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PROBLEM GENERATING ABILITY OF PROSPECTIVE MATHEMATICS TEACHERS

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Abstract: *The present paper focuses on the problem generating ability of prospective mathematics teachers. The tool used is a single item test, termed as Problem Generating Ability Tool (PGAT). Nearly 12% of the sample prospective mathematics teachers come under high problem generating ability. Gender and academic qualifications of the prospective mathematics teachers do not differ significantly in the problem generating ability. With respect to social status of the prospective mathematics teachers, only Backward Communities group differed significantly from the Scheduled Castes and Scheduled Tribes groups. Open Category social status group did not make a significant difference with the other two groups.*

Key words: *problema, Problem generating ability, problem generating ability tool.*

1. INTRODUCTION

In every walk of life, we come across problems. These are to be solved to lead a happy and peaceful life. For this everyone has to develop problem solving ability. From this point the value of mathematics is of great importance in training pupils to think and solve problems. We make pupils solve problems in the classroom with a view to make them solve the problems life offers. The term 'problem' is derived from the Greek word 'problema'.

Every mathematics teacher trains his/her pupils to solve problems given in the prescribed text books. With the rich experience the authors give sums and problems in exercises, arranging them following the principle from easy to difficult. If more number of problems is given in each exercise, then the textbook will become bulky. This has its effects on the size and price of the book. In the state of Andhra Pradesh, the textbooks at the elementary and secondary level are nationalized and are supplied free in all government run schools including aided and local body schools.. Rise in the cost of mathematics textbook in the above case causes heavy expenditure on the part of the government. In such a case the field functionary, i.e., the classroom teacher has to prepare / create / generate /formulate problems for his classroom purpose. This calls for resourcefulness on the part of the mathematics teacher. But as we know that individual differences exist in every aspect, we should not expect that each and every mathematics teacher should possess such resourcefulness at the same level. Some individuals acquire the ability with training. Practicing teachers with the help of experience and generate variety of problems not only to make the leaning interesting but also to help their students to become successful problems in later life. This is the case with the working teachers. However an assessment of problem generating ability of the pre-service teachers, that is, prospective teachers helps teacher educators, trainers and others in the field of education to reorganize the training progammes in such a way that they are ultimately suitable to the teachers to prepare them successful problem generators in heir their day to day teaching and learning activities. With this background, the investigators planned to assess the problem generating ability of prospective mathematics teachers.

In an earlier study the present authors studied the problem creating ability of prospective teachers. This present paper focuses exclusively on the problem generating ability of prospective Mathematics teachers only.

The operational definition of the term 'problem generating ability' is as follows.

a) Ability to generate sums from a given mathematical stem and
b) Adding some more data to the given mathematical stem so that more number of problems can be generated.

2. OBJECTIVE OF THE STUDY

The objectives of the present investigation are as follows.

1. To study the problem generating ability of prospective teachers.
2. To study the influence of the following variables on the problem generating ability of prospective teachers.
   a. Gender b. academic qualifications c. social status.

3. HYPOTHESES OF THE STUDY

Basing on these objectives of the study, the following hypotheses have been formulated.

1. The prospective teachers differ in their levels of problem generating ability.
2. The following variables make a significant difference in the problem generating ability of prospective teachers.
   a. Gender b. academic qualifications c. social status.

4. SAMPLE

Three Colleges of Education situated in Krishna District of Andhra Pradesh are selected for this project. They are A.J. College of Education, Machilipatnam; S.P.M.H. College of Education, Machilipatnam and A.N.R. College of Education, Gudivada. Prospective teachers who have opted mathematics methodology as one of their methodology subjects constituted the sample for this study. The investigators took the permission of the concerned heads of these institutions for administering the tool to the prospective teachers who are present on the day of administration.

5. INSTRUMENTATION

The investigators prepared a single item test for this project. Because prospective teachers have to generate sums as well as problems from the given mathematical stem by adding some more data to the stem. Menstruation is one of the most important content areas of mathematics at the high school stage. That is why the investigators selected menstruation for this project. In two dimensional figures, square is the first and foremost figure to be introduced. Basing on this fact, the investigators framed the following stem as the statement:**The side of a square is 60 units.** This tool is a single test item one. **This tool is termed as Problem Generating Ability Tool (PGAT).**

6. ADMINISTRATION OF THE PGA TOOL

The investigators approached the concerned heads of the said three Colleges of Education for administration of the single test item tool on the dates they have accepted for administration. The mathematics prospective teachers who are present on that particular day constituted the sample. Before the administration of the tool, they are explained about the importance of this project and how they have to generate sums or problems from the given mathematical stem.

The doubts of the prospective teachers are clarified and the administration of the tool is done in a mathematical atmosphere. They are requested to furnish the following information regarding them: name, name of the College of Education in which they are undergoing training, gender, social status on their response sheets. If necessary they can use some more sheets for this purpose. All the response sheets were collected from the prospective teachers. The size of the sample from each College of Education is presented in Table No.1.

Table No.1 *Description of the sample – College wise*

Sl.No.	Name of the College of Education	Male	Female	Total
1.	A. J. College of Education, Machilipatnam.	21	19	40
2.	S.P.M.H. College of Education, Machilipatnam.	--	65	65
3.	A.N.R. College of Education, Gudivada.	24	15	39

The description of the sample, variable wise, is presented in Table No.2.

Table No.2 *Description of the sample – Variable Wise*

Sl. No.	Variable	Description	Size	Total
1.	Gender	Male	45	
		Female	99	144
2.	Academic Qualification	Graduate	132	
		Post graduate	12	144
3.	Social status	Open Category	52	
		Backward Classes	65	
		S.C. and S.T.	27	144

7. SCORING

The response sheets were scored by following the principle given below.

Every mathematically tenable sum/problem is awarded one score, after its solution. No score is awarded to a sum/problem which is not mathematically tenable. In this way, each prospective mathematics teacher's responses are quantified. An observation of the 144 response sheets led to listing of the following 25 categories of sums/problems generated by them. The categories along with the number of respondents and the rank assigned to each category are presented in Table No.3.

Table No.3 *Problem Generating Ability - Categories - Ranks*

Sl. No.	Name of the Category	No. of respondents	Rank allotted
1.	Find the area of square	134	1
2.	Find the perimeter of square	133	2
3.	Find the length of diagonal of square	48	3
4.	Square - Rectangle	30	4
5.	Cost of fencing the square	24	5
6.	Square – Triangles (Internal)	24	5
7.	Square- Sum of the opposite sides	23	6
8.	Square - Square	16	7
9.	Square - Circle	12	8
10.	Construction of square	11	9
11.	Square - Paths	10	10
12.	Square - Cube	07	11
13.	Square – Triangles (External)	06	12
14.	Square - Cylinder	05	13
15.	Square - Rhombus	04	14
16.	Sector	04	14
17.	Square - Sphere	03	15
18.	Square - Cuboid	03	15
19.	Distance covered for running (perimeter)	03	15
20.	Cost of cleaning/leveling the square	02	16
21.	Sum of the diagonals of square	02	16
22.	Square - Cone	02	16
23.	Square internal	02	16
24.	Square - Trapezium	01	17
25.	Area of 4 walls of a room	01	17

8. TESTING OF HYPOTHESES

The formulated two major hypotheses are tested by applying appropriate statistical techniques.

H1: The prospective teachers differ in their levels of problem generating ability.

To test this hypothesis the following procedure is followed. Mean and standard deviation of the scores obtained on the problem generating ability tool (PGAT) of the total sample of 144 prospective teachers are calculated.

The values are Mean = 4.44 and Standard deviation = 2.85.

One standard deviation is subtracted from the mean (4.44 – 2.85 = 1.59). The number of respondents, whose scores are less than this value of 1.59, is counted and converted into percentage.

One standard deviation is added to the mean (4.44 + 2.85 = 7.29). The number of respondents, whose scores are greater than this value of 7.29, is counted and converted into percentage.

The number of respondents whose scores lie between the values of M - 1 S.D. and M + 1 S.D. are counted and converted in to percentage.

These values are presented in Table No.4 along with their verbal description.

Table No.4 *Distribution of Sample – Group Wise – Verbal Description*

Score Value	N	%	Verbal description
Below 1.59	06	4.17	Low Problem Generating Group
In between 1.59 and 7. 29	121	84.02	Moderate Problem Generating Group
Greater than 7.29	17	11.81	High Problem Generating Group

From Table No.4 it can be inferred that around 4% of the total sample comes under low problem generating ability group. Around 12% of the group falls under high problem generating ability group and 84% of the group comes under the moderate problem generating ability group. This is shows that the sample prospective mathematics teachers differ in their problem generating ability.

H2: The following variables make a significant difference in the problem generating ability of prospective teachers.

a. Gender b. Academic qualifications c. Social status.

To test this major hypothesis, the following sub-hypotheses have been formulated and tested one by one.

SH1: Gender of the prospective teachers makes a significant difference in their problem generating ability.

SH2: Academic qualifications of the prospective teachers make a significant difference in their problem generating ability.

SH3: Social status of the prospective teachers makes a significant difference in their problem generating ability.

Testing of sub-hypotheses of hypothesis 2.

SH1: Gender of the prospective teachers makes a significant difference in their problem generating ability.

SH0: Gender of the prospective teachers makes no significant difference in their problem generating ability.

To test this sub-hypothesis the following procedure is followed. Mean and standard deviation of the scores obtained on the problem generating ability tool (PGAT) of the two sub-groups of gender (male and female) of the total sample of 144 prospective teachers are calculated. From this the difference between the two means and the standard error between the two means are calculated. From these values Critical Ratio, as suggested by Garrett, is calculated and the data is presented in Table No. 5

Table No.5 *Gender – Mean, Standad Deviation and Critical Ratio*

Variable	M	S.D.	N	D	SED	C.R.
Male	**4.60**	**3.15**	**45**	**0.23**	**o.55**	**0.42***
Female	**4.37**	**2.72**	**99**			

*Not significant at 0.05 level

From Table No.5 it is observed that the obtained C.R. value (0.42) is less than 1.96. Hence it is not significant at 0.05 level and the null hypothesis is retained. So it can be inferred that the gender of the prospective mathematics teachers does not make a significant difference in their problem generating ability. The mean difference is in favor of male, but it is not statistically

significant. The mean of the male group prospective teachers is just 0.16 points greater than the overall mean of 4.44 and that of their counterparts is just 0.07 point less than the overall mean.

SH2: Academic qualifications of the prospective teachers make a significant difference in their problem generating ability.

SH0: Academic qualifications of the prospective teachers make no significant difference in their problem generating ability.

To test this sub-hypothesis, the following procedure is followed. Mean and standard deviation of the scores obtained on the problem generating ability tool (PGAT) of the two sub-groups of academic qualifications (graduate and post-graduate) of the total sample of 144 prospective teachers are calculated. From this, the difference between the two means and the standard error between the two means are calculated. From these values Critical Ratio, as suggested by Garrett, is calculated and the data is presented in Table No. 6.

Table No.6 *Academic Qualifications – Means, Standard Deviations – Critical Ratio*

Variable	M	S.D.	N	D	SED	C.R.
Graduate	4.51	2.92	135	0.76	0.63	1.21*
Post-graduate	3.75	1.96	12			

*Not significant at 0.05 level.

From Table No.6 it is observed that the obtained C.R. value (1.21) is less than 1.96. Hence it is not significant at 0.05 level and the null hypothesis is retained. So it can be inferred that the academic qualifications of the prospective mathematics teachers does not make a significant difference in their problem generating ability. The mean difference is in favor of graduates, but it is not statistically significant. The mean of the graduates' group prospective teachers is just 0.07 points greater than the overall mean of 4.44 and that of their counterparts is just 0.69 points less than the overall mean.

SH3: Social status of the prospective teachers makes a significant difference in their problem generating ability.

SH0: Social status of the prospective teachers makes no significant difference in their problem generating ability.

To test this sub-hypothesis, the following procedure is followed. Mean and standard deviation of the scores obtained on the problem generating ability tool (PGAT) of the three sub-groups of social status (O.C., B.C., and S.C. and S.T) of the total sample of 144 prospective teachers are calculated. From this, the differences between each two means and the standard error between those two means are calculated. From these values Critical Ratio, as suggested by Garrett, is calculated and the data is presented in Table No.7.

Table No.7 Social Status Groups – Means, Srtandard Deviations – Critical Ratios

Variable	M	S.D.	N	D	SED	C.R.
O.C.	4.39	2.64	52			
B.C.	4.83	3.20	65	0.44	0.54	0.82*
O.C.	4.39	2.64	52	0.76	0.56	1.36*
S.C. and S.T.	3.63	2.19	27			
B.C.	4.83	3.20	65	1.20	0.58	2.07**
S.C. and S.T.	3.63	2.19	27			

*Not significant at 0.05 level ** Significant at 0.05 level.

From Table No.7, it is observed that the obtained C.R. values (0.82 and 1.36) in respect of O.C. social status are less than 1.96. Hence they are not significant at 0.05 level and the null hypotheses are retained. So it can be inferred that the O.C. social status group prospective mathematics teachers does not differ significantly in their problem generating ability when compared to the other two sub-groups. The mean difference is in favor of B.C. social sub-group when compared with O.C. social sub-group, but it is not statistically significant. The C.R. value (2.07) is greater than 1.96. Hence it is significant at 0.05 level. Therefore the null hypothesis in respect of the two social status sub-groups B.C., and S.C. and S.T., is rejected. It can be inferred that the problem generating ability of B.C. social status sub-group is significantly different from those of S.C. and

S.T. social status sub-groups. The mean of the B.C. social status sub-group prospective teachers is 1.20 points greater than the comparable group. It is just 0.39 points greater than the overall mean of 4.44.

9. FINDINGS

1. Four percent of the sample prospective mathematics teachers fall under low problem generating ability group. Nearly 12% of the sample comes under high problem generating ability group and the rest 84% comes under moderate problem generating ability group.

2. Gender of the prospective mathematics teachers does not make a significant difference in their problem generating ability.

3. Academic qualifications of the prospective mathematics teachers do not make a significant difference in their problem generating ability.

4. Open Category (O.C.) social status prospective mathematics teachers did not differ significantly from the other two sub-groups in their problem generating ability, whereas Backward Communities (B.C.) social status sub-group prospective mathematics teachers differed significantly from the S.C. and S.T. social status sub-group.

10. EDUCATIONAL IMPLICATIONS

This study reassures that mathematics teachers possess adequate problem generating ability and hence they can nurture the trait among their wards.

As prospective mathematics teachers possess problem generating ability, this fact is to be kept in view while designing course and course material in Mathematics education.

The teacher training programs also must keep in view the finding of this study so that suitable assignments and practical activities can be incorporated in the training schedules.

A discussion on the problem generating ability and the need and importance can be included in the "teaching of Mathematics" course material of the teacher training course.

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