ISSN - 0973 - 8614
Volume - 9 Number - 2 April - June, 2014

# VETRI EDUCATION

(Quarterly Journal in Education)


VETRI PUBLICATIONS
PUDUCHERRY - 605 013

# Vetri Education (Quarterly Journal in Education)


| | | | |
|---|---|---|---|
| 1. | Name of the Journal | : | **VETRI EDUCATION** |
| 2. | Language | : | English |
| 3. | Periodicity | : | Quarterly |
| 4. | Printer, Publisher and Owner | : | Er. **G. GANESH**, B.Tech. |
| 5. | Chief Editor | : | Prof. Dr. **MAMOTA DAS**, M.A., (Psychology) M.Ed., Ph.D. |
| 6. | Full address of the place | : | VETRI<br>No.8, Govindapillai Street,<br>Kannan Nagar, (NEAR NEW BUS STAND)<br>Puducherry-605 013<br>E-mail:vetriorgpondy@gmail.com |


## EDITORIAL ADVISORY COMMITTEE



**Visit: www.vetrieducation.com**

# VETRI EDUCATION

(QUARTERLY JOURNAL)


**Vetri Publications**

Puducherry - 605 013

# Vetri Education (Quarterly Journal in Education)

## EDITORIAL BOARD



**A Journal Devoted to School Education**


Subscription: Rs.200/- Annually

**Visit: www.vetrieducation.com**

# VETRI EDUCATION

**Volume 9** **Number 2** **April – June, 2014**

## Contents

**Articles** Page

# Editor's Note

**Dear Readers,**

**Vetri Education** tries its best to provide educational articles to help quality guidance and improvement in human resource development for its readers. Our arduous desire to maintain the quality, format and the timely publication of **Vetri Education** continues undiminished, with your support. You are viewing the Second issue of the 9th volume of the Journal before the middle of April, 2014.

The first article in this issue: *Intellectual Ability and Working Memory on Mathematics Achievement* by **R. D. Padmavathy and M. S. Lalithamma** explains the finding of their research study showing significant relationship among working memory, general intelligence, numerical ability and spatial ability; abstract reasoning has association; but verbal reasoning has no association on mathematics achievement.

**Mohammad Saheel Khan** in his article (second of the issue): *Teacher Burnout - Causes and Prevention,* describes the general causes of teacher burnout and suggests remedial measures to overcome or diminish the effect of the phenomenon on teachers.

**Ranjan Kumar Biswas**, through the third article: *Availability and Use of ICT Software at Different DIETs of Tribal Areas,* explains the inadequacies and shortcomings of the optimum use of the ICT software for want of the infrastructure and/or scarcity of the items and offers practical and remedial suggestions.

The fourth article: *Instantaneous Classroom Evaluation: A Technique for Bridging the Gap between Teaching and Learning* by **Talmeez Fatma Naqvi** explains the use of an Instantaneous Classroom Evaluation Technique (One-Minute Question) to improve quality of teaching and learning avoiding the time-lag between teaching-learning and tests.

**Pratimam Saxena** in: *Teachers in the Current and Future Scenario Viewed by Adolescents*, forming the fifth article, describes in detail the inputs, generated in a symposium, from the teenage students to re-define certain un-touched aspects of domain knowledge, communication, teaching for understanding and importance of bonding between teachers and their students.

The sixth and last article of the issue: *Accidental Discoveries* by **A. G. Ramachandran Nair** briefly brings together several unexpected or accidental discoveries in different fields over a long period and suggests all of them are products of sincere and systematic observation and follow up, rendering the serendipitous advantage not significant.

**Vetri Education** expresses sincere appreciation and thanks for the valuable contributions and encouragement from authors, subscribers and all our well wishers, and for the earnest efforts of Mr. P. R. Anebarassane Rada and Mr. N. R. Prabu for the successful and timely publication of the issues of the Journal.

**Academic Editor,**
**Vetri Education**

Vetri Education, Quarterly Journal (ISSN - 0973 - 8614), IX (2), 2014, 7-14

# Intellectual Ability and Working Memory on Mathematics Achievement

**R. D. Padmavathy* and M. S. Lalithamma**

School of Education, Pondicherry University, Puducherry - 605 014

## Abstract

The main objective of the study is to explore the effect of Intellectual ability and Working memory on Mathematics achievement. The investigators employed descriptive survey method and used proportionate stratified random sampling technique to draw the sample. Standardized instrument, namely Digit span Working Memory Test (Wechsler, DBT- WISC-III UK, 1992), Raven's Standard Progressive Matrices for Intelligence (Raven, Court and Raven,1992), Sub tests of Differential Ability Test (DAT: Bennett, Seashore and Wesman, 1962) to understand numerical ability, verbal reasoning, spatial ability, abstract reasoning, and mathematics diagnostic cum achievement test (MDAT) constructed by investigators were used. A large sample of 1200 school students studying in IX standard were sampled in the data collection with the overall aim of getting a clear picture of the effect of intellectual ability and working memory on mathematics achievement. Mean, standard deviation and correlation t-test, and One Way Analysis of Variance (ANOVA) were the statistics used to analyse the data. Results indicate there is significant relationship among working memory, general intelligence, numerical ability and spatial ability; abstract reasoning has association; but verbal reasoning has no association on mathematics achievement.

**Key words: Working memory, general intelligence, intellectual ability, mathematics achievement**

## Introduction

Mathematics is an important subject in school curriculum. It is more closely related to one's daily life as compared to other subjects. Except one's mother tongue there is no other subject which is more closely related to one's daily life as mathematics. Mathematics is considered to be the father of all sciences (Hashmi *et al*., 2012). Mathematics problem solving is a multi dimensional task. Successful completion of any mathematical task requires high cognitive complex skills.

Every individual learner differs in their intellectual ability, and their educational needs are also different from others. Many empirical investigations have shown that intelligence is the best single predictor of academic success. Many studies focus on one variable or on only a limited number of variables which makes prediction less effective because the interaction between different variables is ignored. General intelligence was shown to be a complex concept which involves cognitive abilities used in a person's intellectual functioning across contexts. These abilities are required in all learning situations to a greater or lesser degree and are therefore also tapped in tests measuring aptitude (Marais, 2007). In this paper an attempt has been made to analyse the effect of Intellectual ability and Working memory on Mathematics achievement and the effect of gender, locality and type of institution on mathematics achievement.

***E-mail: padmajothi@yahoo.in**

*Working Memory*

Working memory is a cognitive process that allows a person to multitask, or simultaneously think about and hold information at the same time as completing other tasks, and is responsible for temporarily storing and manipulating information (Alloway, 2006).

The most influential models of working memory suggested by Baddeley and Hitch (1974) conceived that working memory has three sub-components; the central executive is aided by two peripheral and independent systems – the phonological loop and the visuo-spatial working memory.

The central executive system (CE) is responsible for initiating and controlling processes, making decisions, and retrieving information from long-term memory.

The phonological loop (PL) is a subsidiary system for holding and handling sound and speech.

The visuo-spatial working memory (VSWM) is holding and manipulating visual material (nonverbal).

*Working memory and Mathematics achievement*

There are studies made to understand the influence of working memory on mathematics achievement. A few studies reveal central executive function plays an important role and correlates with mathematical learning disability (Russell *et al*., 1996); one task interferes with the other (Hecht, 1999); disrupts subtraction (Geary *et al.*, (1993), single-digit addition and multiplication (Seitz and Schuman-Henstler, 2000) and division (Lefevre and Morris, 1999). In the same way the role of the *phonological loop* has also been explored in adult counting (Logie and Baddeley, 1987), and Holmes and Adams (2006) indicates that phonological loop is important for the attainment of number facts in early childhood. Even though there are researches done in this area, many other cognitive factors responsible for low achievement in mathematics remain unexplored.

## Discussion

*Intellectual ability*

*Intelligence*

Piaget defined intelligence as a cognitively driven process of assimilation and adaptation to the environment (Cohen and Swerdlik, 2002)

*Aptitude*

”Aptitude is the potential of a person which enables the person to achieve a certain level of ability with a given amount of training and/or practice”. Learners’ ability to reason abstractly on the basis of verbal and non-verbal material, their memory for meaningful material, their quick and accurate visual and spatial perceptual abilities, and their ability to see and apply arithmetical, mechanical and physical principles, will give an indication of the level at which they will be able to complete an academic, technical or practical course successfully” (Owen *et al*., 2000).

*Hypotheses of the study*

1. There is no significant relationship among Working memory, General intelligence, Numerical ability, Verbal reasoning, Spatial ability and Abstract reasoning on Mathematics achievement

2. There is no significant difference in mathematics achievement with respect to (i) gender, (ii) locality of the school and (iii) type of institution

*Delimitations of the study*

The study was delimited to students from IX standard, studying in English medium schools following Tamil Nadu state board syllabus in Puducherry. Visuo-spatial working memory was not taken for research.

*Methodology*

*Design of the study*

The investigators employed descriptive survey method (Radhamohan, 2010).

*Participants*

In this study participants were drawn using proportionate stratified random sampling technique (Radhamohan, 2010). A total number of 1200 ninth standard students (600 boys and 600 girls) from twenty four English medium schools in Puducherry were selected as the sample.

*Research tools*

1. The Digit Span (Forward and Backward) subtests of the *Wechsler Intelligence Scale for Children*-Third Ed. (DBT- WISC-III UK, 1992)

2. Raven's Standard Progressive Matrices for Intelligence (Raven, Court and Raven, 1992)

3. Differential Ability Test (DAT; Bennett *et al*.,1962) subtests - Numerical ability, Verbal reasoning, Spatial ability, Abstract reasoning

4. Mathematics Diagnostic cum Achievement Test (MDAT) constructed by investigators (See below)

*Mathematics Diagnostic cum Achievement Test (MDAT)*

The Mathematics Diagnostic cum Achievement Test (MDAT) consisting of 150 multiple choice items was developed by the researchers. This test item was piloted on 300 ninth standard students.Content validity for this achievement test was ascertained with the help of two professors, eight assistant professors and two mathematics teachers in education having above 15 years of experience in teaching mathematics. The help of four mathematics teachers currently teaching students of 9th standard in government schools was also utilized and the instrument was carefully scrutinized by colleagues, research scholars, and their valuable suggestions and comments were incorporated for the improvement of the instrument.

Thus, the test assesses achievement consisted of 150 items; the quantum of achievement assessed by awarding 1 point for every correct answer in the multiple choice questions. Consequently, the possible achievement scores of the participants could range from 0 to 150. For every item, error analysis was done and separately recorded.

*Variables of the study*

*Independent variable:* Mathematics achievement score

*Dependent variables:* Working memory, General intelligence, Numerical ability, Verbal reasoning, Spatial ability, Abstract reasoning

*Data collection*

This study was conducted during the academic year 2012-2013. Permission was secured from Department of Education, U.T. of Puducherry and the concerned Principals of schools for conducting the study. All participants were tested at their own school during regular school hours. On the first day of conducting the test, researcher provided detailed procedure followed by explanation on the aim, objective and the proper sequence of answering to all the participants, before providing the instruments. Students were instructed to be ready with pen, pencil. While administering the test seating arrangement was also taken care of. Except working memory measure all the remaining tasks were group based.

***Step 1:*** Before giving the test paper, investigator provided the Information schedule to students and instructed to fill the necessary details. After this, Sub tests of Differential Ability Test (DAT) namely numerical ability and spatial ability tests were conducted.

***Step 2:*** Mathematics diagnosis cum achievement test (MDAT) was conducted and students were informed of the time limits of the test and freedom to ask any question while attempting the test. Sufficient time was given to read, understand and mark the responses to the questions. Once completed answering (3 hrs.), questionnaire and answer sheet were collected back. Verbal reasoning and Abstract reasoning tests were conducted.

***Step 3:*** Digit span (forward and backward) test was conducted for each student individually in a quiet room of the school. Data regarding marks obtained in different tests and errors committed in the tests were noted from the answer sheets.

*Analysis and interpretation*

The data were analyzed using the SPSS 17 program. The mathematics achievement score, intellectual ability and working memory of IX Standard students (N=1200) were found to form a normal distribution.

## Table 1: Descriptive analysis of intellectual ability and working memory on mathematics achievement and correlation among the variables

| Variables | N | Mean | Median | Mode | S.D. | r-value with Mathematics achievement | Level of significance |
|---|---|---|---|---|---|---|---|
| MDAT score | 1200 | 87.40 | 91 | 89 | 19.83 | | |
| Intelligence | 1200 | 47.25 | 50 | 50 | 26.35 | 0.185** | S |
| Phonological loop | 1200 | 8.74 | 9 | 8 | 2.35 | 0.265** | S |
| Central executive system | 1200 | 4.85 | 5 | 3 | 1.96 | 0.662** | S |
| Numerical ability | 1200 | 80.14 | 85 | 97 | 18.7 | 0.084** | S |
| Verbal reasoning | 1200 | 71.36 | 75 | 75 | 23.84 | 0.000 | No association |
| Abstract reasoning | 1200 | 49.02 | 45 | 45 | 22.99 | 0.020 | NS |
| Spatial ability | 1200 | 55.9 | 55 | 60 | 14.53 | 0.019 | NS |

** Correlation is significant at the 0.05 level (2- tailed).

Table 1 showing the mean, median, mode and standard deviation indicates the distribution of intellectual ability and working memory on mathematics achievement as almost normal. The finding reveals that general intelligence, working memory (central executive system phonological loop) and numerical ability correlation coefficients p value are less than 0.05. Hence these variables are significant at 5% level of significance. There is a strong evidence to reject the null hypothesis, suggesting all the above variables are strong and positively correlated to mathematics achievement. Also noticed is: increase in one of these variables corresponds to increase in the other. Abstract reasoning and spatial ability have association on mathematics achievement; verbal reasoning has no association with mathematics achievement.

## Table 2: Effect of gender, locality and type of institution *on mathematics achievement*

| Variables | Sub samples | N | Mean | S.D. | t-Value | 5%levelof significance |
|---|---|---|---|---|---|---|
| Gender | Male | 600 | 90.4 | 15.49 | 0.00 | NS |
| | Female | 600 | 84.4 | 23.00 | | |
| Locality of school | Urban | 600 | 87.21 | 18.11 | 0.04 | NS |
| | Rural | 600 | 87.58 | 21.42 | | |
| Type of institution | Govt | 400 | 83.72 | 21.25 | F-value 10.6 p-value 0.00 | NS |
| | Govt aided | 400 | 89.58 | 19.68 | | |
| | Private | 400 | 88.90 | 17.94 | | |

## Table 3: ANOVA

| MDAT typed | Sum of squares | df | Mean square | F | Significance |
|---|---|---|---|---|---|
| Between groups | 8213.562 | 2 | 4106.781 | 10.609 | 0.000 |
| Within groups | 463355.625 | 1197 | 387.097 | | |
| Total | 471569.187 | 1199 | | | |

Tables 2 and 3 revealed that the calculated p value for gender, locality and type of institution is less than 0.05; thus, the null hypothesis is accepted at 5% level of significance. Hence, there is no significant effect by difference of gender and locality of schools on mathematics achievement of IX standard students of Puducherry.

## Table 4: Test of significance of difference between mean score of mathematics achievement and different types of institutions

| Post hoc test (Tukey's multiple comparison test) | | | |
|---|---|---|---|
| (I) School type | (II) School type | Mean difference (I-II) | Significance |
| Students in government schools | Government aided schools | -5.858 | .000 |
| | Private schools | -5.180 | .001 |
| Students in government aided schools | Government schools | 5.858 | .000 |
| | Private schools | .678 | .878 |
| Students in private schools | Government schools | 5.180 | .001 |
| | Government aided schools | -6.78 | .878 |

In Tables 3 and 4, significance value is less than alpha value. That indicates there is significant differences between the groups F (2, 1197) = 10.6 (F-value), p=0.000. Post hoc test (Tukey's multiple comparison tests) reveals students studying in private schools does not differ significantly from the students studying in government aided schools on mathematics achievement, but students studying in government schools significantly differ (less achievement) from government aided and private schools.

## Conclusion

Cognitive abilities are very important for intelligence function. The current study has made a contribution to the literature regarding the consideration of interaction between different variables which seems ignored earlier. All these factors - general intelligence, working memory (central executive system, phonological loop), numerical ability, abstract reasoning and spatial ability - have correlation on mathematics achievement; verbal reasoning has no association with mathematics achievement. The fact that different abilities are required in learning situations, and increase in one of these variables influences increase in the other individual ability to a certain extent, is an important finding of the study. Students studying in private schools in Puducherry do not differ significantly from the students studying in government aided schools on mathematics achievement; students studying in government schools however, significantly differs (less achievement) from their counterparts in government aided and private schools on mathematics achievement. As seen generally, private school students exhibiting upper hand in many aspects compared to government ones, mathematics achievement too follows suit, for well known reasons. A small state like Puducherry should make all out efforts to eliminate this disparity and be a leader for others

## References


Alloway, T. P. (2006), *How does working memory work in the classroom?* Educational Research and Reviews, **1**(4), 134-139.

Baddeley, A. D. and Hitch, G. (1974), *Working memory*, The Psychology of learning and Motivation, G. H. Bower, Academic Press, New York, pp. 47-90.

Bennett, G. K. Seashore, H. G. and Wesman, A. G. (1962), *Differential Aptitude Tests.* Psychological Corporation, New York.

Cohen, R. J. and Swerdlik, M. E. (2002), *Psychological testing and assessment: an introduction to test and measurement,* 5th Ed., McGraw-Hill, Boston.

Geary, D. C., Frensch, P. A. and Wiley, J. G. (1993), *Simple and complex mental subtraction: Strategy choice and speed-processing differences in younger and older adults,* Psychology and Aging, **8**, 242-256.

Hashmi, M. A., Zeeshan, A., Saleem, M. and Akbar, R. A. (2012), *Development and Validation of an Aptitude Test for Secondary School Mathematics Students*, Bulletin of Education and Research, **34**(1), 65-76.

Hecht, S. A. (1999), *Individual solution processes while solving addition and multiplication Math facts in adults*, Memory and Cognition, **27**, 1097-1107.

Holmes, J. and Adams, J. W. (2006), *Working Memory and Children's Mathematics Skills: Implications for mathematical development and mathematics curricula,* Educational Psychology, **26**(3), 339-366.

Lefevre, J. and Morris, J. (1999), *More on the relation between division and multiplication in simple Arithmetic: Evidence for mediation of division solutions via multiplication*, Memory and Cognition, **27,** 803-812.

Logie, R. H. and Baddeley, A. D. (1987), *Cognitive processes in counting,* Journal of Experimental Psychology: Learning, Memory and Cognition, **13**, 310-326.

Marais, A. C. (2007), *Using the Differential Aptitude Test to Estimate Intelligence and Scholastic Achievement at Grade Nine Level*, M. Ed. Dissertation, University of South Africa, South Africa.

Owen, K., Vosloo, H. N., Claassen, N. C. W. and Coetzee, H. (2000), *Manual for Differential aptitude tests Form L (DAT-L) - Aaniegtoetse Form L (DAT-L),* Human Sciences Research Council, Pretoria.

Radha Mohan (2010), *Research Methods in Education*, Neelkamal Publications Pvt. Ltd, New Delhi.

Raven, J. C., Court, J. H., and Raven, J. (1992), Standard progressive matrices, Psychologists Press, Oxford, U. K.

Russell, J., Jerrold, C. and Henry, L. (1996), *Working memory in children with autism and with moderate learning difficulties*, Journal of child Psychology and Psychiatry, **37**, 673-686.

Seitz, K. and Schumann-Hengsteler, R. (2002), *Phonological loop and central executive processes in mental addition and multiplication,* Psychological Beitrage, 44, 275-302.

xxxxxxxx

## CURIOUS FACTS, MATERIALS, PROCESSES AND BIO ACTIVITIES

### Life study (Imaging dynamics of small biomolecules inside live cells)

Researchers at Columbia University have made a significant step toward visualizing small biomolecules inside living biological systems with minimum disturbance. Wei Min and colleagues have developed a general method to image a broad spectrum of small biomolecules, such as small molecular drugs and nucleic acids, amino acids, lipids for determining where they are localized and how they function inside cells. The team have departed from the conventional paradigm of fluorescence imaging of fluorophores instead coupled stimulated Raman scattering (SRS) microscopy with the use of an alkyne tag that gives them a strong, characteristic Raman signal. "Our new technique will open up numerous otherwise difficult studies on small biomolecules in live cells and animals", explains Min. "In addition to basic research, our technique could also contribute greatly to translational applications. I believe [it] could do for small biomolecules what fluorescence imaging of fluorophores such as green fluorescent protein has done for larger species."

### Metabolic map (International Consortium Builds 'Google Map' of Human Metabolism)

A kind of "Google Map" of human metabolic processes has been drawn up by international researchers. The work builds on a pioneering study at the University of California, San Diego, and gives us a comprehensive virtual reconstruction of human metabolism. The model, Recon 2, could be used to track the detailed causes of diseases like cancer, diabetes and even psychiatric and neurodegenerative disorders and so open up new routes to therapeutic discovery and pharmaceutical targets. UCSD's Bernhard Palsson likens the metabolic map to Google Street View allowing researchers to zoom in on metabolic avenues that lead to cancerous tumour growth for instance or obtaining finely detailed images of individual metabolic reactions.

Continued on Page 22...

Vetri Education, Quarterly Journal (ISSN - 0973 - 8614), IX (2), 2014, 15-22

# Teacher Burnout - Causes and Prevention

**Mohammad Saheel Khan***

College of Teacher Education, Maulana Azad National Urdu University,
Hyderabad, MHKITC Campus, Rafiqia School Road, Bhopal- 246 001, M. P.

## Abstract

In this study aimed at finding out the various causes and prevention of teacher burnout, the main causes form three types of burnout - work related, lifestyle related and personality trait related. The golden saying: *prevention is better than cure* is more relevant to teacher burnout compared to other physical illnesses. Detection and identification of causes in time help prevention and even effective cure of burn out to a great extent. The role of the individual, colleagues as well as the organisation plays important part in all the three stages - detection, prevention and amelioration/cure - of the burnout and render the teacher a physically and mentally healthy person to serve the students and contribute to human resource development. Some of the main causes of burn out like heavy workload, higher responsibility with minimum administrative power, competition from younger colleagues for learning and mastering new knowledge, strategies and techniques of instruction and the desire to be perfectionist in a not so conducive academic atmosphere, lack of recognition from the management and superior colleagues, etc. and suggestions to overcome them and ameliorative strategies to provide relief from the symptoms and achieving cure and academic rehabilitation are briefly discussed.

---

**Key words: Professional burnout, teacher burnout, causes, prevention**

## Introduction

The concept of teacher burnout can be traced back to the writing of H.J. Freudenburger with his publication in the journal of Social Issues in 1974. He is the first to coin the term teacher burnout (Wood and McCarthy, 2000). Freudenburger (1974, 1975 and 1977) and Cherniss (1980) have given a very comprehensive definition of burnout of working professionals, dealing with human services. They use the term *burnout* to characterize a malady experienced by human service professionals who appear to "wear out" or reach a stage where their work efficiency decreases and become incapable of performing their tasks effectively, and some times even fail to take care of their clients.

Later, Maslach and his group refined the meaning and measurement of the burnout construct in 1980 -1990 (Maslach, 1976, 1978 and1982; Maslach and Jackson 1981; Maslach and Schaufeli, 1993) to include three sub-domains, namely:

1. Depersonalization: by which one distances oneself from others and views others impersonally
2. Reduced personal accomplishment: by which one devalues one's work comparing with others
3. Emotional exhaustion: by which one feels emptied of personal emotional resources and becomes highly vulnerable to stressors

***E-mail: dr.saheelkhan@yahoo.com**

The earlier important findings explain more clearly the concept of teacher burnout. According to Bullough and Baugman (1997), teachers are susceptible to the great risk of burnout, because they feel that there work is futile and inconsistent with the ideals and goals they had set as a teacher in the beginning. Prolonged period of stress can cause burnout.

Stress comes from the perception of a teacher that the resources available are not adequate to cope with the existing responsibilities in the work place. According to Wood and Mc Carthy (*loc cit.*), the situation leading to teacher burnout occurs when teachers must face a classroom full of students every day, negotiate potentially stressful interactions with parents, administrators, counsellors and other teachers, remaining contended with relatively low pay and shrinking school budgets, and at the same time ensuring students receiving increasingly higher standards of knowledge, skill and accountability. The characteristics of burn out as well as causes, precautions, preventive strategies and ameliorative support for the victim are briefly discussed here.

## Discussion

There are many causes for burnout for a professional, especially a teacher in a noble profession due to the necessity of dealing the public affairs and encountering with the pupils of different background, varied I.Q., temperament, ambition, emotion, and preoccupied with the desire to do well but not able to carry out causing stress and disappointment. Here, main focus to avoid burn out of teachers to the extent possible is to know the causes of burnout or the areas which are the main source of teacher burnout. It is said that the school is a miniature society. Thus the teacher is living in the society and working in dealing with students, parents, superior officers, management and public, including local politicians; but having no power in improving the facilities or working atmosphere which can often be providing helplessness, depression and irritation leading to stress, the ignition for burnout. In the present and latter half of the earlier century the regard and respect for the teacher by the students and more by the society has seen a continuous fall affecting devoted persons expecting due regards enjoyed by the profession for centuries. The education has, of late, become a commercial business with money determining the nature of the institution, and more return with minimum establishment facilities for human resource development. Often students are selected on criteria, other than academic merit and they expect to pass the course with grades in proportion to their influence with the management, leaving sincere teachers dejected and disappointed. The relation of pupil with teacher becomes weak and fragile and the reward of seeing his pupils acquiring knowledge, and developing discipline and other human values becoming scarce. Needless to say the sad fall in his status in the group - *Matha, Pitha, Guru* - of visible gods. The state of a number of schools under government control is not different, in inculcating knowledge and values, from private ones owing to mal-administration, high handedness of the head of the institution and higher ups and the abundance of teachers interested more in their rights and less in their responsibilities. A sincere, systematic and devoted teacher will be branded by the majority as misfit and not clever. Also such teachers have to take up more duties and additional tasks, often receiving criticism and exclusion making them sad and dejected. They are likely to commit more mistakes and aggravate their grievances leading to some mental depression - beginning of a burn out behaviour. Any one who feels overworked and undervalued is at the risk of imbibing a burnout. The sincere teacher will find little time and energy left after his academic activities in the institution and social commitment in the neighbourhood compelling to ignore any help in domestic matters at home causing displeasure from the family members. None appreciates the time he utilizes for correction of assignments, test papers, designing and preparing for the classes for the next day etc., and to be up to date during this Net age (with access to all for new knowledge and sources). It is very difficult to maintain the old notion that a teacher is the walking encyclopaedia for his students and the general public.

*Causes of teacher burnout*

The causes of burnout are broadly categorized into the following three types:

I. Work related causes of burnout
II. Lifestyle related causes of burnout
III. Personality trait related causes of burnout

*Work-related causes of burnout*

The work place is a source of burnout because a teacher is performing many tasks at the same time: a nurse, a counsellor, an administrator, a classroom manager, a guide and an educator besides a teacher and philosopher. All these stressful works cause a burnout because teacher feels that all these work except teaching is supplementary and futile for consideration of any significant regard, recognition or professional development, needed for improvement and elevation of status. Futility of the teacher's extra work, service and sincerity arises out of the following factors:

1. The teacher feels that there is little or no control for self over the work or responsibilities; in other words teachers are often power less in their professional work. LeCompte and Dwarkin (1991) identified powerlessness in professional roles as instrumental in creating stress.

2. The higher ups in the school or above and the society do not recognize or reward good work of the teacher. If a teacher is performing admirable work and is not recognised by the concerned person or group in the institution, he starts thinking negatively promoting initiation for disappointment and depression.

3. Sometimes teachers may feel their work as monotonous and unchallenging, especially with no change in status and responsibilities for long, creating a feeling of mental fatigue, escapism and cursing the profession for the effects contributing to stress.

4. The teacher is often working in a chaotic and high-pressure environment. A teacher is working in a situation where lack of resources, lack of time, excessive engagements, uncontrollable class sizes, lack of assistance, lack of support, hostility from parents, unhelpful attitude and behaviour of administrators and even public - all are contributory to stress followed by burnout. There has been report from research studies conducted in Virginia of the hesitation of a few teachers to join duty after reopening of the new academic year, indicating stress as the leading cause.

*Life style related causes of burnout*

At present life is very fast and every person is busy in his work; nobody has time to talk, share others' views, sit together to discuss common events and topics -political, economic, social and what not – to help him to relax and be socialized. In the olden days especially in India there were chaupal, baithak, deewane aam, inn, etc. where the people sit together and discuss their problems and receive some relief, relaxation and direction from their friends through their advice and counselling. Every individual is running in the four lane fast track i.e. privatization, globalization, Industrialization and modernization and want to get more and more benefits from them. Teacher, a member of the society primarily, also involves himself in the economic activity and wants to become richer through economical growth often at the expense of his professional ethics and values and ending up in stress. The major contributors to the causes of lifestyle related burnout are:

1. *Too much work*

If teachers do too much work without enough time for relaxing and socializing they will experience stress, a long time experience of stress can lead to burnout.

2. *Much expectation for too many things from too many corners*

Expectation of lots of ideal and exemplary conduct and contribution of a teacher by society, pupils, colleagues, guardians, management and well wishers, if left unfulfilled can negatively affect not only the teacher's optimism, enthusiasm and passion for constant evaluation and improvement but also make him feel unachieved, likely to be humiliated, sowing the seeds of stress and starting of burnout.

3. *Taking too much responsibility*

If a teacher takes too many responsibilities of the school unmindful of the time, resources and support from others, it will make him overwork, fail to complete them well and in time and even get the blame for the delay and sloppy execution. He will be feeling self pity and even receive hurting remarks from colleagues and other higher-ups belittling his commitment, efficiency and sense of responsibility- all these lead to disappointment, disenchantment and stress.

4. *Sleeplessness*

Sleeplessness is often a product of tension, stress, mental fatigue, etc. in sincere and devoted people when they realise delay or imperfection in their tasks. For teachers, additional contributors are overwork, un-controllable classes, low level of students' discipline, absence of value education, destructive criticism from stake holders and lack of empathy from colleagues and administration. Sleeplessness creates health problems and lethargy in work, leading to further blame and increased stress.

5. *Lack of close supportive relationship*

Sleeplessness is often a product of tension, stress, mental fatigue, etc. in sincere and devoted people when they realise delay or imperfection in their tasks. For teachers, additional contributors are overwork, un-controllable classes, low level of students' discipline, absence of value education, destructive criticism from stake holders and lack of empathy from colleagues and administration. Sleeplessness creates health problems and lethargy in work, leading to further blame and increased stress.

*Personality traits related causes of burnout*

Personality traits are stable features of an individual recurring in different situations. Personality traits are always marked by varying degree of prominence in different people, across various situations and by the potential capacity to be measured. In experimental psychology, personality traits include extroversion- introversion, worry, rigidity, and impulsivity. Personality traits contribute a lot towards teacher burnout. A teacher, having perfectionist tendencies, will see his whole work in a critic's point of view and try to improve the same more, till self satisfied. When one fails to achieve this, it becomes a source of worry; more such worries disturb peace of mind and sense of judgement giving way to stress. The major contributors for trait related burn out are:

1. *Perfectionist tendencies*

Many teachers, especially in the beginning of their career entertain perfectionist tendency: they always think nothing is good enough, much improvement is possible, criticize the school management, students behaviour, style of teaching of other teachers, school facility, etc. They often waste their time in imagining and dreaming of impracticable interventions becoming realties and thus running short of time to complete even normal tasks. This can create more unpleasantness in them and become stressed.

2. *Pessimistic view*

Teachers have a tendency to take a gloomy view of things, rendering them unrealistic and unenthusiastic losing proper care, planning and interest in the work. They hold generally a pessimistic view of themselves, others and the world.

3. *Reluctance to delegate tasks to others*

The teacher having this type of personality trait always entrust duties to an agent. He always tries to give up his responsibility to others and place himself in someone's shelter. He always searches for an obliging and faithful person to delegate his responsibility. Thus running away from duties and thus declining experiences, he loses speed and accuracy (efficiency) to face bigger challenges in the profession. With such loss of irreparable efficiency he becomes an easy victim of stress and will be susceptible to suffering from burn out on encountering problems and difficult tasks.

*Prevention of burnout*

Teacher burnout is a syndrome and is the result of a long period of unhappiness, dissatisfaction, impatience – all leading to mental stress. Similar to prevention being better than cure in physical illness, researchers point out that it is easier to prevent teacher burnout than to reverse it once developed. Albee (2000), one of the pioneers of prevention research, opines that "It is accepted in public health doctrine that no disease or disorder has ever been treated out of existence". Professional development programmes of the teachers such as in-service teachers training programme should take efforts in explaining the recognition, identification, occurrence, ill effects and effective prevention strategies for burn out syndrome. Periodical and objective survey of teaching centres and teacher education institutions has to be undertaken on priority basis to nip in the bud of tendencies of developing burn out among the teacher community. Effective preventive measures for the syndrome and rehabilitation interventions for the affected can be carried out efficiently following the regimen:

1. Preventive measures taken at the organizational level
2. Full concentration on early detection of problems
3. Amelioration of teachers with burnout symptoms

*Preventive measures taken at the organizational level*

The prevention of burnout at organizational level is very effective and prevents the teacher from burnout. At the organizational level the teachers should exercise some control over their daily challenges. It is said that at the individual level, self- efficacy and the ability to maintain perspective in regard to daily events provide what is termed as "anxiety-buffer", a type of shock absorber (Greenberg, 1999).

In the institution there are other factors which mitigate the teacher's stress. Kyriacou (2001) reproduces the following advice from Education Service Advisory Committee Report (1998) for schools:

• The teachers are the main persons to implement all policies and programmes; they must therefore be consulted for curriculum development or instructional planning because they are directly affected and to bear the impact in the classroom.

• Good infrastructure and adequate resources are essential for effective teaching, and hence providing them at the school is the indispensable responsibility of the administration and management.

• Provide clear job descriptions, responsibilities and expectations in an effort to address and eliminate role-ambiguity and conflict.

• The administrator and teacher should establish open lines of communication to facilitate continuous and effective administrative support from the teachers to the administrator and performance feedback to the teachers to act as buffer against stress.

• The administrator should allow and encourage the teachers for taking part in educational programmes - computer literacy programme, mentoring, refresher and in-service training and networking to help them to enrich their knowledge and share their experience and views with fellow teachers for mutual benefit and benefit of the educational venture; teachers will earn a sense of accomplishment and a more developed professional identity.

*Full concentration on early detection of the problems*

It is essential to detect the problems as early as possible. Early detection of the problems of burnout eliminates its emergence as a full blown disorder difficult to cure later. Symptoms of teacher stress contributing to burnout may take many forms (Brown and Ralph, 1998). Several researchers (Hinton and Rotheiler, 1998; Brown and Ralph, 1998; Kyriacou, 2001; Troman and Woods, 2001) have studied the early symptoms of teacher burn out and catalogued them as:

• Not feelings like going to work place or actually missing the days

• Having difficulty in concentrating on the task and not enjoying one's work and work place

• Start feeling of overwhelmed by the work load and having a related sense of inadequacy to the tasks entrusted

• Withdrawing from colleagues or engaging in conflictual behaviour /relationship

• Expressing a general feeling of dislike or irritation regarding school

• Experiencing insomnia (sleeplessness), digestive disorders, headaches and heart palpitation

• Incapacitation and inability to function professionally in severe instances

*Amelioration of burnout symptoms*

Burnout is not a disease but a syndrome. If a teacher experiences burnout and it occurs once, he must decide whether he will continue the job or leave it. When burnout among the teachers emerges as full blown disorder, it becomes very difficult to cure; the teacher has to decide his choice of continuing the job or quitting.

According to Troman and Woods (2001) a series of stressful events or a single major event may lead teacher to make what they term 'pivotal decisions'. It is a fact that teacher goes through many such events over the course of the career. Troman and Woods (*loc cit.*) interviewed the teachers and rarely viewed that decision made in response to high levels of stress as transformative in the positive sense. In spite of high stress and without any power they stay on with their job due to personal factors such as less job opportunity, personal financial and family obligation, experience of teaching not counted for other jobs. Teaching profession being respectful and less strenuous, teacher wants to stay with the expectation of retirement benefits and other privileges.

One has to feel sympathy for the teachers suffering from burn out. The burnout can be minimized through social support from the colleagues, creating organizationally-supportive environment, providing stress management training, conducting Employee Assistance Programme such as counselling and psychological services and proper rehabilitating efforts to ease the mind of the victim teacher in reducing the burnout.

## Conclusion

Teacher burnout is a syndrome and it is not occurring in one day; but is due to long term stress experienced at the work place. Teacher will experience burnout due to workload, powerlessness, more responsibilities, perfectionist tendency and feeling as passive individual during designing and drafting important academic interventions like curriculum enrichment, introduction of new teaching strategies, etc. The teacher burnout may be prevented at the organizational level. The teacher should exercise some control over the daily challenges. At the individual level, self-efficacy and the ability to maintain perspective in regard to daily events are effective as "anxiety-buffer" in preventing burn out. Identification of early symptoms helps in prevention or reducing the seriousness and even preventing the development of the syndrome.

## References


Albee, G. W. (2000), *Commentary on prevention and counselling psychology,* The counselling psychologist, EJ 622 673, 847.

Brown, M. and Ralph, S. (1998), The identification of stress in teachers, in: Dunham, J. and Varma, V. (Eds.), Stress in Teachers: Past Present and Future, Whurr Publishers Ltd., London, pp.37-56.

Bullough Jr., R. V. and Baugman, K. (1997), *First Year Teacher, Eight year later: An inquiry into teacher development*, Teachers College Press, New York.

Cherniss, C. (1980), *Staff burnout: Job stress in the human services*, Sage studies in Community Mental Health, Sage publication, Beverly Hills, CA.

Education Service Advisory Committee (1998), *Managing work-related stress: a guide for managers and teachers in the school.*

Freudenberger, H. J. (1974), Staff burnout, Journal of Social Issues, **30**, 159-165.

Freudenberger, H. J. (1975), *The staff burnout syndrome*, Drug Abuse Council, Washington D.C.

Freudenberger, H. J. (1977), *Burnout: Occupational hazard of the child care worker*, Child Care Quarterly, **6**(2), 90-97.

Greenberg, J. S. (1999), *Comprehensive stress management*, VI Ed, Boston McGraw- Hill, New York.

Hinton, J.W. and Rotheiler, E. (1998), *The psychophysiology of stressing teachers*, in: Dunham, J. and Varma, V. (Eds.), Stress in teachers: Past, Present and Future, Whurr publishers ltd., London, pp.95-119.

Kyriacou, C. (2001), *Teacher stress: directions for future research*, Educational Review, ERIC digest in the public domain, **53**(1), 28-35.

Le Compte, M. D., and Dwarkin, A. G. (1991), *Giving up on school: Student drop outs and Teacher Burnouts*, Corwin press, Newbury Park, California.

Maslach, C., (1976), *Burnout*: Human Behaviour, **5**, 16-22.

Maslach, C. (1978), *Job-burnout: How people cope*, Public welfare, **36**(2) 56-58.

Maslach, C. (1982), Burnout: *The cost of carrying*, Prentice-Hall, Englewood Cliffs.

Maslach, C. and Jackson, S. E. (1981), *The measurement of experienced burnout,* Journal of Occupational Behaviour, **2**, 99-113.

Maslach, C. and Jackson S. E. (1982), *Burnout in health professionals: A social socio-psychological analysis,* in: Sandders and Sils (Eds.), Social psychology of health and illness, Laurence Erlbaum, Hillsdale N.J., pp.227-251.

Maslach, C. and Schaufeli, W. B. (1993), *Historical and conceptual development of burnout,* in: Maslach, C., Schaufeli, W. B. and Marek, T. (Eds.), Professional burnout: Recent development in theory and research, Taylor and Francis, Washington DC, pp. 1-16.

Troman, G. and Woods, P. (2001), *Primary Teachers' Stress*, in: ERIC digest in the public domain, Clearinghouse on Teaching and Teacher Education, American Association of Colleges for Teacher Education, Routledge / Falmer, New York.

Wood, T. and McCarthy(2000), *Chris Understanding and Preventing teacher burnout*, ERIC Clearing House on Teaching and Teacher Education, Washington D.C.

xxxxxxxx

Continued from Page 14...

**Anti-frost, anti-fog glass (A new anti-frost and anti-fog coating for glass)**

Imagine that your car's windshield never fogged up and never got frozen over with frost. Robert Cohen of Massachusetts Institute of Technology and colleagues explain that anti-fogging coatings that absorb water have been the focus of attention lately because of their ability to reduce light scattering and the resultant distortion caused by condensation. They have now developed a new coating that rapidly absorbs water molecules that cannot freeze in the coating but at the same time is hydrophobic and so repels larger droplets. The material consists of a functionalized material prepared using hydrogen-bonding-assisted layer-by-layer (LbL) assembly of poly (vinyl alcohol) (PVA) and poly (acrylic acid) (PAA). The functionalization is through incorporation of poly (ethylene glycol methyl ether) (PEG) segments, which enhances the anti-fogging and anti-frost properties.

Continued on Page 30...

Vetri Education, Quarterly Journal (ISSN - 0973 - 8614), IX (2), 2014, 23-30

# Availability and Use of ICT Software at Different DIETs of Tribal Areas

**Ranjan Kumar Biswas***

CIET, NCERT, Sri Aurobindo Marg, New Delhi-110 016

## Abstract

This article is endeavoured to highlight the meaning of ICT and utilization of ICT especially in District Institutes of Education and Training (DIETs) for promoting teacher education. DIETs are considered as educational institutions and various ICT facilities have been provided at different times. Nevertheless, DIETs in tribal areas are somewhat backward and are more or less deprived of many of the ICT facilities. Though ICT software is one item among all installed facilities, the present study is constrained to investigate the availability of such ICT software facility and its utility by the faculty members of the DIETs in promoting educational training. Information, collected from principals of the DIETs as response to an appropriately designed questionnaire, reveals that there is only limited ICT software facility available in these institutions and the frequency of its utilization is scarce and insufficient. The article also tries to discover some of the specific reasons for the non-availability of all the required ICT software and suggestions for remedial action.

---

**Key words: ICT, ICT in Education, ICT Software, DIETs**

## Introduction

ICT (Information and Communications Technology) is meant to those technologies which are used for accessing, gathering, manipulating and presenting or communicating information and thereby, it includes hardware like computers and internet connectivity, other infrastructure devices and software required for proper functioning for local networking, video conferencing, etc. (Anderson and Glen, 2003). ICT is an umbrella term, includes any communication device or application, encompassing radio, television, cellular phones, computer and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as videoconferencing and distance learning (Rouse, 2005). In a simple way, ICT indicates those technologies which are used to meet human need or purposes including processing and exchanging ideas and knowledge. Nowadays, it is accepted as a school subject that deals with computers, electronics and telecommunications (Macmillan Dictionary, 2009). ICT is the digital processing and utilization of information by the use of electronic computers. It comprises the storage, retrieval, conversion and transmission of information (Okauru, 2011). The most recent information regards ICT as the means of utilizing of computers, along with other electronic equipments and systems to collect, store, use and send data electronically (Cambridge Dictionary, 2013). As technology, ICT supports activities involving in transferring information. Such activities include gathering, processing, storing and presenting of data. Increasingly, these activities also involve in collaboration and communication.

***E-mail: rbiswas68@gmail.com**

All innovative technologies generally create new challenges to the teachers to continuously retrain themselves and to acquire new knowledge and skills for maintaining the status of their teaching performance (Bowes, 2003). Effective ICT based teaching by experienced teachers can simplify the complicated exercises, create ideal teaching environment, provide scope for interactivity and enhance understanding of learners. For this, all the teachers must be oriented and facilitated by both professional and technical support concerned with the ICT hardware and software, other infrastructural and support facilities as well as cooperation of administration (Holland and O'Connor, 2004). Besides, knowledge of teacher, time, access to ICT tools and the alignment of ICT use with pedagogical goals play significant roles to help teachers to integrate ICT and to support students' increased use of it for learning. However, there are many essential factors needed for effective implementation of ICT based teaching- learning activity. These vital factors are manifold as ICT infrastructure and physical resources, curriculum and policy development, special training, including pedagogical training of teachers in ICT (Altun, 2007). 'ICT innovation is more a new process to be developed than a technology' (Pulkkinen, 2009) is apt for ICT application. Training of teacher for effective employment of ICT is very decisive to facilitate the teaching-learning process and make it real, challenging and practicable. It makes the content attractive and reduces teacher talks and encourages student centric discussions which help to initiate more productive teaching-learning (George, 2012).

District Institutes of Education and Training (DIETs) are established in almost all districts across the country and nearly all ICT facilities are installed there. In DIETs, ICT based trainings are frequently organized for the teacher educators so that they can further train in-service and pre-service teachers to use ICT in classroom teaching in their schools. But DIETs in tribal areas are somewhat backward and there, all ICT facilities are not available and training for teacher educators are organized very rarely. Teacher educators having inadequate knowledge and skills in ICT cannot effectively train teachers who are given responsibilities to use ICT facilities for teaching-learning in classrooms of various schools. Against this background and as supplement to the article on the shortcomings of ICT facilities at DIETs of tribal areas (Biswas, 2013) the present study is to further investigate the availability of ICT facilities with special reference to the availability and utilization of ICT software in DIETs of tribal areas.

## Discussion

*Methodology*

Of late, ICT is used by almost all sections of society. As an important device, ICT confers the dynamic benefits for those who are specially attached with teaching and learning activities in various educational institutions. DIETs are considered as teacher educational institutions and ICT facilities are more or less available for the purpose of teaching-learning and professional development, especially of teacher educators. But DIETs, established in tribal areas are somewhat backward and these DIETs are sometimes failing to install the latest ICT facilities. Even the installed ICT facilities are not used properly. This study was intended to probe specially the availability of ICT software as one of whole facilities and its frequency of utilization. First of all, a research design was made consisting of study population, sample size, method of data collection, data processing and entry, data analysis and interpretation with references to other studies.

Regarding the objectives of the study, research materials were collected from different sources. On the basis of the collected materials, questionnaire for principals of DIETs was developed consisting of the relevant items. The initially developed questionnaire was finalized by incorporating the suggestions of experts.

In perspective of outsized concentration of tribal population, total 111 DIETs were purposively selected and the developed questionnaire was sent to each principal of those DIETs. The duly filled up responses to questionnaire were returned from 62 principals. They were coded by number, processed and entered in the computer. By using computer, quantitative data were tabulated and side by side percentages of each column and row were calculated in a systematic manner. Data analysis was done to obtain the existing activities in DIETs. It helped to establish the hidden relationship with each other activities. Data analysis was undertaken to focus on inference, the procedure of deriving a conclusion based on the points which were already known to the researcher. Interpretation was done as a device to explain the factors which were collected by researcher in the course of the study. The collected issues were interpreted in terms of the underlying processes to find out the thread of uniformity, laid under the surface layer of the diversified research findings.

*Results and analysis*

Under results and analysis, the collected data were presented in statistical tables. Quantitative data under various components were analyzed and interpreted in the context of other studies and these are shown as follows:

1. *Availability of ICT Software*

The term 'software' is defined as the computer programme which provides the instructions telling to a computer what to do. As a set of instructions, varieties of software are installed in the computer to solve users' problems and to control different operations of the computer. All software are always intangible and there is no scope to touch. No software has any substance and it is exists as ideas, concepts and symbols. Very systematically, software is developed in programming languages. All software are functionalised in coordination with the ICT hardware. Software plays a significant role and therefore, the concerned software is needed in every computer for private or institutional uses. Regarding the significant role, this study attempts to focus the availability and utility of the listed software which are not adequate to fulfil the pedagogical needs. Also, absence of multi variety software is reported in DIETs of tribal areas. According to the present study (Table 1), it is seen that maximum DIETs possess the presentation software (69.4 %), followed by spreadsheets (50.0 %), media players (46.8 %) and open source software (43.5%), whereas ccollaborative web tools accounts (8.1 %), aaudio editing software & subject based software like-geogebra (19.4 %), video editing software (21.0 %) and database management one (27.4 %). Also, absence of any particular software in any DIET is recorded

Studies in this regard reveal that ideally, teachers are required to be trained to quickly adopt computer and new computer software applications for representing as young and well experienced in the concerned areas. Intensive teacher training using particular ICT hardware and software can orient them to involve in the process of technology integration and to prepare them for experiment based classroom teaching. Therefore, institutions are mandated to have at least relevant technologies which help to orient teachers for overcoming barriers and creating healthy ICT based teaching-learning environment (Woodrow, 1992; Rogers, 1995). Keeping in view, many studies specify that computers generally consist of different types of software such as word-processing, spreadsheets, etc. and these help to the learners to manipulate and make modification and changes in the information and also evaluate the effect of those changes. Connected to this, studies further point out that the available software in computer are enabled to ensure that learners can be given assignments at an appropriate level and these can be matched to their prior attainment or their individual needs (Ainsworth, *et al*., 1997; Lynch, et al., 2000; Haddad, 2002; Anderson and Dexter, 2003). Findings of various studies show that in many institutions, installation of technologies is less common.

There, technical support is to be summoned from outside solve the relevant problems. In that context, the limited teachers are to be willing to introduce new hardware as well as software. Availability of appropriate software in institutions is accessed to meet learners' particular need in the concerned area (Leach, 2005; Dunmill and Arslanagic, 2006; Olakulehin, 2007). In different studies, it is further noticed that very rarely, institutions are facilitated to install ICT software which are required to use for organizing different training programmes. Teachers must be a part of the decision makers to install the required ICT software to make them to commit and encourage the innovative teaching and trainings with conviction (Gulbahar and Guven, 2008; Thompson, 2009; Kozma *et al*., 2010)

**Table 1: Availability of ICT software in DIETs of tribal districts**

| Sl. No. | Items of ICT Software | Yes | | No | |
|---|---|---|---|---|---|
| | | Freq. | % | Freq. | % |
| 1. | Presentation software | 43 | 69.4 | 19 | 30.6 |
| 2. | Spreadsheets | 31 | 50.0 | 31 | 50.0 |
| 3. | Media player | 29 | 46.8 | 33 | 53.2 |
| 4. | Database management | 17 | 27.4 | 45 | 72.6 |
| 5. | Audio editing software | 12 | 19.4 | 50 | 80.6 |
| 6. | Video editing software | 13 | 21.0 | 49 | 79.0 |
| 7. | Collaborative web tools | 5 | 8.1 | 57 | 91.9 |
| 8. | Open source software | 27 | 43.5 | 35 | 56.5 |
| 9. | Subject based software(Geogebra) | 12 | 19.4 | 50 | 80.6 |

2. *Frequency of Use of ICT Software*

The word software is meant as various kinds of programme which are used to operate computers and other related devices. Software consists of the organized instructions and code, written by programmers in any of many computer languages. Software is available in source code forms and these source codes and certain other rights are normally reserved for copyright holders and these are also made available under a software license which permits users to study, change and improve the software. Open source licenses are mostly found to meet with the requirements of the open source definition. Development of open source application software is done in a public or collaborative manner and these are accessible within the public domains for wider use. Keeping in view, the present study presents the actual scenario of DIETs in the context of ICT software use to upgrade education. It is evident that most of the DIETs are not well equipped by the required ICTs including both hardware and software. The collected information reveals that even the available software in DIETs are not used properly. According to the study (Table 2), it is also perceived that in DIETs, frequency of uses of open source software (55.6 pre cent) and spreadsheets (29.0 pre cent) are estimated as the maximum and minimum respectively. In the category of occasional uses, spreadsheet (45.2 pre cent) and audio editing (8.3 pre cent) software show highest and lowest frequency. Frequency of uses of collaborative, 2.0 tools is non-existent whereas frequency of uses of audio editing software (25.0 pre cent) is highest under the category of sometimes uses. Lastly, study also enabled to know that all enlisted software are not totally used by a group of the faculty members in various DIETs.

Very relevant studies in this regard display that the learners who frequently use educational software and the internet or web environment and consequently achieve a higher perception of efficacy compared to those who never / sometimes use all these items. Likewise, teachers who have high perception of efficacy employing frequent use of computer related tools in the classroom are more competent than others who never / some time use them (Maddin, 1997; Lewin, 2000; Zhao and Cziko, 2001; Kington *et al.*, 2002; Zhao *et al*., 2002). Studies in this connection point out that short term in-service training on hardware and software is not enough to make sure comprehensive trainees. Effective in-service training needs follow-up support, peer coaching and peer dialogue to ensure frequent utilization of new technologies. Active involvement of experienced teachers can change the whole process of education system and they can be the element of ownership of the innovation (Norris *et al*., 2003; Aduwa-Ogiegbaen and Iyamu, 2005; Albrini, 2006). Findings of other studies also reveals that classrooms of several institutions are fully equipped with all types of computer hardware and software and teachers are encouraged to improve both the academic performance and their ability of teaching by repeatedly using and applying all these technologies. Effective use of ICT provides knowledge as module forms which are very convenient for the teachers to integrate ICT into lessons. Therefore, ICT materials are explored to provide excellent ideas and activities through classroom teaching for developing and strengthening concepts and skills of students (Slaouti and Barton, 2007; Gulbahar and Guven, 2008; Hamzah *et al*., 2009).

## Table 2: Frequency of the uses of ICT software in DIETs of tribal districts

| Sl. No. | Items of ICT software | No. | Always | | Occasionally | | Sometime | | Not at all | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Fr. | % | Fr. | % | Fr. | % | Fr. | % |
| 1. | Presentation software | 43 | 16 | 37.2 | 15 | 34.9 | 8 | 18.6 | 4 | 9.3 |
| 2. | Spreadsheets | 31 | 9 | 29.0 | 14 | 45.2 | 5 | 16.1 | 3 | 9.7 |
| 3. | Media players | 29 | 10 | 34.5 | 13 | 44.8 | 2 | 6.9 | 4 | 13.8 |
| 4. | Database management | 17 | 5 | 29.4 | 6 | 35.3 | 4 | 23.5 | 2 | 11.8 |
| 5. | Audio editing | 12 | 6 | 50.0 | 1 | 8.3 | 3 | 25.0 | 2 | 16.7 |
| 6. | Video editing | 13 | 7 | 53.8 | 3 | 23.1 | 1 | 7.7 | 2 | 15.4 |
| 7. | Collaborative web tools | 5 | 2 | 40.0 | 2 | 40.0 | 0 | 0.0 | 1 | 20.0 |
| 8. | Open source software | 27 | 15 | 55.6 | 5 | 18.5 | 3 | 11.1 | 4 | 14.8 |
| 9. | Subject based software | 12 | 3 | 25.0 | 4 | 33.3 | 3 | 25.0 | 2 | 16.7 |

## Summary and Conclusion

Findings and analysis suggest that ICT plays a significant role in promoting all types of education. DIETs are considered as important educational institutions and here, ICT facilities are installed in large measure for professional development and improving teaching-learning strategies. But many DIETs, established in tribal areas are sometimes deprived of several items of required ICT facilities. Different ICT software are regarded as important items and therefore adds credibility to the present study on the availability of such software and frequency of their use at various DIETs in tribal areas.

Data collected from 62 DIETs seem more or less adequate availability of presentation software, spreadsheets, media players, open source software, database management, video editing software, audio editing software and subject based software like geogebra and collaborative web tools. Uses of open source software, video editing software, audio editing, collaborative web tools, etc are found more compared to others in the studied DIETs. Study also shows that all ICT software are not installed in the studied DIETs and the available software are not frequently used in promoting education. Due to limited number of ICT software and their use, teacher educators of DIETs are underprivileged in professional development creating a negative atmosphere for teaching-learning activities. As remedial measure, the latest ICT software are required to be provided at every DIET and professional development programmes arranged at short intervals to inspire to the teacher educators for creating and experiencing a healthy teaching-learning atmosphere.

## References


Aduwa-Ogiegbaen, S. E. and Iyamu, E. O. S. (2005), *Using Information and Communication Technology in Secondary Schools in Nigeria: Problems and Prospects*, Educational Technology and Society, **8** (1), 104 -112.

Ainsworth, S. E., Bibby, P. A. and Wood, D. J. (1997), *Information Technology and Multiple Representations,* New Opportunities-New Problems, **6**, 93-106.

Albrini, A. (2006), *Teachers' Attitudes toward Information and Communication Technologies: The Case of Syrian EFL Teachers*, Computers and Education, **47**, 373-398.

Altun, T. (2007), *Information and Communication Technology (ICT) in Initial Teacher Education: What Can Turkey Learn From Range of International Perspectives?* Journal of Turkish Science Education, **4** (2), 45-60.

Anderson, J. and Glen, A. (2003), *Building Capacity of Teachers/ Facilitators in Technology-Pedagogy Integration for Improved Teaching and Learning.* Available from UNESCO Bangkok. http://www.unescobkk.org/fileadmin/userupload/ict/ebooks/ICTBuidlingCapacity/Building Capacity.pdf.

Anderson, R. E. and Dexter, S. (2003), *Trends in Educational ICT*, in: Cross-national Information and Communication Technology: Policies and Practices in Education, Eds. R. Anderson, T. Plomp, N. Law and A. Quale, Information Age Publishing Inc., Greenwhich, CT.

Biswas, R. K. (2013), *ICT Infrastructure Facilities at Different DIETs of Tribal Areas*, Vetri Education, **8** (3), 20-29.

Bowes, J. (2003), *The Emerging Repertoire Demanded of Teachers of the Future: Surviving the Transition*, Retrieved, September, 1, 2004. From http://crpit.com/ confpapers/ CRPITV23 Bowes.pdf.

Cambridge Dictionary (2013), Cambridge Dictionaries Online, Cambridge University Press http://dictionary.cambridge.org/dictionary/ business- English/ict

Dunmill, M. and Arslanagic, A. (2006), *ICT in Arts Education, A Literature Review*, University of Canterbury, New Zealand.

Gulbahar, Y. and Guven, I. (2008), *A Survey on ICT Usages and the Perceptions of Social Studies Teachers in Turkey*, Educational Technology and Society, **11**(3), 37-51.

George, A. N. (2012), *Nurturing the spirit of inquiry*, Teacher Plus, Secunderabad, Available from: www.linkedin.com/pub/anna-george/65/39a/4a6.

Haddad, W. D. (2002), *Technology and Teacher Education: Making the Connection*, Editorial, Technologia, Academy for Educational Development, Oakton.

Hamzah, M. I., Ismail, A. and Embi, M. A. (2009), *The Impact of Technology Change in Malaysian Smart Schools on Islamic Education Teachers and Students*, World Academy of Science, Engineering and Technology, 49.

Holland, C. and O'Connor, P. (2004), *Like Writing Off the Paper: How Students Learn in the Arts*, Ministry of Education, Wellington.

Kington, A., Harris, S. and Leask, M. (2002), *Innovative Practice Using ICT in Schools: Findings in Two Case Studies,* Management in Education, **16** (1), 31-35.

Kozma, R., Vota, W. and Bsaiso, R. (2010), *ICT Policy and Strategy, Operational Plan, Monitoring and Evaluation Plan: For 2011-2015 and Moving Towards 2025*, Ministry of Education, Amman, Jordan.

Leach, J. (2005), *Do New Information and Communication Technologies Have a Role to Play in Achieving Quality Professional Development for Teachers in the Global South?* The Curriculum Journal, **16** (3), 293-329.

Lewin, C. (2000), *Exploring the Effects of Talking Books Software in UK Primary Classrooms*, Journal of Research in Reading, **23**(2), 149-157.

Lynch, L., Fawcett, A. J. and Nicolson, R. I. (2000), *Computer-Assisted Reading Intervention in a Secondary School:* An Evaluation Study. British Journal of Educational Technology, **31**(4), 333-348.

Macmillan Dictionary (2009), *View Dictionary Entry for Work Experience*, Macmillan Publishers Limited, Available from: http://www.macmillandictionary blog.com/about.

Maddin, E. (1997), *The Real Learning Begins Back in the Classroom: On-the-Job Training and Support for Teachers Using Technology*, Education Technology, Sept. – October, 56-59.

Norris, C, Sullivan, T. and Poirot, J. (2003), *No Access, No Use, No Impact: Snapshot Surveys of Educational Technology* in K-12, Journal of Research on Technology in Education, **36** (1), 15-27.

Okauru, I. O. (2011), *FIRS Staff News Bulletin*: A Publication of the Corporate Communications Department, 1 September. Available from: http://www.firs.gov.ng/Resource-Centre/Documents/Newsletter,SepVo1.

Olakulehin, F. K. (2007), *Information and Communication Technologies in Teacher Training and Professional Development in Nigeria*, Turkish Online Journal of Distance Education, **8** (1), 1-9.

Pulkkinen, J. (2009), *Preliminary Conclusions and the Way Froward, in*: UN Global Alliance for ICT and Development, Expert Group Web-Forum. Available from: http://ungaid.ning.com/forum/topics/preliminary-conclusions-and-1

Rogers, E. M. (1995), *Diffusion of Innovations,* (4th Ed.), The Free Press, New York.

Rouse, M. (2005), *ICT- Information and Communication Technology*, Available from: www.maximise. ICT.co or http://searchcio-midmarket.techtar get. com/definition/ICT

Slaouti, D. and Barton, A. (2007), *Opportunities for Practice and Development: Newly Qualified Teachers and the Use of Information and Communication Technologies in Teaching Foreign Languages in English Secondary School Contexts*, Journal of In-service Education, **33** (4), 19.

Thompson, T. L. (2009), *New Models of Professional Development*, in: UN Global Alliance for ICT and Development Expert Group Web-Forum. Available from: http://un-gaid.ning.com/forum/topics/preliminary-conclusions-and-1.

Woodrow, J. E. (1992), *Locus of Control and Student Teacher Computer Attitudes*, Computers & Education, **14** (5), 421-432.

Zhao, Y. and Cziko, G. A. (2001), T*eacher Adoption of Technology: A Perceptual Control Theory Perspective*, Journal of Technology and Teacher Education, **9** (1), 5-30.

Zhao, Y., Pugh, K., Sheldon, S. and Byers, J. L. (2002), *Conditions for Classroom Technology Innovations,* Teachers College Record, **104** (3), 482-515.

xxxxxxxx

Continued from Page 22...

**Solar improver (UC Santa Barbara scientists develop a whole new way of harvesting energy from the sun)**

Chemist Martin Moskovits and his colleagues have developed what turn out to be only the first viable alternative to semiconductor-based solar conversion devices in the last 70 years. In conventional solar, photons impinge on a semiconductor surface and generate a current. Moskovits' team has instead turned to a nanoscopic metal forest to generate an electron flow for splitting water to generate hydrogen, one of the end-points for current solar systems. Early prototype systems comprise the complex-sounding but robust system of gold nanorods capped with a layer of crystalline titanium dioxide decorated with platinum nanoparticles, and set in water with a cobalt-based oxidation catalyst deposited beneath.

**Waste not, want not ( New: An environmentally friendly chemical reaction that does not waste any atoms)**

A new atom efficient chemical synthesis of alpha-arylated carbonyl derivatives has been developed by Nuno Maulide and colleagues at the University of Vienna. An early serendipitous discovery revealed an unusual transformation of amides and the addition of an activating agent revealed that a reactive intermediate can be formed that undergoes a simple rearrangement. The team took advantage of the process to carry out an efficient acid-catalysed redox-arylation that precludes the need for a costly transition metal catalyst, the team reports.

Continued on Page 38...

Vetri Education, Quarterly Journal (ISSN - 0973 - 8614), IX (2), 2014, 31-38

# Instantaneous Classroom Evaluation A Technique for Bridging the Gap between Teaching and Learning

**Talmeez Fatma Naqvi***

College of Teacher Education, Bhopal Maulana Azad National Urdu University, Hyderabad – 462 001

## Abstract

This paper seeks to provide a strategy to bridge the large space between instruction and learning. It is a known fact that too many students learn too little whereas some of them do really well, and that there are some known factors, contributing to student success or lack of it. Appropriate as well as timely assessment is a tool for procuring concrete information about student learning. The attempt is to ascertain if the use of an Instantaneous Classroom Evaluation Technique *(One-Minute Question)* may be of some use for improving quality of teaching and learning in that it can take care of the deficiency that are inbuilt in the tests in vogue in terms of time-lag between teaching-learning and tests. The answer sought through a qualitative study suggests that it provides useful information instantaneously about student learning with minimum investment of time. In addition, instant use of the technique may facilitate fostering of healthy rapport with students and increasing efficacy of teaching and learning. Finally, it may motivate to treat teaching as a formative process that evolves over the time with feedback and thus, serves as a means for ensuring, sustaining and creating quality.

**Key words: language acquisition, strategies, globalization, communication competency, professionalism**

## Introduction

Methodology is based on the presumption that when teacher asks self: "How much of what I am teaching, students learn?" And when specific kind of feedback to answer this question provides then and there, one can identify lacuna or pitfalls and better focus one's teaching. In effect, teacher can then begin to determine what works or not in the classroom, for some and/or many. Classroom or in-course assessment provides a simple and relatively easy way of finding out what and how well the students are learning. It also helps students to know where they stand and to find out an answer for what they need to do to develop their academic or learning skills.

Traditionally many teachers evaluate their students' knowledge by giving mid-term and end-term tests/examinations. The inbuilt time factor in the evaluation in vogue deprives the teacher engaging particularly a large introductory class, from the procurement of much needed feedback on the current state

***E-mail: naqvitalmeez@gmail.com**

of teaching-learning i.e. teaching-learning in action. One might not recognize, until after the mid-term test, that many students had trouble in understanding and/or explaining or applying a concept covered, say, in the second week of the session, or that some students remained in a state of confusion rather consistently and thus not able to differentiate two closely related ideas.

Homework too may not serve the required purpose. Even if a teacher collects homework, some students may complete assignments without fully understanding the central concepts or developing the skills which form the larger aim of the course. And even in a small class where students offer comments and ask questions, crucial issues may have been misunderstood or overlooked by those who prefer silence.

Any way, relevance of classroom assessment is undeniable in that it focuses on the learner and provides feedback to both the teacher and the students on the quality of learning and the effectiveness of the teaching process in the classroom. Of course its purpose is to inform the teacher whether there are gaps between what the students know and what the teacher expects them to have understood.

The three main categories of information assessment are assessment of:

- The level of students' academic skills and intellectual development
- Students' awareness of the effectiveness of their own learning skills
- Student reactions to various teaching methods, materials and assignments

Through an understanding of the status of students' academic development (e.g., do they have sufficient background knowledge or academic skills?) and knowing immediately their reactions to specific aspects of a class (e.g., do they believe the exams cover the material stressed in class?); teachers can make required adjustments in their teaching to help students learn better.

Feedback is at the core of learning and teaching. In its simplest form feedback is a conversation between student and teacher. It aims to be insightful, critical and enabling; feedback is an exercise in learning rather than a quantitative measure of how well you have done in your last piece of work. It is reasonable to expect that you will have received feedback before undertaking any major piece of assessed coursework during the year and all your formal feedback before the end of prescribed tests and examination.

From time to time, teachers may evaluate aspects of their teaching or identify areas of student understanding or misunderstanding well before the end of the session. The students' feedback emanating from such evaluation generally provides the personal benefit. But this information provides little in the way of detail on specific aspects of teaching and learning. The information may also be collected through informal feedback. The day-to-day informal feedback is a quick and easy method to obtain information from students to assist classroom transaction. It offers an opportunity for students to provide timely, constructive information that will assist learning.

Keeping in view the fact that end-of-unit/lesson evaluations provide important information to help fine tune delivery, they are of little help after the completion of the activities with many unanswered questions or unidentified concerns. In this, the deficiency of time-lag necessitates search for a way out, a dynamic evaluation tool such as the *'one minute paper'*.

Even if the teacher prepares the classroom presentation well, the probability of a gap occurring betwwhat the students hears and what the teacher thinks as stated may not be ruled out. The probability of disjuncture that may occur so often needs to be addressed and taken care of. The one-minute paper, described by Angelo and Cross (1993) in *Classroom Assessment Techniques* may serve the purpose; as it is a quick and easy assessment tool that helps alert teacher on students' way of understanding, soon after the occurrence of disjuncture. At the same time, it gives timid student an opportunity to ask questions and seek clarification.

A *"one-minute paper"* may be understood as a very short, in-class writing activity (taking one-minute or less to complete) in response to a teacher-posed question, which prompts students to reflect on the day's lesson and thus provides the teacher with useful feedback. Originally, a physics professor at the University of California, Berkeley (Davis *et al*., 1983), developed this strategy which was popularized later by Cross and Angelo (1988) as one of a wide variety of quick "classroom assessment techniques" (CATs), designed to provide instructors with anonymous feedback on what students are learning in class. For example, the exercise was undertaken by asking students to write a one-minute paper in response to such questions: "What was the most important concept you learned in class today? or "What was the 'muddiest' or most confusing concept covered in today's class?"

## Discussion

*Research problem and objective*

A number of researchers have noticed multiple advantages for one minute paper. The advantages include immediate feedback, demonstration of the teacher's interest in student's concerns, helping students to focus on the most important concepts discussed during a teaching session, effectively creating a conceptual bridge between classes in addition to highlighting individual needs (Galzie, 2012; Tollefson, 2011). Despite promising findings at early stage, empirical support for one minute paper is in its infancy. Data regarding its usefulness, relevance and effect on student learning is minimal. Primarily an insight into understanding the impact of a one minute paper on teaching-learning process may best be viewed by the teachers, essentially because the teachers are mostly in complaining posture about the changes introduced without taking into consideration their opinion. Even otherwise, collecting data from a teacher perspective is of vital significance. There is then the issue of time gap between teaching particular lesson (s) and the feedback emerging out of periodic tests and end-term examinations. Such feedback is neither meticulous nor available for immediate use for understanding issues relating to day-to-day teaching-learning. Also, the probability of memory part overshadowing the understanding and application of the aspect in the tests in vogue may not be ruled out.

The main objective of the study is to increase understanding the informal as well as immediate feedback among teachers and to look into the effectiveness of one minute paper in the teaching-learning process and of course to add to the existing body of knowledge so that teachers can better implement the proposed method and make quick adjustments for bridging gaps.

*Methodology*

Qualitative methodology was implemented in the study, using semi-structured interviews and focus groups. In the preparation phase teachers were trained in the way the one minute paper was to be implemented and used as informal feedback for effecting qualitative improvement in teaching.

*Participants and procedure*

Subjects in the current study (n=20) comprised secondary school teachers, teaching science and social studies from private schools of Bhopal (Madhya Pradesh) during the academic session 2011-12. The study involved two distinct phases over a period of three months. The details involved in each phase are presented below as phases 1 and 2.

*Phase 1*

During the phase 1, the subject-teachers teaching senior secondary level students were familiarized with and oriented towards the concept and use of one minute paper focusing on its merit of being a quick and simple way to elicit students' feedback on the cognitive, affective and social dimensions of the teaching and learning processes. They were introduced with the form and number of questions that is in its most basic form, the students were expected to respond to two written questions: What is the most important thing you learnt today? What question do you mostly wish to answer at this moment?"

Attempt was made to convince the teachers that one minute paper is a simple but excellent technique to get feedback from learners on how the learning-teaching process is going. Students were required to write their names on their papers. After class, simply go through the papers and check what type of responses they gave. Since the purpose of the one-minute paper is to identify and clarify points of confusion, start the next class with a few minutes spared for discussing student answers to the first question and explaining the misunderstandings that seemed to be shared by more than one student. Teachers were requested to furnish feedback after three months.

*Phase 2*

In the phase two semi-structured interviews and discussions with focus group were conducted by keeping the research objective in mind. Teachers were motivated to tell their experiences in detail. Their experiences and the problems they faced were taken into consideration.

*Results and analysis*

In the preparatory phase teachers were lackadaisical in their attitude and quite apprehensive of the study. One or two teachers shared their rather pre-conceived opinion by stating that nothing was going to change; only the studious one would turn up; nothing would change in the black sheep. At the end of the day, the teachers however, agreed to take up the task, during the last minute (or, realistically, three minutes) of class and ask students to write down short answers to two questions: What was the most important point made in the class today? What unanswered question do you still have?

The teachers found the students' responses to the first day test quite depressing. They were 'shocked" to see the answers, surprising enough to raise question mark on what they *actually* taught, i.e. they noticed the gap between students' learning and teachers' teaching was too wide to be believed. They noted the inability of most of the students to state even what they understood well and what least. The teachers discussed the 'disappointing' responses with the researcher who suggested them to keep up the process and take it to logical end. One of the teachers confessed that she perceived herself to be a good teacher, but the students' responses revealed that so many of them just pretended to be attentive.

After a week the teachers noticed heartening change as they found considerable qualitative improvement in the students' responses.

One of the teachers reported that the students, in the mean time, realized that the one-minute paper was simply a means of checking on whether or not they were attentive in class. On her part the teacher realized that what she had presumed that the student knew, in realty they did not know, though they are the basic things taught in lower classes. Her presumption on students' previous knowledge turned out to be a misplaced expectation and this obstructed the process of further (ongoing) learning. After the rectification of presumption the teacher sensed how well the class was following her. She observed that the one-minute paper often alerted her to such problems which otherwise would have evaded her awareness much longer. "The minute papers began purely as an attendance device"; Tollefson (2011) quoted Professor Schwartz: "As I began to read their responses, however, I found them very useful in evaluating how successful I had been in conveying the material that day. In fact, now I often quote one or two of their essay responses at the beginning of the next discussion period to get the discussion started".

Teachers reported that student told them that they understood well what the teacher taught but somehow they were unable to express it in words. It seems the students' conditioning to 'bookish style' of presentation made them reluctant, depriving them of the confidence to say what they intended to say in their own way.

As is the case with many educational experiments, the present one had an additional unintended benefit. The students were mainly from science discipline. As we know science students are seldom asked to write in detail, the researcher convincingly pointed out that the one-minute papers were good practice for the essay questions which would constitute their final. As the term progressed, considerable improvement was noticed in the presentation, which became 'longer, better developed and more carefully phrased'. It goes to substantiate Schwartz's pointing out that the 'more students write, in any discipline, the better they are in terms of comprehension and synthesis of the material'.

The one-minute paper is a revealing exercise as reporting poured in. The teachers confessed and reported: if most of the students miss the main points, then problem lies somewhere in our teaching style. It provides a good opportunity to test ourselves along with our students. It facilitates in two-way delineation of the otherwise lingering problems at the right point of time. It prompts us to think and think quickly at the appropriate moment, analyse and synthesise. Besides being a self improvement, it is fun to the extent of being sarcastic also.

What and how many students answer in year-end assessment is not what we taught; rather it may be memorized content as given in the textbook, they reproduce. The technique under reference seems to be sound enough to make out what the students understood without resorting to textbooks. Besides, it is instrumental in enhancing the level of their understanding and generating self-confidence.

Davis (1993) provided some practical ideas on getting useful information from students and its utilization with the intended purpose of assisting teachers in improving both short and long term teaching. With immediate feedback and some action, it is not too late for our students to benefit. The feedback can help in the selection of teaching methods, knowing what students need, improving clarity and revising expectations and possibly adjusting assignments.

In the long run, observes Cuseo (2005), minute papers can provide a "conceptual bridge" between successive class periods. For instance, at the beginning of class, a quick review of student responses to the one-minute paper, made at the end of a previous class, can provide an effective segue between successive class sessions. One-minute papers can improve the quality of class discussion by making students write briefly about a concept or issue, before they begin discussing it.

The researcher has found that this gives the more reflective students a chance to gather their thoughts prior to verbalizing them and benefits students who are more fearful of public speaking by giving them a script to fall back on (or build) and use as a support structure for communicating their ideas orally.

One-minute paper is found to be an effective way of involving all students in the class simultaneously. It ensures equal participation of every class member, including one who may be too shy or fearful to participate orally. It sends a message of high expectation, namely, every student is expected to participate and has something important to contribute, no matter what their cultural background or prior level of academic preparedness. It may thus be utilized for creating multicultural milieu and providing education to accommodate all.

The best part of the research is the teachers' post-exercise reporting; bringing forth that the students became relatively more attentive and they themselves realized the change and volunteered what otherwise was withheld. In essence, it paved the way for students to volunteer to report, on daily basis, what they listened (or not) attentively.

Students accounted that they faced the problem in making report on what they understood least. They require exposure to two sides of the same issue - what to say and how to say it. The one-minute paper exercise may meet this requirement.

Employing one-minute papers is a more efficient way to promote writing across the curriculum than the traditional term paper. It is a shorter and more focused writing-to-learn assignment that promotes greater reflection and deeper thinking in the classroom than the writing engagement taking place with rote recording of lecture notes.

An encouraging observation has been reported by teachers that some of the students did show signs of critical thinking and analytical ability as well. Such students' responses were found to be systematically organized in that: (i) they presented well what they regarded as the major purpose of the day's class and (ii) the most important point or central concept that the teacher communicated during the day's presentation. The teachers further accentuated that it helped to identify course concept that is so important and significant. It was brought out by encouraging them to step back and ask: "What is the most important idea or message that the teacher wants students to think about before they leave class today?" Some of them contended that one minute papers encouraged them 'to think more carefully about how to prioritize course content and to identify "core" concepts that teachers emphasize students to examine deeply.

Teachers observed that appropriate use of one-minute paper as a learning tool, necessitated consistency and regularity and spending time clarifying what one wanted, early in the course. It is also good checks on how accurate are teacher' perceptions of what students are learning and what questions remain unanswered at the end of each class. The beauty of this tool lies in its simplicity and flexibility.

Writing one-minute papers serves as a way to seal ideas in students' minds, provides teachers with an idea of where they are, develops critical thinking skills and, not the least, tells teachers something about their own teaching.

In short, one-minute paper was found to be a very efficient and versatile instructional strategy, whose multiple advantages traverse cognitive, affective and social dimensions of the teaching-learning processes.

A number of research studies also indicate, when engaged in a short review of material presented to students at the end of a class period, they retain almost twice as much of its factual and conceptual content when tested at a later date, say, after two months (Menges, 1988).

## Conclusion

The study highlights that one-minute question technique facilitates alignment between teaching and learning. It shows a way for supporting student learning. The one-minute question paper, as evaluation tool, has the potential of narrowing the gap between teaching and learning. By the dictum that the only real mistake is the one from which we learn nothing (Powell, 1974), the technique facilitates to know immediately one's own (teacher, in our case) darkness which is believed to be the best method for dealing with the darkness of other people (students).

It underlines the need to assess regularly what the student has learnt rather than what is easy to assess. The suggested practice of evaluation may blossom critical thinking process, training in the art of 'what to say' and 'how to say it' and thereby raising the level of confidence in students. The most desired outcome of this short but effective assessment mode is improvement in the quality of teaching-learning.

## References


Angelo, T. A. and Cross, K. P. (1993), *Classroom Assessment Techniques,* 2nd ed., Jossey-Bass, San Francisco, pp. 148-153.

Cross, K. P. and Angelo, T. A. (1988), *Classroom assessment techniques: A handbook for faculty.* National Centre for Research to Improve Postsecondary Teaching and Learning Ann Arbor, MI.

Cuseo, J. (2005), *The One-Minute Paper On Course Newsletter* (February), Monkton, M D, http://www.oncourseworkshop.com/Awareness012.

Davis, B. G., Wood, L. and Wilson, R. (1983), *.ABC's of Teaching with Excellence: A Berkeley Compendium of Suggestions for Teaching with Excellence*, Office of Educational Development, University of California, Berkeley.

Davis, G. (1993), *How can I get useful feedback from my students*, in: Innovation and Excellence in Learning, www.viu.ca/iel/teachlearn/guide/chapter_3b.asp -

Galzie, Z. (2012), *Evaluating Teaching and Learning Using the 'One Minute Paper'*: Retrieved from www.geoffpetty.com/downloads/WORD/OneMinutePaperZoya.**doc** -

Menges, R. (1988), *Research on teaching and learning: The relevant and redundant*, Review of Higher Education, **11**, 259-268.

Powell, J. (1974), *The secret of staying in love*, Argus Communications, Niles, IL.

Tollefson, S. (2011), *Gone in Sixty Seconds: The One-Minute Paper as a Tool for Evaluation of both Instructor and Students:* Retrieved from www. *writing.berkeley.edu/web/2-2-g**one**.htm-*

xxxxxxxx

Continued from Page 30...

Snippets of medical samples are usually preserved with formaldehyde and paraffin wax, which had precluded subsequent chemical analysis until now. He has now shown that a banned compound from some herbal medicines, aristolochic acid, known to react with adenosine nucleotides to form DNA adducts can be identified and quantified at the same time in a preserved tissue sample.

**Aspirin by any other name (McMaster Researchers Find Potential for New Uses of Old Drug)**

An international research program has revealed once more that the earliest of commercial pharmaceuticals, aspirin, has yet more roles to play in medicine. The researchers have demonstrated that salicylate, the active metabolite, directly increases the activity of AMP-activated protein kinase. This enzyme is key player in the regulation of cell growth and metabolism and is, figuratively speaking, the cellular fuel-gauge. It is triggered by exercise and by the anti-diabetic medication metformin, so understanding and modulating its activity could be relevant to overweight, obesity and type 2 diabetes. "We show that salicylate increases fat burning and reduces liver fat in obese mice," says McMaster University's Greg Steinberg who is a principal investigator on the project.

**Printable photonics (Novel exfoliation method developed by NUS chemists paves the way for two-dimensional materials to be used in printable photonics and electronics)**

Research at the National University of Singapore led by Loh Kian Ping has successfully developed a way to chemically exfoliate molybdenum disulfide crystals to make high-quality monolayer flakes. The high-yielding method for exfoliated flakes could be exploited to create an ink-like material that could be used to print photonics and electronic devices using nothing more elaborate than a modified inkjet printer. The same technique should work with other two-dimensional chalcogenide materials including tungsten diselenide and titanium disulfide. The NUS team collaborated with scientists from the Ulsan National Institute of Science and Technology in Korea.

(Indebted to: Nature, Science, New Scientist, Online Daily Mail, Alchemist News Letter, The Science and Advanced Materials Journal, British J. Nutrition, Discover Newsletter, Agence France-Presse, Journal of Science transactional Medicine The daily telegraph, New Indian Express, Google and BBC)

Vetri Education, Quarterly Journal (ISSN - 0973 - 8614), IX (2), 2014, 39-44

# Teachers in the Current and Future Scenario Viewed by Adolescents

**Pratimam Saxena***

Faculty of Education, Amity Institute of Education, Saket, New Delhi – 110 017

## Abstract

Adolescence is the distinctive stage of life when accelerated physical, emotional and intellectual developments take place in a child's life at an unprecedented scale. This stage marks a transition from higher level of dependence on instinctive decision making and concrete rather than abstract form of reasoning. This also plays a significant role in deciding the final shape of the personality of children in future. Educating adolescents therefore becomes a critical aspect, and importance of honest feedback on them to shape their learning sessions cannot be overemphasized. It has been therefore a very heart-warming experience to witness this face to face interaction between over thirty five adolescents from thirty five schools of National Capital Region (NCR) that took place during one day national seminar conducted by Amity Institute of Education, Saket, New Delhi. This event was the result of initiatives taken by Dr. Ranjana Bhatia, Principal, Amity Institute of Education (AIE), Saket who pursued this idea envisioned by Dr. Ashok K. Chauhan, President, Amity Institute of Education and Founder President, Ritnand Balved Education Foundation (RBEF). The inputs rendered by the teenage students actually seemed to re-define certain un-touched aspects of domain knowledge, communication, teaching for understanding and importance of bonding between teachers and their students.

---

**Key words: Adolescence, characteristics, expectations from teachers, communication, bonding with teachers**

## Introduction

Early adolescence, which is aptly described by Lounsbury (2000) as "The Wonder Years", is a time of unprecedented growth and transformation for young people. Parents wonder whether the children will survive their journey through puberty, school teachers worry how to keep their students focused on learning and young adolescents themselves apprehend how they are normal. The interesting study: "Understanding and Appreciating the Wonder Years" by Lounsbury (loc cit.) has helped in generalization of characteristics of young adolescents. Recalling some of these characteristics is helpful in understanding how adolescent minds function and therefore what expectations they entertain from their teachers. A few of the generalizations on adolescents' characteristics (Hughes, 2009) are:

***E - mail: pratimam.saxena@yahoo.com**

• Early adolescence is a *distinctive developmental stage* of life

• The *accelerated physical and personal developments* that occur during this period is the greatest in the human life cycle and is marked by *great variance in both the timing and rate of growth*

• These are the years during which every individual develops *their adult personality, basic values, and attitudes*

• They seek *autonomy and independence*

• They are by nature *explorers, curious and adventurous*

• They have *intellectual capacities seldom tapped* by traditional schooling

• They learn best through *interaction and activity* rather than by listening

• They are sensitive, *vulnerable and emotional*

• They are open to *influence by significant others* in their lives

• A significant portion of today's teenage population is *alienated from society*

More and more researches show that teenage brains don't function the way adult ones do. The neocortex - the part of the human brain responsible for language, planning, empathy, and executive functions - hasn't fully developed inside the head of the average 13-year-old. They, therefore still rely on a more reactive, gut-instinct part of the brain - the amygdale - which handles emotions and memories associated with emotion. In addition to the obvious physical signs of adolescence, teens and 'tweens are undergoing a major neurological overhaul, influencing to show their usual expression: "I don't know" which might be closer to the truth than we would realize (Raleigh, 2007).

In terms of intellectual development, the adolescent is experiencing a transition from the concrete form of reasoning that typifies the middle childhood years to one that is abstract and hypothetical. The intellectual need of the adolescent is thus a need for abstract conceptualization. In social terms, the adolescent needs more than simply to belong within the peer group. In their social interactions and in their play, adolescents express a compelling need for communication. Finally, the adolescent is engaged in a struggle to create a stable and permanent sense of self to achieve a degree of self-awareness and self-acceptance. It is for this reason that one of the greatest challenges for teachers is to gainfully engage the adolescents in the process of learning. For teaching community this means that they must be both patient and persistent. Yet it is the most difficult thing to understand and practice what can eventually form the constructive engagement, mutually benefitting end states. The conflict and lack of clarity associated with adolescents who may feel grown up one day, but want to be children the very next day are obvious, as during this stage of life, young adolescents experience more growth than at any other time in their life except in infancy. Families and educators see the physical changes and they hear much about the emotional and social dilemmas of puberty; however, many people are not sufficiently knowledgeable about the intellectual changes occurring during early adolescence. Not only educators must address these developmental changes, but must also deal with the varying rate at which students undergo these changes. Interestingly, the only consistent point about the development of young adolescents is that it is inconsistent.

In view of this, it is not too difficult to understand the complexities of designing and executing suitable learning programs for adolescents. The most important issue in this entire gamut of adolescence learning would therefore be to get the authentic and reliable feedback. With this in the background and in an attempt to build a one on one dialogue between adolescent students and the teacher community, a one day seminar was organized on the theme: "The Teachers in the Current and Future Scenario through the Lens of Adolescence" under the aegis of Amity Institute of Education Saket on Decenber11, 2013.

## Discussion

*Objectives of the seminar*

The principal objectives of the seminar were to seek a perspective on what adolescents feel about their teachers, what do they expect from them and what measures can be taken to strengthen the student-teacher bond in order to improve the teaching-learning process involving the adolescents.

*Conduct*

The seminar was conducted in two distinct sessions. Thirty seven children from thirty five schools of NCR participated. Six panellists, including eminent educationists and dignitaries who are not only conscientious parents and active citizens but also undisputed authorities in their respective fields moderated the interaction during the event, in each session.

Pre Lunch Session was moderated by six panellists headed by Dr Anita Satia, Director State Council of Educational Research and Training (SCERT). She was assisted by Professor Pranati Panda of National University of Educational Planning and Administration (NUEPA), Professor C. B. Sharma, Coordinator, School of Education, Indira Gandhi National Open University (IGNOU), Ms. Jyoti Prabhakar, Assistant Editor Delhi Times, Times of India, Ms. Komal Sood, Director Shiv Nadar School, Ms. Renu Singh, Principal Amity International School, NOIDA and Ms. Shalini, Assistant Professor Amity Institute of Education (AIE).

Post Lunch Session was moderated by Ms. Sapna Chauhan, Vice Chairperson Amiown (Amity's caring pre-school). Her other team members included Dr. Renu Malviya, Assistant Professor, Lady Irwin College, Dr Alka Mudgal, Officiating Principal, Amity Institute of Education, Amity University Uttar Pradesh (AUUP), Ms. Abha Sehgal, Principal Sanskriti School, Ms. Shipra Sharma, Education Officer, CBSE and Ms. Shalini, Assistant Professor Amity Institute of Education.

*Outcome of the seminar and recommendations*

Pre lunch session commenced with presentations of fifteen different representatives of schools from NCR region. Remaining presentations were held during the post lunch session. In between, the panellists presented their views on the topic. The students' presentations were lucid, to the point and remarkably specific to indicate their expectations and perceptions of what is the image of a teacher in their eyes. A brief overview of summary of what present adolescents admire and abhor as emerged from their vivid expressions amply demonstrates the clarity of their thought process as listed below:

*Communication*

What the adolescents of today expect unambiguously and important from their teachers is not to treat them as passive objects. The teaching-learning has to be a two way process with a steady feedback from the students to reshape and remodel class room sessions. Therefore effective '*communication*' and two way '*interaction*' emerged to be the all pervasive requirements of teenage students from their teachers. The other aspect that seems to be most necessary for the adolescents is the need to *retain interest* of students in whatever goes on in the classroom, lest they exhibit anxiety and worry. They obviously perceive their teachers to be the *facilitators* who need to maintain the *classroom environment congenial for learning*. Students suggested creative use of teaching aids and ingenuity in using cutting edge technology for imparting knowledge towards this end.

*Domain knowledge*

The most important aspect, the students are critical about is the inadequacy of subject knowledge of their teachers. Today's adolescents feel very strongly about this and are not prepared for any compromise on it. In the backdrop is the basic requirement of their teachers to be able to *impact knowledge base* to their students positively *without being judgmental*. The teachers must love teaching and should have strong domain knowledge. They should make necessary efforts to keep abreast of all changes taking place and must not be found lagging in latest updates in their respective fields.

*Teaching for understanding*

One of the students brought out the aspects of '*understanding*' vis-à-vis '*learning*', thereby dwelling into an altogether different dimension of teaching-learning process. It is commonly understood that knowledge and skill have traditionally been the mainstays of our education. We want students to be knowledgeable about history, science, geography, sociology, *etc*. We want students to be skilful in the routines of arithmetic, the craft of writing and the use of languages. Achieving this is not easy, but we work hard at it. So with knowledge and skill deserving plenty of concern and getting plenty of attention, why pursue understanding? Among several reasons, one stands out: *Knowledge and skill in them do not guarantee understanding*. People can acquire knowledge and routine skills without understanding their basis or *when* to *use them*. By and large, knowledge and skills that are not understood, do students little good. What use can students make of the history or mathematics they have learned unless they have understood it? In the long term, education must aim for active use of knowledge and skill. Students garner knowledge and skill in schools so that they can put them to work in professional roles - scientist, engineer, designer, doctor, businessperson, writer, artist, musician - and in lay roles - citizen, voter, parent - that require appreciation, understanding and judgment. Yet *rote knowledge generally defies active use, and routine skills often serve poorly because students do not understand when and how best to use them*. In short, we must teach for understanding in order to realize the long-term payoffs of education. At the heart of teaching for understanding lies a very basic question: What is understanding? Ponder this query for a moment and one will realize that there are no good and obvious answers. To draw a comparison, we all have a reasonable concept of what knowing is. When a student knows something, the student can bring it forth upon call - tell us the knowledge or demonstrate the skill. But understanding something is a more subtle matter. A student might be able to regurgitate reams of facts and demonstrate routine skills with very little understanding. Somehow, understanding goes beyond knowing, but is difficult to tell exactly how.

This performance perspective says that understanding a topic of study is a matter of being able to perform in a variety of thought-demanding ways with the topic, for instance: to explain, muster evidence, find examples, generalize, apply concepts, analogize, represent in a new way, and so on (Perkins, 1993). Suppose a student "knows" Newtonian physics: the student can write down equations and apply them to three or four routine types of textbook problems. In itself, this is not convincing evidence that the student really understands the theory. The student might simply be parroting the test and following memorized routines for stock problems. But suppose the student can make appropriate predictions about the snowball fight in space. This goes beyond just knowing. Further, suppose the student can find new examples of Newton's theory at work in everyday experience and make other extrapolations, it is indicative of understanding. The more thought-demanding performances the student can display, the more confidently one can infer that the student understands.

Understanding performances contrast with what students do, spending most of their time. While understanding performances can be immensely varied, by definition they must be thought-demanding; they must take students beyond what they already know. Most classroom activities are too routine ones to understand performances - spelling drills, true-and-false quizzes, arithmetic exercises, many conventional essay questions and so on. Such performances have their importance too. But they are not performances of understanding; hence they do not help much to build understanding.

*Bond between teacher and adolescent*

In a very heart-warming manner a few students expressed some of the finer aspects of their expectations from the teachers that were incredible, considering the volatility of adolescent minds. It was brought out that the teacher is responsible for *holistic development* of their students and therefore the emphasis must be on '*teaching beyond words*'. The students appeared convinced that while knowledge may be available from various sources in today's technology driven world, it is for the '*emotional support*' and '*understanding the metaphor*' that a true teacher cannot be replaced with anything what so ever.

Some presentations brought out the changing role of teachers from being a '*mother*' of children when dealing with younger lot to a '*friend*' of them when they grow up. The need for *detailed knowledge of their students* thus emerged as a pre requisite for someone aspiring to be a teacher. One of the speakers brought out the need for '*ability to design mind and soul*' while others felt that ability to '*effectively shape present and future*' of the students, as the essential qualification of a teacher.

There were some aspects that the adolescent despises most and consider extremely harmful for the bonding and does not expect to be present in their teachers. First and foremost is giving no room for **bias** of any kind while dealing with the students. Another to follow is the undue *emphasis on completion of syllabus without caring for understanding of concepts*. It is for this reason some speakers recommended that greater restrain needs to be exercised while selecting this profession especially by those who do not love teaching. It was very interesting to note that one of the speakers felt that there is a huge gap in what qualities should a good teacher posses and what are actually residing in them. The *growing western influence* on our educational set up was considered harmful for the mutual understanding and bonding between teachers and the students. Overall the adolescent minds look for role models in their teachers who are ready to put heart and soul into their profession and inspire them to achieve higher.

## Conclusion

The panellists were found to echo similar sentiments albeit in a moderate way. They agreed that today's teacher cannot remain '*a sage of the stage*' but will have to perform as '*a guide on the side*'. The major area of concern focused is on the expectations from the teacher community are huge but the present dispensation in our country is far from being geared up to create requisite numbers with such qualifications and abilities. A reality check is badly needed to draw attention of policy makers in this regard.

The seminar although represented children from National Capital Region; ended up drawing certain universal lessons and redefined some untouched aspects in matters of communications between the teachers and adolescents, domain knowledge of teachers, need for teaching for understanding and importance of developing necessary bond between the teachers and adolescent students.

Event like this is an excellent example of collective venture towards understanding the aspirations and expectations of adolescents by not only those who are directly responsible for imparting education but those who are in policy formulation and policy implementation also. Direct inputs by the target group itself generated some honest revelations and a food for thought for all concerned who wish to see teaching-learning process reaching a higher level in the modern context. It is believed that initiatives taken during such dialogues would go a long way in facilitating excellent traditions in the field of imparting education including strengthening the much talked about student teacher bonding that our cultural heritage is best known for.

## References


Hughes, F. P. (2009), *General Characteristics of the Adolescent*, in: Children, Play and Development, Fourth Edition, Pearson Allyn Bacon, Prentice Hall, London, 136.

Lounsbury, J. H. (2000), *Understanding and Appreciating the Wonder Years*, National Middle School Association Web site (www.nmsa.org).

Perkins, D. (1993), *Teaching For Understanding*, American Educator: The Professional Journal of the American Federation of Teachers, **17**(3), 28-35.

Raleigh, P. (2007), *Engaging 'Tweens and Teens - A Brain-Compatible Approach to Reaching Middle and High School Students*, in: Understanding How Adolescents Think: An interview with Raleigh Philip, accessed on line: *http://www.edutopia.org/classroom-management-learning-states-teenagers-interview).*


xxxxxxxx

Vetri Education, Quarterly Journal (ISSN - 0973 - 8614), IX (2), 2014, 45-55

# Accidental Discoveries

**A. G. Ramachandran Nair***

Vetri Venkareswara College of Education, Moolakulam, Pondicherry - 605 010

## Abstract

In an era of constant innovation and discovery, we may not realize that most inventions take years - even decades - to develop. Although some breakthroughs take a lifetime of dedication, the curious mind needn't worry. The serendipitous or accidental inventions have led to healthier food, vital medicines and even development of new regions of science, besides providing the thrill of excitement to readers. A few of the unexpected, accidental or mistake guided discoveries are briefly retold in this article.

---

**Key words: Serendipity, accidental discoveries, invention from mistakes**

## Introduction

As history shows us, people have crafted new inventions and stumbled upon discoveries unexpectedly, by accident or mere luck. However, many of the unexpected results or accidental desirable outcomes often occur for those who pursue their efforts sincerely and with perseverance. No doubt, such things happen not to all, but a few who have significantly used their time and brain in productive ways. Sir Szent Gyorgyi (1934), biochemist and recipient of Nobel Prize, says: "A discovery is said to be an accident meeting a prepared mind". And a prepared mind is usually what it takes. As we learn about accidental inventions and discoveries, remember that some were serendipitous, meaning they were stumbled upon by chance, whereas others occurred while the inventors were trying to discover something else. Slinky, Silly Putty and Play-Doh (childhood amusements) discovered by their inventors were by chance, while trying to discover or invent other things. Such accidental discoveries aren't that rare, actually. Sir D H R Barton (1989) explains how a convenient and more economical process of industrial preparation of vinyl chloride - the all important monomer molecule of the famous PVC polymers - was achieved. Though the observation was serendipitous, his hard work and systematic analysis led to the standardization of the process acceptable to Industry. This trait, he admits, is the reason for many of his chance discoveries. The accidental formation of phthalic acid from naphthalene with sulphuric acid and mercuric ions (during determining m. p. of naphthalene using sulphuric acid bath and mercury thermometer), observation of the formation and psychic effects of LSD, chance observation of the different absorption behaviour of NMR radiation by the same hydrogen nucleus in water and ethanol (leading to its application in chemistry), development of super glue (providing joint strength better than bolt and screw), the extract from a microorganism (penicillin) preventing the growth of other microbes, the development of immune-chemicals starting with use of serum of an infected species, the synthesis and use of saccharin as a sweetening agent (especially for diabetics), the discovery of the use in erectile dysfunction of *sildenafil* (Viagra, a drug developed for controlling blood pressure), the use of certain chemicals as pheromones to control insect pests (through pest traps) etc., etc.,

***E-mail: ramchand2211@gmail.com**

familiar to students and even common people, have an element of serendipity or chance discovery. Louis Pasteur once said: “chance favours the prepared mind”. That is the genius behind all these accidental inventions - the scientists were prepared. They did their science on the brink and were able to see the magic in a mistake, set-back, or coincidence.

The interested can collect more of such items through search of Google (Wikipedia and other Encyclopedia Dictionaries) or similar sources, books and monographs like: Accidental Discoveries in Science (Roberts, 1989), Accidental Discoveries from Gravity to Velcro (Roberts and Roberts, 1994), Top Ten Accidental Discoveries (Frater, 2008), and relevant websites therein (See under references).

A few of them and similar others from the field of science (Biology, Chemistry and Physics) and Industry are discussed briefly here, to give an insight to the phenomenon and encourage young minds with a scientific attitude to develop keen observation, reasoning on the unexpected results and derive the benefit of serendipitous or accidental inventions for the enthusiasts by turning the accident as discovery by their inquisitive human mind.

## Discussion

Some of interesting and well documented chance / accidental discoveries are presented here under three different application headings, without ruling out overlapping, and providing the relevant references at the end.

## Household related

*Corn flakes*

It all started with Will Keith Kellogg with his interest in medicine and a bout of forgetfulness. Kellogg assisted patients and their diets of his doctor brother, at the Battle Creek Sanitarium in Michigan. While conducting research with his brother and helping to cook meals for patients, Kellogg stumbled upon a discovery that would change his life.

Responsible for making bread dough, one day Kellogg accidentally left his main ingredient - boiled wheat - sitting out for several hours. When he came back to roll the ingredient into dough, the wheat became flaky. Curious to see what would happen, Kellogg baked the flaky dough anyway, creating a crunchy and flaky snack. The flakes were a hit with patients, so Kellogg embarked on a mission to enhance the product for sale on a large-scale.

Kellogg tinkered with his recipe and finally settled on using corn as the main ingredient for the flakes. He launched his business, “The Battle Creek Toasted Corn Flakes Company”, in 1906, which eventually came to be known as the Kellogg’s company that sells Corn Flakes, other cereals and other convenient foods today.

*Potato Chips*

The first potato chip was invented by George Crum (Half American Indian half African American) at Moon’s Lake House near Saratoga Springs, New York, on August 24, 1853. He was fed up with the constant complaints of a customer who kept sending his potatoes back to the kitchen because they were too thick and soggy. Crum decided to slice the potatoes so thin that they couldn’t be eaten with a fork. Against Crum’s expectation, the customer was ecstatic about the new chips.

They became a regular item on the lodge's menu under the name "Saratoga Chips" and a large contributing factor of the Western world's obesity problems.

*Saccharin – the sugar substitute*

Artificial sweeteners surely top the invention list for those of you with a sweet tooth. But many do not know the story how saccharin, one of the first sweeteners, came to be?

Working in the lab of Ira Remsen at Johns Hopkins University, Constantine Fahlberg discovered saccharin by chance in 1879 while studying coal and tar to discover alternative uses. As was the case with other accidental inventors, Fahlberg unknowingly carried some of his work home with him on his hands.

On one such day, he left his office and forgot to wash his hands before sitting down to dinner. He noticed, upon eating one of his wife's rolls, that it tasted much sweeter than it ever had before. He questioned her new recipe but learned that she had done nothing different. It was during that discussion that he noticed that he had forgotten to wash and returned to his office to search for the sweet ingredient.

After running more tests on the strange, sugary substance, Fahlberg patented saccharin independently - a decision that angered Remsen, who had collaborated with Fahlberg to create the compound. Although Fahlberg's poor hygiene would be considered a nightmare for most lab practices today, his discovery expanded consumers' choices in the food industry.

Years later, saccharin can be found in many products, including the popular artificial sweetener Sweet'N Low. Since saccharin is not metabolized by the body, it is virtually a non-calorie option. In reality, one gram of the sweetener contains less than five calories, which is usually reported as zero, according to U.S. Food and Drug Administration standards. Further, roughly in place of 1gm sugar only 1/300gm saccharin is sufficient, making the calories negligible. Saccharin appeals to people looking to sweeten food without sugar, especially those living with diabetes - a condition in which sugar levels are already high in the bloodstream.

*Aspartame*

Like many artificial sweeteners, the sweetness of cyclamate was discovered by accident. Michael Sveda was working in the laboratory on the synthesis of anti-fever medication. He put his cigarette down on the lab bench and when he put it back in his mouth he discovered the sweet taste of cyclamate. Aspartame was discovered in 1965 by James M. Schlatter, a chemist working for G.D. Searle & Company. Schlatter had synthesized aspartame in the course of producing an anti-ulcer drug. He discovered its sweet taste serendipitously when he licked his finger, which had accidentally become contaminated with aspartame. It is a white crystalline powder derived from the two amino acids, aspartic acid and phenylalanine. It is 2/3times as sweet as saccharin and is used as table top sweetener or in frozen desserts, gelatins, beverages and chewing gum. It has no bitter after taste like saccharin; but does not taste exactly like sugar as it reacts with other food flavours. Initial safety testing suggested it to cause brain tumours in rats. Based on safety evidence, in 1981, FDA approved aspartame as a food additive. It cannot be used for cooking since heating destroys its sweetness (Nair and Badmanabane, 2007).

*Popsicles*

The Popsicle was invented by an 11 year who kept it secret for 18 years. The inventor was Frank Epperson who, in 1905, left a mixture of powdered soda and water out on the porch, which contained a stir stick. That night, temperatures in San Francisco reached a record low. When he woke the next morning, he discovered that it had frozen to the stir stick, creating a fruit flavoured ice treat that he humbly named the *epsicle*. 18 years later he patented it and called it the *Popsicle*.

*Teflon (coating in nonstick pans)*

Teflon was invented accidentally by Roy Plunkett of Kinetic Chemicals in 1938. Plunkett was attempting to make a new CFC refrigerant, the perfluorethylene polymerized (say that 3 times fast!) in a pressurized storage container. In this original chemical reaction, iron from the inside of the container acted as a catalyst. In 1954, French engineer Marc Grégoire created the first pan coated with Teflon non-stick resin under the brand name of Tefal after his wife urged him to try the material that he'd been using on fishing tackle, on her cooking pans. Teflon is inert to virtually all chemicals and is considered the most slippery material in existence.

*Velcro (Forerunner of Nylon for hooking)*

What do Velcro, a dog's fur and cocklebur plants have in common? Such was the thinking of George De Mestral, an electrical engineer, after returning from a walk with his canine companion. Once inside, De Mestral noticed how perfectly cockleburs bound to his dog's fur. So, with microscope in hand, he examined the bur closely.

He discovered that the cocklebur was lined with numerous tiny *hooks* that could easily attach to the *loops* of his clothing and the fur of his dog. With this concept in mind, De Mestral toyed around with other materials, creating surfaces with hooks and loops to develop a stronger bond. In 1955, De Mestral settled on nylon as his material to perfect his accidental invention, calling it Velcro. Today we still use Velcro, or a similar product, in our daily lives.

*Microwave (The fast cooker)*

Researchers proposed the use of high-frequency electric fields for heating dielectric materials in 1934. The invention of Microwave relates to heating systems for dielectric materials and the object of the invention is to heat such materials uniformly and substantially simultaneously throughout their mass. It has been proposed therefore to heat such materials simultaneously throughout their mass by means of the dielectric loss produced in them when they are subjected to a high voltage, high frequency field" (Wikipedia).

The specific heating effect of a beam of high-power microwaves was discovered accidentally in 1945, shortly after high-powered microwave radar transmitters were developed and widely disseminated by the Allies of World War II, using the British magnetron technology that was shared with the United States company Raytheon in order to secure production facilities to produce the magnetron. Percy Spencer, an American self-taught engineer from Howland, Maine, worked at the time with Raytheon. He was working on active radar set when he noticed that a chocolate bar he had in his pocket started to melt - the radar had melted his chocolate bar with microwaves. The first food to be deliberately cooked with Spencer's microwave was popcorn, and the second was an egg, which exploded in the face of one of the experimenters. To verify his finding, Spencer created a high density electromagnetic field by feeding microwave power from a magnetron into a metal box from which it had no way to escape. When food was placed in the box with the microwave energy, the temperature of the food rose rapidly.

On October 8, 1945, Raytheon filed a US patent for Spencer's microwave cooking-process, and an oven that heated food using microwave energy from a magnetron was soon placed in a Boston restaurant for testing. The first time the public was able to use a microwave oven was in January 1947, when the Speedy Weeny vending machine was placed in Grand Central Terminal to dispense "sizzling delicious" hot dogs. Among those on the development team was robotics pioneer George Devol, who had spent the last part of the war developing radar countermeasures. Tens of millions of lazy cooks now have him to thank for their dull food!

*Brandy (More tasty than wine)*

Initially wine was distilled as a preservation method and as a way to make the wine easier for merchants to transport. It was also thought that wine was originally distilled to lessen the tax which was assessed by volume. The intent was to add the water removed by distillation back to the brandy shortly before consumption. It was discovered that after having been stored in wooden casks, the resulting product had improved over the original distilled spirit. No one is sure who it was that discovered the delightful taste of this distilled liquor, but he was clearly guided by God in its discovery for the betterment of man.

## Health related

*X- Rays*

All of us are familiar with the use of X-rays for diagnostic purposes taking image of bones, teeth and organs in the human body; to detect cracks in metal in industry; and even at airports for luggage inspection. Despite their versatility, the invention of the X-ray wasn't intentional. The scientific and medical community will forever be indebted to an accidental discovery made by German physicist Wilhelm Conrad Röntgen in 1895.

While experimenting with electrical currents through glass cathode-ray tubes, Röntgen discovered that a piece of barium platinocyanide glowed even though the tube was encased in thick black cardboard and was across the room. He theorized that some kind of radiation must be traveling in the space. Röntgen didn't fully understand his discovery so he dubbed it X-radiation for its unexplained nature.

To test his newfound theory, Röntgen enlisted the help of his wife for his first X-ray photos and captured images of the bones in her hand and her wedding ring in what would become known as the first *rontgenogram*. He discovered that when emitted in complete darkness, X-rays passed through objects of varying density, rendering the flesh and muscle of his wife's hand mostly transparent. The denser bones and the ring left behind a shadow on a special photographic plate covered in barium platinocyanide. The term X-radiation or X-ray stuck although it is still sometimes referred to as the Röntgen ray in German-speaking countries.

Rontgen's discovery received much attention in the scientific community and with the public. He gave his first public lecture on X-rays in January 1896 and showed the rays' ability to photograph the bones within living flesh. A few weeks later in Canada, an X-ray was used to find a bullet in a patient's leg.

*Pace maker*

Wilson Greatbatch expressed an insatiable interest in circuitry and held revolutionary thoughts about how to fix naturally occurring problems in the human body.

Greatbatch was on the hunt for a solution for "heart block," a condition in which a heart does not receive messages from surrounding nerves to pump blood correctly. In contrast to other scientists who used large and cumbersome gadgets to stimulate heart muscle, Greatbatch wanted to devise a smaller implant to get the job done.

Though Greatbatch intended to create a machine to mend a broken heart, his moment of discovery may surprise one. While building an oscillator to record heart beat sounds in animals at Cornell University in 1958, he accidentally grabbed the wrong transistor and installed it in his device. Realizing his mistake, Greatbatch was still curious to see what would happen. Not expecting the oscillator to work, he switched it on and heard a familiar, rhythmic pulsing sound - a pattern remarkably similar to a heart.

By chance, his invention, known as the *pacemaker*, was ideal for pulsating signals to the heart. He tested his new creation on animals and fine-tuned the device before implanting it into a human in 1960. Before then, pacemakers were hulking machines the size of TVs. Greatbatch's implantable device of just 2 cubic inches forever changed life expectancy in the world. Now, more than half a million of the devices are implanted every year.

In recent years, Greatbatch has been lauded for his achievement - even if he discovered his solution by chance.

*LSD (Lysergic acid diethylamide)*

Lysergic acid diethylamide, popularly known as LSD, was not invented by accident. Yet the effects of one Lysergic acid derivative were discovered perchance (Merhoff and Porter, 1974).

When Swiss chemist Albert Hofmann began working for Sandoz laboratories in 1929, he was on a mission to map the unchartered territory of compounds derived from a fungus called *ergot*. Hofmann wanted to examine the properties and stability of these compounds to gauge their potential as medicine. He produced one derivative called LSD-25, but the compound wasn't particularly interesting to other scientists and physicians at the time.

Five years later, Hofmann decided to look at LSD-25 once more. While producing the compound in 1943, Hofmann claimed he was "interrupted in his work by unusual sensations". Hofmann somehow accidentally ingested the substance, placing him in an intoxicated and stimulated state. After leaving work early to go home and lie down, Hofmann claimed to perceive "fantastic pictures" and shapes with "intense kaleidoscopic play of colors"

Hofmann had accidentally discovered the effects of one of the strongest psychic drugs in modern times. Although Hofmann experimented further with the drug and pushed for its use in medical and psychiatric settings, he was not thrilled to learn that people were abusing the drug recreationally in the 1960s. As a result, he resorted to calling LSD his problem child.

*Sildenafil (Viagra, the blue pill)*

When you think of side effects, you usually consider them to be bad. But in some cases, as we'll soon find out, certain side effects can lead to substantial discoveries.

When Simon Campbell and David Roberts, two researchers working at the pharmaceutical company Pfizer, began studying the effectiveness of a new drug, they had no clue what their product would turn into. The two developed a drug they hoped would treat high blood pressure and a heart condition called angina. By the late 1980s, it was ready to be tested on human patients in clinical trials.

The team administered the drug - called UK-92480 - to patients in a trial and learned that it was not as effective as researchers predicted. Yet as scientists looked at the side effects of the trial, they noticed multiple patients reporting that the treatment led to erections. With an open mind, researchers at Pfizer moved forward to learn more about this unintended side effect.

Rather than using the drug experimentally to treat blood pressure and heart issues, the company launched a new clinical trial to use the drug for *erectile dysfunction disorder*. The trial proved successful, and the newly named *Viagra*, also known as sildenafil citrate, was approved by the U.S. Food and Drug Administration in 1998.Viagra may spice up lackluster relationships.

*Nitrous oxide (Laughing gas for anesthesia)*

Although the true discoverer of *anesthesia* is contested, the people who contributed to its development and use were inspired by similar accidental observations.

Crawford Long, William Morton, Charles Jackson and Horace Wells all come to mind when talking about anesthesia. These men realized that in some cases, ether and nitrous oxide (laughing gas) inhibited pain in people under their influence.

In the early 19th century, inhaling either of these compounds was somewhat popular for both recreation and entertainment. By witnessing and even partaking in these events, often called “laughing parties” and “ether frolics”, anesthesia’s founding fathers learned more about how these experiences affected people’s perceptions of pain.

One example in particular demonstrates the accidental discovery of these compounds used to prevent pain in the medical field. In 1844, Horace Wells attended an exhibit and witnessed a participant injure his leg while under the influence of laughing gas. The man, whose leg was bleeding, told Wells that he didn’t feel any pain.

After his accidental discovery, Wells used the compound as an anesthetic while he removed his tooth. From there, anesthesia’s use during medical procedures and surgeries took off. Wells, Morton and Jackson began to collaborate and use anesthesia in dental practices, while Crawford Long used ether for minor surgeries.

*The Colour Mauve*

In 1856, 18-year-old chemist William Perkin turned out to be quite the young prodigy, inventing synthetic dye and going on to help fight cancer. The dye was nowhere close to what he intended on making.

Perkin was working on creating an artificial version of the malaria drug quinine. Instead, his experiments produced a dark oily sludge. Not only did the sludge turn silk a striking shade of light purple, it didn’t wash out and was more vibrant and bright than the existing dyes on the market.

Up to that point, dyes were made mostly of insects, mollusks, or plant material. As later chronicled in the book *Mauve*:

H*ow One Man Invented a Color That Changed the World*, by Simon Garfield, Perkin's invention of mauve coloring became the hit of the Paris and London fashion scenes

Perkin's work with dyes inspired German bacteriologist Paul Ehrlich, who used the inventions to pioneer immunology and the first chemotherapy, eventually winning a Nobel Prize.

## Industry related

*The Slinky*

The famous children's song: "A spring, a spring, a marvelous thing! Everyone knows it is Industrial equipment stabilizer", wouldn't have been quite effective in describing its function. Yet that was the intended use of the springs, naval engineer Richard James was developing in 1943. The sensitive springs were meant to keep fragile equipment steady on ships. Then James knocked one of his new springs from a shelf and, like a kid on Christmas morning, watched it do that famous Slinky walk down instead of just hitting the ground, as *Time* noted in its all-time greatest toys list last year.

James took the creation home to show his wife, Betty, who saw the potential for a new toy. After consulting the dictionary, a name sprung (sorry) to mind: *Slinky*, a Swedish term meaning "sleek and sinuous." By time the toy was demonstrated in front of Gimbels Department Store in Philadelphia, during the 1945 Christmas season, it was clear it would be the Tickle Me Elmo of its time. The industrial machine James had could coil 80 feet of wire into two inches, and hundreds of Slinkys were already being sold.

That's not all, either: The Slinky has found other uses, including as an antenna by soldiers in Vietnam and as a therapy tool. Whatever the use, everyone knows it is Slinky.

*Vulcanized Rubber*

Rubber, which comes from the rubber tree, can rot and smell when it's not vulcanized. For many years, scientists attempted to come up with a more sustainable form of rubber to no avail. In 1939, Charles Goodyear brushed rubber powder and sulfur off of his hands, which simultaneously landed on a hot stove. The rubber reacted with the sulfur to create vulcanized rubber. Rubber is now treated with sulfur at high temperatures to form a resilient, less sticky and less smelly product.

*Plastic (The all purpose material)*

Plastics are substances which can be shaped and moulded. Such plastics as amber, tar, pitch and resins are known for a long time; but during and after the Second World War many synthetic plastics are in use. Plastics are typically organic polymers of high molecular mass, but they often contain other substances. They are sometimes called the alloy of organic chemistry. The word *plastic* is also used to designate certain manufactured products which have been shaped or moulded while in a softened condition and hardened into a relatively rigid condition. Plastic occupies an important place in our everyday life today (Ahrens, Bush and Easley, 1952). It is interesting and important to know that like certain other items, plastic too is included among inventions from mistake (Google, 2013).

Following the chance discovery of vulcanisation of rubber, came the invention of plastic through an accidental spill in John Wesley Hyatt's shop. Inspired by a $10,000 contest to find a replacement for elephant ivory in billiard balls, Hyatt accidentally spilled a bottle of collodion, only to discover that when it dried it formed a flexible-yet-strong material. He didn't win the contest (nor did anyone, for that matter), but by 1872 his brother Isaiah coined the term celluloid to describe what was becoming the first commercially successful plastic--even used in the first motion-picture film used by George Eastman.

*Dynamite (Fund generator for Nobel Prize)*

Alfred Nobel, a Swedish chemist and engineer, learned this the hard way. In efforts to stabilize nitroglycerin, an explosive, Nobel and laboratory workers experienced several accidents - one of which ultimately proved fatal. An explosion in Stockholm, Sweden, left Nobel's younger brother and a few others dead in 1864.

No one knew how exactly this accident affected Nobel, but most suspect it further pushed him to find a solution to safely store explosive materials. With this new knowledge of the instability of nitroglycerin, Nobel continually tested methods to detonate and store explosives. Some say that Nobel discovered the key to stabilizing the substance through another accident.

While transporting nitroglycerin, Nobel noticed that one of the cans accidentally broke open and leaked. He discovered that the material in which the cans were packed - a sedimentary rock mixture called kieselguhr - absorbed the liquid perfectly. Since nitroglycerin is most dangerous to handle in its liquid form, the incident led Nobel to explore kieselguhr as a stabilizer for explosives. Ingeniously, Nobel developed a formula that allowed the explosive to be mixed with kieselguhr without hindering its power.

He patented his product in 1867, naming it *dynamite*, which revolutionized construction practices and the creation of explosives. With continuous flow of money through his dynamite, Nobel financed for Nobel Prize, recognizing meritorious contributors to science and society.

Chemistry was the most important science for Alfred Nobel's own work. The development of his inventions as well as the industrial processes he employed was based upon chemical knowledge. The Royal Swedish Academy of Sciences this year awarded the Nobel Prize in Chemistry jointly to Martin Karplus, Université de Strasbourg, France and Harvard University, Cambridge, MA, USA, Michael Levitt, Stanford University School of Medicine, Stanford, CA, USA and Arieh Warshel, University of Southern California, Los Angeles, CA, USA, "for the development of multiscale models for complex chemical systems". In the 1970s, Martin Karplus, Michael Levitt and Arieh Warshel laid the foundation for the powerful programs that are used to understand and predict chemical processes. Computer models mirroring real life have become crucial for most advances made in chemistry today (Alchemist News letter, 2013)

*Super Glue (Cyanoacrylate)*

Some people also consider Super Glue a household necessity. This unyielding adhesive did not spring to life from someone's imagination, though. Rather, its inventor came across it twice before realizing its potential. First, while looking to create plastic for guns during World War II, Harry Coover noticed that the substances he worked with - called *cyanoacrylates* - were particularly sticky. It wasn't until he began working with them again in efforts to develop heat-resistant materials that he came back to these compounds, which hold a superior bond with no heat.

*Benzene (Kekule's dream molecule)*

Kekule was worried and disturbed for days for not finding a suitable structural formula for benzene, a stable compound, a liquid at room temperature and analyzing for $C_6H_6$ and with three double bonds. In the absence of previously known compounds with similar properties his trying different structures did not satisfy its unsaturation and stability. One night he had a dream of a snake swallowing its own tail and thus forming a cyclic form. Kekule's brain kindled the answer of a cyclic structure for benzene opening up several other compounds related to it called aromatics or benzenoids. There are many unexpected or accidental discoveries encountered by systematic researchers and also the same person benefiting repeatedly, suggesting the requirement of a prepared mind to receive them. Luis Pasteur's keen observation led to the development of the rabies vaccine as well as the differentiation of the enantiomeric forms of tartaric acid by their difference in crystal shape under the microscope.

The choice of the best solvent for purifying a new compound to have the constant physical constants after repeated crystallization in olden days, having no sophisticated techniques like HPLC, HPTLC, etc. was often a matter of luck or accident and the benefit of such accidents have been enjoyed by many organic chemists including the author.

## Conclusion

The stories of accidental or chance discoveries should motivate young researchers to be expectant of such benefits after systematic and sincere efforts but failing to achieve the expected result in time. Patience and perseverance paid in the past and it will in future too. Let the conclusion be the noble words of Sir Szent-Gyorgyi: "A discovery is said to be an accident meeting a prepared mind", and Sir Louis Pasteur: "Chance favours the prepared mind".

## References


Ahrens, M. R., Bush, N. F. and Easley, R. K. (1952), *Living Chemistry*, Ginn and Company, New York.

Alchemist News letter (2013), Award: *Nobel theory – Nobel Prize in Chemistry, 2013*, The Alchemist Newsletter from ChemWeb.com, October 25.

*Nobel Prize in Chemistry 2013*, October 25, 2013.

Google.com announcements (2013), *Nine brilliant Inventions made by mistake.*

Roberts, R. M. (1989), *Serendipity: Accidental Discoveries in Science,* Wiley Eastern Limited.

Roberts, R. M. and Roberts, J. (1994), *Lucky Science: Accidental Discoveries from Gravity to Velcro,* Wiley Eastern Limited.

Barton, D. H. R. (1989), Foreword in: *Serendipity: Accidental Discoveries in Science*, Wiley Eastern Limited.

Frater, J. (2008), *Top 10 Accidental discoveries*, http://knowledgenuts.com

Ramachandran Nair, A. G. and Batmanabdane, G. (2007), Sugar *substitutes – Artificial sweeteners – Anti-obesity Agents,* Vetri Education, **2** (4), 25-30.

Szent-Gyorgyi, A. (1934), *Biochem. J*., **28**, 1625.

## Web information

http://as.wiley.com/wiley.CDA/wileyTitle/productCd-0471009547.html (Accidental discoveries)

http://taming the rays.com/TTR3-Early Years of X-rays.pdf (X-rays)

http://nobelprize.org/nobelprizes/physics/1901/rotgen.bio.html/ (X-rays)

http://mythverse.com/2011/07/14/sweet-notings/ (Aspartame)

http://www.ehow.com/list_7249962_accidental-inventions.html#ixzz2hkgCu2tT (General)

http://science.howstuffworks.com/innovation/inventions/10-accidental-inventions11.htm (General)

http://en.wikipedia.org/wiki/LSD (LSD)

http://health.howstuffworks.com/medicine (Pace maker)

http://rosalindfranklin.edu/dnnchicagomedicalschool/home/cms/biochem/faculty/walters/sweeteners/saccharin.aspx (Saccharin)

http://science.howstuffworks.com/innovation/edibleinnovations/artificialsweetener.htm (Saccharin)

http://as.wiley.com/wiley/cdasection/id-302477.html?query=Royston+M=Roberts (Serendipity)

http://recipes.howstuffworks.com/question255.htm (Super glue)

http://www.omg-facts.com/History/The-Slinky-Was-InventedByAccident/28154#6ECTtboVBrbO-JI43.99 (The slinky)

http://www.nobelprize.org/nobel_prizes/chemistry/laureats/2013/press.html (Nobel Prize)

xxxxxxxx

# Vetri Education: Quarterly Journal in Education (ISSN-0973-8614)

## Articles of Volume I -VIII; 2006-2013 (Title and Author)

### Volume 1, No. 1 (July – September, 2006)

1. School Curriculum in India at Primary Stage: A Study: S. K. Yadav
2. Teacher Education in India: Issues and concerns: S. K. Yadav and Sumbul Rehan
3. Hypothetico-reductive reasoning among convent school Teachers: A. C. Pachaury
4. A survey of Teachers' Perception on New Science & Technology Text Books
   N. D. Deshmukh and S. C. Agarkar
5. Integration of Science Education with ICT: M. N. Bapat
6. Education of Human Values: Manas Ranjan Panigrahi

### Volume I, No. 2 (October-December, 2006)

1. Effectiveness of Communicative Strategy in Spoken English
   E. Ram Ganesh and S. Raja Soundara Pandian
2. Encouraging Students' Achievement through Educational Technology: Siba Charan Subudhi
3. Organising Teachers' workshops for Effective Utilization of Microscope:
   Narendra D. Deshmukh and S.C. Agarkar
4. A Study of Emotional Intelligence as Correlates of Cognitive and Non-cognitive Variables:
   Kajal Devi Manhas and S. C. Gakhar
5. School Curriculum in India at Upper Primary Stage, A study: S. K. Yadav
6. Molecular Basis of Biological Phenomena: A. G. Ramachandran Nair

### Volume II, No. 1 (2007)

1. School Curriculum in India at Secondary Stage: A Study: S. K. Yadav
2. Feedback Analysis of the Content based Teleconferencing Programme: M. K. Dash
3. Multiple Intelligences-based Curriculum Development: Lalith Kishore
4. Need of Teacher Education Programme through Distance mode: G. C. Bhattacharya
5. Implementation of Information Communication Technology in Teacher Education: A case of Egertone University: Joseph Mworia Wamutitu
6. Parental Expectations and Level of Satisfaction from Children's School:
   Rajni Dingra, Sarika Manhas and Neetu sethi
7. Molecular basis of Defence of Lower Animals: A. G. Ramachandran Nair
8. Model to Teach GCD and LCM of two or more Positive Integers for Blind Students:
   N. Gururajan

## Volume II, No. 2 (2007)

1. Peer Interaction and Learning in Small Groups – A Social Pedagogy of Class Room: Manas Ranjan Panigrahi
2. A Study of Alienation and Adjustment of School Going Adolescents: Amardeep Kaur
3. Need of Value Based Education and Value Inculcation in Contemporary Society: Narayana Prasad Behera and Debedra Nath Dash
4. Nurture of Tribal Child's Classificatory and Creative Abilities: A. C. Pachaury
5. Protection and Defence Strategies of Plants: A. G. Ramachandran Nair and R. Gunasegaran
6. Statistics for the Teachers-I: N. Gururajan

## Volume II, No. 3 (2007)

1. Implementation of Ten-year School Curriculum in Different States in India: S. K. Yadav
2. Opinion of the Secondary School Geography Teachers of Kenya regarding Field work Technique: G. C. Bhattacharya and Joseph Mworia Wamutitu
3. The relationship between Emotional Intelligence and Academic Achievements of Post Graduate Students: Siba Charan Subudhi
4. Laboratory Oriented Science Learning: Lalith Kishore
5. An Investigation into the Manifestation of Social Insight of College Students: M. Harikrishnan and R. Ramachandran
6. Computer Assisted Education at School Level: A. G. Ramachandran Nair

## Volume II, No. 4 (2007)

1. The Child's Thinking in Piagetian Perspective: A. C. Pachaury
2. Professional Development for Effective Inclusive Class Room: Manoj Kumar Dash
3. Teacher as Motivator and Facilitator: Ranjana Bhatia
4. Opinion of Twelfth Passed Science Students about the Use of Analogies in Understanding Biological Concepts by the Ninth / Tenth Class Learners: S. A. Shaffi, A. C. Pachaury and Ranjana Agarwal
5. Sugar Substitutes - Artificial Sweeteners – Anti-obesity Agents: A. G. Ramahandran Nair and Gitanjali Batmanabane
6. A report of regional Workshop on Alternate and Innovative Education (AIE): Lalith Kishore

## Volume III, No. 1 (2008)

1. Role of Family in Promoting Social Inclusion of Children with Special Needs
   G. C. Bhattacharya and Joseph MworiaWamutitu
2. A Comparative Study on Syllabi of MBOSE and ICSE: Siba Charan Subudhi
3. A Correlation Study of Higher Secondary Students' Achievement in Commerce and their Emotional Adjustment: R. Babu and K. Kaliamoorthy
4. Impact of Sarva Shiksha Abhiyan on Retention of Learners in Primary Grade:
   Manoj Kumar Dash
5. The Recommendations of National Knowledge Commission and Its Implementations for the System of Higher Education in India: Manas Behera
6. Fragrance and Flavours to Enhance Comfortable Living: A. G. Ramachandran Nair and R. Gunasegaran

## Volume III, No. 2 (2008)

1. Evolution of School Curriculum in India: S. K. Yadav
2. Revamping of Teacher Education Through Information Communication Technology:
   Manoj Kumar Dash
3. Eleven-year-old Convent School OBC and General Category Students' Performance on Arithmetic Reasoning Tasks: A. C. Pachaury
4. Quiss - An Innovative Method to Transform Physics Teaching in Classrooms:
   P. R. Lalitha and M. N. Bapat
5. Making Learners of English Communicate Effectively – MAP Formula and Commutainment Activities: Albert P' Rayan
6. Workshop on Specifications for Alternative Learning Systems (ALS): Lalith Kishore

## Volume III, No. 3 (2008)

1. Innovative Evaluation Strategies for Improvement in Achievement of School Learners:
   G. C. Bhattacharya
2. Quality Improvement in School Education: Ranjana Bhatia
3. Personality of Adolescent Students: Digumarti Bhaskara Rao, Kale Madhava and Harshita Digumarti
4. Group Discussion – Meeting the Demand of Employers: Subbu Nisha
5. Quality Improvement in School Environment and Health Education: Sadhna Tyagi
6. How to make the best use of Library: N. Jeenath

## Volume III, No. 4 (2008)

1. Adolescent Education for Quality of Education: Saroj Yadav
2. Value Preferences of Secondary Students: Lalith Kishore
3. What to expect of a Professional Educator? M. N. Bapat and S. P. Kulkarni
4. Sleep - The elixir of Life: Gitanjali Batmanabane
5. "Quality Circles" for Quality Teacher Education: Z. Zayapragassarazane
6. The Philosophy of Physics: S. Mayilavelan

## Volume IV, No. 1 (2009)

1. A study of Students' and Teachers' Misconceptions in Biology at the Secondary School Level: Narendra D. Deshmukh and Veena M. Deshmukh
2. Teaching with Technology: A. V. Ramani
3. Collaborative Teaching - Learning Approach for Inclusive Classroom: Manoj Kumar Dash
4. Challenges in Primary Education: S. Lakshmi
5. The Neoliberal Onslaught on Public Funded Education Causing Inequality and Exclusion: Manas Behera
6. Food Adulteration – A Menace: S. Thyagarajan, T. K. Annapoorani and M. Ravichandran

## Volume IV, No. 2 (2009)

1. Parental perception related to Preschool Education and Role of ICDS in Preschool Education: Sarika Manhas and Fouziya Qadri
2. Perception of Scientific Values of B. Ed. Student Teachers of Science: A. C. Pachaury and S. A. Shaffi
3. An Inquiry of Practical Skills in Biology among Higher Secondary Students of Puducherry: R. Suresh @Venguidaragavane, P. Viswanathan and S. Nirmala Devi
4. Environment Science for Secondary and Higher Secondary Classes: Some Issues and Suggestions: S. K. Padhi and P. K. Acharya
5. Reaction of Participants towards In-service Programme in English Designed with Specific Advance Organisers: Lalith Kishore
6. Quality Improvement in School Education using Educational Technology: P. Palani

## Volume IV, No. 3 (2009)

1. Empowering Teacher Education through E-learning Technology: G. C. Bhattacharya
2. Effect of age on Morality of Children: Ranjana Bhatia
3. Suicidal Behaviour among Adolescents: Sadhna Tyagi
4. Total Quality Management in Higher Education: G. Lokanadha Reddy, A. Kusuma and R. Ppoornima
5. Environment and Health Education: P. Lalitha
6. Quality Improvement in School Education: N. Rajeswary

### Volume IV, No. 4 (2009)

1. A Challenge for the Contemporary Society towards Understanding Values across Cultures: Nikme, S. C. Momin
2. Organisational Citizenship Behaviour and Empowerment of Teachers: S. Suresh and P. Venkatammal
3. Conservation of Piagetian volume Tasks by the ninth Grade School Girls: A. C. Pachaury
4. Educational Problems of Tribal Children in Central India: Ranjan Kunmar Biswas
5. Play way Science Activities for Lower Primary Students: Lalith Kishore
6. Appraising Quality of Training: Tools and Techniques: S. K. Yadav

## Volume V, No. 1 (2010)

1. Integrated Character Education for Sustainable Development; G. C. Bhattacharya and Joseph Mworia Wamutitu
2. Vocational Preferences among Secondary School Students in relation to their Gender and School Achievement: Abdul Raheem, Sajid Jamal and Mohd. Moshahid
3. Use of Math type Symbols in Conceptual Understanding of Science at Upper primary Level: M. N. Bapat, Sandhya Gautam and Alveera Khan
4. Effectiveness of Direct, Oral - Situational and Communicative Approaches in Teaching English Language: Siddiqui Mohd. Mahmood
5. Inferiority Feelings among randomly sampled High School Students R. Soureche @ Venguidaragavane, B. Boopathi and V. Rajakumaran
6. Gender bias in Computer Science and Technical Subjects in Higher Education Sector: Parna (Chakrabarti) Ray

## Volume V, No. 2 (2010)

1. Climate Change Necessitating Environmental Action Learning Curriculum: Joseph Mworia Wamutitu
2. Teachers'Training in Relation to Active Learning Method Utilization: Gara Latchanna and Asrat Dagnew
3. Altruistic Deeds among the Post Graduate Students: M. Balamurugan
4. Perception on English Language Teaching in Secondary Schools of Punjab Amardeep Kaur and Seema Chopra
5. Social Maturity of Adolescents in Relation to Mental Health: Vijay Laxmi
6. Population Education Awareness among Secondary School Teachers: Digumarti Bhaskara Rao, Shaik Johni Bhasha and Harshitha Digumarthi

## Volume V, No. 3 (2010)

1. Student Participation in Communicative English Lesson at The Bahir Dar University, Ethiopia: Gara Latchanna and Asrat Dagnew
2. Training of Moderate Mentally Retarded Learners: G. C. Bhattacharya
3. Pedagogy of tribal children in India: R. Ranjana Bhatia
4. Effect of Career Guidance on scholastic improvement of Class X Students: Siddiqui Mohd. Mahmood
5. Adjustment Problems of Hearing Impaired Children at Home and School: Jampala Madhu Bala and Digumarti Bhaskara Rao
6. Chemotaxonomy or Biochemical Systematics of Plants: A. G. Ramachandran Nair, N. Jeenath and R. Gunasegaran

## Volume V, No. 4 (2010)

1. Innovations in Teacher Education: S. K. Yadav
2. Planning and Implementation of Multicultural Education in Ethiopia: Gara Latchanna and Asrat Dagnew
3. Enhanced Peer interaction: N. D. Deshmukh
4. Children with intellectual disability: Sadhna Tyagi
5. Improvement of Mathematical Ability: Siba Charan Subudhi
6. ICT: Bridging the Knowledge Distance: S. Amutha

## Volume VI, No. 1 (2011)

1. How to Improve Status of School Education: A. Gnanam
2. Facilitative Factors in the Spread of Innovations in Teacher Education: B. C. Das
3. Students' Misconceptions and Cultural beliefs in Biology at the Secondary School Level: Narendra D. Deshmukh
4. Empowerment of Women – A Practical Experience: Ranjana Banerjee
5. Primary School Teachers' Perception on Mid-day Meal Programme: Chirag Nagpal and Anamika Rai
6. Professional Ethics of Teachers in the Higher Educational Institutions: Tanu Shukla
7. Students' Attitude towards Urdu Medium High Schools of Maharashtra's Vidharbha Region: Mohammad. Imran Ahmad

## Volume VI, No. 2 (2011)

1. Technology and Teacher Enrichment: A. V. Ramani and Monica Verma Saha
2. Institutional Climate Perception Variables for Assessing Morale of Teacher Educators: Amruth G. Kumar
3. Role of Ethics and Morality in character building: Puneet Rahi
4. Status and Quality Concerns of Teacher Education in Arunachal Pradesh: P. K. Acharya
5. Effectiveness of use of Computer in Teaching Mathematics at School Level: R. D. Padmavathy
6. From Home Language to School Language with Cultural Linkage Leads: Lalit Kishore

## Volume VI, No. 3 (2011)

1. Role of Teacher, Learner and Pedagogies in Constructivist Classrooms: G. C. Bhattacharya
2. Teachers' Assessment of Use of Wikis in Higher Education: Noushad Husain
3. Multiple Intelligences and Thinking Style of Prospective B. Ed. Teachers: F. L. Antony Gracious and P. Annaraja
4. Learner-friendly Tasks for a Successful ESL Classroom: Subbu Nisha
5. Primary School Teachers' unwelcome Attitudes and Approaches: Namrata
6. Quality Concerns in Teacher Education: Sanjna Vij

## Volume VI, No. 4 (2011)

1. Attitude of Teachers towards the Use of Active Learning Methods: Asrat Dagnew
2. Adjustment Patterns of Government and Public School Students: Shalini
3. Writing-Issue and Challenge for Dysgraphic Students: Prasanta Kumar Mohanty
4. Learning Style Preferences among Students of urban and rural Locality: Rashmi Agarwal and Deepak Jaiswal
5. Emotional Maturity of Teachers in Relation to Gender and Locality: V. Balakrishnan
6. A study of Self-disclosure among Adolescents in relation to Adjustment: Raj K. Gupta and Prabha Verma

## Volume VII, No. 1 (2012)

1. The Importance of Inclusive Education: Ranjana Bhatia
2. Ethiopian Health Science Students' Attitude towards Legalization of Abortion: Yirgalem Alemu and Manas Ranjan Panigrahi
3. A Qualitative Study of Indicators of Performance in College Physics; Sajid Jamal and Sheeba Hasan
4. Awareness of Maternal Health of Rural Mothers: R. Yasoda, C. Siva Sanker and K.Kavitha
5. Family environment on Academic Achievement of B.Ed. Students: I. Muthuchamy and C. Maria Ugin Joseph
6. Care of Emotional Health of Children by Parents and Teachers: Sadhna Tyagi

## Volume VII, No. 2 (2012)

1. Education for Sustaining Rural Environment: G.C. Bhattacharya
2. Web 2.0 in Higher Education: Noushad Husain3.
3. Assessment of Personality and Academic Achievement of Higher Secondary Students: K. Ramkumar and X. Vengo Regis
4. Exploratory Study of Self-regulation for Science Learning: N. Johnson
5. Multiple Intelligence and Teaching competency of Prospective B. Ed. Teachers: F. L. Antony Gracious and F. L. Jasmine Anne Shyla
6. Techno-Pedagogy - Creating Meaningful Learning Experiences: Subha Anantharaj

## Volume VII, No. 3 (2012)

1. Impact on Implementation of practicum-based Biology student-teachers' Training: Gara Latchanna and Garkebo Basha
2. Attitude towards ICT of School Teachers of Chandigarh: Vandana Mehra and Jaipreet Singh
3. Role of Parental Education, Occupation, Income, Cultural-living and Social Participation on Scholastic Achievement: Mohd. Moshahid, Abdul Raheem and Sajid Jamal
4. Reflective Effects of Micro-teaching and Field Experiences on Pre-service Teachers: Asrat Dagnew
5. Significance of Minimum Level of Learning Specification at Secondary Level in National Curriculum Framework: G. C. Bhattacharya
6. Effectiveness of Neuroscientific Research Based Pedagogy in Science: Gagandeep kaur

## Volume VII, No. 4 (2012)

1. Rights of Women versus Human Rights: G. C. Bhattacharya
2. Psychological Wellbeing among College Students of Punjab: Navdeep Kaur
3. Achievement in Science in Relation to Study Habits and Learning Style: Kiranjeet kaur
4. Instructional Package on Disaster Management at High School Level: RM. Kalyana Sundaram and P. Sivakumar
5. Podcasting: A Revolution in English Language Teaching: M. Subbu Nisha
6. Higher Learning Excellence and Transformational Teacher Leaders: V. Mariappan

## Volume VIII, No. 1 (2013)

1. Importance of Education of Teacher Educators for Quality Assurance in Teacher Education: G. C. Bhattacharya
2. Problems and Prospects of Education of Tribal Women: Manoj Kumar Dash, Rasmi Ranjan Puhan and Lakshmi Priya Malla
3. Study of Well-being among School Teachers: Ripenjeet Kaur
4. Role of Mentors in Guiding and Supporting Novice Teachers of Elementary Schools: Asrat Dagnew
5. An Introduction to Personality Structure: Ripenjeet Kaur
6. Pheromones – Function and Importance: A. G. Ramachandran Nair

## Volume VIII, No. 2 (2013)

1. Effect of Problem Solving Teaching Method on Elementary School Students' Learning of Physics: Asrat Dagnew
2. Impact of Stress on Intelligence of Adolescence: Ram Mohan Tripathi and Gagandeep Kaur
3. Handling Learning Disabled in Class Rooms: Asha Gopalan and Amruth G. Kumar
4. Study of the Teacher's Perception about the Mathematical Behaviour of the Child and Achievement: Subha Anantharaj
5. Multiple Intelligence and Mathematics Achievement: R. D. Padmavathy
6. Risk Taking Behaviour in relation to Emotional Intelligence of Adolescents: Amardeep Kaur and Sonika

## Volume VIII, No. 3 (2013)

1. Innovation in Teaching of Geography at Secondary School Level: G. C. Bhattacharya
2. ICT Infrastructure Facilities at Different DIETs of Tribal Areas: Ranjan Kumar Biswas
3. Analysis on Personality Dimensions of Student Teachers: S. Prakash and S. Amaladoss Xavier
4. Burnout in Elementary School Teachers of Rayagada Districts of Odisha: Manij Kumar Dash, Lakshmi Priya Malla and Rashmi Ranjan Puhan
5. Antioxidants - Molecules for healthy long Life: A. G. Ramachandran Nair

## Volume VIII, No. 4 (2013)

1. Effective E-learning: Ganesh Gunasegaran
2. Relationship between Attitude and Aptitude for Teaching: G. C. Bhattacharya
3. Employability of Fashion and Garment Making Students from Youth Polytechnics of Kenya: Peninah Wakiuru Kamaul, Joseph Mworia Wamutitu and Gladwell Mbugua
4. Current Issues in the School Curriculum: Marlow Ediger and Digumarti Bhaskara Rao
5. Teacher Educators' Perception towards Pedagogical Benefits of Wiki: K. Thiyagu
6. Role of Supervisor in Learning and Achievement: Marlow Ediger and Digumarti Bhaskara Rao

xxxxxxxx

# VETRI EDUCATION

## Quarterly English Journal in Education (ISSN – 0973-8614)

### Kind Attention of Contributors to Vetri Education

**Vetri Education** has reached a high level of standard among the educational journals in India with a wide readership, and increased number of contributions received from all over India and abroad, prolonging the time interval between submission and publication. Despite this, authors occasionally contribute articles in a format and length not conducive to Vetri Education. We again request our contributors to pay more attention to content, language (English, U.K.), brevity through citation of references (instead of explaining well known methodologies, in detail) and to the format and presentation - **Title, Author** (Name, Department; no degree and designation) with full address of the institution, giving PIN, Phone number and e-mail address to be followed by **Abstract, Keywords, Introduction, Discussion, Conclusion** and **References.** The email address of the communicating author is essential.

The reference to previous work has to be indicated in the body (Author, Year) as well as under references (full details). Examples are: **(Journal)** Behera, M. (2008), *Recommendations of the NKC and implications,* Vetri Education, **3**(1), 27-31., **(Book)** Kothari, C. R. (1985), *Research Methodology- Methods and Techniques,* Wiley Eastern Limited, New Delhi., **(Article in a book)** Carskadon, M. A. and Dement, W.(2005), *Normal Human Sleep: An Overview,* in: Kryger, M. H. *et al.* (Eds.), Principles and Practice of Sleep medicine, 4$^{th}$Edn., Elsevier Saunders, Philadelphia, pp. 13-23., **(Thesis)** Wamutitu, J. M. (2007), *A Study on Imparting Environmental Education through Secondary School Geography Curriculum in Kenya,* Ph. D. Thesis, Faculty of Education (K), Banaras Hindu University, Varanasi (UP), India. and **(Web)** Gomes, A. A. *et al.* (2007), Sleep-wake patterns and academic performance in university students, http: //www.leeds.ac.uk/educol.documents/00002200.htm accessed on December 22, 2007.

**References** at the end have to be in the alphabetical order (of the last part of the name, followed by initials and other parts of the name (A. G. Ramachandran Nair as Nair, A. G. R.), Year in bracket, Title of the publication in italics, Name of the Publication, (Vol. No. bold and issue No. in bracket), page numbers for Journals. Books should contain, besides authors and year, Name of Editors, if any, Publishers and Place of publication, with page numbers preceded by pp.

A **certificate** from the communicating author regarding the originality of the work, conferring ownership right of the article to Vetri Education, when accepted and not requesting any other journal for publication of the article has to be submitted along with the article.

**E-mail: vetriorgpondy@gmail.com**

**You may view the latest issue of the Journal at: www.vetrieducation.com for further guidance**

# ALL INDIA MEDICAL & ENGINEERING ENTRANCE EXAMINATIONS

## Online Summer Coaching for Students Appearing for Medical & Engineering Entrance Examinations in INDIA by VETRI

Registration is open right now

## http://akshi.com

Take akshi's online

## "FT Course 2014".

★ Finishing Touches ★ Fine Tuning ★ Fast Track

FREE

**Students who join FT Course 2014 for Summer, can enjoy all previous recorded lectures.**

**Classes: 7-9 AM and 5-7 PM daily during Summer (2014) except on Sundays**
**(Fee: Rs 5200/-)**

## Test Only

**Take Effective Training (>40 tests) for Online Entrance (JIPMER/AIIMS) by paying only Rs. 200/-**

**Subjects : Maths, Physics, Chemistry, Zoology, Botany & English**

- Maths : Prof. Dr. N. Gururajan
- Physics : Prof. Dr. S. Mayilavelan
- Chemistry: Prof. Dr. R. Gunasegaran
- Botany : Prof. Dr. M.P. Ramanujam, Prof. Dr. B. Kannabiran
- Zoology : Prof. M. Ilangovan
- English : Dr. M. Doss

akshi

VETRI Group of institutions

Administrative Office: akshi.com pvt., Ltd.,
No - 8 Govindapillai Street, Kannan Nagar,
Pondicherry - 605013 (INDIA)
Phone: +91 413 2202348, +91 413 2205259
Mobile: +91 9894176425, +91 9500774799
Email: info@akshi.com Web: http://akshi.com

Registered Office : akshi.com pvt., ltd., No - 10, Main Road, Kamban Nagar, Reddiarpalayam, Pondicherry - 605010 (INDIA)