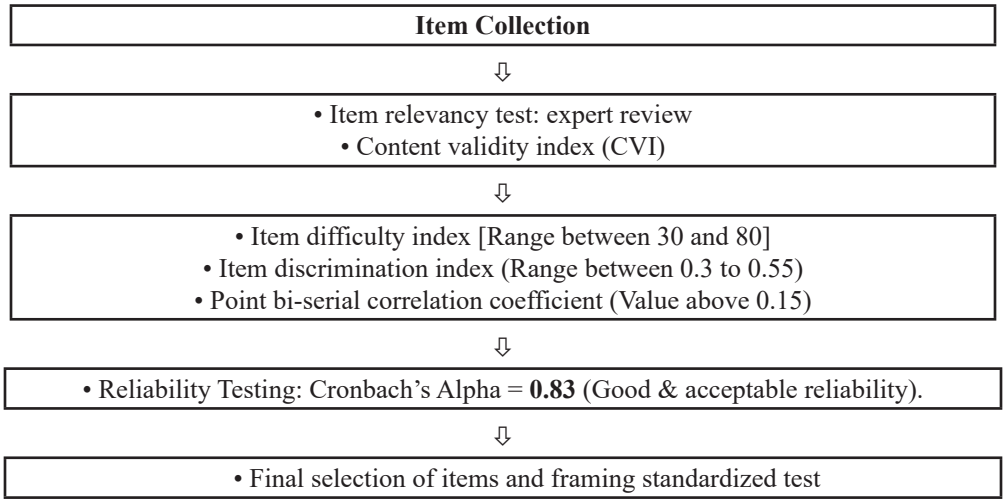

Fig. 1 Steps in constructing standardized knowledge test

Construction of knowledge test

To develop a knowledge test for eco-friendly conservation practices, the methodology outlined by Digarse et.al (2025) and Bardhan &Bhardwaj (2022) was adopted with necessary modifications to fit the specific requirements of this study.

Collection of items

The initial phase of constructing the knowledge test involved assembling a set of objective questions, referred to as "knowledge items," covering the thematic area of *"recommended eco friendly conservation practices."* Items were gathered from a variety of reputable sources, includingresearch and review papers, popular articles, book chapters, and pilot studies conducted in the target area. Additional insights were derived from expert consultations and theresearchers' own field experiences.

Item selection

Selecting appropriate items is crucial for developing a knowledge test that not only encourages critical thinking but also effectively distinguishes between well informed and less-informed respondents. This stage demands a deep understanding and critical analysis of the topic by the researcher. Based on these criteria, an initial set of 25 items was constructed, encompassing essential aspects of eco-friendly conservation practices such as organic farming, Soil and water conservation, Biofertilizers & Biopesticides, Agroforestry and crop residue management. Each item was designed to be objective and structured in a multiple-choice or binary (yes/ no) format to ensure clarity and ease of response.

Expert validation

The set of 25 items was then subjected to expert review for relevancy assessment. Experts were asked to evaluate whether each item accurately measured respondents' knowledge of eco-friendly conservation practices. They were encouraged to suggest modifications, additions, or deletions to ensure that each item aligned with the test's objectives. The items were rated on a three-point scale for relevance: 3 for "most relevant," 2 for "relevant," and 1 for "irrelevant."

Based on expert feedback, six items were eliminated, resulting in a final selection of 22 items deemed appropriate for the knowledge test.

Difficulty index

A difficulty index used to measure the degree of difficulty in answering a particular question. For every correct response one score was assigned while no score was assigned to the incorrect answers. Difficulty of an item refers to the relative aggravation or ado faced by the respondents to answer the item or question correctly. (Garret 1966) described several ways to determine the difficulty of an item (i) by the judgments of the competent people who rank the items in order of difficulty, (ii) speed with which the items can be correctly solved, and (iii) by the number of examinees in the group who can solve the item correctly. In the present study, the method of calculating the difficulty index of items was used to determine the difficulty level of all the items in the test batter. Difficulty Index can be defined as the proportion of the respondents giving correct answer to the particular item Dadheech et al., (2024); Chandran et al. (2024); Abhishek et al. (2023); Ray and Mondal (2014); Pandey et al. (2025); Kumar et al. (2025); Ansari et al. (2024); Kavad et al. (2024); Mallappa et al. (2023);

Vegad et al. (2021); Pratik and Vinaya (2022). The difficulty index was calculated by using the following formula:

$$DI = (nc/N)*100$$

Where, *DI*= difficulty index in percentage

nc = number of farmers who correctly answered

N= total number of respondents (for present study it is 36)

Accordingly, questions with difficulty index of less than 30 and above 80 rejected as these represent either too easy or too difficult response.

Discrimination index

Discrimination Index is calculated to expresses the extent to which a particular item discriminates the respondents who sharply has more knowledge about the topic with those who lacks the same. The statement or items which is either answered correctly by everyone or none in the sample, is supposed to have no power of discrimination. In order to compute discrimination indices for all the items, the total scores of all the respondents were arranged in the descending order. Out of this, the top 27 per cent and the bottom 27 per cent of the respondents were treated as high and low a group, which was further, used to calculate the discrimination index. Discrimination index (Kelley`s 1939) was calculated using following:

$$\text{Discrination index} = \frac{(U- L)}{N}$$

U= Number of non-sample respondents in 27 per cent Upper group who answered correctly

L = Number of non-sample respondents in 27 per cent Lower group who answered correctly

N = Total number of non-sample respondents in 27 per cent upper group and 27 per cent lower group.

Point-bi-serial correlation coefficient

Point-Bi-serial correlation coefficient is the statistics used to work out the internal consistency of the items of dichotomous or binary nature, which signifies the relationship of the total score to a dichotomized answer of any given item. The point bi-serial correlation for each of the item of initial knowledge test was calculated by using the formula given by Garret (1966):

$$rpbis = \frac{MP-MQ}{\sigma} * \sqrt{pq}$$

Where,

r = point bi-serial correlation

MP= mean of the total scores of the respondents who panswered the items correctly.

MQ =mean of the total scores of the respondents who answered the items incorrectly.

p = proportion of the sample in the first group

q = proportion of the sample in the second group

σ = standard deviation of the entire sample

Final selection of Items

Those items, which met all the following conditions, were finally selected for the knowledge test: Difficulty index (DI) between 0.30 and 0.80, Discrimination index value between 0.30 and 0.55 and Point bi-serial correlation coefficient at five and one percent level of significance. Thus, a total of 22 items from a total 25 items were retained finally, for the final knowledge test.

RESULTS AND DISCUSSION

The jury opinion method was used to calculate

the item relevancy test Item difficulty index analysis shows that items p value ranged between 30 to 95. (Table 1) Items whose value ranged between 30 to 95 were selected for final test (Althouse, 2000).The items fallon less than 30 value are supposed to be easy and items with value more than 95 are assumed to be very difficult to answer.

A higher discrimination value indicates greater item validity. The acceptable range for item selection was 0.15 to 0.60. The analysis revealed that the discrimination index values of the items ranged from 0.05 to 0.45.

The bi-serial correlation (rpbi) was used as a measure of the validity of test items. This metric reflects the relationship between the overall test score and the dichotomous response for each item. The value of bi-serial correlation (rpbi) at least 0.15 is recommended for selection of items in test. From the Table 1, it is cleared that the bi-serial correlation (rpbi) of all items is ranged between -0.06 to 0.67. Based on the acceptable range 0.00 (9^{th}), 0.11 (12^{th}) and -0.06 (19^{th}) items were excluded from the test. On the basis of item difficulty, item discrimination and point bi-serial correlation, total 22 items were included for final test.

Table 1: Difficulty index, discrimination index and point – biserial correlationCoefficient of knowledge items related to eco- friendly conservation practices

Sr. No.	Items	Difficulty index (P)	Discrimination index (DI)	Point-Biserial Correlation Coefficient (rbpis)
Section 1: Organic farming				
1	Which of the following is NOT an organic farming practice?	83.30	0.20	0.67
2	What is the main benefit of organic farming?	61.10	0.30	0.22
3	Why is green manure used in organic farming?	66.70	0.45	0.33
4	Which type of composting method is commonly used for organic farming?	83.30	0.15	0.67
5	A farmer wants to shift to organic farming but is struggling with pest control. What should be recommended?	80.60	0.25	0.61
Section 2: Soil and water conservation				
6	Which of the following practice helps in reducing soil erosion?	77.80	0.20	0.56
7	What is the primary purpose of contour ploughing?	80.60	0.15	0.50
8	Why is rainwater harvesting important for farmers?	75.00	0.20	0.50
9*	How does mulching help in water conservation?	50.00	0.05	0.0
10	Which of the following irrigation method is having highest water use efficient (WUE)?	63.90	0.45	0.28
Section 3: Agroforestry				
11	A farmer's land is in a hilly area, and prone to soil erosion. Which technique should be recommended?	58.30	0.35	0.17
12*	What is agroforestry?	55.60	0.40	0.11
13	Which tree species is commonly used in agroforestry for soil improvement?	63.90	0.25	0.28
14	How does agroforestry help in biodiversity conservation?	58.30	0.40	0.17
Section 4: Biofertilizers and biopesticides				
15	A farmer wants to improve soil fertility while earning extra income. Which eco-friendly practice is most suitable?	61.10	0.25	0.22
16	Which of the following is an example of a biofertilizer?	66.70	0.40	0.33

Sr. No.	Items	Difficulty index (P)	Discrimination index (DI)	Point-Biserial Correlation Coefficient (rbpis)
17	What is the role of Azospirillum in cereal crop?	69.40	0.30	0.39
18	Why are biofertilizers preferred over chemical fertilizers?	58.30	0.40	0.17
19*	Which of the following is a natural alternative to chemical pesticides?	47.20	0.30	-0.06^{NS}
20	A farmer observes pest damage on crops but wants to avoid synthetic use of pesticides. What is the best alternative?	63.90	0.30	0.28
Section 5: Crop residue management				
21	What is the best method of managing crop residue to improve soil health?	58.30	0.40	0.17
22	Which technique is used to convert crop residues into organic compost?	77.80	0.15	0.56
23	How does crop residue mulching benefit soil?	66.70	0.25	0.33
24	Why is burning of crop residues discouraged?	67.00	0.20	0.33
25	A farmer wants to reduce stubble burning. What should they do with crop residues instead?	63.90	0.15	0.28

*Rejected items on the basis of calculated item difficulty, discrimination index and point bi-serial value; NS- Non-Significant

Reliability of the test

To assess the reliability of the test, the split-half method was used due to its advantages over other methods. This approach allows for the collection of data in a single session, minimizing variations that can occur between two testing situations (Garret, 2007). The test items were randomly shuffled and split into two parts—one with odd-numbered items and the other with even-numbered items.

Table 2: Reliability of the test

Reliability Statistics			
Cronbach's Alpha	Part 1	Value	.80
		Number of Items	13[a]
	Part 2	Value	.76
		Number of Items	12[b]
			.713
Correlation Between Forms			.832
Spearman-Brown Coefficient	Equal Length		.832
	Unequal Length		.833
Guttman Split-Half Coefficient			.829

The correlation between the scores of these two halves was then computed and found to be 0.80, which is statistically significant. This high correlation demonstrates that the knowledge test possesses good reliability.

Table 3: Final list of screened knowledge items which are included in the standardized test

Sr. No.	Knowledge test Items
Section 1: Organic farming	
1	Which of the following is NOT an organic farming practice?
2	What is the main benefit of organic farming?
3	Why is green manure used in organic farming?
4	Which type of composting method is commonly used for organic farming?
5	A farmer wants to shift to organic farming but is struggling with pest control. What should be recommended?

Sr. No.	Knowledge test Items
Section 2: Soil and water conservation	
6	Which of the following practice helps in reducing soil erosion?
7	What is the primary purpose of contour ploughing?
8	Why is rainwater harvesting important for farmers?
9	Which of the following irrigation method is having highest water use efficient (WUE)?
Section 3: Agroforestry	
10	A farmer's land is in a hilly area, and prone to soil erosion. Which technique should be recommended?
11	Which tree species is commonly used in agroforestry for soil improvement?
12	How does agroforestry help in biodiversity conservation?
Section 4: Biofertilizers and biopesticides	
13	A farmer wants to improve soil fertility while earning extra income. Which eco-friendly practice is most suitable?
14	Which of the following is an example of a biofertilizer?
15	What is the role of Azospirillum in cereal crop?
16	Why are biofertilizers preferred over chemical fertilizers?
17	A farmer observes pest damage on crops but wants to avoid synthetic use of pesticides. What is the best alternative?
Section 5: Crop residue management	
18	What is the best method of managing crop residue to improve soil health?
19	Which technique is used to convert crop residues into organic compost?
20	How does crop residue mulching benefit soil?
21	Why is burning of crop residues discouraged?
22	A farmer wants to reduce stubble burning. What should they do with crop residues instead?

CONCLUSION

Comprehending the knowledge of individuals regarding any particular topic is of utmost importance in social science research domain as it directly influences the attitude formation and thereby impacts ones behaviour. The present study calls for developing a standardized test on eco-friendly conservation practices in Satpura plateau agro- climatic zone of Madhya Pradesh which will help the researchers, academicians, different stakeholders and policy makers to formulate and refine policy guidelines and new strategies that will augment the adoption of eco-friendly conservation practices by farmers. This study tried covering all the possible aspects of eco-friendly Conservation practices and developed knowledge tool can be used by researchers in other related fields with needed modification.

RECOMMENDATION

The knowledge test can serve as a useful tool for policymakers, researchers, and extension personnel to assess the impact of their programs and to make evidence-based decisions related to eco-friendly conservation practices.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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