IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
IJARSCT
Impact Factor: 6.252
Volume 2, Issue 7, May 2022

Self-Efficacy in Mathematics and Students of Geometric Levels of District Una of Himachal Pradesh

Dr. Ashwani Kumar
Assistant Professor, Department of Mathematics
Dronacharya PG College of Education Rait, Kangra HP, India

Abstract: *The objective of the present study is to determine the relationship between Mathematics Self-efficacy and acquisition of Geometric levels of Class XI students i.e., their geometrical thinking levels. The sample consisted of 800 students, both male and female of Class XI, selected from 25 schools in the district of Una of Himachal Pradesh. The tools used were the "Mathematics Self Efficacy Questionnaire" adapted from Mathematics Self Efficacy and Anxiety Questionnaire (MSEAQ), (May 2009). The results show that self-efficacy differs among students with different geometric levels. In particular, the higher the Geometric level of students, the better their self-efficacy. Thus, self-efficacy in mathematics can be regarded as a factor in the acquisition of Geometry.*

Keywords: Self-efficacy, Geometric Level, Mathematics, critical thinking

I. Introduction

Educators are entrusted to find a way in which children may be better educated. This is nonetheless so for mathematics, which is often regarded as a 'bug-bear' by students. Foremost in the hierarchy of mathematics is geometry. School geometry is directly applicable to everyday life and the basis of many an interesting puzzle. Thus, it has the potential of being attractive to students. Yet it is possibly the most feared aspect of mathematics. Ergo, it is often educational researchers' aim to find out what it is that deters children from acquiring geometric concepts.

Children are believed to refer to their own ideas and experiences in perceiving the world and evolving concepts regarding it. Ensuring social interactions further contribute to their life experiences and intervene in knowledge construction.

Thus, perceptions of impending success or failure tinge academic achievement. Bandura's social cognitive theory (Bandura, 1986), in fact, points to the learner's judgment of their own ability in estimating academic success. Bandura's term for this quality is 'self-efficacy'. Bandura et al. (1996) have shown that self-efficacy may be confirmed by traits like motivation, perseverance, resilience, and analytic thinking.

Self-efficacy has been shown to be a forecaster of academic achievement. Thus, high self-efficacy implies confidence about academic skills, allowing the student to hone good skills, and allowing them to expect good results in the examinations and to work objectively for it. Conversely, low self-efficacy relegates the student to expect failure even before attempting the task and subsequently low self-esteem as per academics. Research regarding mathematics achievement and self-efficacy shows that high self-efficacy induces students to compute accurately and display a greater tendency in problem-solving (Zimmerman, Bandura, and Martinez-Pons, 1992; Pujaris and Miller, 1994).

Betz &Hackett (1994) found mathematics self-efficacy to be moderately, but positively correlated with scores in mathematics examinations. Hendel (1980) & Hodge (1999) also found mathematics self-efficacy, mathematics anxiety & mathematics performance to be highly correlated. Fast et al. (2010) found that students with low self-efficacy yield easily when confronted with mathematical problems. Canturk-Gunhan and Baser (2007); Saracoglu and Yenice (2009); Usher (2009); Yenilmez and Uygan (2010) in different studies have shown, among other factors, that enhanced self-efficacy can improve the acquisition of geometric concepts, particularly when interventions involving creative activities were used. The Van Hiele Theory of How children improve their understanding of geometry and their spatial sense has been an area of research over the past 60 years (Usiskin, 1982; Burger & Shaughnessy, 1986; Fuys, Geddes & Tischler, 1988; Clements & Battista, 1992; King, 2003; Atebe, 2008). A theoretical perspective put forward by Dina van Hiele-Geldof and Pierre M. van Hiele at the University of Utrecht, explained the model of geometric thinking using three aspects: the existence of levels, properties of the levels, and the movement from one level to the next level. The van Hiele model consists of five levels of geometric thinking.

These levels, as arranged from the lowest to the highest, are as follows:

Level 1. Visualization: The student can merely recognize a shape.

Level 2. Analysis: The student is able to analyze a shape because he/she knows the properties of the shapes in Level 1

Level 3. Abstraction: The students have learned geometric properties after having attained the first two levels

Level 4. Deduction: The student is able to construct proofs of geometric properties after having attained the first three levels

Level 5. Rigor: The student is able to understand the implications of non-Euclidian geometry after having attained the first four levels. (Crowley, 1987; Kundu and Ghose, 2016) Usiskin tested the ability of the van Hiele model to describe and predict the performance of students in secondary school geometry (Usiskin, 1982).

Currently, there are two lines of research based on the van Hiele theory in the world: one transposing the van Hiele theory to other areas of mathematics (Boolean Algebra, Function-Analysis-Calculus), and another one using dynamic geometry to achieve higher geometric levels (De Villiers, 2010). The emanation of the Problem Frequent expressions of apprehension about succeeding in mathematics and geometry in particular pose a problem for educators. The reason for this inhibition and intimidation by geometry needs to be identified so that students can be assisted to acquire the basics of the subject.

As students in Class XI are near to completion of school, they are expected to be acquainted with the geometry of basic ideas of culture and more intrinsically, geometry itself. Also, the apprehensiveness regarding the geometry of so many people points to a lack of self-efficacy among individuals. Perhaps this is what impedes a student from succeeding in geometry. Thus, this study aimed to examine whether students in Class XI with different Geometric levels exhibited different extents of self-efficacy.

Methodology: The study consisted of a survey using a quantitative technique.

Sample: The sample consisted of 800 Class XI learners from 25 schools in the southern districts of Una of Himachal Pradesh. These were urban schools and drew learners from middle socio-economic communities. Formal approval from the Department of Education and the school Head Teachers was obtained in order to access data from students in these schools. The sample is as follows:

Table No 1. The sample

Sr. No	Male	Female	Total
1	375	425	800

Tools

"Mathematics Self Efficacy Questionnaire" adopted from "Mathematics Self Efficacy and Anxiety Questionnaire" (MSEAQ), (May 2009) consisting of 14 Likert type items translated into Bengali from English. The Test-retest reliability coefficient of the scale is 0.97. Van Hiele Geometry Test was constructed by Usiskin (Usiskin, 1982). The test consisted of multiple-choice questions, with five questions pertaining to each of the five van Hiele levels. The "Forced van Hiele Level" (VHL), was used to assign levels from 0 to 4, The Cronbach Alpha coefficient for the reliability of the test ranged from .69 to .79.

II. DATA ANALYSIS

The tools were administered to the sample, and the responses were duly scored and tabulated. The results were subjected to descriptive statistics:

Table 2

Forced Geometric Level	N	Mean (Self-efficacy score)	St. Deviation (Self-efficacy Score)
A	169	42.89	11.77
B	268	49.47	12.25
C	175	53.80	10.26
D	148	56.46	09.47
E	40	59.14	09.72

IJARSCT

ISSN (Online) 2581-9429

Impact Factor: 6.252

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

Volume 2, Issue 7, May 2022

Figure 1: Mean self-efficacy of each Geometric Level

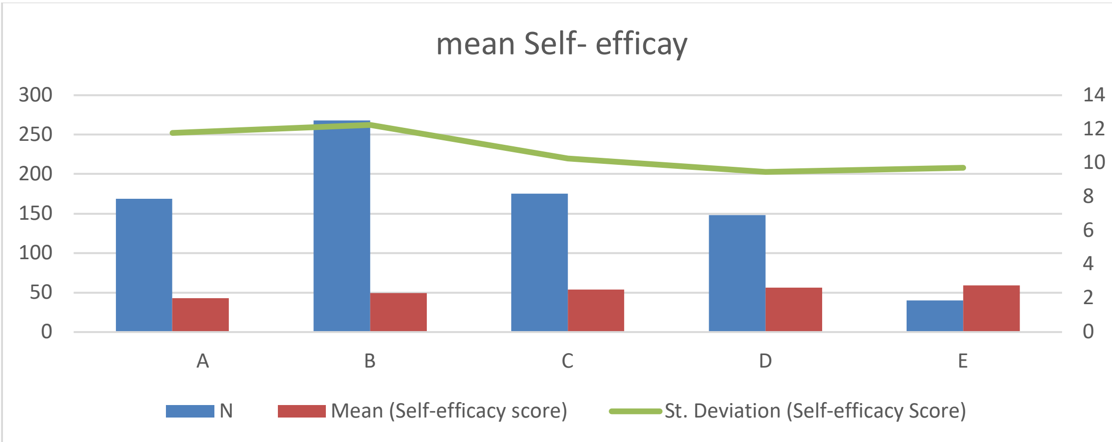

Table 2 and figure 1 show that mean self-efficacy scores increase with the rise in Geometric levels. The data were subjected to inferential statistics. As an appropriate examination of the data did not reveal normality of the distribution of self-efficacy scores (pp test, Kolmogorov-Smirnov test) non-parametric test, i.e., Kruskal Wallis Test was employed. The null hypothesis for this was H0: There is no significant difference in self-efficacy in mathematics between students with different Geometric levels of Geometry among Class XI students.

Table 3. Test Statistics of Kruskal Wallis Test and Grouping Variable: Forced VHL

	Self -Efficacy
Chi-square	145.823
D.F	4
Asymp. Sig.	.000

Table-3 shows that H0 may be rejected. Self-efficacy scores are significantly different among students with different geometric levels. The result was further tested to check whether the self-efficacy scores differed between Geometric levels using the Mann-Whitney U test.

Table 4. Mann-Whitney Test and Test Statistics

Ranks			**Test Statistics Grouping variable: Forced VHL**	
Forced VHL	**N**	**Mean Rank**	Mann Whitney U	Asymp. Sig. (2- tailed)
Self-Efficacy A B	169 268	170.32 239.66	14410.500	**.000**
Self-Efficacy B C	268 175	189.87 229.19	16269.000	**.001**
Self-Efficacy C D	175 148	137.58 159.84	9060.000	**.026**
Self-Efficacy D E	148 40	090.72 111.60	3238.000	**.015**

Table 4 shows that self-efficacy scores consistently increase for students with higher geometric levels.

III. DISCUSSION

The result shows that self-efficacy in mathematics is indeed higher for students at higher levels. This is indicative of the effect of self-efficacy in acquiring geometric concepts. In other words, students who succeed in geometry may be expected to be endowed with self-confidence regarding their ability in the process of the subject. The studies reassert Bandura's (1997) claim that self-efficacy is a predictor of academic outcomes. Other researchers, too, have reported significant relationships between self-efficacy and the motivation for academic achievement (Hacket & Betz, 1989; Ma & Kishor, 1997; Middleton & Spanias, 1999). Focussing on mathematics, Hackett (1985) & Lent & Hackett (1987), and Pajares (1996

IJARSCT

ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

IJARSCT
Impact Factor: 6.252

Volume 2, Issue 7, May 2022

b), have shown that self-efficacy in mathematics and achievement in mathematics are strongly related. The implication of this study is that teachers require motivating students so that their self-confidence regarding mathematics and geometry, in particular, can be raised. This will avert the inhibitions felt regarding the subject and serve to foster much-needed geometric concepts (Bandura, 1997; Pajares, 1997, Schunk, 1991;). In day-to-day language, the teacher needs to tell students "You CAN" rather than just keep trying.

REFERENCES

[1]. Chief Examiners Report (2005, 2006, 2007). West African Examination Council (WAEC). Yaba Lagos.

[2]. Clements, D. H., & Battista, M. T. (1991). Van Hiele Levels of Learning Geometry. In International Group for the Psychology of Mathematics Education. Assisi, Italy.

[3]. Crowley, M. L. (1987). The van Hiele model of the development of geometric thought, in Learning and Teaching Geometry, K-12. M.M. Lindquist, ed., NCTM, Reston, Virginia, 1–15.

[4]. De Villiers, M. (2010). Some Reflections on the Van Hiele Theory, Invited plenary from 4th Congress of teachers of mathematics. Zagreb, (available from: http://frink.machighway.com/dynamicm/vanhiele-reflection.pdf).

[5]. Fuys, D., Geddes, D., &Tiskler, R. (1988). An investigation of the Van Hiele levels of thinking in geometry among adolescents. Journal for Research in Mathematics Education Monographs, No.3, NCTM., Reston

[6]. Hackett, G. (1985). Role of mathematics self-efficacy in the choice of math-related majors of college women and men: A path analysis. Journal of Counseling Psychology. doi:10.1037/0022- 0167.32.1.47

[7]. Hackett, G., & Betz, N. (1989). An Exploration of the Mathematics Self Efficacy Mathematics Performance Corresponding. Journal for Research in Mathematics Education, 20(3), 261-273.

[8]. Kundu, A & Ghose, A. (2016). Gender-Related Difference in the Acquisition of Van Hiele Level in Geometry of higher Secondary Students in West Bengal.

[9]. International Journal of Multidisciplinary Educational Research, Vol. 5, Issue 6(3), 74- 87.

[10]. Lent, R.W. & Hackett, G. (1987). Career self-efficacy: Empirical status and future directions. Journal of Vocational Behaviour, 30, 347-382.

[11]. Ma, X., & Kishor, N. (1997). Assessing the Relationship Between Attitude Towards Mathematics and Achievement in Mathematics: A Meta-Analysis. Journal for Research in Mathematics Education, 28(1), 26-4