

Development and Standardisation of Inquiry Skills Test



Education

KEYWORDS :

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ABSTRACT

The present study is entitled as 'Development and Standardisation of Inquiry Skills Test'. The study aimed to develop and standardise a tool, in order to measure the inquiry skills of higher secondary school students. The tool consists of two dimensions namely interpreting and processing information and thinking Skills. Further, three skills each are taken under each heading. In its final form, the tool consists of 88 multiple choice items and it was administered to a total of 100 higher secondary students in three different schools of Palghat District. The administration time was set at 75 minutes. The reliability of the instrument was also established and found to be high (0.74). The procedures followed in this study will be useful for measuring Inquiry skills such as observation skill, tabulation skill, interpretation skill, research skill, comprehension skill and generalization skill.

Introduction

The process of inquiry starts from the time of our birth. Infants begin to make sense of the world by inquiring. The process of inquiry begins with gathering information and data through applying the human senses -- seeing, hearing, touching, tasting, and smelling. Inquiry is thus, nothing new to the mankind. Inquiry is the set of behaviors involved in the struggle of human beings for reasonable explanations of phenomena about which they are curious. (Novak, 1964).

Therefore, the investigator intended to take up the challenge of developing and validating a tool to measure inquiry skills of students.

Why inquiry skills gains importance?

There is an undeniably deep relationship between inquiry skills and its impact on student outcomes in learning. Inquiry learning is deeply rooted in the belief that human beings are natural inquirers and that inquiry is at the heart of all learning. Children should be made to think and understand things in a different way. Opportunities should be provided to puzzle through problems, to see multiple ways of finding solutions, to gather and weigh evidence, and to apply and test scientific ideas. Nemar(1980), in a study, reported that students taught by inquiry mode of instruction improved their science process skills, critical thinking, scientific attitude, achievement and laboratory skills than students taught by the traditional approach. Gibson and Chase (1994) in their study found that students maintained a more positive attitude towards science and a higher interest in science careers. Nuangchalerm and Thomasine (2009) found that students when trained in inquiry skills improved their analytical thinking ability. Tai and Sadler (2009) found that inquiry type learning activities has a positive influence on academic attainment of different disciplinary data sets (biology, chemistry, and physics). Another study by Black and Hugh (1982) reported an increase in the critical thinking skills of high school students.

The inquiry skills properly identified, trained and nurtured in an individual will prove beneficial as many of the core higher order skills such as critical thinking skills, creativity, reasoning, analytical thinking skills etc.affects the higher learning of students. The students of the higher secondary age group (15-17years) will be able to independently experiment, to question, and to search for answers themselves. During this period, they are as inquisitive as scientists. A tool to assess the inquiry skills of higher secondary students in this regard seems significant.

Purpose of the study

The purpose of this study was to develop, validate and establish the reliability of an instrument to measure students' inquiry skills in an inquiry-oriented setting.

Sample of the study

The sample for the present study consists of higher secondary school students of Palghat district. The sample was drawn from the Government and aided higher secondary schools that fol-

low the Kerala syllabus. The draft version of the tool consisted of 120 eleventh standard students belonging to the science batch and the final form the sample consisted of 100 students of Standard XI.

Development of Inquiry Skills Test

The instrument developed for this study, was based upon the scholarly work of Fraser's Test of Inquiry Skills (1979). The Inquiry Skills Test (IST) is a group test designed to measure the inquiry skills of higher secondary school students. The tool consists of two dimensions- (i) Interpreting and Processing Information and (ii) Thinking Skills. The dimensions for Interpreting and Processing Information include Observation skill, Tabulation skill and Interpretation skill. The dimensions included under Thinking Skills are Research skill, Generalisation skill and Comprehension skill.

The following steps were included for the standardisation of inquiry skills test.

Construction and standardisation of inquiry skills test

Planning the Test

The investigator plans to test the inquiry skills of higher secondary school students. The development of inquiry skills is very essential for the development of scientific temper and attitude among students to continuously ask questions arising from their natural curiosity. All the above mentioned skills are vital to students' development in their process of learning. For these reasons, such a test serves the purpose of the investigation.

Preparation of preliminary test

For the rough draft of the IST, the investigator prepared eighty eight multiple choice items. The whole test was prepared under two dimensions viz. (i) Interpreting and Processing Information and (ii) Thinking Skills. Sub-dimensions included under interpreting and processing information are observation skill, tabulation skill, and interpretation skill. Research skill, generalisation skill, and comprehension skill are the dimensions included under thinking skills.

Pilot testing

The draft version of the instrument was pilot tested with a group of 120 students of standard XI in order to identify the questions that students might have difficulty in understanding with respect to the language used. Another purpose of the pilot testing was to specify an appropriate time length for test administration. Enough time was given to the students so as to enable them to complete the test. The average time used was noted to fix the time limit for the final test. For making scoring easy, the investigator prepared a scoring key for the test. The scoring key of the test was one mark for each correct answer and zero score for every incorrect answer.

After pilot testing it was noticed that

- (a) The students needed a more detailed instruction at the beginning of administration

- (b) Certain questions needed more clarity in terms of language used
- (c) Some questions were above the level of students.
- (d) The test in the draft form was too lengthy for the students to complete in a reasonable time.

Therefore the questions that were identified as too difficult to comprehend were corrected before the final draft.

Administration of preliminary test and item analysis

The draft version of the instrument was pilot tested with a group of 120 students of standard XI. Necessary instructions were given prior to the administration of the test. Separate response sheets were given to students to mark their response.

Item Analysis is the process of establishing the suitability of an item for inclusion in the final test. The quality of each item was ascertained by analysing two important characteristics of the item, namely (i) Difficulty Index and (ii) Discriminating Power. For the present study the procedures and formula suggested by Ebel and Frisbie (1991, pp. 225-233) were used to calculate the Difficulty Index and Discriminating Power.

$$\text{Index of item difficulty} = \frac{U + L}{2N}$$

$$\text{Index of Discriminating Power} = \frac{U - L}{2N}$$

Where U= Number of right responses in the upper group.

L = Number of right responses in the lower group.

N = Number of subjects in any of the group.

Selection of Items for the final test

Items for the final test were selected on the basis of Difficulty Index and Discriminating Power of items. After preliminary test, to get sufficient number of questions, the investigator took the items with difficulty index ranging from 0.30 to 0.75 and discriminating power greater than or equal to 0.25. Out of the 88 items included in the tryout, 64 items were selected for the final test. The final test was printed with all necessary instructions. Separate score sheets were also printed for answering the test. The details regarding the difficulty index and discriminating power of each item, is given in Table1.

Table 1
Difficulty Index and Discriminating Power of Test Items of Inquiry Skills Test

Sl.No	Difficulty Index	Discriminating Power
1.	0.46	0.52
2.	0.68	0.51
3.	0.41	0.60
4.	0.67	0.74
5.	0.58	0.88
6.	0.63	0.41
7.	0.41	0.56
8.	0.71	0.49
9.	0.55	0.68
10.*	0.84	0.09
11.	0.63	0.82
12.	0.71	0.42
13.	0.39	0.36
14.	0.66	0.54
15.	0.62	0.78
16.	0.56	0.52
17.	0.41	0.63
18.*	0.25	0.51
19.	0.63	0.47
20.	0.62	0.68

21.	0.64	0.33
22.	0.73	0.49
23.	0.52	0.65
24.	0.42	0.40
25.	0.50	0.52
26.	0.53	0.48
27.	0.65	0.71
28.	0.68	0.55
29.	0.61	0.42
30.*	0.95	0.64
31.	0.68	0.37
32.	0.40	0.33
33.	0.43	0.61
34.*	0.21	0.07
35.	0.66	0.73
36.	0.57	0.44
37.*	0.42	0.11
38.	0.32	0.34
39.	0.49	0.52
40.	0.59	0.73
41.*	0.29	0.25
42.	0.71	0.65
43.	0.49	0.58
44.	0.43	0.53
45.	0.64	0.47
46.*	0.92	0.18
47.	0.68	0.47
48.	0.42	0.64
49.	0.38	0.45
50.*	0.81	0.20
51.	0.44	0.48
52.	0.72	0.35
53.	0.70	0.46
54.	0.64	0.61
55.	0.67	0.66
56.*	0.93	0.19
57.	0.45	0.58
58.*	0.24	0.28
59.	0.58	0.76
60.	0.64	0.81
61.	0.72	0.35
62.*	0.85	0.36
63.	0.53	0.34
64.	0.71	0.48
65.*	0.47	0.19
66.	0.56	0.78
67.	0.73	0.52
68.*	0.30	0.07
69.	0.57	0.36
70.	0.63	0.58
71.*	0.83	0.31
72.*	0.88	0.27
73.*	0.91	0.06
74.	0.39	0.72
75.	0.48	0.68
76.*	0.78	0.35
77.	0.51	0.55

78.*	0.81	0.09
79.	0.49	0.82
80.	0.69	0.71
81.	0.73	0.47
82.*	0.95	0.09
83.*	0.77	0.23
84.*	0.43	0.21
85.	0.68	0.42
86.*	0.83	0.34
87.*	0.76	0.28
88.*	0.43	0.04

After tryout with smaller sample, the exact time limit for the final test was fixed at 75 minutes.

Validity and reliability of the Inquiry Skills Test

For the inquiry skills test, the face validity was ensured by submitting the test to a panel of experts who certified it after scrutinizing the items of the test. The criterion related validity was ensured as the IST adopted the same dimensions of the standardised Inquiry test developed by Fraser (1979).

Reliability of the test was estimated using test-retest method. The interval given was four weeks. Pearson’s Product Moment

formula was used for finding correlation coefficient between the two test scores. The reliability of the test was found to be 0.74 which shows that the test is highly reliable for the purpose.

Objectivity and practicability of the Inquiry Skills Test

The objectivity is a pre-requisite of reliability. The objectivity was ensured by including objective type test items of the multiple choice form. The application of scoring key for evaluation also ensured objectivity. Steps were taken to ensure the practicability of the test. The test was easy to administer as it was in the booklet form. The duration of the test, type of items included, provisions for separate answer sheets and scoring key ensured the practicability of the test.

Conclusion

An inquiry skill does not depend on a single variable. Multiple components of inquiry such as observation skill, tabulation skill, interpretation skill, research skill, comprehension skill and generalization skill can be assessed with the help of inquiry skills test developed by the investigator. The tool was carefully planned, designed and standardized following the norms of item analysis and the final tool consists of 64 items. The test developed in this research study would be useful for assessing students’ inquiry skills that are most essential for higher education.

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