Construction of Knowledge Test to Measure the Knowledge Level of Farming Families Regarding Environmental Pollution in Punjab, India

ABSTRACT

Today the negative impact of man's activity on our environment is globally highlighted. An increase in knowledge can go a long way in minimizing the causes of environmental pollution. The present study is aimed to develop a knowledge test to measure the knowledge level of farming families regarding environmental pollution. The knowledge about environmental pollution was studied in terms of causes, effects, and mitigation strategies. Test construction involved the systematic generation of pilot test items based on the literature studied. Initially, 36 items were finalized which 27 per cent of the top group were constituted a high group and 27 per cent of the bottom group a low group from Ludhiana district, Punjab, India. Scores of '0' and '1' were given to incorrect and correct answers respectively. Based on responses recorded, pilot items were further calculated for item difficulty index and discriminating power. Accordingly, items were finalized for the knowledge test. The developed knowledge test was tested for reliability and validity which came out to be 86 per cent reliable and 92 per cent valid which showed that the knowledge test was reliable and quite valid. The developed knowledge test can be used to measure the knowledge level of farming families regarding environmental pollution.

Keywords: Knowledge test, Environmental pollution, Farming families, Item analysis

INTRODUCTION

Our planet has been witnessing the most profound changes in the brief history of the human species. These changes are manifested in terms of environmental degradation, loss of biodiversity, climate change, etc (Kumari *et al*., 2020). Humans are responsible for causing all-around damage to the atmosphere, water, land, and the various elements of the environment and to the ecosystem itself (Appannagari, 2017). Today the negative impacts of man's activity on our environment globally can be highlighted (Kalita *et al*., 2017). These activities contribute to the release of waste materials like crop burning, industrial effluents, smoke, dust, solid waste, and so on. This is due to explorations, inventions, and modern technology which have to do with the use of materials that are now threatening the earth and demands urgent attention (Gulumuser *et al*., 2010).

Knowledge is often defined as a belief that is true and justified (Babu *et al*., 2021). It is reasonable to think of a true belief as one that is in accord with how objects, people, processes, and events exist and behave in the real world (Hunt, 2003). Knowledge tests play an important role in environmental pollution. It is a mechanism to measure farmers' knowledge and abilities and provides a snapshot of farmers' performance (Kaur & Tanwar, 2020). Therefore, it can be said that a knowledge test implies the overall mastery of a pupil in a particular context (Sharma and Poonam, 2017).

A researcher has to design knowledge tests, and ability tests to measure different aspects (Collins *et al*, 2004). While writing items, one needs to take care of certain considerations such as the items should be phrased in a manner with no ambiguity regarding their meaning, and contain discriminating power. Item writer should write

twice the number of items to be retained. For 30 items, one should write 60 items (Hussain S, 2020). These questions may be short answer type or long answer type and objective items are more like fill in the blanks, two alternate forms, yes-no, true/false, right/wrong, matching, and multiple choice type (Painter, 2004).

Sullivan and Dunton (2016) conducted a study on "Development and validation of the stroke knowledge test". This study used a systematic test construction process to investigate the psychometric properties of this test and for this 50 undergraduate students from the Queensland University of Technology participated. Results indicated that the final version of the test included 20 items with good content coverage, acceptable item properties, and positive expert review ratings. Findings provide preliminary support for the SKT as a valid and reliable tool for assessing stroke knowledge.

Barnard *et al* (2009) explored the farmers' knowledge and perceptions of health-risk reduction in wastewater-irrigated agriculture. Findings revealed that farmers were not aware of the type of risks they were facing or do not rank the risk high due to a lack of tools and knowledge. Thus, the knowledge test can help in exploring the knowledge level of the farming community regarding environmental pollution, which may contribute to reducing environmental pollution. The details of the construction and standardization of this knowledge test are given below.

MATERIAL AND METHODS

Item Collection

The content of the knowledge test is composed of different types of questions called items and scores were assigned to them. For constructing a knowledge test, a comprehensive list of items about environmental pollution was prepared by consulting the relevant literature. The questions were designed to test the knowledge level of farming families regarding environmental pollution.

Initial Selection of Items

The selection of items was done based on the following criteria:

- It should differentiate the well-informed farming families from the poorly informed ones and should have certain difficulty value.
- It should aware and increase farming families' knowledge rather than rote memorization.

Keeping in mind all these criteria, 36 items were initially selected encompassing the major areas of environmental pollution relevant to farming families such as causes, effects, and mitigating strategies. A schedule was prepared with these 36 items for administering them to the farming families for item analysis and screening out non-relevant and weak items. Correct replies for the items were ascertained in consultation with a specialist and expert.

Preliminary Administration of Test

A knowledge test was developed to assess the knowledge level of respondents regarding environmental pollution. The data was collected through personal interviews. Scores of '0' and '1' were given to incorrect and correct answers respectively. The total scores of each respondent were further categorized into low, medium, and high knowledge levels.

As suggested by Singh (2006), 27 per cent of the top group was constituted as a high group and 27 per cent of the bottom group a low group. The difficulty index (D.I.) and Discrimination power index (D.P.I.) for each pilot

test item were calculated. Thus, the test item has low D.I. (Difficulty index) and D.P.I. (Discrimination power index) values were deleted and the rest of the test items were retained with few modifications based on the responses of respondents. Initially, 36 items were finalized.

Item Analysis:

Analyzing the items is a major and essential step in developing valid and reliable tests (Kumar *et al*, 2021). The difficulty and discrimination indices of the items are calculated in item analysis (Anupama *et al*, 2019). The index of item difficulty revealed how difficult an item was whereas the index of discrimination indicated the extent to which an item discriminates against well-informed individuals from poorly informed ones.

Item Difficulty Index (D.I.)

Based on the responses of pilot testing data, the item difficulty index was calculated. The item difficulty index was expressed in terms of the percentage of respondents who got the item right. The item difficulty index was calculated by the following formula:

$$\text{Difficulty index (D.I.)} = R/T \times 100$$

Where, R = Number of respondents who got the item right.

T = Total number of respondents.

Discriminating Power Index (D.P.I.)

It shows the ability of an item to differentiate the well-informed respondents from the poorly informed ones (Lopamudra *et al*, 2016). The discriminating power index was worked out as under:

$$\text{D.P.I.} = \frac{R_U - R_L}{1/2\ T}$$

Where, $\mathbf{R_U}$ = Right response from the upper group, $\mathbf{R_L}$ = Right response from the lower group and **T** = the total number of respondents.

RESULT AND DISCUSSION

Selection of Items for the Test

In the present study, all the items tested had difficulty index values between 21.43 and 78.60 which were within the recommended limit. The statements with difficulty index values 21 to 80 were retained for inclusion in the final test and others were discarded. Whereas discrimination power index items had values between 0.42 and 0.85, except for one item with a value of 0.14. All the items with an index of discrimination value above 0.4 were included in the final knowledge test.

Table 1. Difficulty index (D.I.) and Discrimination power index (D.P.I.) of pilot-test items

S.No.	Items	Difficulty Index (Percent)	Discrimination Index

1)	**a) Fill in the blanks** _____ This means particular natural surroundings in which you live or exist. (environment, society) **Ans:** environment	21.43	0.14
2)	Pulses crops do _____fixation in fields which improves the quality of the soil. (Oxygen fixation, Nitrogen fixation) **Ans:** Nitrogen fixation	57.14	0.57
3)	During rice crop cultivation _____harmful gas releases affect the environment. (Methane, Oxygen) **Ans:** Methane	50.00	0.43
4)	Air pollution causes _____in temperature causing global warming. (Increase, decrease) **Ans:** Increase	50.00	0.43
5)	_____ Pollution is responsible for the yellowing/ deterioration of infrastructure buildings. (Air pollution, Soil pollution) **Ans:** Air pollution	71.43	0.57
6)	_____ of crops is the major cause of air pollution.(Stubble burning, Harvesting) **Ans:** Stubble burning	71.43	0.57
7)	Harvesting by SMS followed by _____ is an alternative to stubble burning.(Happy seeder, Composting techniques) **Ans:** Happy seeder	50.00	0.42
8)	_____ gas releases from nitrogenous fertilizers. (Nitrogen, Hydrogen) **Ans:** Nitrogen	57.14	0.43
9)	Use of _____can improves the quality of the soil. (Chemicals, Vermicompost) **Ans:** Vermicompost	71.43	0.57
b)	**TRUE/FALSE**		
10)	Deforestation can affect air quality. **Ans:** True	64.30	0.71
11)	Migration is the one cause of environmental pollution **Ans:** True	78.60	0.42
12)	Vehicular smoke does not contribute to air pollution. **Ans:** False	42.85	0.85
13)	Overuse of NPK fertilizer reduces the quality of the soil. **Ans:** True	64.30	0.42
14)	Open defecation does not cause soil pollution. **Ans:** False	64.30	0.42
15)	Livestock waste causes water pollution **Ans:** True	50.00	0.43
16)	The use of plastic can cause water pollution. **Ans:** True	64.30	0.42
17)	The use of detergent for washing clothes does not affect the water quality. **Ans:** False	78.60	0.43
18)	Polluted water bodies do not affect vegetation surrounding these. **Ans:** False	50.00	0.71
19)	Preparing compost from dry leaves/ garbage and using them for plants protects against environmental pollution. **Ans:** True	64.30	0.42

c)	**Multiple choice questions**		
20)	**Air pollution effects:**		
	(a)Loss of soil organic matter (b) Create flood-like situation (c) Increase water hycinth (d) Increase in temprature **Ans:** D	64.30	0.42
21)	**Soil pollution effects:**		
	(a) Occurrence of smog (b) Quality of agro produce (c) Quantity of agro produce (d) Both (b) and (c) **Ans:** D	71.43	0.71
22)	**Example of pollutants:**		
	(a) Oxygen (b)Water (c) Mithene (d) Hydrogen **Ans:** C	64.30	0.42
23)	**PAU develop an alternative technique to stop the burning of crops:**		
	(a)Tractor (b) Thrasher (c) Happy seeder (d) None of these **Ans:** C	64.30	0.42
d)	**Match the following**		
(1)	**Match the type of pollution:**		
24)	Environment pollution - Changes in air, water, and soil quality	64.30	0.42
25)	Air pollution - increase in smog during winters.	50.00	0.43
26)	Water pollution - Throwing of industrial waste in the river	71.43	0.71
27)	Soil pollution - Excessive use of fertilizer and insecticides.	64.30	0.42
(2)	**Match the effects of environmental pollution on human health:**		
28)	Air pollution - Respiratory diseases/asthma.	78.60	0.42
29)	Water pollution - Stomach infection.	42.85	0.57
30)	Soil pollution - Hepatitis.	50.00	1.00
(3)	**Match the cause of pollution:**		
31)	Air pollution - Stubble burning of crops.	50.00	0.71
32)	Water pollution - Industrial waste.	64.30	0.42
33)	Soil pollution - Excess use of chemicals.	50.00	1.00
(4)	**Match the mitigation strategies to control different types of pollution:**		
34)	Air pollution - Use of smokeless chullah	57.14	0.57
35)	Water pollution - Proper waste management	57.14	0.57

36)	Soil pollution	-	Use of FYM (farm yard manure)	64.30	0.42

Item difficulty index and item discrimination index of all the items were calculated and 36 items that fulfilled both criteria were selected for the final format of the knowledge test (Table 1).

Scoring Method

The Summation of scores for correct replies over all the items of particular respondents indicated his or her level of knowledge about the environmental pollution mentioned above. The range of scores was, therefore, from 0 to 36.

Reliability

It is referred to the consistency of measurement i.e. how consistent the scores are from one measurement to another (Rajan *et al.*, 2020). All 36 items on environmental pollution types, causes, effects, and mitigation were selected. The data was collected through personal interviews. The coefficient of correlation was worked out for the two sets of test by using the Spearman-Brown Prophecy formula as given below:

$$\text{Reliability on full test } (r_{SB}) = \frac{\text{two times correlation between half test}}{\text{one plus correlation between half test}}$$

$$\text{i.e. } \frac{2\,rt}{1+rt}$$

The reliability of the test was 0.86 which showed that the knowledge test was reliable.

Validity of Knowledge Test

The knowledge items in the preliminary test concerning knowledge regarding environmental pollution were collected from farming families. The empirical type of validity which Guilford (1954) called intrinsic validity was determined by taking the square root of the calculated reliability coefficient. The content validity of the knowledge test was ensured by discussing it thoroughly with the members of the advisory committee.

$$\text{Validity} = \sqrt{r}SB$$

The validity of the test was found to be 0.92. It showed that the Knowledge test was quite valid.

CONCLUSION

Knowledge test provides a more comprehensive measure of a person's knowledge, detects and identifies topics in which people are misinformed, and measures the retaining ability of learned material. The application of this test to assess the knowledge level of farmers regarding environmental pollution will give an idea of the existing knowledge level of farming families. The 35 items reliable and valid knowledge test for assessing farmers' knowledge regarding environmental pollution with appropriate item analysis was developed in the study. The reliability of the test was 0.86 and the validity of the test was found to be 0.92. It showed that the Knowledge test was quite reliable and valid for measurement of the level of knowledge of farming families regarding environmental pollution.

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