Chapter: 7

Summery Findings and Recommendations

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7.1 Introduction:

Aptitudes are given the specific importance instead of intelligence to give the proper educational & since last some years. For the measurement of Aptitude various types of aptitude measurement tests have been constructed and standardized. In order to give guidance to student in foreign countries, these tests are used extensively.

Even in India and Gujarat also, aptitude measurement tests have been constructed and standardized.

Considering mechanical aptitude as a component of intelligence, the questions assessing the reasoning ability are put in various Intelligence tests, but in order to be successful in some occupations, Reasoning ability plays an important role instead of intelligence e.g. in order to be engineer, successful pleader, Scientist, reasoning ability is most essential with the scientific knowledge. In various types of Reasoning ability, the mathematical Reasoning ability, Special Reasoning ability, verbal Reasoning Ability, Nonverbal Reasoning Ability etc can be included.

In order to be successful in each work in practice, in some specific fields, in Educational Achievement and in some occupations also mechanical aptitude is most important.

Keeping in view the work of the construction and standardization of the various types of Aptitude measurement tests in Gujarat state, according to the need of the present period, in the field of psychological measurement in Gujarat state, the present study has been undertaken by an humble objective of constructing & standardizing mechanical aptitude test.
The subject of the present research is “Constructions and standardization of the mechanical aptitude test for the students of secondary schools of Gujarat state”. The main objective of the present study was to construct & standardize mechanical aptitude test for the students studying in Gujarat medium of Std. IX and Std X. Moreover in secondary objective, to establish the norms by finding the mechanical aptitude and to assess reliability and validity of the test.

7.2 **Summary of the Research:**

- **Statement of the Problem:**
  
The problem selected for the present study has been as follows:
  
  “Construction and standardization of Mechanical Aptitude test for the students of Secondary school of Gujarat state.”

- **Objectives of the research:**

  Why does the research undertake the research in relation to any subject? The answers obtained of this question are all the objectives and those are the foundation stone of the research. There is no meaning of any work or research without objectives, because the researcher gets the direction of one’s own research work by the, objectives. The process without the objectives is being misleading. In short to decide the objectives of the research is very important for the researcher. After deciding the undertaken. The following are the objectives of the present research:

  1. To construct the items of Mechanical Aptitude test.
  2. To undertake item analysis of Mechanical Aptitude test.
  3. To assess the Reliability of Mechanical Aptitude test.
  4. To assess the validity of Mechanical Aptitude test.
5. To establish the norms of Mechanical Aptitude test.
6. To assess the effect of Sex on the mean scores of Mechanical Aptitude test.
7. To assess the effect of std. on the mean scores of Mechanical Aptitude test.
8. To assess the effect of Area on the mean scores of Mechanical Aptitude test.

- **Variables of Research:**
  Variables are most important in deciding the framework of research study or study activity. To undertake the scientific study without the knowledge of variable, measurement of variable and control of research for understanding clearly any research is very necessary:

  (1) Dependent variable: Scores of Mechanical Aptitude test
  
  (2) Independent Variable: Independent Variable

  Independent Variable:

  - Sex
    - Boys
    - Girls
  - Std
    - 9
    - 10
  - Area
    - Urban
    - Rural

- **Hypotheses of the Research:**
  The following are the Null hypotheses of the present research.

  Ho₁ There will not be the significant difference between mean scores of MAT of all the Boys and Girls taken in the sample.

  Ho₂ There will not be the significant difference between mean scores of MAT of the student of urban and rural area.

  Ho₃ There will not be the significant difference between the mean scores of MAT of the students of Std.-9 and Std.-10.
Ho₄ There will not be significant difference between mean scores of MAT of boys and girls of Std.-9.

Ho₅ There will be significant difference between the mean scores of MAT of boys and girls of std.-10.

Ho₆ There will be significant difference between the mean scores of MAT of boys and girls of urban area.

Ho₇ There will be significant difference between the mean scores of MAT of boys and girls of rural area.

Ho₈ There will be significant difference between the mean scores of MAT of boys and girls of std.-9 of urban area.

Ho₉ There will be significant difference between the mean scores of MAT of boys and girls of std.-9 of rural area.

Ho₁₀ There will be significant difference between the mean scores of MAT of boys and girls of std.-10 of urban area.

Ho₁₁ There will be significant difference between the mean scores of MAT of boys and girls of std.-10 of rural area.

• **Importance of the study:**

  Some special abilities are there in the children. Their abilities can be developed with the help of education or training. Aptitude is the hidden ability in the individuals as a seed of specific types. When the effort is done to develop it by giving the training, it can be developed e.g. a child can sing well if his competency is developed by training then one good singer can be prepared but if the same child may be put in the other vocation, then his singing ability will not be developed. As aptitude is in latent form as a seed it can be well estimate by proper test. Aptitude tests provide such valid estimation so they are important.
By knowing the aptitude of a person some field, his success of that field in future can be forecasted with the help of this type of tests one can conclude the individuals field. They are very improving the development of the career of education. If the efforts undertaken to develop the mechanical aptitudes of students by education from the beginning then by justifying the right abilities of the students, one can know that how much development has taken place in the knowledge of science of mechanical aptitude among the students by the teacher. And as a part of it the remedial program can be arranged. Mechanical aptitude of the student becomes useful in the higher study, vocational fields and in the development of daily life skills.

Thus it is necessary to know mechanical aptitude of a student in order to take proper decision about the future and to give proper guidance about it. Therefore, the present study has been thought out Limitations of the research.

- **Some limitations about the present Research are as follows:**
The students of English, Hindi, Urdu Medium schools except those of Gujarati medium secondary schools have not been included.

The students of Tribal area are not included in this study

- **Population of the Research:**
  In the present research, for the contraction & standardization of the Mechanical Aptitude test, the secondary schools of Gujarat state have been included, so the students of secondary schools of each & every district of Gujarat state becomes the population of the present study.

- **Selection of Sample:**
  In the present study, the students of secondary schools of the entitle Gujarat state is the population. Hence for the selection of the sample the state of Gujarat is divided in 4 zones, out of which total 25 schools have been selected randomly of Urban as well as Rural areas. The selection of one class of Std IX and X each has been selected by cluster method. Thus a sample of total 2000 students has been selected by stratified Random sampling method and cluster method and it is mentioned in the following table.

**Sample for the Final Tryout**

<table>
<thead>
<tr>
<th>Std</th>
<th>IX</th>
<th>X</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
<td>Boys</td>
</tr>
<tr>
<td>Urban area</td>
<td>312</td>
<td>276</td>
<td>248</td>
</tr>
<tr>
<td>Rural area</td>
<td>266</td>
<td>244</td>
<td>227</td>
</tr>
<tr>
<td>Total</td>
<td>578</td>
<td>520</td>
<td>475</td>
</tr>
</tbody>
</table>

- **Method of Research:**

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In the present research as the detailed data is to be collected from the great no. of the community and the norms of the test is to be established, here the Normative survey Method has been used.

- **Tool of Research:**
  - **Pre-pilot Testing:**
    
    The research has constructed the items earlier researches, fields of knowledge, and varieties of experimental tests. Moreover the discussion has been undertaken with the experts in the field and secondary school teachers that respond might have how much attention about mechanical aptitude and which type of items have been constructed by the other test constructions. The construction of the present test is not based on the fixed curriculum keeping in view the necessary components in context to the subject in this situation; the various types of test items have been planned.

    It is necessary to have the complete knowledge about the use of the test, along with the mental process for the test construction. Along with the responses of the respondents in context to its measuring ability, while taking the important decisions, after obtaining the opinions of experts the test has been constructed for the construction of the test, the researcher has kept in view the guidance of experts and content commitment, for doing the methodical work, adopted the path of the observation of the more marks and from the beginning keeping in mind the various components total 80 verbal and nonverbal items were prepared.

    After thinking about the necessary instructions about the test and the form of the test, it has been also planned the administration. Moreover by getting the opinions of experts and by
modifying out of 80 items, 20 items were can called so that each component may be justified. Thus out of 80 items, 60 items were selected which were kept in pilot testing.

➢ **Pilot tryout of the test:**

Sample for pilot tryout of test was taken, keeping in view sex, area and the type of the institution and for it 250 subjects were selected, in which 134 were boys and 116 were girls and they were the students of granted as well as self-financed schools. At the end of the pilot testing with help of the obtained responses, the items were reviewed practical and in order to assess the effectiveness of the distracters the distracter analysis had been undertaken and the suggestions were obtained from the experts and on the basis of which necessary changes were made.

➢ **Item analysis or Content analysis:**

Before assessing the answer states those which were defective were cancelled form total 250 and 223 answers hats were considered for these answer sheets the punch card key was prepared with the help of this key while assessing the answer sheets, one mark was assigned to each correct answer. By adding the marks of the correct answers of all the items the total marks were noted down at the top of the answer sheet. Then all the answer sheets were arranged in order to the descending order. Thus out of such arranged answer sheets, by mentioning upper 27% as an upper group and the lower 27% as a lower group, 60 answer sheets were in upper group and 60 answer sheets in the lower group. The middle one 103 answer sheet were concluded in item analysis. The selected distractions in cache item by the students of
upper group and lower group were noted down. Out of this note, it was found out that in each item how many, student teachers have correct answer in the upper as well as lower group. Out of which the Facility value and discriminating value of each item were calculated. On the basis of these two values 40 items were selected in the final form.

➤ **Preparation of the final test:**

At the end of Item analysis, par item the range of facility value is 0.60 to 0.75 and that of Discriminating value is 0.28 to 0.45 and on that basis also 40 items were included.

- **Data Collection:**

For data collection along with the preparation the planning is necessary. For this, the researcher divided the whole Gujarat state in 4 Zones, In each zone, 6 schools were selected randomly. By thinking about the area of the school and Std. of the students, the permission was taken in advance of the schools by visiting the principals personally. Then according to the time given, by going in various classes and establishing rapport & understanding with the students the proper instructions were given to them. Thus the answer-sheets of the final Mechanical Aptitude Test were filled up by the students. Thus from total 2000 students the data was collected.

- **Data analysis:**

By assessing the answer sheets of the test, the frequency distributions were prepared out of the obtained scores by each subject in sample taken in the study. Out of the statements of each field, the frequency distribution had been prepared sidewise and
sek-wise. From these frequency distributions, Mean, S.D., S.E., Median, Mode, Q, D., skewness, kurtosis PR and r were calculated and the norms were established.

For finding out Reliability of the test, Test-Retest Method, Split-half method and kuder Richardson Method were used and for finding the validity of the test, coefficient of correlation and congruent correlation technique were used.

7.3 Interpretation in contact to Hypotheses while interpreting after assessing the hypotheses, the following results were obtained:

<table>
<thead>
<tr>
<th>No.</th>
<th>Hypothesis</th>
<th>t-value</th>
<th>Level</th>
<th>Accepted/Not accepted</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ho$_1$ There will not be the significant difference between mean scores of MAT of all the Boys and Girls taken in the sample.</td>
<td>3.97</td>
<td>0.01</td>
<td>Not accepted</td>
</tr>
<tr>
<td>2</td>
<td>Ho$_2$ There will not be the significant difference between mean scores of MAT of the student of urban and rural area.</td>
<td>2.34</td>
<td>0.05</td>
<td>Not accepted</td>
</tr>
<tr>
<td>3</td>
<td>Ho$_3$ There will not be the significant difference between the mean scores of MAT of the students of Std.-9 and Std.-10.</td>
<td>3.02</td>
<td>0.01</td>
<td>Not accepted</td>
</tr>
<tr>
<td>4</td>
<td>Ho$_4$ There will not be significant difference between mean scores of MAT of boys and girls of Std.-9.</td>
<td>2.51</td>
<td>0.05</td>
<td>Not accepted</td>
</tr>
<tr>
<td></td>
<td>Ho</td>
<td>Statement</td>
<td>Z-score</td>
<td>P-value</td>
</tr>
<tr>
<td>---</td>
<td>-----</td>
<td>--------------------------------------------------------------------------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>5</td>
<td>Ho₅</td>
<td>There will be significant difference between the mean scores of MAT of boys and girls of std.-10.</td>
<td>3.91</td>
<td>0.01</td>
</tr>
<tr>
<td>6</td>
<td>Ho₆</td>
<td>There will be significant difference between the mean scores of MAT of boys and girls of urban area.</td>
<td>3.28</td>
<td>0.01</td>
</tr>
<tr>
<td>7</td>
<td>Ho₇</td>
<td>There will be significant difference between the mean scores of MAT of boys and girls of rural area.</td>
<td>2.30</td>
<td>0.05</td>
</tr>
<tr>
<td>8</td>
<td>Ho₈</td>
<td>There will be significant difference between the mean scores of MAT of boys and girls of std.-9 of urban area.</td>
<td>2.37</td>
<td>0.05</td>
</tr>
<tr>
<td>9</td>
<td>Ho₉</td>
<td>There will be significant difference between the mean scores of MAT of boys and girls of std.-9 of rural area.</td>
<td>1.13</td>
<td>0.05</td>
</tr>
<tr>
<td>10</td>
<td>Ho₁₀</td>
<td>There will be significant difference between the mean scores of MAT of boys and girls of std.-10 of urban area.</td>
<td>2.31</td>
<td>0.05</td>
</tr>
<tr>
<td>11</td>
<td>Ho₁₁</td>
<td>There will be significant difference between the mean scores of MAT of boys and girls of std.-10 of rural area.</td>
<td>2.19</td>
<td>0.05</td>
</tr>
</tbody>
</table>

### 7.4 Findings of Research:

Main findings of the present research are as follows:

- These are significant difference between the mean scores of MAT of Boys and Girls taken in the sample. Here mean of Boys is more than
that of girls i.e. the boys are superior than girls in contest to MAT. Hence it can be said that there is the sex difference between the boys & girls.

- There is significant difference between the mean scores of MAT of students of urban and rural areas. Here mean of students of urban area is more than that of these of the rural area, i.e. the students of urban area are superior than the students of Rural area in context in MAT. Hence there is area difference between the students of urban area and those of Rural area.

- There is significant difference between mean scores of MAT of the students of Std. IX and Std. X. Here the mean of the students of Std X is more than that of those of Std. IX i.e. the students of Std. X are superior to those of Std. IX in context to MAT. Hence there is Std difference between the students of Std IX and those of Std. X.

- There is significant difference between mean scores of MAT of the boys and girls of Std. IX. Here the mean of the boys is more than that of girls of Std. IX i.e. the boys of Std IX are superior than boys of Std. IX are superior than the girls of Std. IX in context of MAT. Hence there is sex difference between the boys and girls of Std. IX.

- There is significant difference between mean scores of MAT of the boys and girls of Std.-X. Here the mean of the boys is more than that of girls of Std.-X i.e. the boys of Std.-X are superior than the girls of Std.-X in Context to MAT. Hence there is sex difference between the boys & girls of Std.-X.

- There is significant difference between mean sectors of MAT boys and girls of urban area. Here the mean of the boys of Urban area is
more than that of the girls of Urban area i.e. the boys of Urban area are superior to the girls of Urban area in context to MAT. Hence if can be said that there is sex difference between the boys of Urban area and girls of Urban area.

- There is significant difference between mean scores of MAT of boys and girls of rural area. Here the mean of the boys of rural area is more than that of girls of rural area i.e. the boys of rural area are superior than the girls of rural area in context to MAT. Hence it can be said that there is sex difference between the boys of rural area and girls of rural area.

- There is significant difference between mean scores of MAT of boys and girls of Std. IX of Urban area. Here the mean of boys of Std. IX of Urban area is more than that of the girls of Std. IX of Urban area i.e. boys of Std. IX of Urban area are superior to girls of Std. IX of Urban area in context to MAT. So it can be said that there is sex difference between the boys and girls of Std. IX of Urban area.

- There is significant difference between mean scores of MAT of boys and girls of Std. IX of Rural area. i.e. the boys of Std. IX of Rural area are equals to the girls of Std. IX of Rural area in context to MAT. Hence if can be said that there is no sex difference between the boys and girls of Std. IX of Rural area.

- There is significant difference between mean scores of MAT of boys and girls of Std. X of Urban area i.e. the boys of Std. X of Urban area are superior to girls of Std. X of Urban area in context of MAT. Hence it can be said that there is sex difference between the boys and girls of Std X of Urban area.

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• There is significant difference between mean source of MAT of boys and girls of Std. X of Rural area i.e. the boys Std. X of Rural area are superior to girls of Std. X of Rural area in context to MAT. Hence it can be said that there is sex difference between the boys and girls of Std. X of Rural area.

• In Test-Retest method after a week the reliability value is 0.78 and after fifteen days if is 0.71 and after a month It Is 0.64. In Rational equivalence according to KR 20. It is 0.80 where as by KR 21 it is 0.87, whereas by split half method it is 0.69. Thus all are high and significant at 0.01 level so the MAT is reliable.

• The validity of MAT of the students of Std IX with the marks of science subject of second examination of the subject of second examination of the students is 0.71 and validity of the test of the students of Std X is 0.69, validity value with Desai verbal nonverbal Group Intelligence test is 0.64. Hence it can be said that MAT is valid.

7.5 *Recommend actions: About future Researches:*

During the research work the researcher get many new thoughts from one’s own experiences & difficulties but due of the time limit all the ideas cannot be undertaken in application & one has no enough time for it also so for further new researches these thoughts become like the lamplight. For the future researcher some recommendations are suggested as follows:

(1) To make effort from the primary level of the students for the development of mechanical aptitude.

(2) To plan the necessary activities by the science teacher so that since the primary level of the students their mechanical aptitude may develop.
(3) According to various districts of Gujarat state the norms can be established.
(4) For the students of Rural area the norms can be established.
(5) For the students of Tribal area the norms can be established.
(6) For the students of the Higher Secondary schools the norms can be established.
(7) Separate norms can be established for the various branches of science such as Physics, Biology, Chemistry and Botany.
(8) For the other students of secondary schools the norms can be established.
(9) A comparative study can be undertaken of Intelligence and aptitude.
(10) In other language such as English, Hindi and Other the Mechanical Aptitude test can be adopted and it can be standardized by taking the sample from out of the state.
(11) A Comparative study can be undertaken between the aptitude of other subject & Mechanical Aptitude.
(12) At primary level the study of Mechanical Aptitude can be Undertaken.

7.6 Educational Implications:

Educational Implications obtained from the present research are as follows:

(1) The present Mechanical Aptitude test will be the useful tools for measuring Mechanical Aptitude of Students studying in std IX and X.
(2) It will be useful for the teachers to give necessary guidance to the students by measuring Mechanical Aptitude.
(3) Parents will be able to take decision about the study of their children in future by knowing their Mechanical Aptitude.
(4) This test will be useful for Educational Counseling and vocational guidance.
(5) This test will be an important tool for future educational and higher study of the students.
(6) It will be helpful to study the relation between aptitude and Intelligence.
(7) It will be important in Education to compare the aptitude with Intelligence Aptitude and creativity along with the progress of the student.

7.7 **Conclusion:**

In Present period, when there is the increase in the development of science and Technology it is necessary to give guidance to the students by knowing their mechanical aptitude, and keeping in view their interest and attitude. The efforts can be done by knowing the aptitude of the student by Mechanical Aptitude test and one can contribute necessary in the national property by developing the future the student.