CHAPTER I
INTRODUCTION

Educational and vocational guidance is one of the important requisites for man-power-development of any country. Guidance activity is considered to be productive in the sense that it contributes to the development of human resources in terms of productivity, economic balance and mental health. (Rao, p. 48)

The progress of guidance activity in its turn, depends on the availability of reliable, valid and usable psychometric tools, in the hands of guidance workers, at all levels. Concluding a review on Indian researches in guidance, Mohsin has emphasised the importance of evolving suitable tools and techniques for group guidance in Indian setting. (Adaval (Ed.), p. 166)

The utility of psychometric tools in selection and classification of personnel for industry, civil service and education was confidently suggested by the war-time performances of the psychologists in the West. (Thorndike, R.L., 1, p.1)

Since the establishment of State offices of Vocational Guidance at Bombay in 1950 and at Ahmedabad in 1957, the movement has taken roots in this part of the country, but a lot of spade-work still awaits the attention of research workers, properly oriented for tools and techniques of counselling.
Need for ability tests

For the healthy educational and vocational development of students, information regarding occupational avenues and academic records are necessary, but that data is not sufficient for making appraisals and decisions. Even the index of general intelligence is considered to be too global to make precise differential appraisals. Hence, patterns of students' specific abilities and interests are necessary data for scientific counselling, selection and placement.

In a developing country like India, where jobs seem to be fewer than available hands, assessment of abilities get priority over assessment of interests, at least for the while.

The need to develop scientific tools for appraising abilities, at the secondary school stage is felt more acutely because of the following developments during the last two decades.

Cumulative record cards. - Since 1953 the cumulative record cards are introduced in all the secondary schools of Gujarat, as a part of the Old Bombay State. It requires the secondary school teachers to assess and enter students' attributes such as general scholastic ability, special abilities, interests, preferences etc., along with the academic achievements and health progress from standard eight to eleven. This has induced the development of some original tests of general intelligence for group administration to the
high school students in Gujarat. The area of special ability measurement is left almost untouched.

**Selection without guidance.** - The recruitment procedures due to Apprentice Act and involvement of Employment Exchange Agencies for public sector have put the cart before the horse. There are confidential tests for selection but none exists for guidance of the applicants to Industrial Training Institutes, before they leave school or college for any reason. Even the technical information regarding the reliability and validity of such tests in use, is not published adequately. (Long, p. 269)

**Expansion of education.** - According to the Reference Annual Gujarat 1968, per capita expenditure on Education and Science departments was Rs. 10.99, which formed 18.27 per cent of the State expenditure. It is estimated to be 27.69 crores of Rupees. (Govt. of Gujarat, 3, p.199) In the said year 7205 post-high school technical students were on the roll as against 3126 on the roll of trade courses and technical high schools.

For want of proper tests, admissions to science colleges and engineering colleges are decided on the results of the Secondary School Certificate Examination, conducted by the Gujarat S.S.C.E. Board. The Evaluation Reports on Junior Technical Schools and Polytechnics indicate the need for more scientific procedures and tools of guidance, selection and classification of the technical course applicants. (Govt. of Gujarat, 1 and 4)
Indian Education Commission (1964-66) laid emphasis on production of literature and tools of guidance along with researches into problems of guidance in Indian situation. (Govt. of India, 2, pp. 240, 306)

In Gujarat, a student can opt seven subjects from 117 different subjects for standard eleven. (Govt. of Gujarat, 3, p. 208) A conspicuous waste is inevitable in absence of scientific planning by institutions and students themselves. In this context, diagnostic and prognostic tools are the need of the day. (Govt. of Gujarat, 1 and 4)

Present work

The appraisal of specific abilities such as numerical, verbal and mechanical forms the core of guidance testing programme at the secondary school stage. Hence, original construction and standardization of the present Numerical Ability Test, along with two other tests, being developed by fellow authors, each on one’s own, would fulfill the long-felt need of guidance workers in the Gujarat State.

Nature of the test. - The present test is designed to appraise the ability of high school students in Gujarat, to deal with numerical concepts in different ways. The test booklet contains three practice problems and fifty items for the test proper. There are ten items each for numerical facility, number series, numerical concepts-lower, numerical concepts - higher and numerical problems stated verbally. The items are multiple-choice-type with the fifth response as
'none of these'. They are cast in five-spiral omnibus format, with a separate answer-sheet, containing instructions to examinees.

It takes fifteen minutes for instructions and forty minutes for the test proper. The test can be administered conveniently to a group of fifty students by any teacher, with some orientation and practice in giving tests.

Construction of the test. - The usual procedures of test construction were followed with the following additional steps for precision.

1. The test items were first coined and tried out in the free-response form. The distractors were drawn from the actual incorrect responses of a representative sample of pupils. This provided three or four popular distractors for each item for the second pilot test form.

2. The fifth alternative response was put as "E: none of these", which was to be specifically written by the testee. This reduced chances for guessing at an important stage of getting data for item-analysis.

3. This second pilot, meant for item-analysis, was printed in two parts with sixty items in each. This reduced chances for copying.

4. The difficulty values and discrimination values were calculated, after applying Horst's formula, in case of
all the items. Thus the most popular distractors were taken into account.

(5) The indices of difficulty and discrimination were calculated by using the Psychometric Research and Service Chart published by Mānasāyan, New Delhi.

(6) The items for the third pilot were selected on the basis of proper range of indices at all the grade levels considered separately, cumulatively and generally.

(7) The items for the final run were not selected from the items put at the rear end of the second pilot test form. Those items were put there to keep the early finishers busy and allow sufficient time for the slow workers on the former items.

(8) The selected items, ten in each aspect, were arranged, in the spiral omnibus format, to leave scope for further scrutiny of test performance, by enlightened counsellors.

(9) The test items were weighted equally on the basis of data from 300 tenth standard boys. The weights were estimated by using an abac suggested by J. P. Guilford.

(10) The answer-sheets were also tried and revised to suit the test format and test taking situations in this part of the country.
Scope of the present work. - The test was administered to 3743 boys and 3249 girls of common secondary schools in the Gujarat State. It was also administered to 338 admitted trainees of Industrial Training Institute and 376 Diploma in Engineering students in two polytechnics.

Percentile grade norms are computed for boys and girls opting Elementary Mathematics as well as for those opting Algebra-Geometry at their respective grade levels. Percentile norms for each score point 1 to 50 are computed for technical groups also, eventhough the (technical) samples are small and incidental. Stanines are given only for high school students.

Limitations of the present work. - The numerical ability is considered to be largely a learnt ability. Hence the test is speeded to some extent at the ninth standard and further at the eighth standard levels.

Secondly, the validity of a tool of guidance requires a long range and comprehensive programme of study, which was hardly possible in the present work. Differential prediction of the three developing tools was studied on a sample of 86 students only. The study should be replicated on different samples for ensuring the consistancy and generalizability of these tests separately and in combination, when the tests are adjudged acceptable.
Thirdly, the problem of sampling was found to be tough beyond standard nine. The classes are formed on the basis of option in Mathematics. Officially, there are uniform courses upto tenth standard, but the students are segregated in different classes just after ninth standard in many a places. Hence the inclusion of any class in the samples of tenth and eleventh standards is largely purposive rather than random. It is true that the students opting mathematics form the target population for the purpose of the test, but their proportion and ability level is progressively changed from ninth standard onwards. Hence application of statistical formulae based on probability sampling are hardly justifiable for some purposes on some of the sub-samples.

In spite of these practical limitations, the test is found to be reasonably reliable and valid, in absence of any better substitute.