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A KNOWLEDGE TEST OF TRIBAL FARMERS REGARDING CLIMATE CHANGE ADAPTATION STRATEGIES

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ABSTRACT

The evaluation of fundamental knowledge in climate change adaptation strategies is essential. Nevertheless, current instruments frequently lack such as updated material on tribal farmers knowledge. The methodical development and validation of the Knowledge test, a standardized tool intended to assess knowledge competency among tribal farmers, is described in this study. The development process followed a methodology: (1) Item Generation, where a pool of 41 items was created based on Climate change adaptation strategies (2) Content Validation, involving a panel of 60 subject matter experts to ensure relevance and representativeness (3) Pilot Testing with a sample of 30 participants. Results from Item Analysis indicated a mean difficulty index of range 0.30- 0.80 and a discrimination index of >0.40. The final version of the test, consisting of 19 items, demonstrated high internal reliability of 0.85 . These findings suggest that the knowledge test is a reliable and valid tool for assessing knowledge of farmers regarding climate change adaptation strategies, providing a robust framework for future educational evaluation and research. The findings provide a diagnostic baseline for creating dialect-based, location-specific extension modules that close the knowledge gap between climate-resilient technology adoption and awareness.

Keywords: *climate change, knowledge test, item analysis, reliability, validity.*

INTRODUCTION

"Climate change' means a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods**."** (UNFCCC, 1992)

Climate change can affect our health, ability to grow food, housing, safety and job. Some of us are already more sensitive to climate consequences, such as people living in small island nations and other impoverished countries. Many individuals think climate change mostly means warmer temperatures. But temperature rising is merely the beginning of the story. Because the Earth is a system, where everything is connected, changes in one place can influence changes in all others (Devojee et al., 2025; Borra et al., 2025; Anu et al., 2025; Yadav et al., 2025). As climate change causes violence across the world, women and girls face heightened vulnerabilities. The repercussions of climate change are global, but countries like India are especially vulnerable in view of the vast population reliant on agriculture and in which tribal farmers mostly have their own system of living because of that they might have less access to information and knowledge about coping strategies. Climate resilient technologies are promising tool to guard a farming system from climate variations (Devojee et al. 2025; Parikh et al., 2024; Vinaya & Gadde, 2026; Vinaya & Tapan, 2023; Vinaya et al., 2022).

However, identifying areas/groups and agricultural production systems that are less aware or have less knowledge would be made easier with the use of a knowledge assessment. Furthermore, region-specific adaptation strategies might be recommended in addition to resource allocation and adaption prioritization (Parikh et al., 2024; Vinaya & Gadde, 2026).

Knowledge is one of the important components of behaviour and plays an important role in overt and covert behaviour of an individual. Knowledge includes those behaviour and test situations which emphasized the remembering either by recognition or recall of ideas, material or phenomenon (Bloom and others, 1956). The higher level of knowledge leads the higher-level adoption regarding scientific farming practices improves production and income level of farmers. (Chaudhary et al, 2024; Vinaya & Tapan, 2023; Vinaya et al., 2022).

OBJECTIVE

To construct a knowledge test for assessing knowledge of tribal farmers regarding climate change adaptation strategies.

CONSTRUCTION OF KNOWLEDGE TEST STEPS:

Test was developed to assess knowledge of farmers regarding climate change adaptation strategies, the methodology outlined by Bardhan & Bhardwaj (2022) was adopted, with necessary modifications to fit the specific requirements of this study.

Construction of knowledge test steps:

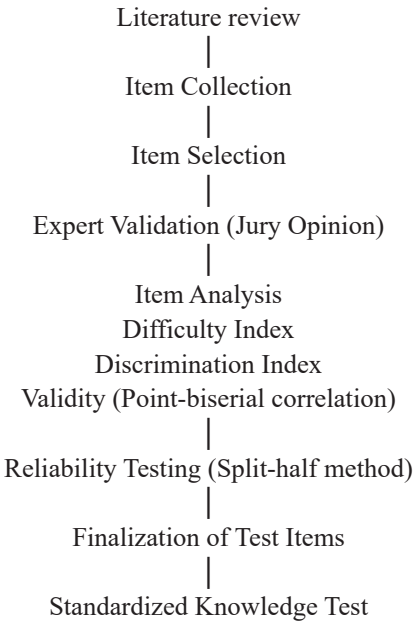

Fig. 1: Steps followed in Construction of knowledge test

METHODOLOGY

Locale of the study

To develop the knowledge test, a pilot survey was conducted in Lalpur village Karanjia block, Dindori district, Madhya Pradesh because it is the village with same tribal group. A random sample of 30 non-sample respondents included in the pilot survey, providing valuable insights for the test's development. The descriptive research design was adopted for this study. At the time of final data collection, same village was not included. The developed knowledge test was further administered to the sample respondents of the one district of Madhya Pradesh for quantitative analysis. At the end, quantitative analysis was done by MS excel version of 2021 for proper interpretation.

Collection of items

The initial process of developing the knowledge test involves assembling a set of questions, referred to as "knowledge items," encompassing the theme area of "recommended adaptations practices." Items were collected from a range of reliable sources, such as book chapters, popular articles, research and review papers, and pilot projects carried out in the target area. Expert consultations and the researchers' personal fieldwork provided further insights.

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 41 items was constructed, encompassing essential aspects of interventions under the Technology Demonstration Component of the NICRA project. 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 (Jury Opinion)

The set of 41 items was then subjected to expert review for relevancy assessment. Experts were asked to evaluate whether each item accurately measured respondents' knowledge of climate change adaptation strategies. 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, eleven items were eliminated, resulting in a final selection of 30 items deemed appropriate for the knowledge test.

RESULTS AND DISCUSSION

Item analysis

The item analysis involved three critical metrics: the item difficulty index, the item discrimination index, and the item validity index. These indices together served to ensure that each item in the knowledge test on climate change adaptation strategies was relevant, effectively discriminated between different knowledge levels, and held validity within the test structure. The 30 items were administered to 30 identical respondents who were not included in sample but they were included in pre-testing. The whole test was consisting of multiple choice questions. Each question was having two response categories either correct or wrong. Each correct answer was given '1' score while wrong answer was awarded '0' mark.Thus total score secured by all individual respondents on 30 items for correct answers was the knowledge score. The scores obtained by 30 identical respondents were arranged in descending order and divided into six group's i.e. 5 respondents in each group. The groups were named as G1, G2, G3, G4, G5 and G6. For the purpose

of item analysis, the middle two groups G3 and G4 were eliminated keeping four extreme groups with high and low scores. The data containing to the correct response for all the items in respect of these four groups were tabulated for calculating the difficulty and discrimination indices.

Table 1: Calculation of Item difficulty and discrimination

Group	Correct Answer Range	Number of Respondents
1	15 - 21	5
2	22 - 27	5
3	28 - 29	5
4	30 - 31	5
5	31 - 31	5
6	32 - 35	5

Item difficulty index

The item difficulty index was defined as the proportion of respondent farmers giving correct answer to that particular item. The basic assumption in this case was that the difficulty in answering any question was linearly related to knowledge level of farmers regarding climate change adaptations i.e. more the knowledge level, the easier the farmer finds to answer the question and vice-versa. Difficulty Index was calculated using the following formula:

$$Pi = (ni / Ni) \times 100$$

Where, Pi= difficulty index in percentage of i th item ni = number of farmers who correctly answered i th item Ni = total number of respondents to whom i th item was administered (for present study it is 30).

Item discrimination index

Calculation of discrimination index results in identifying the extent to which a specific item discriminates the farmers having more knowledge regarding the topic with those having poor knowledge level. The items which are either answered by all correctly or incorrectly are supposed to have no power of discrimination. The item discrimination index is calculate by "E1/ 3" formula given by Mehta (1958).

It is represented as: E1/3= {(S1+S2) - (S5+S6)}/ (N/3)

Where, S1, S2, S5 and S6 are frequencies of correct answers from groups G1, G2, G5 and G6 respectively and N denotes the total sample size for item analysis. The discrimination index varies from 0 to 1.

Item validity

The assurance of good test validity rests upon good item validity. The methods employed to analyse item validity were expert/jury opinion and point bi-serial correlation. At the beginning content validity was ensured by administering the test items to different experts to assess the exemplification of the universe by the test and approve its face validity.

Point-biserial correlation

The point biserial correlation was used to know the internal consistency of the items i.e. the relationship of the total score to a dichotomized answer to any given item. In a way, the validity power of the item was computed by the correlation of the individual item of preliminary knowledge the test is calculated by using the formula suggested by Garret (1966).

$$r_{pbis} = \frac{MP - MQ}{SD} \times \sqrt{pq}$$

rpbis = Point biserial correlation.

MP = Mean of the total scores of the respondents who answered the item correctly.

$$MP = \frac{\text{sum total of XY}}{Total\ number\ of\ correct\ answer}$$

MQ = Mean of the total scores of the respondents who answered the item incorrectly.

$$MQ = \frac{\text{sum total of X} - \text{sum total of XY}}{Total\ number\ of\ wrong\ answer}$$

SD = Standard deviation of the entire sample.

P = Proportion of the respondents giving the correct answer to the item.

$$P = \frac{\text{Total number of correct answers}}{Total\ number\ of\ respondents}$$

Q= Proportion of the respondents giving an incorrect answer to the item (or) Q = 1-P

X = Total score of the respondent for all items.

Y = Response of the individual for the items i.e. (Correct = 1; Incorrect = 0)

XY = Total score of the respondent multiplied by the response of the individual to the item. i.e. (Correct =1; Incorrect = 0) Items having significant point biserial correlation either at 1 percent (or) 5 percent level was selected for the final test of the knowledge

Table 2: Difficulty index, discrimination index and point-biserial correlation coefficient of knowledge items related to climate change adaptation strategies

Sr. No.	Knowledge items	Difficulty index (P)	Discrimination index (D)	Point bi-serial correlation coefficient (rpbi)
1.*	Which of the following is a key impact of climate change that directly affects agriculture in your region?	37.79	0.68	0.512
2.*	What is the primary goal of climate adaptation strategies for farmers?	46.71	0.63	0.454
3.	What is the benefit of practicing crop diversification?	40.00	0.57	0.477
4.*	Which type of crop is good for dry and hot conditions?	52.12	0.6	0.452
5.	How agroforestry helps in climate change adaptation?	6.67	0.2	0.219
6.*	How access to weather forecasts helps farmers?	56.41	0.56	0.548
7.*	Why growing many types of crop is good?	66.73	0.59	0.596
8.*	How does using mulch and organic manure help?	59.10	0.63	0.305
9.*	What is the main advantage of ridge-and-furrow planting?	63.33	0.45	0.479
10.*	Which type of soil is most suitable for ridge-and-furrow raised bed planting?	46.67	0.2	0.05
11.	Which crop is commonly grown using ridge-and-furrow raised bed planting?	26.67	0.11	0.03
12.	What is the benefit of using pest-resistant crop varieties?	53.34	0.39	0.422
13.	What is the full form of IPM?	30	0.1	0.131
14.*	Integrated Pest Management (IPM) focuses on?	67.78	0.62	0.476
15.*	How does crop diversification help in managing pest outbreaks?	60.12	0.16	0.557
16.*	What is the role of cover crops in soil conservation?	68.73	0.42	0.621
17.*	What is the benefit of leaving crop residues on the field after harvest?	63.33	0.55	0.638
18.	What is the role of check dams in soil water conservation?	43.33	0.2	0.06
19.*	How does Soil health management helps?	60.00	0.33	0.297
20.*	How does rainwater harvesting help in water conservation?	56.37	0.57	0.604
21.*	What is the purpose of constructing farm ponds in drought-prone areas?	58.22	0.56	0.404
22.	Which of the following practices helps in reducing evaporation losses from soil?	93.33	0.1	0.190
23.	How does planting trees help in water conservation?			
24.	Why is staggered planting recommended in drought-prone areas?	21.22	0.3	0.166
25.*	How does zero tillage contribute to water conservation?	70.12	0.67	0.463
26.*	What is the purpose of silage in livestock management?	51.00	0.29	0.433
27.*	What is the role of vaccination in livestock management?	70.00	0.68	0.617
28.	Which of the following is a climate-resilient practice for goat farming?	36.67	0.3	0.134
29.*	What is one of the key adaptation strategies against Climate-Responsive Design for goat farming recommended by NICRA?	49.61	0.43	0.478
30.*	What is the recommended minimum water depth for fish farming in ponds?	73.92	0.49	0.440

Reliability of the test

Split half method was used to compute the reliability of the test. The test administered to 30 respondents was divided into two halves based on odd and even numbered statements. Two sets of scores were derived on half forms of the test and the scores were correlated for the reliability of the half test.

The self-correlation of the whole test was then estimated by the Pearson correlation and Spearman Brown correlation formula.

Pearson Correlation Coefficient (r) :

The Pearson correlation measures the linear relationship between the two halves of the test (Odd and Even items). This correlation value is (0.75) the reliability of the half-test.

Spearman Brown correlation coefficient :

It measures the extent to which, as one variable consistently increases, the other variable also consistently increases (or decreases), even if the relationship between the two is not perfectly linear. The Spearman-Brown formula adjusts for this and provides the final full-test reliability coefficient.

In the present study the calculated value of reliability Co-efficient (0.85) for whole test found to be highly significant, hence it was concluded that test was reliable.

Validity of the test

Knowledge test designed on climate resilient technologies was examined to content and construct validity. The construct validity of the test items was examined by the approach of point biserial correlation (r pbis). The test's validity was demonstrated by the items with significant values at the 1% and 5% levels.

A sizable pool of test items was used independently to determine the content validity of the knowledge test. The entire spectrum of climate-resilient technology was represented by the test items. Therefore, it was believed that the results of this study's knowledge test measured what was meant to be measured.

Thus, the knowledge test created in the present study can measure the knowledge of the beneficiary and non-beneficiary farmers on climate resilient technologies and exhibited a greater degree of reliability and validity indicating that the test items were valid.

Administration of the test

Each item was read out to the respondents by the investigator and response was recorded with a score of one for correct answer and zero for wrong answer. The possible maximum and minimum possible score that an individual respondent would get were 30 and 0 respectively.

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

Sr. No.	Knowledge items
1	Which of the following is a key impact of climate change that directly affects agriculture in your region?
2	What is the primary goal of climate adaptation strategies for farmers?
3	Which type of crop is good for dry and hot conditions?
4	How access to weather forecasts helps farmers?
5	Why growing many types of crops is good?
6	How does using mulch and organic manure help?
7	What is the main advantage of ridge-and-furrow planting?
8	What is the benefit of using pest-resistant crop varieties?
9	Integrated Pest Management (IPM) focuses on?
10	How does crop diversification help in managing pest outbreaks?
11	What is the role of cover crops in soil- water conservation?
12	What is the benefit of leaving crop residues on the field after harvest?
13	How does rainwater harvesting help in water conservation?
14	How does Soil health management helps?
15	What is the purpose of constructing farm ponds in drought-prone areas?
16	What is the purpose of silage in livestock management?
17	How does zero tillage contribute to water conservation?
18	What is the role of vaccination in livestock management?
19	What is the recommended minimum water depth for fish farming in ponds?

CONCLUSION

In the present study, a knowledge test to assess knowledge about adaptation strategies was developed. The items of test was selected on the basis of difficulty and discrimination index scores. Additionally, the reliability of the test using the split-half method was calculated and reliability coefficient of the full test was worked out by using the Spearman-Brown formula. The instrument was assessed with high content validity. A total of 19 statements were finally retained. Overall, the test was highly reliable and valid. The findings of this study may be utilised to identify knowledge gaps.

Additionally, politicians, researchers, and extension agents can utilize the knowledge exam to assess the success of their programs and make well-informed decisions and can adopt target specific approaches and synergetic extension approaches which can empower women to enhance agricultural productivity and nutritional outcomes for their families. (Vinaya Kumar, H. M. et al.2022)

RECOMMENDATIONS

(1) Digital Extension: Develop Audio-Visual Apps available in local dialects. Companies should develop "Voice-First" interfaces that use basic audio icons to provide weather notifications and market prices to farmers who are illiterate or semiliterate.

(2) NGO Intervention: Serve as the "last-mile" link by establishing Farmer Producer Organizations (FPOs) or Self-Help Groups (SHGs) to jointly purchase pricey inputs, lowering the financial risk for each individual.

(3) Since the households lack the knowledge necessary to adjust to abrupt changes in the climate, policymakers must give them priority for "Social Safety Net" programs.

(4) Front-line demonstrations (FLDs) and skill-based training should be the main priorities of KVKs. Knowledge here is theoretical; it needs to be made practical through "seeing is believing" exercises.

CONFLICT OF INTEREST

The authors declare no conflict of interest

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