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TEACHING OF MATHEMATICS THROUGH MATHS LAB: A MULTI-DIMENSIONAL COMPETENCY BASED APPROACH

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Mathematics plays a vital role in building up our civilization by connecting all the fields. It helps people to give exact interpretations to their various ideas and conclusions. It is an essential tool which is applied in many fields such as Physics, Chemistry, Biology, Medicine, Engineering and so on. In the scientific world, the credit of all the technical progress of science goes to progress of Mathematics. Mathematics, according to National Policy on Education (NPE – 1986), should be visualized as the vehicle to train a child to think, reason, analyze and articulate logically. Apart from being a specific subject, it should be treated as a concomitant to any subject involving analysis and reasoning.

The main goal of mathematics education in schools is the mathematisation of the child's thinking. There are many ways of thinking, and the kind of thinking one learns in mathematics is an ability to handle abstractions, and an approach to problem solving. As stated by the National Focus Group in their Position Paper on Teaching of Mathematics; "Universalisation of schooling has important implications for Mathematics curriculum. Mathematics being a compulsory subject of study, access to quality mathematics education is every child's right". In their vision, school mathematics should take place in a situation where: (1) Children learn to enjoy mathematics, (2) Children learn important mathematics, (3) Mathematics is a part of children's life experience which they talk about, (4) Children pose and solve meaningful problems, (5) Children use abstractions to perceive relationships and structure, (6) Children understand the basic structure of mathematics and (7) Teachers expect to engage every child in class.

On the other hand, mathematics education in our schools is beset with problems. Due to hierarchy of concepts and largely deductive and abstract nature of the subject, Mathematics is considered as a very dull and difficult subject. A phobia has been created in the minds of the children that Mathematics is tough to learn. As a result, most of the students are not taking interest in the subject and it has become one of the main causes of student's failure in Mathematics. No doubt, Mathematics is a subject which requires single-minded concentration and continuous efforts to achieve perfect and accurate learning. Therefore, to remove this phobia, it is necessary to motivate the children by arousing and maintaining their interest in Mathematics. For this, it is necessary to make the involved abstractions tangible and concrete by developing the mathematical concepts out of direct personal experiences. Thus, by putting something concrete into the hands of students, will give a better picture of conceptualization of the problem. Hence, the traditional approach of teaching Mathematics in which abstract concepts are usually presented to the students in an authoritarian way should be discouraged and activity approach which stresses the presentation of concrete experiences should be encouraged. Thus, Mathematics has to be learnt by doing rather than by reading. This doing of Mathematics gives rise to the need of a suitable place for performing these activities. A well-equipped Mathematics laboratory is the suitable place for the same, which can instantly motivate the students and create an environment to Mathematics learning. This long felt need of Mathematics laboratory was emphasized in National Curriculum Framework for Elementary and Secondary Education (1988)   and has also been endorsed in the National Curriculum Framework for School Education – 2000 (NCFSE-2000) and National Curriculum Framework-2005 (NCF-2005) respectively.

Looking to the above importance, the authors have not only developed the Maths lab but also tried to see its multi-dimensional impact on skill development for the pre-service teacher trainees at primary level. This approach is realistic since it envisages student teachers to disseminate these skills to the coming generations in schools and is also pragmatic and relevant in the context of quality based teaching of Mathematics. Also the approach conducted under this study focuses on naturalistic situational research through observation, reflection and intuition; construct grass root theories, addressing the real problems, local wisdom of using resources from surroundings, mainly for quality education.

Maths lab :

Maths Lab is a state-of-art mathematics laboratory for schools. It offers Multiple Teaching and Learning Aids as well as a complete theme based ambience which helps students to visualize and feel mathematics. Learning aids comprise of Technology Applications, Videos, Manipulative, Measuring Instruments, Tables, and Charts etc. A mathematics theme based ambience is created complete with tables, chairs, posters, floor tiles etc. Based on the three pillars of *'Imagination, Investigation and Interaction'*, it provides an opportunity to students to understand, internalize, discover and verify the basic mathematical and geometrical concepts through concrete objects and situations.

A Mathematics Laboratory can foster mathematical awareness, skill building, positive attitudes and learning by doing experiences in different branches of Mathematics. It is the place where students can learn certain concepts using concrete objects and verify many mathematical facts and properties using models, measurements and other activities. It will act as an individualized learning centre for a student. It provides opportunities for discovering, remedial instruction, reinforcement and enrichment. It also provides an opportunity to the teachers to explain and demonstrate many mathematical concepts, facts and properties using available materials in the Mathematics laboratory. It may also act as a place for teachers and students to perform a number of mathematical celebrations and recreational activities.

The establishment of a mathematics laboratory is one way of stimulating interest in learning mathematics. A mathematics laboratory is a place, where things can be stored, kept, counted, ordered, recorded, packed, unpacked, grouped, regrouped, arranged, rearranged, measured, joined and partitioned among numerous other activities. The students carry out their projects and other activities in the laboratory. The Mathematics laboratory should be the focal points of all mathematics work in the school. It should be the calculating center of the school. The truth of abstractions is demonstrated in a concrete manner and the students, who are slow to comprehend abstractions, appreciate them more readily and become interested in mathematics. The mathematics laboratory is a specially equipped room in a building, where mathematics lessons or activities hold on a regular basis or a corner of the regular classroom with tables and apparatus or a room containing a collection of teaching aids for students' manipulation (Odili, 1990). It is also a remedial environment, where advantaged or disadvantaged, the poorest or the best gifted students may have active sensory experiences from which concepts emerge. It is a

resource centre for the learning of mathematics. It is based on the principle of doing, learning by observation, by proceeding from concrete to abstract. Some of the advantages of having a mathematics laboratory according to Ezike and Obodo (1991) include:

- It makes mathematics learning very interesting, meaningful and exciting.

- It is a means of verifying a mathematical principle, law or theory.

- It can be used to illustrate basic principles, laws or rules and development of such principles, laws or rules.

- It is a means of practicing one or more of the cognitive and psychomotor skills like the ability to construct, measure, arrange, observe, classify and interpret data.

- It provides opportunity for students to learn how to use cutters, turners, drill bits, mathematical set, paint, brush, models of solids and charts and other kinds of laboratory equipment in mathematics.

- It encourages mathematical exploration and manipulation by students and keeps them alive and thinking, which also helps them to realize the applications of mathematics.

Some reflections:

The Elementary Mathematics Laboratory (EML) is a teaching and research project at the University of Michigan, School of Education. It features a two-week summer mathematics program for incoming fifth-graders that is taught by mathematics educators. This program provides local school children with an opportunity to work with expert researchers and teachers to improve their mathematical knowledge and skill. At the same time the EML creates a space for diverse professionals representing a range of expertise and perspectives to work together to solve complex problems of learning and teaching.

Okigbo and Osuafor (2008), studied the effect of using Mathematics laboratory in teaching Mathematics on the achievement of Mathematics students. The study investigated the effect of using mathematics laboratory in teaching on students' achievement in Junior Secondary School Mathematics. A total of 100 students were involved in the study. The study was a quasi-experimental research. Results were analyzed using mean, standard deviation and analysis of covariance (ANCOVA). From the findings, it was observed that the use of mathematics laboratory enhanced achievement in mathematics. The results also showed that no significant difference

exists in the achievement of male and female mathematics students taught with mathematics laboratory. The study recommended that teachers should be encouraged to use mathematics laboratory in teaching plane geometry and algebraic expression and mathematics student teachers should be trained on its use in their methodology class.

Olatunde (2010), looked at the adequacy of resource materials (mathematics laboratory) and its attendant effect on students' mathematics achievement in some selected secondary schools in Southwestern Nigeria. The study adopted the descriptive survey design and simple percentages were used in analyzing the data. Three validated instruments: Questionnaire for Mathematics Teachers, Students Mathematics Attitudinal Scale and Mathematics Achievement Test (QMT, SMAS and MAT) were used in collecting data for the study. The subject of the study was made up of 1750 senior secondary school students and 123 Mathematics teachers selected from 2 secondary schools in each of the Senatorial districts in Southwestern part of Nigeria. The results showed that most of the teachers (75%) have a good perception of the need and importance of mathematics laboratory in the school, while few teachers (25%) do not perceive the need to have a mathematics laboratory in the school. The result also showed that students exposed to the use of mathematics laboratory performed better (65%) than students that were not exposed to it and the level of infrastructural facilities available in the schools were very poor. The study therefore, recommends that Mathematics laboratories be established in every school and more teaching aids be provided for effective students learning.

Donnipad (2009), studied the use of Mathematics laboratory in teaching Mathematics by developing a strategy and testing its effectiveness. A total of 80 students were involved in the study. 40 students were included in each experimental and control group. The study was a quasi-experimental research. Two groups Post-test Experimental design was adopted for the study. The strategy evolved for the experimentation consisted three methods namely; Expository Method, Co-operative learning Method and Problem solving Method. The strategy developed was used for 10 weeks on the experimental group of the sample to teach mathematics in a Mathematics Laboratory atmosphere; whereas, the control group was taught the same Mathematics content using traditional method. At the end of 10 weeks, a post-test was administered to both the groups to evaluate and assess the performance of students. The data gathered through post-test administered on students were analyzed. From the

findings, it was observed that the strategy evolved for teaching of Mathematics in a Maths lab was effective than the didactic traditional method. Also the strategy had cultivated a research attitude and positive reinforcement among the students.

The above discussion shows the research initiatives based on Mathematics laboratory. But the very basic question is ; What is next? One needs to awaken his/her sensitivities towards the institutionalization of Mathematics laboratory at all levels. The present paper highlights the efforts carried out in this direction especially at Pre-service Teacher Education (PSTE) level.

Development of Maths Lab in DIET:

The District Institute of Education and Training (DIET), Karelibaug, Vadodara is one of the best DIETs of Gujarat, working under the direct control of Gujarat Council of Educational Research and Training (GCERT), Gandhinagar. Under its major functions, Pre-service Teacher Education and in-service teachers' training are most important, which are needed continuous attention of its faculties, mainly with respect to quality improvement in elementary education.

Looking to the need of improving quality of education in Mathematics at school level, it was decided to develop a Maths lab in the DIET as an innovative practice, which would be useful to pre-service teacher trainees as well as in-service teachers. Based on the existing content of Mathematics at elementary level, some concepts have been identified for their inclusion in Maths lab, in the various forms like mathematical experiments, activities, demonstrations, objects, models, logical proof, puzzles, measuring tools, visualization of abstractions etc. With the support of some in-service teachers, during their in-service training programme, this work was carried out carefully. All the tools / equipments were developed by using the low-cost or no cost row materials available from the surroundings. For the development of some tools, specific/ technical support has been taken from the skilled persons like carpenter, painter/artist, blacksmith etc. Thus, a Maths lab was established in the DIET, on regular basis, with the financial support of GCERT during the academic year 2012-13. The major objectives of its development were: (i) To create interest in teaching and learning of Mathematics among the Pre-service Teacher Trainees. (ii) To develop conceptualization and specific mathematical competencies among the Pre-service Teacher Trainees; and (iii) To institutionalize laboratory approach in teaching - learning process of Mathematics.

The established Maths lab includes the following major tools/equipments/material resources for Activities, demonstration and experimentation while teaching and learning of Mathematics.

Sr. No.	Title of the Concept / Demonstration / Experiment / Equipments / Objects / Visualization etc.	Way of presentation can be done through..
1.	Explanation of Point, Collinear points, Non-collinear points	Demonstration
2.	Projection of the Line segment	Demonstration
3.	Models of Square, Rectangle, Circle, Equilateral triangle, Quadrilateral, Parallelogram, Right angled triangle, Right angle, Acute angle, Obtuse angle, Linear pair, Supplementary angles, Complementary angles etc.	Demonstration
4.	Dimensions of the objects : One, Two & Three Models of Cube, Cuboid, Tetrahedron, Right circular cylinder, Right circular cone, Prism, Sphere etc.	Demonstration
5.	Mathematical instrument set (Ruler, Set-squares, Divider, Protector and Compasses), Meter scale, Measuring tape, Diagonal scale, Calculators, Computer etc.	Demonstration and Experimentation
6.	Wooden cubes to explain Base value and place value	Demonstration
7.	Explanation of Napier scale	Demonstration
8.	Explanation of Fractions : Fractional Kit	Demonstration
9.	Models for verifying the Algebraic identities: $(a+b)^2 = a^2 + 2ab + b^2$ and $(a+b+c)^2 = a^2+b^2+c^2+2ab+2bc+2ca$	Demonstration
10.	Models for deriving formulae for perimeter, area and volume	Demonstration
11.	Models for verifying Pythagoras theorem	Demonstration and Experimentation
12.	Measurement of the length of line segment	Experimentation
13.	Measurement of perimeter of different shapes	Experimentation

14.	Measurement of the weight	Experimentation
15.	Measurement of the Area	Experimentation
16.	Measurement of the Volume	Experimentation
17.	Measurement of the Angles	Experimentation
18.	To draw different Angles with different measurements	Experimentation
19.	Models for verifying the following results: • Sum of the angles of a triangle is 180° • Sum of the angles of a quadrilateral is 360°	Experimentation
20.	Deriving characteristics of Quadrilateral (With reference to : Square, Rectangle, Parallelogram, Rhombus, Trapezium)	Experimentation
21.	Making a Square / Rectangle / Circle on the basis of given Area	Experimentation
22.	Making a Cube / Cuboid / Cylinder on the basis of given Area	Experimentation
23.	Deriving and measuring the angles developed by Transversal of two parallel lines (Alternate angles, Corresponding angles, Vertically opposite angles and Interior angles) : *Parallel lines intersected by a Transversal*	Demonstration and Activity
24.	Magic square of the type 3x3 of Magic constant 15	Activity
25.	Magic square of the type 4x4of Magic constant 34	Activity
26.	Tangram (Popularly known as famous *Chinese puzzle*)	Activity
27.	Model for explaining the formula of the area of a circle	Demonstration and Activity
28.	Some Activities by paper folding	Activity
29.	Geo-board	Demonstration and Activity
30.	A collection of Charts, Pictures and Reference Books on related knowledge and recreational activities.	Demonstration and Activity

The above table shows the wide content coverage of Mathematics in the form of laboratory approach to teaching of Mathematics. With this wide range of activities,

experiments and resource materials under the Mathematics laboratory, the authors have initiated the experiment for the institutionalization of laboratory approach in day to day instructional settings.

The Experiment:

The experiment carried out was in the form of a ***Diagnostic Experimental Action Research***. Under this experiment, a group of 40 Pre-service Teacher Trainees (PSTTs), studying in the DIET, Vadodara during academic year 2013-14 was involved as the target group. The entire process was carried out in three phases, mentioned as below:

Phase : I   Pre-test : In the beginning of the academic year, a pre-test (Conceptual Understanding Test of Mathematics) was administered to the Pre-service Teacher Trainees(PSTTs) with a view to check their conceptualization in Mathematics, especially with reference to the concepts covered under the developed Maths Lab. Apart from this, their learning difficulties were also identified on the basis of the evaluation of the pre-test.

Phase : II   Treatment : Under this phase, the PSTTs were provided instructions on regular basis as per their prescribed time-table with the support of activities under Maths lab. Since the Method class and the Maths lab are in the same classroom, it was quite feasible to deliver a lecture and doing some practical work based on laboratory approach, simultaneously. The laboratory approach was made an integral part of their regular Method classes. Thus, they have been frequently provided learning experiences in Mathematics through laboratory method. While giving treatment through this approach, emphasis has also been given to the pedagogical aspects. Thus, availability of adequate resource materials in the lab has facilitated the intact group of PSTTs. This phase was continued up to the completion of their syllabus in the Method "Teaching of Mathematics", that is up to the end of February, 2014. So this phase was full of activities, practical, experimentation, group-work, demonstrations, visualizations etc. along with the pedagogical knowledge.

Phase : III   Post –test : With a view to study the impact of this experiment in terms of conceptualization and development of competencies, a post-test (Conceptual Understanding Test of Mathematics) and a non-formal performance test were administered to the PSTTs.

Evaluation and Findings:

On the basis of the evaluation done under two phases namely; pre-test and post-test, the achievement scores of the PSTTs were obtained. The significance of difference in mean scores of achievement in pre and post tests was studied by calculating mean, Standard deviation and 't' – value. The detail of the same is given in the following table.

Test	N	Mean	SD	T
Pre-test	40	44.1	13.7	
Post-test	40	50.85	11.89	2.36 *

[*Significant at 0.05 level]

From the above table, it can be seen that the calculated t – value was found to be 2.36 which is higher than the table value of 't' i.e. 2.02 at 0.05 level of significance. It shows that there was significant difference in the mean achievement score of PSTTs in pre-test and post-test. This further indicates that the laboratory approach has significant impact on conceptual understanding of the PSTTs.

Then, with the help of observation technique, mathematical competencies of PSTTs have also been observed in their performance while doing mathematical activities in the Maths lab. This was entirely a qualitative measurement done by the authors during the implementation of laboratory approach in teaching of Mathematics as well as during administration of performance type test.

The various mathematical competencies like formal problem solving, use of heuristics, estimation and approximation, use of patterns, representation, reasoning and proof, making connections, mathematical communication, measurement, visualization of the concepts/abstractions, conceptualization, analogy, critical thinking, creative thinking, deep concentration, logical thinking, case analysis, quantification, using rules of thumb, manipulation, demonstration, experimentation, optimization, reduction to simpler situation, using concrete objects, verifying properties using models / paper folding / paper cutting, using different tables / charts / reference books / equipments kept in the lab, doing recreational activities, drawing figures / graphs etc. were observed during their activities, demonstrations, experiments and under non-formal test of performance.

Educational Implications:

The success story of the said experiment was disseminated by the media through news in the news papers as well as in the TV Channels. During last six months more than 500 people (which includes Teachers, students of different schools, Student teachers, DIET lecturers and school principals) have visited this Maths lab. They were facilitated by providing the learning experiences in Mathematics through experimentation. After getting such learning experiences, some of the schools in the district are inspired to start a Mathematics corner in their schools. Now-a-days, DIET has been working as a resource center of Mathematics for the elementary schools of the district.

Conclusion:

It seems that a paradigm shift from mathematical content to creation of mathematical learning environment has made a difference. Such learning environment invites participation, engage learners, and offer a sense of success. It also facilitates the competencies based on 5E' Learning cycle [Engage, Explore, Explain, Elaborate and Evaluate]. Giving importance to processes under laboratory approach can prove it a multi-dimensional competency based approach. At the same time, a great deal needs to be done towards preparing teachers for mathematics education. A large treasury of resource material, which teachers can access freely as well as contribute to, is badly needed.

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CAUSES AND REMEDIES OF STRESS MANAGEMENT IN ORGANISATION

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Introduction:

Stress may be defined as a state of psychological and / or physiological imbalance resulting from the disparity between situational demand and the individual's ability and / or motivation to meet those demands.

One of the leading authorities on the concept of stress, described stress as "the rate of all wear and tear caused by life."

Stress can be positive or negative. Stress can be positive when the situation offers an opportunity for a person to gain something. It acts as a motivator for peak performance. Stress can be negative when a person faces social, physical, organisational and emotional problems.

Stress management can be defined as interventions designed to reduce the impact of stressors in the workplace. These can have an individual focus, aimed at increasing an individual of ability to cope with stressors. The goal of Stress Management is to help you to manage the stress of everyday life. Many different methods may be employed, such as biofeedback and meditation.

Tips to stress management include calm, clear thoughts and quiet confidence in yourself and your ability to accomplish the goals set for yourself. Every possible societal malfunction affects the classroom – drugs, alcohol, divorce, gangs and poverty.

Stress in the teaching profession gives,

If given the opportunity of all teachers would NOT become teachers again. 20% to 33% of surveyed teachers report teaching is either very or extremely stressful.

Causes of Stress

Factors that cause stress are called "*Stressors*." The following are the sources or causes of an organisational and non-organisational stress.

Causes of an Organisational Stress

The main **sources** or causes of an organisational stress are:-

1. **Career Concern** : If an employee feels that he is very much behind in corporate ladder, then he may experience stress and if he feels that there are no opportunities for self-growth he may experience stress. Hence unfulfilled career expectations are a major source of stress.

2. **Role Ambiguity**: It occurs when the person does not known what he is supposed to do on the job. His tasks and responsibilities are not clear. The employee is not sure what he is expected to do. This creates confusion in the minds of the worker and results in stress.

3. **Role Conflict**: It takes place when different people have different expectations from a person performing a particular role. It can also occur if the job is not as per the expectation or when a job demands a certain type of behaviour that is against the person's moral values.

4. **Occupational Demands**: Some jobs are more stressful than others. Jobs that involve risk and danger are more stressful. Research findings indicate that jobs that are more stressful usually requires constant monitoring of equipments and devices, unpleasant physical conditions, making decisions, etc.

5. **Lack of Participation in Decision Making** : Many experienced employees feel that management should consult them on matters affecting their jobs. In reality, the superiors hardly consult the concerned employees before taking a decision. This develops a feeling of being neglected, which may lead to stress.

6. **Work Overload**: Excessive work load leads to stress as it puts a person under tremendous pressure. Work overload may take two different forms :-

a) Qualitative work overload implies performing a job that is complicated or beyond the employee's capacity.

b) Quantitative work overload arises when numbers of activities to be performed in the prescribed time are many.

7. **Work Under load**: In this case, very little work or too simple work is expected on the part of the employee. Doing less work or jobs of routine and simple nature would lead to monotony and boredom, which can lead to stress.

8. **Working Conditions**: Employees may be subject to poor working conditions. It would include poor lighting and ventilations, unhygienic sanitation facilities, excessive noise and dust, presence of toxic gases and fumes, inadequate safety

measures, etc. All these unpleasant conditions create physiological and psychological imbalance in humans thereby causing stress.

Causes of Non-Organisational Stress

Certain factors outside the scope of an organisation also cause stress.

These main sources or causes of non-organisational stress are:-

1. **Civic Amenities**: Poor civic amenities in the area in which one lives can be a cause of stress. Inadequate or lack of civic facilities like improper water supply, excessive noise or air pollution, lack of proper transport facility can be quite stressful.

2. **Life Changes**: Life changes can bring stress to a person. Life changes can be slow or sudden. Slow life changes include getting older and sudden life changes include death or accident of a loved one. Sudden life changes are highly stressful and very difficult to cope.

3. **Frustration**: Frustration is another cause of stress. Frustration arises when goal directed behaviour is blocked. Management should attempt to remove barriers and help the employees to reach their goals.

4. **Caste and Religion Conflicts**: Employees living in areas which are subject to caste and religious conflicts do suffer from stress. In case of religion, the minorities and lower-caste people (seen especially in India) are subject to more stress.

Tips to manage stress:

1. Be Ruthless

With your time I mean. Teachers could work 24 hours a day and never finish. There is always more, there is always guilt. Decide when to stop work each day and stop. You may love it but it's just a job and for you to do it well over the long term, you have to be happy and healthy.

2. Give the Idiots What They Need

Some people are idiots. Accept it. They just are. And many of them get promoted way beyond their actual competence. Why that is I have not yet worked out, but it happens. Now the thing about promoted idiots is that deep down they actually realize that they are idiots. They can't fully accept this fact, of course, but they do feel that something is not quite right with the world: people don't show them enough respect,

don't immediately applaud or accept their idiotic ideas, opinions and 'initiatives'. This is why promoted idiots need a lot of reassurance and this is why they seem to persecute those who do not reassure them regularly. Look, it's not going to hurt you to play low status to these people who desperately need to feel high status. Make them feel important. Nod and smile at the appropriate moments and make them feel good about themselves. Then they will see you as an ally, give you a far easier time and go and persecute your colleagues. It's a tough world. Live in it.

3. Grow A Pair

Draw a line in the sand that no-one crosses and refuse to be anyone's victim, in class, in school and in life. The first time I 'lost it' with a kid, my colleagues could apparently hear me two corridors away. Needless to say, the kid in question who had been a complete nightmare in my lessons never troubled me again. More importantly however, I gained a level of self -respect that has never left me. Does not under any circumstances be anyone's victim. All bullies really are both idiots and cowards. They'll move on to the next victim. If the bully is your pupil, then try the other advice in this site. If that fails, isolate them and properly loose it with them. As long as they don't laugh, any immediate outcome is fine. It's the long-term effect you are after.

4. Don't Get Promoted

Be absolutely sure before you accept the job of dealing with the aftermath of other (less proficient) teacher's problems and become a pastoral manager. I know that someone has got to do it, but honestly, before you get seduced, flattered or guilted into applying, actually look closely and those more senior to you and notice who smiles more, you or them. Then think laterally and understand that you can move sideways and out as well as up.

5. Remember That You Are Not A Teacher

You simply do a job. An important, socially useful and ultimately rewarding job, but a job nonetheless. Granted you need to 'put on a costume' and 'do a performance' whenever you walk into a classroom. Just remember to take the costume off at the end of the day (in fact at the end of each lesson). There is nothing sadder than going on holiday and being able to tell who the teachers are, just by the way they speak to their children.

6. Start Digging

Take a good look around the staff room at the teachers who have been there 25 years and more and decide if you want to look and sound like them at their age. Then start

digging. Teaching is a young person's game, particularly these days and thankfully plenty of young people still want to do it. But in my view, it's no longer a job for life. Too many colleagues retire without telling anyone and suffer their last years at work, waiting for their pension, when with a little ingenuity and foresight they could have fashioned an alternative career for themselves that would be pleasant enough to occupy them well beyond their retirement years.

I realize that very few of the above pieces of advice apply to children. This is for two reasons. Firstly I like to think that I have dealt with managing children in the course of writing my site. Secondly, I have always found pupils simple to manage compared to other adults and worst of all.

Of course if stress really is getting you down, then I invite you to visit the Dealing with colleagues: How to handle the cynics in the staffroom bursting with ideas and enthusiasm, you run up against the staffroom cynics who tell you something cannot or should not be done. Don't let them grind you down The first term is hard for newly qualified teachers, who can find themselves under pressure and struggling to cope with the realities of teaching. Part of that stress is squaring their passion with the disenchantment of some of their colleagues. While the stereotype of the cynical old hand muttering to himself in the staffroom may not be entirely realistic, there is some truth in the idea that cynical teachers can put a damper on your enthusiasm.

Things to think about

- You have the right to think differently and to believe in your ways of doing things.
- The reason that schools want to work with you is because you bring new ideas.
- The very best teachers are those who are constantly changing their practice.
- Identify the movers and shakers in the staffroom and ally yourself with them.

Methods of stress management

Stressors are always present in the profession of teaching, which suggests teachers should learn techniques to manage stress to remain an effective teacher.

- Know yourself (strengths & weaknesses)
- Stay intellectually stimulated (mental exercise)
- Be current with subject and teaching methods
- Establishing clear classroom expectations can alleviate many of the stressors

existing in a classroom between the teacher and students Gain stability from relationships (family/friends)

- More parental involvement

Conclusion:

The formation of the class to prevent any escalation of anxiety in the classroom. A final proactive stress management technique is control of the work environment. An efficient and effective teacher will be proficient in time management, prioritization and organization. The Commandments for Reducing Stress is a set of guidelines for Teachers to ensure they control their work environment. If teachers continue to see unhealthy stress, even after following the proactive methods.

"I do the very best I know how - the very best I can;

and mean to keep doing so until the end.

If the end brings me out all right, what is said

against me won't amount to anything.

If the end brings me out wrong, ten angels

swearing I was right would make no difference."

- Abraham Lincoln

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ANDRAGOGY V/S PEDAGOGY: IMPLICATIONS FOR TEACHER

PREPARATIONS

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Introduction

Learning is Life not just preparation for life. It is the life's experiences that facilitate learning rather than authoritarian instructions and we learn what we do and more often fail in doing all that we have learnt. Because, for learning to be lifelong and application oriented, it has to be learner centered and learner has to be internally motivated. The great teachers of ancient times, from Confucius to Plato, didn't pursue such authoritarian techniques. They all saw learning as a process of active inquiry, not passive reception. Considering this, it is surprising that teacher-focused learning later came to dominate formal education.

Our academic system has grown in reverse order. Subjects and teachers constitute the starting point, learners are secondary. The learner is required to adjust himself to an established curriculum....Too much of learning consists of vicarious substitution of someone else's experience and knowledge. Psychology teaches us that we learn what we do....experience is the adult learner's living textbook. Unfortunately, a century after Dewey proposed learner-focused education, most formal education still focuses on the teacher.

As a result, many learners leave school having lost interest in learning. Even good-intentioned educators can squelch naturally inquisitive instincts by controlling the learning environment. By adulthood, some people view learning as a chore and a burden rather it is more need based and interest oriented.

The Pedagogical Model

The pedagogical model of instruction was originally developed in the monastic schools of Europe in the middle Ages. Young boys were received into the monasteries and taught by monks according to a system of instruction that required these children to be obedient, faithful, and efficient servants of the church (Knowles, 1984). From

this origin developed the tradition of pedagogy, which later spread to the secular schools of Europe and America and became and remains the dominant form of instruction.

In the pedagogic model, teachers assume responsibility for making decisions about what will be learned, how it will be learned, and when it will be learned. Teachers direct learning. Thus the learning becomes teacher centered rather than learner centered and this increases the burden of cramming the knowledge which the learner feels is not his own. It is based on the assumption that learners need to know only what the teacher teaches them. The result is a teaching and learning situation that actively promotes dependency on the instructor (Knowles, 1984).

Up until very recently, the pedagogical model has been applied equally to the teaching of children and adults, and in a sense, is a contradiction in terms. The reason is that as adults mature, they become increasingly independent and responsible for their own actions. They are often motivated to learn, have an increasing need to be self-directing. In many ways the pedagogical model does not account for such developmental changes on the part of adults, and thus produces tension, resentment, and resistance in individuals (Knowles, 1984). The growth and development of andragogy as an alternative model of instruction has helped to remedy this situation and improve the teaching of adults.

Need for shift from Pedagogy to Andragogy

In the information age, the implications of a move from teacher-centered to learner-centered education are staggering. Postponing or suppressing this move will slow our ability to learn new technology and gain competitive advantage. How can we expect to analyze and synthesize so much information if we turn to others to determine what should be learned, how it will be learned, and when it will be learned?

We must take it upon ourselves to meet our learning needs and demand training providers do the same. To know our demands, we must know how we process information. This demands a move from traditional pedagogical model to andragogical model which emphasizes on dialogue, discussions, inquiry and self learning. Moreover, it is the andragogical model that would take a learner to the higher order thinking (HOT) which in turn would lead to lifelong learning and research and development in the country while how so ever interactive teaching styles may be employed under the pedagogical model it still to a larger extent is limited to

the lower order thinking (LOT) because while andragogy focuses on learning to think and thinking to learn, pedagogy is limited to at the most thinking to learn.

Andragogy as a theory

Andragogy, initially defined as "the art and science of helping adults learn," is an educational theory that utilizes the adult's life experiences to teach and aid in learning rather than using someone else's experience in an attempt to teach. The term currently defines an alternative to pedagogy and refers to learner-focused education for people of all ages.

The andragogic model asserts that five issues be considered and addressed in formal learning. They include:

➢ Letting learners know why something is important to learn

➢ Showing learners how to direct themselves through information

➢ Relating the topic to the learners' experiences

➢ Developing readiness and motivation to learn

➢ Helping overcome inhibitions, behaviors, and beliefs about learning.

If the above issues are addressed the learner will develop readiness to learn and according to Piaget's Cognitive theory will assimilate, accommodate, adjust and try to establish equilibrium with the new content thus promote self learning and motivation to learning. The andragogical model as conceived by Knowles is also predicated on five basic assumptions about learners, all of which have some relationship to our notions about a learner's ability, need, and desire to take responsibility for learning:

✓ **Self-concept**: As a person matures his self concept moves from one of being a dependent personality toward one of being a self-directed human being.

✓ **Experience**: As a person matures he accumulates a growing reservoir of experience that becomes an increasing resource for learning.

✓ **Readiness to learn**. As a person matures his readiness to learn becomes oriented increasingly to the developmental tasks of his social roles.

✓ **Orientation to learning**. As a person matures his time and curricular perspectives change from one of postponed to immediacy of application of knowledge, and accordingly his orientation toward learning shifts from one of subject-centeredness to one of performance centeredness.

✓ **Motivation to learn**: As a person matures the motivation to learn is internal (Knowles 1984:12).

Unfortunately, andragogy usually is cited in education texts as the way adults learn. Knowles himself concedes that four of andragogy's five key assumptions apply equally to adults and children. The sole difference is that children have fewer experiences and pre-established beliefs than adults and thus have less to relate.

Figure 1: Assumptions of Andragogy
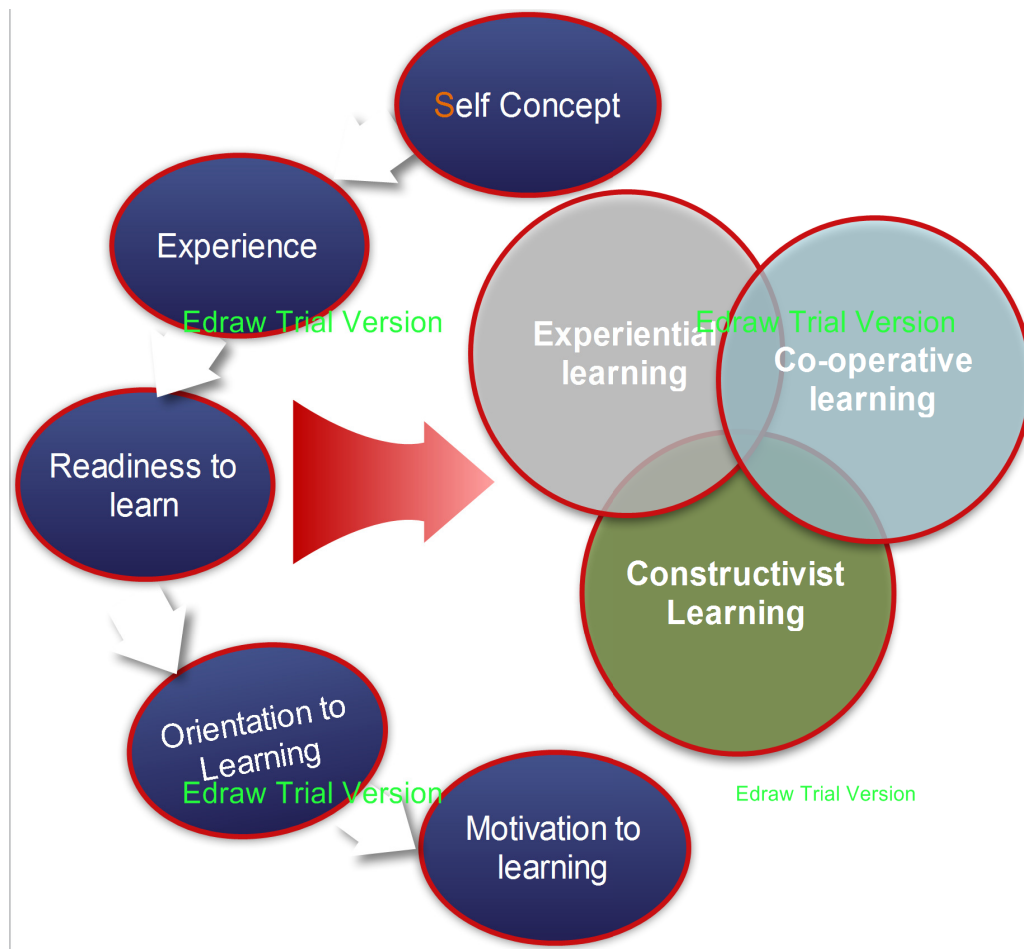
Furthermore, the models are probably most useful when seen not as dichotomous but rather as two ends of a spectrum , with a realistic assumption (about learners) in a given situation falling in between the two ends" (Knowles, 1980, p. 43). The following table represents the basic difference between pedagogy and andragogy.

Difference between Pedagogical and Andragogical Philosophy

Pedagogy	Andragogy
Learners are called "students."	Learners are called "participants" or "learners."
Dependent learning style.	Independent learning style.
Objectives are predetermined and inflexible	Objectives are flexible.
It is assumed that the learners are inexperienced and/or uninformed.	It is assumed that the learners have experience to contribute.
Passive training methods, such as lecture, are used.	Active training methods are used.
Trainer controls timing and pace.	Learners influence timing and pace.
Participants contribute little to the experience.	Participant involvement is vital.
Learning is content-centered.	Learning is real-life problem-centered.
Trainer is seen as the primary resource who provides ideas and examples.	Participants are seen as primary resources for ideas and examples.

Knowles (1975) offered some reasons for his evolving scholarship in the area of self-directed learning. One immediate reason was the emerging evidence that people who take initiative in educational activities seem to learn more and learn things better then what resulted from more passive individuals. He noted a second reason that self-directed learning appears "more in tune with our natural process of psychological development" (1975, p. 14). Knowles observed that an essential aspect of the maturation process is the development of an ability to take increasing responsibility for life.

A third reason was the observation that the many evolving educational innovations (nontraditional programs, Open University, weekend colleges, etc.) throughout the world require that learners assume a heavy responsibility and initiative in their own learning. Knowles also suggested a more long-term reason in terms of individual and collective survival: ". . . it is tragic that we have not learnt how to learn without being taught, and it is probably more important than all of the immediate reasons put together. (Knowles, 1975, p. 15).

Teaching-Learning Practices in Andragogy:

Day and Baskett (1982) offer that andragogy should be understood not as a theory of adult learning, but as "an educational ideology rooted in an inquiry-based learning and teaching paradigm" (p. 150). Andragogical theory "suggests all kinds of humanistically desirable and democratic practices; and it separates educators and trainers of adults from their counterparts in childhood, secondary, and higher education" (Brookfield, p. 96).

Adult learners should be recognized for who they are and where they stand in achieving their educational goals. Their readiness to learn and orientation to learning are inexorably tied together, as both of these assumptions center on learners' life tasks and problems. Nontraditional learners have a life-centered orientation to learning, as opposed to the subject-centered orientation of traditional learners. Stimulating dialogue that is meaningful to the learner capitalizes on this life-centered orientation.

The most effective tools for generating dialogue are discussion questions, case analysis, and other application-oriented materials that put theory into practice. These tools, combined with group and team activities integral to the learning model, allow learners to synthesize theory with their own experiences to best demonstrate learning outcomes. Facilitators learn to design open-ended questions, constructed to require learners to draw and support conclusions based on this synthesis and analysis.

Knowles' concept of andragogy - 'the art and science of helping adults learn' - 'is built upon two central, defining attributes: First, a conception of learners as self-directed and autonomous; and second, a conception of the role of the teacher as facilitator of learning rather than presenter of content' (Pratt & Ass., 1998, p. 12), emphasizing learner choice more than expert control. Both attributes fit into the specific socio-historic thoughts in and after the 1970's, for example the deschooling theory (Illich, Reimer), Rogers person-centered approach, Freire's 'conscientizacao'.

The author in the present paper shares an experience of having employed andragogy to facilitate learners.

The following is an example taken from 'Value Education (VE)' one of the topics studied by the pre-service teachers in Bachelors of Education Programme as one of the optional areas of studies.

The following figure depicts the tactics to be used while employing andragogy as a theory of learning.

Tactics of Andragogy
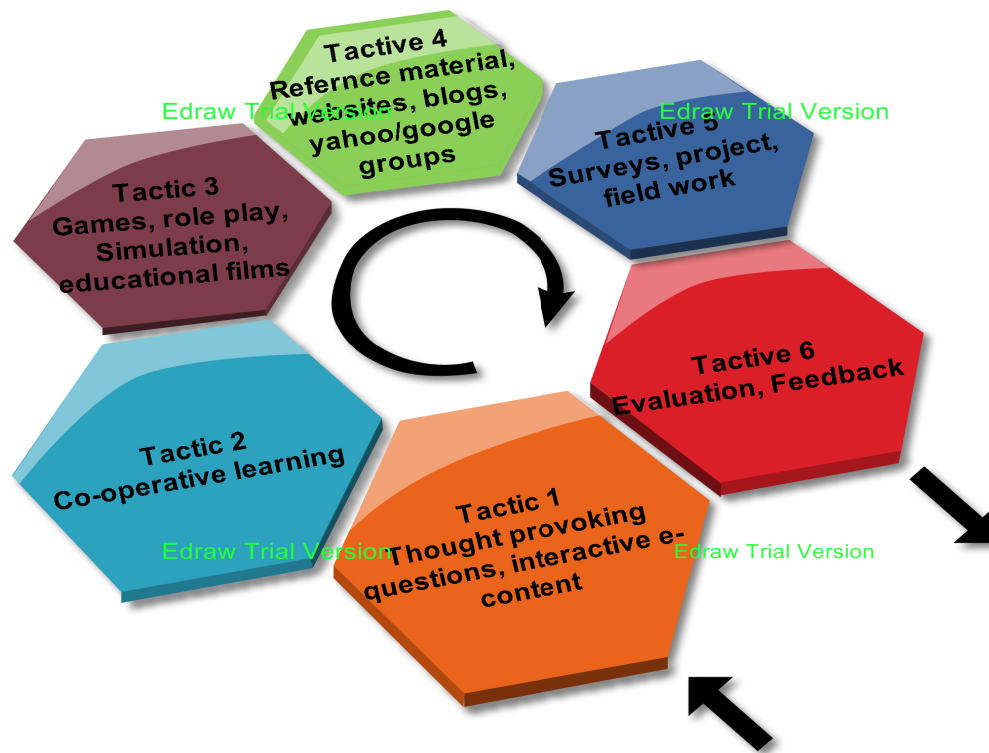
The first tactic to teaching through andragogical model is to put content in the form of thought provoking questions facilitating learners to learn to think and think to learn through series of questions. This would facilitate brainstorming and learners would develop clarity on the concept through inquiry, sharing of experiences, analysis and reference reading. On the basis of this exercise learners prepare a mind map of the concept. This will facilitate the retention of the concept since the knowledge gained is owned by the learners and based on one's own experience and understanding. This facilitates independent learning developing self concept, motivation, readiness to learn and joyful because the involvement of the learner is at it s core.

The teacher is more of a facilitator than the source of knowledge. This exercise if combined with field work, games, role-plays would strengthen learning making it a joyful experience. Listed below are examples of both a simple question as also thought provoking questions which were asked to the student teachers in order to develop in them the Higher Order Thinking Skills (HOT).

Pedagogical questions	Anagogical questions
What do we understand by value education (EE)?	Why value education is an issue? Do we really need to study on it?
What should be the objectives of value education	Should there be different set of objectives of teaching value education at elementary and secondary and/or higher secondary level. If yes, write at least three at each level.
Should VE be taught as a separate school subject or integrated with other subjects?	Will the objectives of teaching the same content differ if introduced as a separate subject? If Yes/No, why and how?
What learning experiences can be designed to facilitate VE?	Analyze the content in your respective method courses and list out topics which have a scope of being taught through an interdisciplinary approach and design learning experiences for any one of the topics.
Discuss role of teacher in imparting environment education.	Enumerate the factors contributing to the irresponsible attitude towards Value and the role of teacher in inculcating responsive behaviour.
Analyze the designed learning experiences vis-à-vis objectives?	Will the designed learning experiences help you to observe the desired learning outcomes with regard to the content as also VE in your students? How do you intend to check those?
How do you evaluate the students?	What items would you design to measure the different levels of learning outcomes in different domains?
Give feedback on the methodology of teaching-learning.	Did the methodology of teaching-learning motivate you to learn, provide scope for sharing of experiences, provoke thinking, joyful learning experience free of the burden of cramming? If yes rate it on a 1 to 5 scale and justify.

The same andragogical assumptions can be used to train the teachers at in-service as well as pre service level. Author has also implemented the same in the course : teaching of science ; to teach them about nature of science andits philosophical relations.

Conclusion:

> "It is the Supreme art of the teacher to awaken
> joy in creative expression and Knowledge."

> - Albert Einstein

The authors through their experience earlier as teachers and then as facilitators learnt that pedaling i. e gradual marching from Pedagogy to Andragogy in a long run would help in grooming inquisitive minds with urge to construct knowledge. Theory of learning facilitates learning to thinking.

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Relevant Web Sites:

For more about Knowles and his work, see:

http://www.nl.edu/academics/cas/ace/resources/malcolmknowles.cfm

http://www.infed.org/thinkers/et-knowl.htm

http://www.newhorizons.org/future/Creating_the_Future/crfut_knowles.html

http://agelesslearner.com/intros/andragogy.html

AN ANALYTICAL STUDY OF SECONDARY SCHOOLS OF BARODA CITY

FOR ENHANCING QUALITY EDUCATION

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INTRODUCTION

The history of education according to Dieter Lenzen, president of the Freie University Berlin 1994 "began either millions of years ago or at the end of 1770". Education as a science cannot be separated from the educational traditions that existed before. Education was the natural response of early civilizations to the struggle of surviving and thriving as a culture. Adults trained the young people of their society in the knowledge and skills they would need to master and eventually pass on. The evolution of culture, and human beings as a species depended on this practice of transmitting knowledge. In pre-literate societies this was achieved orally and through imitation. Story-telling continued from one generation to the next. Oral language developed into written symbols and letters. The depth and breadth of knowledge that could be preserved and passed soon increased exponentially. When cultures began to extend their knowledge beyond the basic skills of communicating, trading, gathering food, religious practices, etc, formal education, and schooling, eventually followed.

Schooling in this sense was already in place in Egypt between 3000 and 500BC. Schooling now occupies an important phase in the life of a child in order to accomplish its wholistic development. Concentration is on the process as society is giving importance to quality of a child than quantity of its knowledge. The school education is divided into clear cut phases, like, pre-primary, primary, secondary and higher secondary. Each stage has its own significance in developing the child in all aspects. But secondary and higher secondary are most significant phases and child is determining his future life related aspects here. For Indian situation it is the stage where a child faces board exams and determined its future course of action.

Rationale

Consistency is an indicator of higher standards on part of any school in a real sense. It can also throw light on success of students in terms of different variables such as sex, socio-economic background etc. This is why the investigators decided to undertake an analytical study of standard 10th public examination results for those schools which have consistently good results for last five years. Further, it is also necessary to study number of factors which do contribute for this consistency. A part from the students' family background, motivation provided by the schools and family members, admission policies of schools, disciplinary practices in schools, infrastructural facilities provided to students etc. do help in improving the performance of students.

Baroda is one of the most progressive cities of Gujarat with its rich educational heritage at all levels. Today, about 200 secondary schools exists with Gujarati, English, Hindi and Marathi mediums in different parts of the city. Some of them are more than 50 years old. These include government aided, private non-aided and central schools. Central schools as well as some of the private non aided schools are not affiliated to Gujarat Secondary Education Board which conducts Std. 10th public examination. Rest of them is affiliated to G.S. E.B. The study was taken up to find the reasons for consistency in giving good result over last several years. To make a guideline for other schools to take appropriate decision as per their context.

Delimitation

This study was delimited to only 20 schools which have consistently good performance i.e. more than 70% results for the last five years i.e. 2003-2008. Only those schools which are affiliated to Gujarat Secondary Education Board were included in this study.

Objectives

1. To identify schools of Baroda city which are affiliated to Gujarat Secondary Education Board and have more than 70% results for the last five years.

2. To analyze the results of the selected schools of Baroda city for the last five years in the terms of the variables namely,

   a. Sex

   b. Category

3. To study an impact of the following factors on results of selected schools of Baroda city with more than 70% results for the last five years.

    a. Nature of the schools – Boys/girls/Co-Education

    b. Types of Management – Private-aided/Private non-aided

    c. Religious & Linguistic Minority Vs others

    d. Medium of Instruction

    e. Qualification of the teaching staff

    f. Motivation provided to teachers

    g. Disciplinary practices of schools

    h. Nature of evaluation for std. 10th during the whole year

    i. Locale of schools and surrounding environment

    j. Linkages with other schools for academic purpose

    k. Infrastructural facilities provided by the schools

    l. Admission Policy of the schools

    m. Facilities for remedial teaching provided by the schools

    n. Staying with parents/any other person/hostel

    o. Role of PTA in schools

    p. Innovations at school level

    q. Participation of students at National and State level competitions

    r. Any special efforts by schools for maintaining higher standards

Population

All the secondary schools of Baroda city following Gujarat State Education Board(GSEB) syllabus constituted the population.

Sample

A total of 20 schools (10 Gujarati medium and 10 English medium schools) with more than 80% results for the last five years were selected from Baroda city.

Tools

1. *Information Schedule* – Information Schedule was prepared to collect the information regarding family background of students and details of the schools. This tool was prepared by the investigators and given to the five

experts for their content validity. After getting their suggestions, final versions was prepared for implementation.

Collection of data

The tools were implemented personally in all the selected schools for collection of data. It took about three months time.

Data was collected regarding all the objectives from 20 schools through school records. Interview schedule were also be administered on principals, teachers. Principals of every school and three teachers were selected from each school randomly.

Analysis and interpretation of Data

The analysis of the data is presented below objective wise:

The **first objective** was to find the schools having more than 70% results for the last five years affiliated to Gujarat Secondary Education Board. The list of all the schools was taken and from that a list of schools was made having more than 70 % result in the board, it was found that there were about hundred schools with such results.

Related to the **second objective** the following table presents the data of students in terms of their result obtained from different schools year wise.

Table 1 **standard X result for last five years of the schools**

Academic year	% pass SC		% pass ST		% pass SEBC		% pass Physically Handicapped		General	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
2003-04	66	98	50	89	83	90	76	95	89	91
2004-05	56	93	55	94	76	89	90	96	93	97
2005-06	76	90	67	96	88	95	98	99	97	99.87
2006-07	87	93	86	98	87	96	95	97	98.9	100

The data presented in table 1 indicates that there is gradual improvement and maintenance of school performance in terms of pass percentages of different categories presented.

The schools were established for almost last 20 to 40 years. The majority of the schools were coeducational. All the schools were located in the urban area within the limits of the city. The schools surveyed were equally distributed among public, private aided and private un-aided having medium of instruction English and Gujarati. Out of all 20 schools only three schools were from linguistic minority. Almost all the schools follow merit system and the rules and regulations of the government of Gujarat for giving admission to the students. The religious minority schools also give preference to the religion for admission over and above merit. Almost all the schools had good quality infrastructure having seminar room, activity room, computer lab, library etc.

1. **Teachers professional development**

Table 2: **Secondary Teaching staff details of schools**

Qualifications of teachers	Years of experience	specialization	Awards
Master degree with B.Ed.	10- 15	Subjects of science , maths, language , social science	At national level State level As well as at graduation and post graduation level

Table 2 represents the qualification of teachers of the school and their years of experience and specialization. The data reveals that majority of the teachers had sound background of the subject as revealed from the qualification of teachers. Further teachers had good experience in terms of numbers of years spent in teaching and were also conferred with awards. The data was also collected from the schools about the teachers training program, motivational activities for increasing teachers' performance and managing regularity on part of teachers.

Implication for improving quality of schools

From the above study conducted it can be seen that it is the steps taken by the school authority and initiation taken by teachers to improve the school quality matters a lot. Following implications emerge from the analysis of the findings.

- There should be involvement of community members to improve and implement the changes.

- Teachers should make effort to update their knowledge and skill to improve teaching. There should be programs for professional development for school teachers as well as principals looking to need of the present context.

- Continues evaluation of students' performance and immediate feed back and corrective measures for their improvement.

- Guidance and counseling cell for the students

- Incentives for students excelling in exams

- Providing opportunity for the students to participate at state / national level competitive and grooming them to participate in the same. Thus providing opportunity to develop their personality.

- Arranging remedial and zero period for extra time to be given to the students.

- Organizing workshops on meditations, yoga to relax and improve concentration in studies; counseling and time management workshops; counseling for parents; regular talks by principal.

Conclusion

From the above study it is seen that it is the cooperative effort of the parents, principal, teachers and students who can bring change in the school system. Quality is something that is in the mind set, it can't be quantified in terms of number of measures taken and implemented. The initiation for quality education should come primarily from the students' side as they are the affected agent in the whole learning process.

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ATTITUDE TOWARDS SCIENCE OF SCIENCE AND NON-SCIENCE
MAJOR STUDENT TEACHERS - A COMPARATIVE ANALYSIS

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INTRODUCTION

Science is one of those human activities that man has created to gratify certain human needs and desires. Curiosity has been the greatest motive power of scientific research. The search for truth has become the dominant in persuasion of science. As it is under persuasion since so many centuries it has attracted the attention of a much persisted group of people.

Science is no longer confined to a few seriously devoted persons. Since the life in the present world invariably warrants to variable degrees of scientific facts and laws, science has now become a part of general education. Science takes its place side by side with other subjects as an essential element of one's education. It affords knowledge of certain facts and laws and an insight into methods and data peculiar to the domain of science. However, the inclusion of any subject in the curriculum should satisfy the intellectual, utilitarian, vocational, cultural, moral and aesthetic values. Besides these, the teaching of science imparts training in the scientific method and develops positive attitude towards science subject, scientific aptitude, which are very valuable and at the same time are transferable to other situations in the life of the learners. The qualities imbibed by the learner through learning science are of great value to the citizens living in the society.

The Scientific Policy Resolution of the Govt. of India (1958) states that "the dominating feature of the contemporary world is the intense cultivation to meet the country's requirement. Science has now become a compulsory subject in the school curriculum in every system of school education right from the elementary stage, because of its multifarious values gifted to the individual as well as to the society."

An attitude is an emotional reaction towards a person or thing. It is a personal response to an object, developed through experience which can be characterized as favourable or unfavourable. The use of science as the object or stimulus of these feelings delineates that set of attitudes known as 'attitude towards science'

NEED FOR THE STUDY

As one of the researchers is a teacher educator working in self finance teacher education institution, the investigator had informal chats with the B.Ed. students and came to know about their level of attitude towards science. He came to know that many student teachers did not possess adequate level of attitude towards science very much needed for them to undergo teacher education programme successfully that would help them to become successful teachers in the future and prepare the youth for a bright future of the nation. As science is a universal subject, the investigator wanted to study the science as well as non-science major student teachers attitude towards science. Under these circumstances, the investigator has decided to undertake a comparative analysis on the attitude towards science of science and non-science major student teachers.

OPERATIONAL DEFINITION

Attitude

The investigator means by attitude as a mental or neural state of readiness organized through experience, expecting a direct or dynamic influence upon the individual's response to all objects and situations with which it is treated.

Student teachers

The investigator means by student teachers as those students, who are undergoing Bachelor's degree in Education (B.Ed.) programme in Colleges of Education, Madurai revenue district, affiliated to Tamilnadu Teachers Education University, Chennai.

Science

The investigator means by science as a cumulative and endless series of empirical observations which result in the formation of concepts and theories, with both the concepts and theories being subject to modification in the light of further empirical observations.

Science major student teachers

The investigator means by Science major student teachers as those student teachers who have opted for Physical science and Biological science as their optional subjects.

Non-Science major student teachers

The investigator means by non-science major student teachers as those student teachers who have opted language and arts subjects other than Physical science and Biological science as their optional subjects

OBJECTIVES

- To find out the level of attitude towards science and its dimensions of science and non-science major student teachers.
- To find out significant difference among science and non-science major student teachers in their attitude towards science and its dimensions

HYPOTHESES

- The level of attitude towards science and its dimensions of science and non-science major student teachers is moderate.
- There is no significant difference among science and non-science major student teachers in their attitude towards science and its dimensions

METHODOLOGY

Survey method of research was adopted for the study.

POPULATION AND SAMPLE FOR THE STUDY

The population for the present study consists of all B.Ed. students of Madurai revenue district.1080 B.Ed. students from 20 colleges of education, Madurai revenue district were selected through random sampling technique for the study.

TOOLS USED FOR THE STUDY

For the present study, the investigator used the following tools,

- Attitude towards Science Scale prepared and validated by the investigator
- Personal Data Sheet prepared by the investigator.

DATA ANALYSIS

To interpret the raw data, analyses were done using Percentage analysis, Mean, Standard deviation, ANOVA and Post ANOVA (Duncan). The results of the analyses are presented in the following tables.

1. The level of attitude towards science and its dimensions all student teachers is moderate.

Table 1

Level of attitude towards science and its dimensions of all student teachers

Dimensions	Low		Moderate		High	
	N	%	N	%	N	%
Personal Confidence about the subject matter	257	23.8	576	53.3	247	22.9
Involvement with the subject	279	25.8	521	48.2	280	25.9
Usefulness of the subject content	289	26.8	493	45.6	298	27.6
Perception of teacher's attitude	322	29.8	456	42.2	302	28.0
Attitude towards science in total	278	25.7	531	49.2	271	25.1

It is inferred from the above table that

a) 22.9% of the student teachers have high level of personal confidence about the subject matter.

b) 25.9% of the student teachers have high level of involvement with the subject.

c) 27.6% of the student teachers have high level of usefulness of the subject content.

d) 28% of the student teachers have high level of perception of teacher's attitude.

e) 25.1% of the student teachers have high level of attitude towards science in total

2. The level of attitude towards science and its dimensions of science and non-science major student teachers is moderate.

Table 2
Level of attitude of student teachers towards science and its dimensions of science and non-science major student teachers is moderate.

Dimensions	Major subject	Low		Moderate		High	
		N	%	N	%	N	%
Personal confidence about the subject matter	Arts	35	26.9	72	55.4	23	17.7
	Science	111	20.2	305	55.6	133	24.2
	Language	111	27.7	199	49.6	91	22.7
Involvement with the subject	Arts	27	20.8	73	56.2	30	23.1
	Science	146	26.6	256	46.6	147	26.8
	Language	106	26.4	192	47.9	103	25.7
Usefulness of the subject content	Arts	28	21.5	66	50.8	36	27.7
	Science	145	26.4	243	44.3	161	29.3
	Language	116	28.9	184	45.9	101	25.2
Perception of teacher's attitude	Arts	39	30.0	58	44.6	33	25.4
	Science	156	28.4	224	40.8	169	30.8
	Language	127	31.7	174	43.4	100	24.9
Attitude towards science in total	Arts	29	22.3	70	53.8	31	23.8
	Science	139	25.3	267	48.6	143	26.0
	Language	110	27.4	194	48.4	97	24.2

It is inferred from the above table that

a) 17.7 % of Arts student teachers, 24.2% of Science student teachers and 22.7% of Language student teachers have high level of personal confidence about the subject matter.

b) 23.1% of the Arts student teachers, 26.8% of Science student teachers and 25.7% of Language student teachers have high level of involvement with the subject.

c) 27.7 % of the Arts student teachers, 29.3%of Science student teachers and 25.2% of Language student teachers have high level of usefulness of the subject content.

d) 25.4 % of the Arts student teachers, 30.8% of Science student teachers and 24.9%   of Language student teachers have high level of perception of teacher's attitude.

e) 23.8% of the Arts student teachers, 26.0%of Science student teacher and 24.2% of Language student teachers have high level of attitude towards science in total.

NULL HYPOTHESIS

3. There is no significant difference among science and non-science major student teachers in their attitude towards science and its dimensions

Table 3

Significant difference among science and non-science major student teachers in their attitude towards science and its dimensions

Dimensions	Major Subject						'F' Value	'p' Value	Remarks at 5% level
	Arts		Science		Language				
	Mean	SD	Mean	SD	Mean	SD			
Personal confidence about the subject matter	25.47	4.38	26.17	4.95	25.63	5.10	1.899	0.150	NS
Involvement with the subject	26.02	5.24	26.06	5.18	26.01	5.00	0.014	0.986	NS
Usefulness of the subject content	21.02	4.43	20.49	4.92	20.31	4.61	1.100	0.333	NS
Perception of teacher's attitude	10.85	2.49	11.10	2.76	10.70	2.92	2.494	0.083	NS
Attitude towards science in total	82.88	12.90	83.83	13.65	82.19	13.55	1.713	0.181	NS

It is inferred from the above table that there is no significant difference among Arts, Science and Language student teachers in their attitude towards science in total and its dimensions personal confidence about the subject matter, involvement with the subject, usefulness of the subject content and perception of teacher's attitude.

DISCUSSION

From the present investigation, it is found that only 25.1% of the sample has high level of attitude towards science. While studying in terms of dimensions of attitude towards science very small amount of the respondents have high level of personal confidence about the subject matter, involvement with the subject, usefulness of the subject content and perception of teacher's attitude. Moreover majority of the sample have moderate level of attitude towards science and its dimensions. This implies that the student teachers might have been exposed to minimum levels of science activities in their under graduate level and hence they possess a moderate level of attitude towards science.

With the sample of the study classified in terms of their major subject, it is observed that the 23.8% of Arts student teachers and 24.2 % of Language student teachers have high level of attitude towards science In the dimensions, personal confidence about the subject matter, involvement with the subject, usefulness of the subject content and perception of teacher's attitude, Science student teachers are found to be marginally better than the non-science major student teachers. This shows the fact that non-science major student teachers studied science subject during their school days, taken arts and language as their major subject still exhibit favourable attitude towards science.

From the analysis of data in the present investigation, Arts, Science and Language student teachers do not differ significantly in their personal confidence about the subject matter, involvement with the subject, usefulness of the subject content, perception of teacher's attitude and attitude towards science in total. This shows the fact that if given opportunity, non-science major student teachers definitely would like to learn science and develop their scientific knowledge and skills

SUGGESTIONS

The authors suggested the following for improving the attitude towards science of science and non-science major student teachers in teacher educational institutions.

✓ Interdisciplinary courses can be introduced in B.Ed. curriculum for non -science major student teachers to develop positive attitude towards science

✓ Similar to some arts and science autonomous colleges, non-science major student teachers can opt for science related electives and vice-versa.

- ✓ The teacher educators should highly motivate the student teachers to learn science with interest. The facilities like library, laboratory, audio-visual aids etc., should be utilized for inculcation and promotion of positive attitude towards science subject for the student teachers.

- ✓ The teacher educators must try to promote the attitude towards science in student teachers by implementing factors that are feasible in their own educational set up.

- ✓ Providing opportunity for the analysis of problem and amount of scientific knowledge or exposure to general science courses can be promoted.

- ✓ Taking the student teachers to exhibitions, excursions, field trips, zoos, parks, industries, natural habits of plants and animals also improve attitude towards science subject.

- ✓ By allowing the student teachers to mingle with various peer and intellectual groups and exposing them to the eminent personalities like scientists, social reformers can also use to develop the attitude towards science subject.

- ✓ The teacher educators can prepare modules and use effective instructional aids for   effective teaching to develop the attitude towards science subject.

- ✓ Efforts should be taken to direct the presentation of science lessons away from the traditional methods to a more students centered approach. This is re-orientation of existing teaching methods from 'chalk and talk' and 'lecture method' to 'activity oriented methods' like project method.

CONCLUSION

The authors concluded that the comparative analysis on attitude towards science of student teachers brought out the fact that science and non-science major student teachers do not differ among attitude towards science and its dimensions personal confidence about the subject matter, involvement with the subject, and usefulness of the subject content and perception of teacher's attitude.

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