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Construction and Validation of Knowledge Test on Indigenous Technical Knowledge Practices

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HIGHLIGHTS

- A standardized knowledge test was designed to evaluate tribal farmers' understanding of Indigenous Technical Knowledge practices across agriculture, indigenous crops, tools, food processing, pest management, livestock healthcare, and folk traditions.
- Content validation by 60 experts retained 43 items from an initial pool of 66 items using Relevancy Weightage (RW), Mean Relevancy Score (MRS) and Overall Mean Relevancy Score (OMRS).
- Item analysis using difficulty index, discrimination index, and point-biserial correlation finalized 35 valid items. The developed test showed excellent internal consistency with Cronbach's alpha value of 0.93.

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ABSTRACT

Indigenous Technical Knowledge (ITK) is vital to tribal farming systems, supporting local resource use, biodiversity conservation, food security, ethnoveterinary care, indigenous food processing and climate adaptation. However, the absence of standardized instruments restricts assessment of ITK knowledge gaps and planning of need-based extension interventions. This study constructed and validated a knowledge test to assess tribal farmers' knowledge of ITK practices. The target population comprised tribal farmers possessing or practising ITK in agriculture and allied activities in the study area. Initially, 66 items were developed through literature review, expert consultation and field-level understanding of ITK domains. The item pool was content-validated by 60 experts. Relevancy Weightage (RW), Mean Relevancy Score (MRS) and Overall Mean Relevancy Score (OMRS) were computed using established procedures. Based on relevancy screening, 43 items were retained and administered to 60 non-sample farmers for pilot testing. Difficulty index, discrimination index and point-biserial correlation were calculated. Item statistics showed difficulty values (0.433–0.667) and discrimination values (0.333–0.567), confirming moderate difficulty and discrimination. Finally, 35 items were retained. Cronbach's alpha was 0.93, indicating excellent internal consistency. The test was valid, reliable and suitable for assessing ITK knowledge, diagnosing gaps, evaluating capacity-building programmes and supporting documentation, preservation and promotion of ITK.

INTRODUCTION

Indigenous Technical Knowledge (ITK) represents a cumulative body of locally evolved wisdom, skills and practices developed by farming communities through long-term interaction with their agro-ecological, social and cultural environments. In tribal societies, such knowledge is not merely a set of techniques; it is embedded in livelihood systems, resource-use behaviour, healthcare traditions, ritual practices, weather interpretation, communication networks and intergenerational learning. Studies on tribal communities have

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shown that indigenous knowledge continues to guide decision-making in agriculture, livestock management, natural resource conservation and household-level problem solving, particularly in areas where formal scientific advisory systems are either limited or less accessible (Lenka & Satpathy, 2020; Gavit et al., 2013).

The relevance of ITK has become more prominent in the context of sustainable agriculture, climate variability and conservation of biocultural heritage. Traditional weather prediction among tribal communities of Mizoram, for example, is based on bioindicators such as behaviour of insects, birds, animals, plants, clouds and winds, demonstrating the observational depth of local ecological knowledge (Chinlampianga, 2011). Similarly, indigenous knowledge has been reported to contribute to drought risk reduction and resilience among communal farmers, especially where resource-poor farming households depend on locally available coping strategies (Muyambo et al., 2017). In the Indian tribal context, ITK is closely linked with medicinal plants, sacred groves, rituals, food systems and community health practices (Roy et al., 2023; Roy et al., 2025). Ethnomedicinal studies among the Karbi tribe of Assam documented the use of sacred-grove plant species for treating different ailments, while recent work in Assam recorded rich traditional knowledge associated with medicinal plants and emphasized its documentation for future pharmacological and conservation research (Baidya et al., 2020; Kalita et al., 2024). Among the tribes of Malkangiri district, Odisha, plants and plant parts are used for rituals as well as medicinal purposes, reflecting the inseparable relationship between ecological resources and cultural belief systems (Bala et al., 2020).

Recent studies on the Bonda tribe further indicate that indigenous medicinal knowledge is transmitted through elders, Desaris and community-based networks and that preservation of such knowledge is essential for sustaining tribal identity, cultural continuity and health security (Kumari et al., 2024; Sahoo et al., 2024). However, the continuity of ITK is increasingly threatened by modernization, declining oral transmission, secrecy of knowledge holders, weakening apprenticeship systems and inadequate documentation. Traditional knowledge often remains tacit, orally transmitted and vulnerable to loss when knowledge holders pass away. At the same time, intellectual property concerns and risks of misappropriation demand ethically sensitive documentation and validation mechanisms. Indigenous cultural practices such as storytelling, music, dance and ritual communication also function as knowledge-transfer mechanisms, indicating that ITK must be understood within its cultural context rather than only as isolated technical information (Borunda & Murray, 2019; Nayak et al., 2011). Despite the growing documentation of indigenous practices, limited empirical attention has been paid to developing standardized tools for measuring farmers' knowledge of ITK practices. A valid and reliable knowledge test is therefore necessary to quantify the extent of knowledge, identify knowledge gaps, compare knowledge levels across respondent categories and support need-based extension interventions. Construction and validation of such a test will provide a scientific basis for assessing tribal farmers' knowledge while respecting the cultural, ecological and practical significance of Indigenous Technical Knowledge.

METHODLOGY

The study adopted an instrument-development research design to construct and validate a standardized knowledge test for measuring tribal farmers' knowledge of Indigenous Technical Knowledge (ITK) practices. The procedure involved item generation, expert validation, relevancy assessment, item analysis, validity testing and reliability estimation. The target population comprised tribal farmers possessing or practising ITK in agriculture and allied sectors in the study area. For content validation, 60 subject-matter specialists from Agricultural Extension, Agronomy, Entomology, Plant Pathology, Animal Science, Forestry, Tribal Studies and allied disciplines constituted the expert panel. For pilot testing and item analysis, 60 non-sample tribal farmers, comparable to the main population but excluded from the final sample, were selected. Thus, 120 response sheets were used: 60 expert sheets (50.00%) and 60 pilot schedules (50.00%) for content validation, field testing, item analysis and reliability estimation. Since classical test theory was followed and no predictive modelling was involved, no training–testing split was required; complete pilot data were used for validation. Initially, 66 items were prepared through review of research articles, extension publications, ethnobotanical studies, ITK documentation reports and secondary sources covering agriculture, indigenous crops, food processing, pest management, ethnoveterinary healthcare, natural resource management and folk traditions. Expert consultations ensured conceptual relevance, technical accuracy, cultural appropriateness and field suitability. Items were framed in multiple-choice and Yes/No formats and rated by 60 experts on a three-point continuum: Most Relevant (3), Relevant (2) and Not Relevant (1). Relevancy Weightage (RW), Mean Relevancy Score (MRS) and Overall Mean Relevancy Score (OMRS) were computed following established procedures (Vijayan et al., 2022; Vijayan et al., 2023; Singh et al., 2026). The formulae used were as follows:

$$RW = \frac{(MR \times 3) + (R \times 2) + (NR \times 1)}{MPS}$$

$$MRS = \frac{(MR \times 3) + (R \times 2) + (NR \times 1)}{N}$$

where MR, R and NR indicate experts' ratings; MPS is maximum possible score; and N is the number of experts. Items with RW $\geq$ 0.80 and acceptable MRS were retained; marginally lower but essential ITK items were revised as per expert suggestions. After screening, 43 items were administered to 60 non-sample tribal farmers. Correct answers were scored one and incorrect answers zero. Total scores were arranged in descending order and divided into six equal groups (G1–G6). For item analysis, only G1, G2, G5 and G6 were used, excluding the middle groups, following classical test theory and educational measurement principles (Ebel & Frisbie, 1991). The Difficulty Index (P) was calculated as:

$$P = \frac{\text{Number of respondents answering correctly}}{\text{Total number of respondents}} \times 100$$

Items with difficulty values between 30 and 70 per cent were retained. The Discrimination Index (E 1/3) was computed as:

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

Where, S_1, S_2, S_5 and S_6 represent the number of correct responses in respective groups. Items with discrimination values between 0.30 and 0.80 were selected. Internal validity was examined using the point-biserial correlation coefficient:

$$r_{pbis} = \frac{M_p - M_q}{SD}\sqrt{PQ}$$

where Mp = mean total score of respondents answering the item correctly; Mq = mean total score of respondents answering the item incorrectly; SD = standard deviation of total scores; P = proportion of correct responses; and Q = 1 - P. Items with positive and acceptable item-total association were prioritized, and items with poor discrimination, extreme difficulty or weak content relevance were deleted or revised. The internal consistency of the finalized knowledge test was assessed using Cronbach's alpha, a standard reliability coefficient for multi-item tests. The obtained alpha value was interpreted to determine whether the selected items measured the intended knowledge construct consistently.

RESULTS

Expert relevancy assessment

Out of 66 initially developed items, 43 items satisfied the prescribed relevancy criteria and were retained for item analysis. The retained items covered major domains of ITK, including general indigenous agricultural knowledge, indigenous crop varieties and food plants, traditional agricultural tools, food processing and preservation, cultivation practices, pest and disease management, livestock and poultry healthcare, agricultural festivals and folk traditions. The expert-screening process confirmed that the retained items were conceptually meaningful, technically sound and contextually relevant for assessing tribal farmers' knowledge of ITK practices.

Item analysis and final item selection

The 43 selected items were administered to 60 non-sample tribal farmers for item analysis. After applying difficulty, discrimination and item-total association criteria, 35 items were retained in the final knowledge test. The difficulty index values of the final items ranged from 0.433 to 0.667, showing that the items were of moderate difficulty and suitable for field-level knowledge assessment. The discrimination index values ranged from 0.333 to 0.567, indicating that the items could differentiate between respondents with higher and lower knowledge levels. The point-biserial correlation values were positive, and most of the retained items showed acceptable item-total association, confirming their contribution to the overall knowledge construct. Items with poor psychometric performance were either deleted or revised before finalization.

Validity analysis

Content validity was established through systematic item generation and expert judgment. The involvement of specialists from multiple disciplines ensured that the knowledge test represented the major conceptual and practical domains of ITK. Construct validity was strengthened through item analysis and point-biserial correlation. Since the retained items were positively associated with the total score and demonstrated acceptable discrimination, the final test was able to distinguish respondents with relatively higher and lower levels of ITK knowledge.

Reliability analysis

The final 35-item knowledge test showed a Cronbach's alpha value of 0.93. This value indicates excellent internal consistency and confirms that the items functioned cohesively to measure a single broad construct, namely knowledge of Indigenous Technical Knowledge practices. The reliability result supports the use of the test for empirical research, field diagnosis, training evaluation and extension planning.

DISCUSSION

The present study was undertaken to develop and validate a standardized knowledge test for measuring regarding Indigenous Technical Knowledge Practices. The findings demonstrate that the systematic procedure followed in the study, comprising item generation, expert validation, relevancy assessment, item analysis, validity testing, and reliability estimation, was effective in producing a scientifically robust and psychometrically sound instrument.

The reliability coefficient obtained in the present study was 0.93, indicating excellent internal consistency of the final knowledge test. This result is in agreement with the findings of Priyadarshini et al. (2021), who reported a comparable reliability coefficient of 0.904 in a similarly structured knowledge test. The high reliability value confirms that the items included in the final instrument were internally coherent and measured the intended construct with consistency. This finding also supports the methodological assumption that knowledge tests developed through systematic item selection, expert screening, and psychometric refinement are more likely to achieve high reliability.

The content validity of the instrument was strengthened through the involvement of experts from relevant disciplines. Their evaluation ensured that the test covered all important dimensions of Indigenous Technical Knowledge, including General Indigenous Agricultural Knowledge, Indigenous Crop Varieties and Food Plants, Traditional Agricultural Tools, Food Processing and Preservation, Cultivation Practices, Pest and Disease Management, Livestock and Poultry Healthcare, and Agricultural Festivals and Folk Traditions. Such multidisciplinary expert involvement enhanced the technical correctness, contextual relevance, and field applicability of the test.

The discrimination index values obtained in the study indicate that the selected items were capable of differentiating between respondents with high and low levels of knowledge. This finding is consistent with the observations of Kumar et al. (2016), Vijayan et al. (2022), and Vijayan et al. (2023), Singh et al., 2026, who emphasized the importance of discrimination power in the development of valid knowledge tests. Items with acceptable discrimination values improve the diagnostic capacity of a test by identifying meaningful differences in respondents' knowledge levels.

The point-biserial correlation values further confirmed the construct validity of the test. Since most retained items recorded rpbis values greater than 0.25, it may be inferred that these items were strongly associated with the total knowledge score and

Table 1. Relevancy, difficulty, discrimination and point-biserial correlation scores used for item selection and item analysis

S.No.	Items	RW	MRS	P	E 1/3	rpbis
1.	Indigenous Technical Knowledge mainly refers to: A. Imported farm technology B. Locally evolved knowledge and practices C. Only laboratory-based knowledge D. Only government schemes	0.96	2.88	0.600	0.400	0.239
2.	Does Indigenous Technical Knowledge contribute to sustainable agriculture? Yes / No	0.91	2.72	0.600	0.400	0.550
3.	Indigenous farming reduces dependence on external inputs mainly through the use of: A. Local resources B. Imported pesticides C. Hybrid seeds only D. Heavy machinery only	0.82	2.45	0.500	0.500	0.395
4.	Is traditional ecological knowledge relevant for farming systems? Yes / No	0.84	2.53	0.633	0.367	0.406
5.	Indigenous agricultural practices support biodiversity conservation by promoting: A. Crop diversity B. Monocropping only C. Excessive chemical use D. Complete removal of local crops	0.81	2.43	0.600	0.400	0.345
6.	Can indigenous practices help farmers cope with climate variability? Yes / No	0.85	2.55	0.600	0.400	0.581
7.	Knowledge of indigenous potato varieties is important because they are often: A. Locally adapted B. Always imported C. Unrelated to food security D. Used only for decoration	0.81	2.43	0.633	0.367	0.290
8.	Should awareness of traditional taro varieties be included in an ITK knowledge test? Yes / No	0.82	2.47	0.567	0.433	0.475
9.	Identification of traditional vegetable crops helps assess farmers' knowledge of: A. Local food plants B. Tractor repair C. Market taxation D. Chemical industries	0.84	2.52	0.633	0.367	0.514
10.	Indigenous vegetables and fruits are important mainly for: A. Dietary diversity and nutrition B. Increasing pesticide residue C. Eliminating local food habits D. Replacing all cereals	0.90	2.70	0.567	0.433	0.528
11.	Is knowledge of local crop varieties cultivated by tribal farmers relevant? Yes / No	0.81	2.43	0.500	0.500	0.387
12.	Traditional agricultural tools are important indicators of: A. Indigenous farming knowledge B. Urban lifestyle C. Factory production D. Banking literacy	0.81	2.43	0.567	0.433	0.611
13.	Does identification of traditional farm implements reflect tribal agricultural knowledge? Yes / No	0.85	2.55	0.567	0.433	0.551
14.	Indigenous farming tools are usually developed according to: A. Local soil, crop and labour conditions B. Foreign designs only C. Urban construction needs D. Industrial standards only	0.81	2.43	0.600	0.400	0.421
15.	Traditional rice beer preparation is an example of: A. Indigenous food processing B. Chemical pest control C. Mechanized irrigation D. Seed certification	0.81	2.43	0.633	0.367	0.256
16.	Should traditional methods of preparing Khari be included in the knowledge test? Yes / No	0.91	2.72	0.667	0.333	0.265
17.	Nakham is traditionally associated with preservation of: A. Fish B. Paddy seed C. Milk D. Fertilizer	0.84	2.52	0.533	0.467	0.464
18.	Are indigenous packaging materials used in food storage and transport? Yes / No	0.84	2.52	0.567	0.433	0.460
19.	Mulching in traditional cultivation is mainly useful for: A. Conserving soil moisture B. Increasing soil erosion C. Burning crop plants D. Reducing organic matter	0.87	2.62	0.567	0.433	0.370
20.	Does mixed cropping help in reducing production risk? Yes / No	0.82	2.47	0.600	0.400	0.543
21.	Traditional fertilizer practices commonly involve the use of: A. Farmyard manure and compost B. Plastic waste C. Industrial acids D. Synthetic dyes	0.82	2.47	0.600	0.400	0.257
22.	Smoke-based pest control is traditionally used to: A. Repel insects and pests B. Increase pest multiplication C. Improve seed colour D. Replace irrigation	0.83	2.50	0.533	0.467	0.165
23.	Is ash application used in some indigenous pest-management practices? Yes / No	0.90	2.70	0.533	0.467	0.382

Table 1. Relevancy, difficulty, discrimination and point-biserial correlation scores used for item selection and item analysis

S.No.	Items	RW	MRS	P	E 1/3	rpbis
24.	Biological pest management mainly involves the use of: A. Natural enemies or biological agents B. Only synthetic pesticides C. Plastic sheets D. Chemical dyes	0.87	2.62	0.567	0.433	0.671
25.	Can birds help in controlling harmful insects in paddy fields? Yes / No	0.88	2.65	0.567	0.433	0.242
26.	Indigenous disease-control practices are generally based on: A. Local materials and traditional experience B. Imported machinery only C. Computer models only D. Chemical fertilizer only	0.92	2.75	0.433	0.567	0.314
27.	Indigenous remedies for cattle diseases are mostly based on: A. Medicinal plants and local healing practices B. Imported feed only C. Artificial insemination only D. Mechanized ploughing	0.89	2.68	0.600	0.400	0.550
28.	Should traditional remedies for goat diseases be assessed in an ITK knowledge test? Yes / No	0.86	2.57	0.500	0.500	0.395
29.	Ethnoveterinary practices for pig disease management generally include: A. Local medicinal plants and traditional treatment B. Chemical fertilizers C. Harvesting methods D. Soil mapping	0.87	2.60	0.633	0.367	0.406
30.	Should poultry disease prevention methods be included in the ITK knowledge test? Yes / No	0.85	2.55	0.600	0.400	0.345
31.	Medicinal plants are used in traditional animal healthcare mainly for: A. Treating or preventing livestock ailments B. Preparing synthetic fertilizer C. Increasing pesticide residue D. Replacing drinking water	0.91	2.73	0.600	0.400	0.581
32.	Do cultural practices linked with farming reflect indigenous agricultural knowledge? Yes / No	0.84	2.52	0.633	0.367	0.290
33.	Rituals related to crop protection are generally associated with: A. Traditional belief and crop safeguarding B. Soil pollution C. Tractor maintenance D. Seed certification	0.92	2.75	0.567	0.433	0.475
34.	Are seasonal agricultural festivals relevant indicators of indigenous agricultural knowledge? Yes / No	0.87	2.60	0.633	0.367	0.514
35.	Can traditional dances preserve agricultural heritage knowledge? Yes / No	0.82	2.47	0.500	0.500	0.387

contributed substantially to the measurement of knowledge regarding Indigenous Technical Knowledge Practices. Items with low or negative associations were removed, thereby improving the precision and internal validity of the final instrument.

The reduction of the item pool from 66 initially generated items to 35 final items highlights the importance of rigorous item filtration in knowledge-test construction. Such refinement eliminates redundancy, ambiguity, weak discrimination, and irrelevant content while retaining only those items that satisfy both conceptual and statistical standards. A shorter but well-validated test is also more practical for field administration, particularly among farming communities, where lengthy instruments may cause respondent fatigue and reduce data quality.

Overall, the study successfully developed a standardized, valid, and reliable knowledge test for assessing the knowledge regarding Indigenous Technical Knowledge Practices. The final instrument can be used by researchers, extension personnel, training institutions, development agencies, and policymakers to diagnose knowledge gaps, evaluate training effectiveness, design need-based extension programmes, and strengthen knowledge regarding Indigenous Technical Knowledge Practices literacy.

CONCLUSION

The study successfully constructed and validated a standardized knowledge test for measuring tribal farmers' knowledge of Indigenous Technical Knowledge practices. The instrument was developed through a systematic process involving item generation, expert validation, relevancy assessment, item analysis, validity testing and reliability estimation. From an initial pool of 66 items, 43 items were retained after expert screening and 35 items were finalized after item analysis. The retained items showed acceptable difficulty and discrimination values, and the final test recorded excellent internal consistency with a Cronbach's alpha value of 0.93. The developed test is therefore suitable for assessing ITK knowledge among tribal farmers and can be used for identifying knowledge gaps, evaluating training effectiveness and designing need-based extension interventions.

DECLARATIONS

Ethics approval and informed consent: The study was conducted following appropriate ethical considerations. Prior informed consent was obtained from all respondents and their respective organisations before data collection. The respondents were clearly informed about the purpose of the study, and their participation was entirely voluntary. Confidentiality of the information provided by the respondents was duly maintained.

Conflict of interest: The authors declare that the research was conducted in the absence of any commercial, financial, or personal relationships that could be construed as a potential conflict of interest. The authors have thoroughly reviewed, revised, and edited the manuscript and take full responsibility for the final content of this publication.

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