

Strengthening Critical Thinking Skills of Prospective Teachers Through Applications Of Vedic Mathematics

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Introduction

Good teachers form the foundation of good schools, and improving teachers' skills and knowledge is one of the most important investments of time and money that local, state, and national leaders make in education. Our changing goals for learning, coupled with shifts in curriculum emphasis and a deeper understanding of teacher learning and student thinking, have led to new findings about the impact of teacher professional development and how best to sharpen teachers' skills and knowledge. Teachers are expected to teach as per the curriculum, take care of all round development of children, develop abilities such as learning how to learn, problem solving, creative thinking, which are crucial for living effectively in the world rapidly changing with the developments in science and technology. A person who does not possess the skills and competencies required for the tasks expected of the teacher cannot be called a teacher. What matters most is what teachers learn. Professional development should improve teachers' knowledge of the subject matter that they are teaching, and it should enhance their understanding of student thinking in that subject matter.

Responsibility of Teacher Education Institutions

The growth of teacher education institutions in the country has shown mathematical trend-producing graduates who are finding it difficult to find employment. This resulted in a drastic down gradation of the standards in our education system and a high rate of rejection of their products. This is the result why we have such a huge number of qualified teachers un/under employed. We have to ensure quality and accountability in the perspective teachers who are the future social engineers. Unless quality is brought into our education sector, it is going to suffer a major setback in the present race of competition. The new breed of teachers should have all the competencies expected of them for performing the exacting educational tasks of the 21st century. We have to create a system of teacher education which can compete with the best anywhere in the world. Delor's report –'Learning: The treasure Within' has rightly emphasized on four pillars of education for the 21st century namely "learning to know", "learning to do", "learning to be" and "learning to live together. Thus the professional preparation of teachers by ultimately ensuring quality and accountability is the need of the hour.

Competencies For 21ST Century

According to Benjamin .S. Bloom (1956) learning is the basis of development in the three imaginative domains of an individual viz: cognitive, affective and psychomotor domain. Traditional and modern classroom learning focus on enhancement of knowledge through preliminary concepts that fall under the cognitive domain as described by Bloom. Should we still focusing on these three domains? Definitely not. Apart from developing basic skills, nowadays twenty first century skills are to be inculcated among learners. Hence it is essential to stress the need for the prospective teachers to 'leave the institution

with a deeper understanding of their subjects and with the skills needed to respond to an unbounded but uncertain 21st century – skills to use their knowledge, to think critically, to collaborate, to communicate, to solve problems, to create and to continue to learn’. Prepare them for critical thinking is the major concern. Critical thinking is a process that challenges an individual to use reflective, reasonable, rational thinking to gather, interpret and evaluate information in order to derive a judgment.

Table 1: Twenty First Century Skills

Learning and Innovation Skill	Digital Literacy Skill	Carrier and Life Skill
Critical Thinking and Problem Solving	Information Literacy	Flexibility and Adaptability
Creativity and innovation	Media Literacy	Initiative and Self Direction
Collaboration	ICT Literacy	Social and Cross Cultural Interaction
		Leadership and Responsibility
		Productivity and Accountability

(Source:<http://www.p21.org/overview> retrieved on 23/01/2014)

Increasingly, the onus is on Teacher Education Institutions (TEI) to ‘rethink’ how they can most effectively prepare future teachers to teach these skills for success in a complex, rapidly changing world.

Vedic Mathematics, A Suitable Solution For Enhancing Critical Thinking

Vedic Mathematics offers an approach to resolving the current crisis in education (Puri & Weinless, 1988; Puri, 1988). It is not simply a collection of new computational techniques; rather, it provides an entirely different approach to mathematical computation, based on pattern recognition (Puri, 1991). It has since been shown that the system is equally applicable to more up-to-date aspects of mathematics both at an elementary level as well as in more sophisticated fields (Nicholas, Williams, & Pickles, 1984). The reason that this is possible relies on the nature of the sutras. They frequently describe how the mind approaches, or deals with, a problem in the earliest way (Puri & Weinless, 1988). The Vedic system teaches this sort of approach systematically rather than leaving it to chance and hence we find a number of different possible methods for any particular sum. This is of tremendous use because it enhances variety of strategy. It also enables the subject to be kept alive by directing the attention towards underlying pattern and relationship (Stoddard, 1962; Starkey & Gelman, 1982). It is a system with mental multi choice procedures, which keep the mind alert and agile. It is a complete and most natural Vedic System, which develops our brain to wonderful levels, stimulates critical thinking (Reyes, 1984). Puri points out that the naturalness and ease of Vedic Sutra based computation “brings smiles on the face and joy in the heart” of the students which bring mental strength and confidence (Puri, 1986). Further, Vedic Mathematics reduces anxiety and increases playfulness.

This spark tempted the investigator to apply Vedic computational strategies in improving computational speed and critical thinking ability of prospective teachers and thereby empower them to be skillful enough in order to meet the situational challenges of their career and life.

Objectives of The Study

The study was conducted among members of prospective teachers. The present study was undertaken with the following objectives:

1. To test the effectiveness of the Supreme power of Vedic Mathematics in strengthening Computational Speed and Critical Thinking Ability of prospective teachers
2. To equip the prospective teachers with self-confidence by attaining skills of Computational Speed and Critical Thinking Ability through Indian intellectual tradition of Vedic Mathematics

Hypotheses of The Study

The following **hypotheses** were formulated by the investigator to lead the study

1. Vedic Mathematics applications are very much effective in strengthening Computational Speed and Critical Thinking Ability of prospective teachers.
2. Acquisition of the skills of Vedic Mathematics applications is a true solution in equipping prospective teachers with adequate skills.

Methodology

Population and Profile of The Sample

In this paper the researcher made an attempt to strengthen the Computational Speed and Critical Thinking Ability of prospective teachers. The sample selected were 100 B.Ed.students from various disciplines of Sree Narayana Training College, Nedunganda of Thiruvananthapuram District of Kerala State, India. The samples were selected using random sampling technique. Study was undertaken for a period of one week.

Instrumentation

The tools used for the study were

1. Modules prepared on Vedic mathematics ‘Ekadhikena Purvena’, Ekanyunena Purvena, ‘Nikhilamnavatascharam Dasatah’ and, ‘‘Urdhva Tiryagbhyam’’ Sutras.
2. Computational Speed Test (developed and standardized by the investigator) and Critical Thinking Ability Test (Excerpted from: From Critical Thinking Skills Success In 20 Minutes a Day. 2010 by Learning Express, LLC).

Design, participants and procedure

The Research Team intended to test the effectiveness of the prepared Modules on Vedic Mathematics. Thus an experimental study was designed. Hence selected the Non-equivalent Pre test-Post test Control Group Design (Gay, 1987) which is one of the strongest of the Quasi Experimental Designs. It was decided to conduct the experiment in the casual classroom groups and to equate the group statistically by applying the technique of analysis of covariance. Experimental and Control Groups were divided with 50 trainees in each group. Both groups shared the same Team Member as the mathematics teacher. Before the intervention, a pre-test was conducted among the sample. The Control group was given the existing instructional system of Mathematics and the Experimental Group, Vedic Mathematics instructional system. At the end, Post-Test was administered and the scores were collected. After an interval of 1 month, a retention test was given without any notice. The same tools were used for administering the retention test. Analysis of Co –Variance was applied (ANCOVA) to compare Pre Test-Post Test Scores.

Data Analysis

Table 2.

Mean values and Standard Deviations of computational speed scores in pre, post tests of prospective teachers in experimental and control groups

Group	N	Mean	SD
Pre Experimental	50	19.65	2.88
Post Experimental	50	9.13	0.87
Pre Control	50	19.13	2.47
Post Control	50	16.16	2.68

Table 3.

Summary of ANCOVA of Computational Speed scores in Post & Retention Tests of prospective teachers in the experimental and control groups

Test	Source	Sum of Squares	df	Mean Squares	F-ratio
Post test	Pre Speed	254.90	1	254.90	41.53**
	Between Groups	2437.44	1	2437.44	397.14**
	Within Groups	1454.57	97	6.14	
	Corrected Total	3917.73	99		
Retention Test	Rt Rt Speed	129.22	1	129.22	17.83**
	Between Groups	1474.75	1	1474.75	203.53**
	Within Groups	1717.29	97	7.25	
	Corrected Total	3200.25	99		

**significant at 0.01 level

In the post test, the obtained F-ratio for the Between Groups is 397.14 ($F_{(1, 97)} = 397.14, p < 0.01$). This indicates that the mean difference between experimental and control group is statistically significant.

Table 4

Comparison of pre-test score and post- test score of Critical Thinking Ability and Computational Speed of prospective teachers in experimental group

Particulars	Pair	Mean	SD	Mean Difference	t-value
Critical Thinking Ability	Pre Score	18.03	2.213	8.12	17.000*
	Post Score	26.15	1.703		
Computational Speed	Pre Score	19.65	2.88	10.52	18.008*
	Post Score	9.13	0.87		

* Significant at 5% level

The statistical analysis using t test reveals that there is significant difference between the Pre-test and Post-test scores of experimental group regarding Critical Thinking Ability and Computational Speed of prospective teachers. ($t:17.00, P \leq 0.05$) and ($t:18.008, P \leq 0.05$).

Discussion

When the results of Analysis of Covariance of post-test scores on Computational Speed Test of participants were taken, the difference between the means was found to be statistically significant. In the post test, the obtained F-ratio for the Between Groups is 397.14 ($F_{(1, 97)} = 397.14, p < 0.01$). This indicates that the mean difference between experimental and control group is statistically significant. Also the statistical analysis using t test reveals that there is significant difference between the Pre-test and Post-test scores of experimental group regarding Critical Thinking Ability and Computational Speed of prospective teachers. ($t:17.00, P \leq 0.05$) and ($t: 18.008, P \leq 0.05$). The result clearly gives the evidences that Vedic Sutras are very effective in strengthening Critical Thinking Ability and increasing Computational Speed among the sample of study. Research on the effects of Vedic Mathematics on improving Computational Speed includes the works by Nicholas, Williams & Pickles (1984), Hope (1987), Muchlman (1994), and Haridas (2004) who concluded that “ Vedic Mathematics provides very easy, one line, mental and superfast methods”.

Findings

1. Vedic Mathematics applications are very much effective in strengthening Computational Speed and Critical Thinking Ability of prospective teachers.
2. Acquisition of the skills of Vedic Mathematics applications is a true solution in equipping prospective teachers with adequate skills.

Conclusion

One of the most important streams of higher education is teachers' training. It is from here that thousands of young men and women spread out to teach children in schools, virtually holding the destiny of the future generations in their hands. Teacher Education is ever-evolving and dynamic. In order to prepare teachers who are competent to face the challenges of the dynamic society, Teacher Education has to keep abreast of recent developments and trends.

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