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Editor's Note

Dear Readers,

You are viewing the third issue of the electronic form of our Journal Vetri Education, Vol. VIII (2013) with improvement in style and appearance. The title and name(s) of authors of articles of Volumes I-VIII are given after the articles. As usual the issues will be available by the middle of the first month in the quarter at: **www.vetrieducation.com** Authors and subscribers can receive a PDF file of the Journal on request, providing e-mail address. The Vetri Group looks forward to the continued support and encouragement to the new format.

In the first article in this issue: *Innovation in teaching of Geography at secondary school level,* **G. C. Bhattacharya** presents a comprehensive account of innovation in academic settings, innovative measures appropriate for teaching of geography at secondary level of school education and basic requirements for its accomplishment along with derived merits.

Ranjan Kumar Biswas, in the second article titled: *ICT infrastructure facilities at different DIETs of Tribal areas* explains the condition of the present facilities and suggests ways of improving the facilities and their better utilization.

Explaining the significance of personality as a whole, along with its different dimensions, **S. Prakash and S. Amaladoss Xavier** analyse them in a selected group of teacher pupils and report the result, including the small difference influenced by gender difference, in the third article: *Analysis on Personality Dimensions of Student Teachers.*

In the fourth article of the issue: *Burnout in Elementary School Teachers of Rayagada Districts of Odisha*, **Manij Kumar Dash, Lakshmi Priya Malla and Rashmi Ranjan Puhan** present their result of the analysis of the level of teacher burnout among elementary school teachers of the selected districts of Odisha and offer suggestions for reducing the burn out and improving efficiency.

In the fifth and last article: *Antioxidants - Molecules for healthy long Life*, **A. G. Ramachandran Nair** reviews briefly the beneficial effects of antioxidants along with their occurrence, structural variation, mode of isolation, explanation of certain important functions in biological system, etc.

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

Academic Editor,
Vetri Education

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Innovation in Teaching of Geography at Secondary School Level

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Abstract

It is said that any thought, behaviour or thing that is new and qualitatively different from the existing form, may be considered as innovation, in general and in educational setting, in particular. Various authors have tried to define innovation in different ways but in the field of education, need of innovation is always justified due to changing socio-educational scenario and diversified cultural background of the learners on account of universalization of elementary education to be followed eventually by that at secondary level. If education is to be considered as a need 'for the life, through the life and throughout the life', as Mahatma Gandhi said, attainment of its goals may hardly be possible for catering the basic requirements of democratic set up of the country, without innovative measures. As a social as well as natural science, teaching of geography has a crucial role to play to respond to the specific challenges and demands of the twenty first century, like enhancement of eco literacy, feeling the basic needs of maintaining natural balance and sustaining resource cycles, protection of socio-natural environment, etc. If geography is taught well at secondary level of school education, with the help of suitable and appropriate teaching strategies and measures, attainment of democratic norms and inculcation of concerned value system may be possible; but for such an attempt, a lot of changes are required in terms of our existing geography curriculum at secondary level, along with mode and ways of its transaction in class room teaching-learning situation as well as in teaching schedule, allocation of time, resources and facilities for teaching of geography. An attempt has been made in this paper to discuss systematically innovation, innovation in academic settings, innovative measures appropriate for teaching of geography at secondary level of school education and basic requirements for its accomplishment and merits derived.

Key words: Innovation, teaching of geography, method, secondary education

Introduction

Geography is known as mother of all sciences in true sense because it encompasses correlated knowledge of all other disciplines comprising and combining with mathematics to physical sciences and sociology to life sciences.

As such, if geography is taught in a proper way from the initial level, social uplift, mobility and social change may not remain as mere bookish terminologies.

Traditional methods of teaching geography is not very much effective, attractive and potent enough to do justice with the requirements of learners of twenty first century when mere making oral transaction of information is not considered as teaching because there are a lot of different media, techniques and technologies available for the purpose.

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Traditionally, teaching of geography or class room transaction of geography curriculum was basically concerned with making pupils aware of various facts and figures whereas innovatively, it is related with enhancement of awareness, sensitization and feelings, in one hand and observation and practice in life, on the other. As such, application of innovative measures is inevitable in teaching-learning situation in the modern geography classroom, in general and at secondary level of school education, in particular when arousal of imagination power is evident and inculcation of creativity is obvious among learners. Innovation has been tried to define in many ways by various authors. For example, Barnett (1988) specified that any thought, behaviour or thing that is new and qualitatively different from the existing form may be termed as innovation.

Similarly, for Rogers (1988) an innovation is an idea perceived as new by individual.

At the same time, Miles (1988) defined innovation as deliberate, novel, specific change which is thought to be more efficacious in accomplishing the goals of a system.

From the above three definitions, it is clear that innovation is required to be a new or novel thing or idea usually, not in practice in previous days and at the same time, it must bring some change, helpful for attainment of goals of a system like educational system.

Bhola (1965) considered it as a concept, an attitude, a tool with accompanying skills of two or more of these together, introduced to an individual or culture that has not functionally incorporated it before.

So, innovation is meant for improving the situation functionally and to raise interest through awareness. Rogers (1988) specified clearly that awareness, interest, evaluation, trial and adoption are five major stages included in the process of adoption of any innovation which may either be of social interaction type or problem solving type, according to the purpose of implementing innovation in a system.

Information about any innovation is obtained either from a person, or an institution or a group of people through participation in discussion and interaction. Such type of innovation is called social interaction type of innovation which is being adopted by people due to its benefits and merit, scoring over the existing pattern or practices; but when innovations are
attempted to design and bring into practice, for the purpose of solving any problem like socio-personal or cultural problem, it is categorized under problem solving type of innovation.

But it is observed that every innovation has to face resistance in adoption either from personality based or from action oriented forces because innovations are meant for bringing a change in the status quo in society and community and may not be liked by all initially, due to its nature.

Maintaining homeostasis is the nature of individual or organisation and thus resists ensuring any sudden change. Similarly, formation of habit also creates resistance to implement any change caused due to innovative measures. Dependency is another factor related with personality which creates fear in mind to be dependent upon some thing like computer or person or being ridiculed by some body.

Faith in old traditions and elements like super ego of an individual may also cause hindrance to accept a change. Self distrust and feeling of insecurity and regression or tendency to come back to make use of good old traditions, fear of loss or becoming unsuccessful etc. all are basically related to personality variation which may cause resistance on the way of implementation of an innovation.

Within the category of resistance in action, lack of knowledge, errors and commitment of errors, social reaction and interpersonal relationship, etc. are the dominating factors causing hindrances in application of adoption of innovations. The tendency to follow others may be yet another to create disruption in innovative practices because only a few persons may be initiated and involved with innovation in the beginning. No innovation is ever practiced by many and in such a situation, leaders thus, has faced criticism and received negative reinforcement or feedback.

In 1967, educational technology movement was initiated by National Council of Educational Technology of Britain after publication of Brinmore Jone's Report and accordingly, educational technology was considered as the development, application and evaluation of systems, techniques and aids to improve the process of human learning.

Discussion

Approaches in teaching of geography

Initially, there were two basic approaches in geographical studies called systematic approach and regional approach; but now educational technology approach has also been incorporated in teaching of geography.

The systematic approach is also known as topical approach in which landforms on the surface of the earth is studied feature-wise according to various geographical elements or more complex criteria like soil characteristics, determined by the nature and presence of the content of element / complex in the soil. Thus, it is concerned with the study of elements and complexes in different regions, based on the characteristic composition of the world (Kaushik, 1972).

The regional approach is based on classification of the earth into homogeneous regions of approximately similar geographical conditions and internal coherence, known as natural regions such as equatorial region. The whole world has been divided in to 14 natural regions facilitating study of the entire world compartmentally.

The educational technology approach incorporates audio visual aids, cybernetics and psychological traditions. This approach lays emphasis over audio visual aids to supplement verbal communication in geography classroom with technological support, initiating with good old blackboard, leading to the use of episcope, epidiascope, over head projector and filmstrip as well as LCD projector, besides educational television, talking typewriter and use of computer in teaching-learning process.

The cybernetics tradition of educational technology approach has originated from the Greek word 'cybernetic' meaning steer man and making use of feedback control system to organize and control input, match output in terms of quality with the target or objectives decided in pre hand for achievement and reorient output to improve it. Programmed instruction of linear or branching or mathematics type is developed to foster teaching-learning, using feedback control system on one hand and computer assisted instruction, on the other. The branch of role playing, gaming and practice in simulation is also associated with cybernetics tradition which is generally being used in providing training in teaching and management skills to the prospective teachers in the field of teacher education. Computer is proved to be of great use in creation of simulated environment to extend training in skills as it happens through various ordinary and computer based games.

The psychological tradition is the third one which is an application of psychological principles in the field of learning, initiated by development of linear teaching machines, self testing machines, etc. This tradition relies upon behaviour modification of learners through repeated attempts in a specific situation on the basis of stimulus control and principle of operant conditioning.

All these traditions of educational technology approach are in much use in the field of teaching of geography at school as well as higher levels of education to produce quality outcomes. Some scholars consider that educational technology is an applied field and consists of hardware and software traditions and systems approach, in which first and foremost one is associated with projective equipments, teaching machines, computers, video recorders, closed circuit television, etc., and their subsequent use in classrooms whereas the software tradition is based on modification of human behaviour on the basis of learning experience, and reinforcement. The third one is concerned with analysis of any system like educational system or class room teaching system in terms of input, process and output variables functioning under a situation or environment through interrelated and self controlled functions.

Need of innovative measures in teaching of geography

Innovative measures are very much required in geography classroom because:

a: Geography is the subject in which a lot of memorization may be required to cause enough monotony and diminishing interest among young learners at secondary level of school education,

b: It is required to help pupils to understand geographical concepts well through identification of attributes of concepts concerned,

c: Innovations support retention and help to enhance span of attention, especially for the young and differently-abled learners,

d: Innovations in teaching-learning of geography is required to motivate learners to know about new terms, landscape features and geographical facts and figures without giving much stress upon memory,

e: It helps to create interest in teaching-learning of geography and develop ability to feel and appreciate nature and natural realities,

f: Environmental awareness and eco-literacy including environment-friendly practices may be initiated among young learners through utilization of appropriate innovative strategies like establishment of eco-club, using eco-friendly materials in day today life, preventing use of non bio-degradable materials, etc.,

g: The socio-economic and cultural aspects of geography may be taught well through support of educational technology and concerned instructional materials to the students at the stage of abstract thinking and reasoning,

h: The teaching methods in common use, may not help the young learners much at secondary level of school education to inculcate ability of imagination and logical reasoning, essential for learning of a subject like geography and for which some specific models of teaching may be put into use, like inductive thinking, concept attainment, creative thinking and problem solving, and

i: Training in some basic geographical concepts like longitudes and latitudes, direction and skills like preparing and making use of maps, etc. are supposed as essential in learning of geography which may be provided easily with the help of modern innovative teaching-learning techniques.

Use of innovation in teaching of geography

Based on the above premises, educational technology approach is recently in use in the field of teaching-learning and practical training in geography which is associated with use of information communication technology, according to need and availability.

Some of such innovative measures which are now commonly in use to teach geography at secondary level of school education are Personalized System of Instruction (PSI) and Computer Assisted Instruction (CAI) on one hand and some specific models of teaching, on the other.

As we are marching ahead towards the attainment of a prime target of universalization of secondary education in our country, soon after ensuring right to education for each and every learner up to the age of 14+ through universalization of elementary education, in last plan period, use of innovative measures for class room instruction has to become necessary. Classes may eventually become more over crowded in our secondary schools in near future and availability of enough number of competent teachers in general and of geography teachers, in particular may become a serious issue, soon. Thus, use of some other modes of class room transaction becomes essential.

Personalized system of instruction (PSI)

Personalized system of instruction or PSI was introduced as early as in 1963 but much improvement was incorporated subsequently and now it is also known as Keller plan (Keller, 1974). It is concerned with individual oriented instruction; but not in frequent use till date in India. Green (1974) specified that PSI considers one to one pupil-teacher interaction and ensures learning appropriately up to mastery level, irrespective of the number of students in a class.

Objectives of PSI may be specified as to:

i. Establish good socio-personal relationship between teacher and taught in a way, that the related learning problems and issues may be resolved on personal basis with care and sole responsibility,

ii. Enhance frequency of feedback regarding individual performance of learner and learning efforts regularly along with the specific attainment of the learner,

iii. Enhance reinforcement on learning systematically and on time along with providing remedial suggestions regarding learning problems and deficiencies,

iv. Reduce faith in lecture and / or verbal communication in teaching and making use of other class room transactional techniques including demonstration, class work and practical activities and guided field work to teach geography at secondary level of school education,

v. Stress on individualized evaluation of learner's attainment or performance achievement following a definite or pre-determined objective or criterion without any time constraint or limit and with emphasis on attainment of competency in learning,

vi. Compare attainment of individual learner with the set target or learning objectives and not comparing with attainment of any other learner and thus avoiding the ranking in class like first, second, third, etc.

Process of PSI

In this system, the whole content or syllabus is divided into small parts or aspects which may be learnt properly by a learner in a week and evaluation of skills acquired or content personalized as explicit in behaviour of the learner done in a certain time period. So, it is based on the unit approach and each unit framed is having introduction of the unit, behavioural objectives of the unit, teaching-learning process related with the unit, including use of text book and other instructional materials and lastly the unit test.

In the teaching-learning process, plan is being made to decide what is to be learnt, where to obtain the learning materials from, how much to learn and memorize, which points are to be understood well and how to frame the readiness test.

The role of teacher is to provide the learners with instructions for learning, preparing them to learn, providing the instructional booklet and reducing errors / problems, while learning.

Afterwards, readiness tests are used and evaluation done in presence of the learners to let them know why and how score is given; after completion of first unit without any conceptual error, either in a single or subsequent attempts, the next unit based learning materials are provided to the learners; or for some requiring better performance, the same unit is given to learn again with personal assistance of teacher to help avoid doubts and difficulties, followed by a new readiness test on the same content.

After completion of two or more units successfully, the advanced learners are selected as proctors to assist teacher in extending individual guidance, helping in administration of tests and scoring of answer sheets. They make use of proctor's guide sheets for this purpose and for this additional duty, outside their own study, they are often rewarded or complimented.

In this system the criterion of learning is considered as 80/80 level attainment of specified objectives. Review tests and extra mural lectures, excursions to industrial / historical / educational institutes, practical activities, etc. are also used in PSI.

Characteristics of PSI

Characteristics are many in number like promoting learning according to own ability, status and interest of learners, self pacing in learning, ensuring mastery in learning, frequent positive reinforcement with immediate feedback, continuous formative evaluation and knowing the reasons for high or low attainment.

Basically, it helps to learn the process of learning and eradication of learning errors / difficulties and ensures true representation of learning in the explicit behaviour of learners leading to habit formation on one hand and characterization of value system on the other which form the two highest categories in taxonomy of educational objectives in the psychomotor and affective domains.

Besides, while learning 'why and how' aspect of evaluation, learners equip to function as good evaluators, promoting evaluation abilities, whose attainment is among the highest category of educational objectives in the cognitive domain.

PSI may be used for teaching of geography at secondary level of school education suitably if:

i. Teacher believes in the possibility of mastery level attainment in geography,

ii. Ample text books, reference and other learning materials are available,

iii. Having ample time, facilities and assistance,

iv. Students are motivated enough to learn and have sound previous background / knowledge,

v. Teacher is self motivated to make use of PSI,

vi. Teacher is competent enough to write educational objectives properly and frame instructional objectives in behavioural terms, prepare and make use of unit as well as readiness test and be competent to evaluate objectively.

Ruskin (1974) reviewed more than two hundred research papers on PSI and found it as effective for learners in terms of academic achievement, conceptualizing learning, transfer of learning and so on.

Computer Assisted Instruction (CAI)

Computer Assisted Learning is possibly now used in many form and categories. CAI may be defined literally as a type of instruction in which assistance of computer is taken for individualizing instruction.

But the most significant one which is in effective use in teaching of geography at secondary level of school education in many other countries and also in some parts of India is known as Multi Media Approach to teaching of geography.

CAI was initiated in 1961 as Programme Logic for Automatic Teaching Operations (PLATO) at Illinois University. Subsequently, in 1966 at Stanford University, it was used to teach mathematics and pronunciation at primary school level with the assumption that it may instruct a number of learners at a time with self pacing and accuracy as per individual need, along with making provision of continuous individualized feedback. Secondly, it facilitates automatic recording of output/terminal behaviour of learners for checking and future planning of teaching.

It may be used for teaching of different disciplines and while using different methods of communication and transaction of content.

Mechanism of CAI

Unlike teaching machine in which content is presented in small frames for learning, in CAI, computer used to analyze the previous knowledge of learners and their entering behaviour to select and present appropriate initial content with the help of electric typing device, from the stored programmes.

Instruction is being categorized into pre tutorial phase and tutorial phase. In the pre-tutorial phase, computer selects a learner according to his entering behaviour and individual needs, and in the tutorial phase appropriate programme is placed before the learner for going through and responding / practicing during which it also evaluates the achievement.

The steps followed are:

i. Selection of target population by reading the stored data in punched card or magnetic tape or in hard disk about any learner after providing with a pre-test, to select suitable programme and

ii. Presentation of programme and learning control followed by feedback and change in programme to control learner's behaviour.

For implementation of CAI, some expert services are needed like that of programmer, computer engineer and system operator besides the subject expert or specialist for writing, selecting or preparing correct learning materials or programmes to store.

For drill and continuous practice, CAI may be used successfully in language lessons as well as in teaching of geography. Both tutorial and dialogue are possible in case of CAI and students may write on screen using light pen or key board since, through audio tape, computer may explain content very well.

Simulation, role playing and gaming may also be possible to motivate learners and develop self confidence among them. Thus, for practice of teaching in simulation, use of CAI is also helpful along with practice in class room teaching because use of multimedia approach is much easier while using CAI.

Lastly, it is much more beneficial for the purpose of information processing and handling in case of each and every individual learner including maintenance of cumulating records for proper counselling, on need.

So, individualization of instruction in an overcrowded class room is possible through making use of computers in instruction in spite of its costly nature and mechanical behaviour through which attainment of objectives related with affective domain may hardly be possible.

For development of values and humanity based characteristics among learners, CAI may be a failure but for attainment of cognitive domain based objectives of teaching, it may serve well and therefore, it is now receiving more appreciation.

Models of teaching

Models of teaching or teaching models may be another innovative approach, found more fruitful for creation of a specific teaching-learning environment and shaping of behaviour of learners, according to the objectives determined, in pre-hand.

As a social as well as natural science, teaching of geography has a crucial role to play to respond to the specific challenges and demands of the twenty first century, like enhancement of eco literacy, feeling the basic needs to sustain natural balance and resource cycles, protection of socio-natural environment, etc., and creation of different teaching-learning environment.

If geography is being taught well at secondary level of school education with the help of suitable and appropriate teaching strategies and measures, attainment of democratic norms and inculcation of concerned value system may easily be possible among future citizens; but for such an attempt, a lot of changes may be required in terms of our existing geography curriculum at secondary level along with mode and ways of its transaction in class room teaching-learning situation as well as in teaching schedule and allocation of time and resources and facilities for teaching of geography, as per requirements of various models of teaching.

Models of teaching is defined as well structured, logically consistent, cohesive and lucidly described alternatives patterns of teaching. If we are agreeing with this definition of models of teaching given by Schaefer (1972), we have to admit that instructional process may become more structured, explicit or easy to follow and logically sound as well as more suitable for the learners at secondary level comprising especially of the students of class IX and X with age range of 14+ to 16+ with developing comprehensive ability.

Various authors tried to classify models of teaching, yet identified in different ways:

Hilgard and Bower (1975) grouped models cantered on principles of learning and on principles of cognitive development.

Joyce and Weil (1972) classified models of teaching, on the basis of objectives, into four families known as social interaction, information processing, personal development and behaviour modification.

Patterson (1977) attempted to make categories of historical teaching model including lecturing, Montessori, personal development and Socratic models and psychological model including basic teaching model, computer based teaching model, interactive teaching model, carol school teaching-learning model etc.

Teaching models, unlike methods of teaching, are described in terms of few components or characteristics like focus, syntax, social system, support system, applicability etc., in place of based activity steps.

Focus means the point of reference keeping in view of which the model has been developed and thus includes the basic idea, base or objectives. Not only the objectives but also the situation or specific environments in which attainment of said objectives may easily be possible, are also specified under the title of focus.

Syntax means sequential activities through which specified objectives could be achieved. Thus, it includes, steps, continuity there in, and interrelation etc.

Social system describes specific class room interaction style and behaviour, role of teacher and learners' inter relationship, responsibilities and role expectations, etc. along with expected behaviour of learners, feedback and reinforcement.

Support system indicates instructional materials required to create a specific teaching- learning situation or environment, equipments, learning materials, data, facts and figures, charts etc., which are used in support of class room presentation.

Applicability shows the categories or group of learners for whom the teaching model is considered as more suitable or the content or discipline for which may be used effectively. It consists of application of knowledge too in terms of day to day life and living as well as application in other situations.

Now, one illustration of models of teaching may be taken into account to indicate the use of it for the students of secondary level of school education.

Geography, like other sciences, is a discipline in which there are a number of basic or fundamental concepts, without following which no one can acquire sound knowledge in the content. For example, longitude and latitude is a concept like slope, contour lines, isotherms, and so on.

To teach concept of geography at secondary level, information processing family based models of teaching are generally considered as more suitable because one who processes information better and more systematically, is supposed to learn a concept more efficiently and in a better way.

Concept attainment model of teaching, propounded by Bruner, Goodnow and Austin in 1967, is one such models of teaching which may be used frequently to teach concepts of geography.

Bruner (1969) subsequently described it saying that it is based on learner's power of classification of information or data because one who classifies better may acquire concept better.

Focus

1. Identification of characteristics of content / data / information provided,

2. Understanding differences present in the content / data / information,

3. Grouping of objects / data / information / content and

4. Finding the base or ground of grouping to arrive at the underlying concept.

For example, India, Sri Lanka or Ceylon, Thailand, Java, Sumatra, Borneo, etc. are placed in a category and learners may try to find out the base of this categorization as South East Asian Countries.

Syntax

Presentation of the names of objects / facts / figures / data before the learners which may have some common characteristics or base or attribute to be identified by learners after providing repeated exemplars or illustrations or information provided to them,

Students' attempts to identify the criteria of classification or placing of objects in a specific group through various lists / exemplars,

Identifying the same base or attribute or concept from another list of objects / data / information, and

Concept practicing through gaming with different types of exemplars.

Social system

In this model of teaching, social system is required to be flexible, cooperative and conducive enough to conduct concept gaming in geography class room. Much more time, planning and practice may be required to understand the concept.

Role of teacher

He is the controller of learning who presents data / information / objects, provides hints / guidelines to find out attributes of the concepts, involves in concept attainment practices to arrive at underlying concept and gives motivation through proper feedback, wherever required.

Role of learners

Learners are supposed to try to find out the underlying relationship among data/ objects / information presented, identify other attributes of the concept, and participate in concept attainment game / practice, etc. like involvement in cross word puzzles,

Interaction

In concept attainment gaming, a number of strategies may be used to reduce monotony and sustain interest of learners like modern instructional aids and devices. Interaction pattern is to be supportive, cooperative and helping in nature.

Support system

Concept laden supportive data / information / objects and negative exemplars are the main supports along with suitable audio-visual teaching or instructional materials including projective devices, sources of information etc .

Here, it is to be clarified well that the learners are not supposed to invent or determine any new concept in this model but attempts are being made by the learners only to identify the previously known concepts, identified by someone, with the help of underlying and indicated /given attributes.

Application

It is explicit that the concept attainment model of teaching may be used well to teach concept of geography but at the same time may be utilized for teaching of grammar, mathematics, scientific concepts, etc.

Environment

This model of teaching requires a cooperative and learner friendly environment in class room with structured outlook to participate in concept attainment gaming by each and every learner, one by another.

A competent geography teacher may use it for the students of secondary level in an innovative and interesting manner with the help of day to day life exemplar and non-exemplar ones, in which the attributes of the concept is present and the other in which it is absent.

Innovative measures are many in number in the field of education in general and educational technology and technology of teaching-learning, in particular; but selection and optimum utilization of which requires proper training and practice and only devoted and dedicated effective geography teachers may be able to succeed in application of the same in class room teaching-learning situation, provided the required facilities, time and support are available from the management and institution.

Let us hope, that our teaching community may come forward soon to adopt and make use of all viable innovative measures to teach geography at secondary level of school education in near future in place of mere verbal mode of direct transaction of concepts, facts and figures to make the prospective drive of universalization of secondary and senior secondary education, a grand success and open the access of right kind of education to all prospective learners who are yet out of reach of the purview of secondary education.

References

Barnett, H.G. (1988), *Innovation*, in: Srivastava, S. S., Innovations and Modern Trends in Education, Har Prasad Bhargava, 4/230, Katcheri Ghat, Agra, p. 5.

Bhola, H.S. (1988), *Innovation*, in: S. S. Srivastava, S. S., Innovations and Modern Trends in Education, Har Prasad Bhargava, 4/230, Katcheri Ghat, Agra, p. 5.

Joyce, B. and Weil, M**.** (1972), *Models of Teaching*, Prentice-Hall Inc., Englewood Cliffs, New Jersey.

Bruner, J., Goodnow, J. J. and Austin, G.A. (1967), *A Study of Thinking*, Science Editions Inc., New York.

Bruner, J. (1969), *The Functions of Teaching*, in: Readings in Classroom Learning, Frey and Haugen (Ed.), Van Nostrand Reinhold & Co., New York.

Green Jr., B. A. (1974), *The Personalized System of Instruction*, National Education Association, Washington D.C.

Hilgard, E. R. and Bower, G. H. (1975), *Theories of Learning,* Prentice-Hall Inc., Englewood Cliffs, New Jersey.

Kaushik, S. D. (1972), *Geographic Thought and Methodology (in Hindi)*, Rastogi Publications, Shivaji Road, Meerut (U.P.), pp. 45-48.

Keller, F. S. (1974), *Ten Years of Personalized Instruction*, Teaching of Psychology, **1**, 4-9.

Miles, M. B. (1988), *Innovation,* in: Srivastava, S. S., Innovations and Modern Trends in Education, Har Prasad Bhargava, 4/230, Katcheri Ghat, Agra, p. 6.

Patterson, C. H. (1977), *Foundations for a Theory of Instruction and Educational Psychology,* Harper and Row, New York.

Rogers, E. M. (1988), *Definition of Innovation*, in: Srivastava, S. S., Innovations and Modern Trends in Education, Har Prasad Bhargava, 4/230,Katcheri Ghat, Agra, p. 7.

Ruskin, R. S. (1974), *The personalized system of Instruction: An Educational Alternative*, ERIC Higher Education Report No.5, Washington D.C.

Schaefer, R. J. (1972), *Foreword*, in: Bruce, J. and Marsha, W., Models of Teaching, Prentice-Hall Inc., Englewood Cliffs, New Jersey.

Srivastava, S. S. (1988), *Innovations and Modern Trends in Education (in Hindi)*, Har Prasad Bhargava, 4/230, Katcheri Ghat, Agra.

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CURIOUS FACTS, MATERIALS, PROCESSES AND BIOACTIVITIES

Pen that checks grammar

A German firm claims to have created a hi-tech pen which vibrates every time it senses a spelling or grammar mistake. German company Lernstift developed the pen to help youngsters learn to write, but it could catch on with people of all ages. . The pen, which is at the prototype stage, has two functions: Calligraphy mode – pointing out form and legibility or Orthography mode – detecting orthographic and grammatical mistakes. (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)

Sunny delight (Empa takes thin film solar cells to a new level - A new world record for solar cell efficiency)

The slow, but inexorable climb to more and more efficient solar energy conversion materials takes another step forward. Scientists at the Swiss Federal Laboratories for Materials Science and Technology (EMPA) have developed thin film solar cells using copper indium gallium diselenide on flexible polymer foils. They claim a new record efficiency of 20.4% for conversion of sunlight to electricity. The development could increase dramatically the cost-effectiveness of solar power although the technology now needs additional testing, development and scale-up for industrial applications.

Seeding biofuel idea (Tree seeds offer potential for sustainable biofuels)

Could seeds of common trees found across India act as a new and sustainable feedstock for biofuel production? That's the question addressed by Sukumar Puhan of the GKM College of Engineering and Technology in Chennai and colleagues there and elsewhere. Writing in the International Journal of Automotive Technology and Management, they report that vast quantities of seeds from the deciduous mahua (Madhuca indica) and semi-deciduous sal (Shorea robusta) trees are simply left to rot on the forest floor. These seeds, rich in oils, could be converted to cleaner biofuels without recourse to planting fuel crop plants and exploiting fertile soil and water that could better be used to grow food. "Biodiesel production from tree seeds in India will not only reduce the dependence on crude oil imports, but also reduce the environmental impact of transportation and increase employment opportunities," the team says.

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ICT Infrastructure Facilities at Different DIETs of Tribal Areas

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Abstract

An attempt to highlight the present situation of infrastructure facilities for ICT in DIETs (District Institute of Education and Training) of tribal areas across the country is made. Investigation included both the quantity and quality of buildings as well as rooms, especially for conducting ICT related activities in those DIETs and to find out whether there existed well equipped ICT laboratories and their desired role in teaching-learning. The present situation of depleted power supply and internet connectivity was also examined. With almost all types of ICT instrument installed at every DIET, exploring the study of actual number of available ICT instruments and their functioning became important. The study revealed the genuine grubby situation of DIET and gave an opportunity to suggest remedial measures to improve the infrastructure facilities to enhance the teaching-learning efficiency as well as training strategies for professional development.

Key words: ICT, infrastructure at DIETs, malfunctioning instrments , remedy

Introduction

ICT (Information and communication technology) is a term to encompass a range of human-devised hardware, software and telecommunication technologies which facilitate communication and sharing information crossing all the boundaries. ICT is an acronym for Information and Communication Technology and represents a 'diverse set of technological tools and resources, used to communicate and to create, disseminate, store and manage information'. It includes computers, internet, broadcasting technologies (radio and television) and telephony. ICT is described as a 'third revolution in the dissemination of knowledge and in the enhancement of instruction' (Haddad, 2002). Drenoyianni (2006) states that technology cannot revolutionize but can only strengthen further and reinforce established educational goals, curriculum contents and teaching-learning methods. Concurrence of Pulkkinen (2009) on the evidences of more recent reports on technology for development is based on the fact that introducing a technology, no matter how innovative, does not necessarily change the reality at school level, if there is insufficient capacity and knowledge to develop new processes, to alter the institutional settings and to effectively utilize the given technology.

At present ICT is considered as essential for teaching and learning and thus, teachers are required to be familiar and willing to improve the use of the technologies' potential, and adopt to train, support and experiment. They must become self confident to use new technologies in their teaching profession (Perraton et al., 2001). Because teaching is considered as one of the most challenging professions, all innovative technologies are employed to face new challenges for the teachers to continuously learn and master new knowledge and skills, for maintaining their proficiency and self-evaluation in learning- teaching ability (Carlson and Gadio, 2002). The innovative technologies, providing new possibilities to the teaching profession, demand the teachers of familiarizing, mastering and profitably employing them for their learning and more efficient teaching.

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Teachers are to acquaint with new concepts of learning and teaching methodologies and transfer them to the prospective teacher-students rather than providing knowledge and skills (Robinson and Latchem, 2003). Professional development of teachers using ICT is not only to equip teachers with basic ICT skills but also to encourage the evolution towards integrating technologies into teaching methodologies, subjects and practices (Shafika, 2006). Thus, ICT integration denotes a change in pedagogical practice which makes ICT less peripheral in classroom teaching-learning (Hallissey, 2009).

DIETs, all over the country, are functioning as educational institutes, and ICT based pre-service and in-service teacher training programmes for professional development are generally organized throughout the year. Successful organization of ICT-based training programmes in DIET is dependent on the knowledge and skills of faculty and the availability of ICT infrastructure facilities. Knowledge and skills of faculty can be gained by participating in ICT-based training programmes, organized by other institutes. But ICT infrastructure facilities, available in DIETs play a greater role to improve all training programmes. All DIETs can boast of ICT infrastructure facilities, indicative of well-constructed building with many rooms, equipments, scientific instrumentation laboratories, e-class rooms, computation laboratories, server rooms, backup power supplies, redundant data communication connections, environment controls, security devices, etc. These facilities form the basic physical and organizational structures, used to help generate maximum outputs of training programmes. But many DIETs, established in tribal areas are somewhat backward in nature and devoid of a few or many such ICT infrastructure facilities. In view of this, an investigation on the infrastructure facilities, available in these DIETs was considered desirable and the data collected are presented here.

Discussion

Research methodology

Computers, internet, broadcasting technologies (radio and television), telephone, etc. are used as essential tools for professional development and innovative teaching-learning. Achieving maximum benefits through these technologies is dependent on technical skills and pedagogical knowledge. Besides, the availability of relevant infrastructure facilities is also interrelated to create a healthy environment and to ensure the functioning of these technologies to produce maximum outputs. DIETs, all over the country, are considered as professional institutes and therefore, all necessary infrastructure facilities are acquired. DIETs, established in tribal areas, considered backward in many respects, are expected not to fall in line with others in respect of ICT facilities and thus worthwhile to examine them in a systematic way and to assess the facility, note the short comings and suggest remedial measures. The research design consists of various relevant items related to the area of study, population of the sample, sample design, duration of the study, development of questionnaire, techniques of data collection, analysis, interpretation, etc.

For the intended objective of the study, a descriptive type of questionnaire was developed and finalized after consultation with experts. These were sent to the principals and faculty members of DIETs (62) in tribal areas and the duly filled up ones were received. Additional information or clarification on certain items was obtained from the respondents through telephone. The received data were processed and coded for converting into other forms. Data entry was electronically executed and statistical analysis made to find significance of results for different variables (See Tables 1- 4). Data analysis was also done for the purpose of drawing conclusions. Interpretation was accomplished to explain the factors which were noticed in the course of the study. Elucidation and interpretation were also extended beyond the data of study, by comparing the results of other researches.

Results and analysis

Under results and analysis, is presented the acquired data on ICT infrastructure facilities in tabular forms and interpretation of the study results with input from the studies, conducted by various researchers earlier. They are tabulated below category-wise:

1. Infrastructure (building and room) facilities

Infrastructure is meant as the basic physical and organizational structure. It is connoted as the set of interrelated structural elements which are used to support for an entire structure of development. Instead of only this infrastructure, ICT infrastructure facilities in the present study considered well-constructed building including several rooms, laboratories having all pertinent ICT equipments, server facility in laboratories as well as in class rooms, data communication connections, etc. It also consists of backup power supplies, environment controls and security devices. Thus, based on the overall infrastructure facilities required for ICT, this study attempts to present status of such facilities in DIETs. In the context of available infrastructure, the present study, first of all, focuses on the total number of buildings and rooms available in DIETs. Accordingly, majority of DIETs (Table: 1), in tribal areas are found to have one building (45.3 per cent), followed by two buildings (30.6 per cent), three buildings (16.1 per cent), four buildings (4.8 per cent) and five buildings and above (3.2 per cent). Study again reveals that different activities of many DIETs are confined in 1-5 room sets (38.7 per cent), followed by 6-10 room sets (24.2 per cent), 11-15 room sets (19.4 per cent), 16-20 room sets (12.9 per cent) and 20 or more room sets (4.8 per cent).

The accumulated information specifies that in most of the DIETs, buildings as well as rooms especially for the use of ICT are not constructed properly. Rooms used for other purposes earlier were utilized, with certain adjustments, for installing ICT equipments and providing facilities. Rooms are found often inadequate in terms of number, size and quality. Studies in this regard exhibit that in the building complex, ICT rooms need to be optimally located to have security, fire resistance, noise resistance, temperature and electrical field control, equipment transport, floor loads, etc. (Plomp and Pelgrum, 1992; Tinkler, *et al.,* 1996; Fountain, 2001; Paul, 2002). As part of the platform, infrastructure supports transformation of practice. Availability of latest infrastructure promotes standard outputs of the activity and therefore, professionals generally demand the standardized resources for their work practice (Johnson, *et al.,* 2005; Horvati and Moen, 2008). Findings of some other studies indicate need of ICT rooms to possess server facility, telecommunication, shielded printer for various security groups, etc. and its associated infrastructure like cable pathways, electrical power supply, cooling systems and accident prevention. It is also felt that inadequate number of ICT equipments and their low quality can lead to reduced outputs. Conclusion of many studies suggests that promotion of ICT based education in developing countries still requires more schools with adequate teachers, better teacher training facility, learning resources and significant investment for ICT hardware, software and infrastructure facilities (Nygaard, *et al.,* 2010; Nygaard and Torbergsen, 2010; Hayran, 2011).

Table: 1
Infrastructure (building and room) facilities in DIETs of tribal areas

S. No.	Number of buildings			Number of rooms		
	Number	Freq.	%	Number	Freq.	%
1.	One Building	28	45.3	1-5	24	38.7
2.	Two Buildings	19	30.6	6-10	15	24.2
3.	Three Buildings	10	16.1	11-15	12	19.4
4.	Four Buildings	3	4.8	16-20	8	12.9
5.	Five Buildings or >	2	3.2	20 /or >20	3	4.8
	Total	**62**	**100.0**	**Total**	**62**	**100.0**

2. Facility of ICT laboratory

ICT laboratory is defined as the learners' work station where it is mandatory to have at least two similar sets of ICT instruments such as computer sets or others which are primarily used by learners to complete their course work, making at least one serving even if the other is non-functional. All such ICT instruments must be configured and supported by the ICT Services Computer Lab Management Team (SCLMT). Well-equipped ICT facilities in educational institutions play a significant role in improving teaching-learning as well as training programmes. Generally, DIETs are popular in providing proper teachers' training programmes. Naturally, assessment of the condition and output of ICT laboratories in DIETs for facilitating teachers training programmes and classroom teachings merits consideration. The present study (Table-2) shows that 71.0 per cent DIETs have ICT laboratories while the rest (29 %) are devoid of such facility. In respect of the DIETs with the facility, 54.5% have one laboratory, followed by 27.3% with two laboratories, 23.6% with three laboratories and only 4.6% four or more laboratories. More disappointing situation points to the insufficient facilities in 54.8% laboratories of DIETs, with only 21% possessing sufficiency. Further, 24.2% has not responded to the sufficiency status, leading the investigator to infer negatively. Thus, one can realize that many DIETs are functioning without any ICT laboratory and many among those with the facility, don't make proper use of it.

In this context, findings of divergent studies depict that on one side, most of the teachers in institutions are instigated to show less enthusiasm for computer-aided training and on the other, many are constrained to skip use of computer laboratory due to the shortage of space and inadequacy of computers; all these create a negative environment to integrate ICTs in teaching-learning processes (Mantas, 2000; Gasper, 2002). Related case studies accentuate that several factors are responsible lack of integration of ICT in teaching and learning. ICT capability deprivation among educators, lack of freedom for educators to access the laboratory and the scarcity of the facility comprising the computer laboratory, management system, etc. create a very non-conducive environment upsetting the initiative and enthusiasm of the learners. Further, studies indicate that standard learning management system helps to set up ICT laboratories in institutions which disseminate ICT based experimental knowledge for all teachers, students, technicians and other concerned groups and facilitate them to be comfortable for collaborative life-long learning through ICT (Higgins, 2003; Grainger and Tolhurst, 2005). Accordingly and evidenced by many other intensive studies, teachers have to regularly arrange classes in ICT laboratories and use LCD projectors, instead of tape recorders to enhance the interest and understanding of students. A few of the teachers believe that the number of laboratories and equipments are still not adequate to initiate ICT-based teaching for the students, willingly using the existing facility. Studies reveal the beneficial effect of computer laboratories used as classroom in improving the outcome of the teaching-learning tasks and replacement of the conventional teaching by more interesting and versatile ICT based pedagogy (Bingimlas, 2009; Hamzah, et al., 2009).

Table: 2
Infrastructure (building and room) facilities in DIETs of tribal areas

S. No.	Number of ICT laboratory			Sufficiency of ICT laboratory		
	Number	Freq.	%	Sufficiency	Freq.	%
1.	One lab	24	54.5	Yes	13	21.0
2.	Two labs	12	27.3	No	34	54.8
3.	Three labs	6	23.6	No information	15	24.2
4.	Four or > labs	2	4.6	----	----	----
	Total	**44**	**71.0**	----	----	----
5.	No Lab	18	29.0	----	----	----
	Grand Total	**62**	**100.0**	**Total**	**62**	**100.0**

3. Availability of ICT support facility and their functioning

Information and communication technologies always consist of internet posting such as message boards and website-blog, public address system as well as cellular telephone, two-way radios, e-mail, fax, postal mail, texting and instant messaging. Besides teachers exploring adequate ICT knowledge and skills, they need to equip themselves with all such ICT support facilities. A combination of ICT support facilities and adequate knowledge and skills of teachers will witness great improvement in effective teaching. Teachers are also inspired to be more dynamic and proactive for providing technology-based healthy teaching so that students ensure themselves as heavy users of technologies for the achievement of educational benefits. In this milieu, the present study, conducted at different DIETs of tribal areas across the country enabled to inspect the availability of ICT support facilities and assess the status of their functioning. Based on collected data (Table-3), internet connections are found functional continuously in 51.6% and occasionally in 22.6% DIETs; while 25.8% DIETs are deprived of any benefit from internet. Likewise, electricity facility is always functional in almost all studied DIETs (85.5%) with 14.5 % facing occasional load-shedding problem; 59.7 per cent DIETs are disadvantaged with no generator facility. The study has noted lack of space, fund, technical assistance, motivation and inspiration; abrupt power cut being the villain for deficient ICT support facilities in a large number of DIETs.

Different studies throw light on internet use in training programmes providing an opportunity to develop new learning experience of learners by managing self-directed learning and sharing information and ideas in a cooperative and collaborative manner. Studies also point to the desirability of broadband access with several hundred times faster than its precursors. Provision of continuous internet connectivity ensures more interactive experience and a richer delivery of contents than simple text (Trentin and Scimeca, 1999; Greene and O'Brien, 2002). Results from other studies show that several technical problems such as delayed opening of website, failure of internet connectivity, non-cooperation of printer, malfunctioning and slowing of computers, unexpected misbehaviour caused by computer virus, etc. are major obstacles for the teachers to organize ICT-based educational programmes (Schoep, 2004; Sicilia, 2005). Findings of some experiment-based studies reflect that nearly all teachers are confident and competent in the subject and they are also fascinated to have serious integration of ICT in education. But in most of the cases, they get discouraged when encountered with insufficient access to the resources including software, hardware and technical support. In addition, studies further reveal that teachers need support services related to the office applications, computer operations, email, intranet, chat system and special software set up for designing their teaching strategy and implementing it in classroom teaching (Olakulehin, 2007; Baruah and Handique, 2009; OPG, 2010).

Table - 3
Availability of ICT support facility and its functioning in DIETs of tribal areas

S. N.	Name of Items	Always functional		Sometimes		Not at all	
		Freq.	%	Freq.	%	Freq.	%
1.	Electricity	53	85.5	9	14.5	0	0.0
2.	Generator facility	13	21.0	12	19.3	37	59.7
3.	Internet connection	32	51.6	14	22.6	16	25.8

4. Availability of ICT equipments

Equipment for ICT is considered as the act of equipping or the state of being equipped, as for expedition like - Radio, Television, Radio Cum Cassette Player (RCCP), CD (Compact Disc) player, Computer, Laptop, Public Address System (PAS), Mobile Phone, etc. As electronic amplifications, these are used to make communication system in public sectors. Its electro-acoustic transducer is enabled to convert electrical signals into sound which is heard at a distance. Whereas the term, 'Hardware' is somewhat different. It is indicated as a computer's hardware which includes the physical components, needed to operate and interact with a computer. Many examples may be mentioned as key board, hard disc, UPS, LCD projector, laser printer, inject printer, scanner, etc. under ICT hardware. There is ample scope to achieve educational benefits by using all such equipments. In relation to this, the present study aimed to acquaint with the availability of ICT equipments in DIETs (Table-3). Maximum DIETs in tribal areas are crazed to have public address system (98.4%), followed by computer and laser printer (88.7%), television and scanner (82.2%), LCD projector (65.5%), CD player (59.7%), radio (58.1%), digital camera (54.8%), laptop (46.8%), inkjet printer (43.5%), web camera (30.6%) and head phone (25.8%); only a smaller number (16.1%) of DIETs are facilitated with RCCP. Along with the cataloguing of ICT equipments in DIETs, the number of each item is also shown in the Table. It can be noted that computer occupies the highest place among ICT equipments in DIETs. The non-availability status of any particular equipment is also provided.

For the improvement of teaching-learning processes, all types of latest technology are required in every educational institute. Availability of all latest ICT instruments in the institutes provides moral strength, a feeling of self sufficiency, extra support in the training process, added attraction for faculty, students and the institution and an elevated pride for the institution.

Institutes are required to submit proposals with justification and commitment to use and maintain them properly. Acquiring technological equipments and its operating skills take priority over the unclear educational objectives (Postman, 1995; Riffel and Levin, 1997). Other studies in this regard divulge that for the installation and implementation of ICT equipments, institutes are required to be capable of management as well as academic utilization. ICT, in favourable environment, creates a more flexible, institutional, decentralized and varied educational system. Further, ICTs, including radio, television, computers and internet are touted as potentially powerful tools for educational change and reform in communication strategies (Soby, 2000; Tinio, 2002; Steketee, 2005). Some studies also reveal that ICTs can increase enthusiasm for teaching. Teachers, possessing own laptop or computer, are known to enhance positive attitude towards their work. Studies further contend that availability of ICT equipments like PC / lap top, CD-ROM, scanners, web and digital camera, interactive white boards, etc. and their frequent operations generate hands on experiences which help to integrate ICT in education system (Balanskat, et al., 2006; Castro, 2009).

Table: 4
Availability of ICT equipments in DIETs of tribal areas

S. No.	Items of equipment	Equip. available		Number	Not available	
		Freq.	%		Freq.	%
1.	Radio	36	58.1	36	26	41.9
2.	Television	51	82.2	83	11	17.8
3.	RCCP	10	16.1	12	52	83.9
4.	CD Player	37	59.7	52	25	38.7
5.	Computer	55	88.7	544	7	11.3
6.	Laptop	29	46.8	61	33	53.2
7.	Public Ad. System	61	98.4	74	1	1.2
8.	Digital camera	34	54.8	52	28	45.2
9.	Web camera	19	30.6	19	43	69.4
10.	LCD projector	53	65.5	61	9	34.5
11.	Laser printer	55	88.7	83	7	11.3
12.	Inkjet printer	27	43.5	31	35	56.5
13.	Headphone	16	25.8	62	46	74.2
14.	Scanner	51	82.2	51	11	17.8

Summary and conclusions

The present study presents the actual situation of infrastructure facilities in DIETs of tribal areas. It has found that the maximum DIETs are desirous to have one building (45.3 per cent) and 1-5 room sets (38.7 per cent) intended for faculty members, administrative works, classroom activities, ICT based activities, etc. Under infrastructural facilities, laboratories play a significant role and the study finds that 71% DIETs are proud to boast of ICT laboratories and most of the DIETs are obsessed with acquirement of one laboratory (54.5%) without having the sufficient ICT support system. Regarding availability of ICT equipments, study reveals that a large number of DIETs are equipped with public address system (98.4%), computer and laser printer (88.7%), television and scanner (82.2%), LCD projector (65.5%), CD player (59.7%), etc. But all these available instruments are not in proper functional condition. Inadequate number of rooms and dilapidated situation of building of institutes create a negative teaching-learning atmosphere. Scarcity of well-equipped ICT laboratory, power supply and internet connection makes an obstacle to organize training programmes and improve teaching-learning strategies. In such anomalous situation, there is urgent need to have well-furnished building as well as meticulously planned rooms for specific purposes, including laboratories, before establishing ICT facility with modern equipments and support system. Co-ordination, co-operation and support of all the stake holders are indispensable for the best contribution of the ICT for innovative quality education for the teacher candidates.

References

Balanskat, A., Blamire, R. and Kefala, S. (2006), *The ICT Impact Report: A Review of Studies of ICT mpact on Schools in Europe,* European Schoolnet in the Framework of European Commission's ICT Cluster, Education and Culture, http://ec.europa.eu/education/pdf/doc254_en.pdf.

Baruah, T. D. and Handique, K. K. (2009), *Effectiveness of ICT in Open and Distance Learning: A Case Study of Indira Gandhi National Open University,* e-Asia Conference 2009, http: //www.e-asiaorg.

Bingimlas, K. A. (2009), *Barriers to the Successful Integration of ICT in Teaching and Learning Environments: A Review of Literature,* Eurasia Journal of Mathematics, Science & Technology Education, **5**(3), 235-245.

Carlson, S. and Gadio, C. T. (2002), *Teacher Professional Development in the Use of Technology,* in: Technologies for Education: Potential, Parameters and Prospects, .W.D. Haddad and A. Draxler, UNESCO and AED, Washington, DC.

Castro, C. (2009), *Education in the Information Age: Promises and Frustrations,* Retrieved January, 4; http://www.iadb.org/sds/doc/ Edu &Tech2.pdf

Drenoyianni, H. (2006), *Reconsidering Change and ICT: Perspectives of a Human and Democratic Education,* Education and Information Technologies, **11**(3, 4), 401-413.

Fountain, J. E. (2001), *Building the Virtual State: Information Technology and Institutional Change,* Brookings Institution Press, Washington, DC.

Gasper, D. (2002), *Is Sen's Capability Approach an Adequate Basis for Considering Human, Development,* Review of Political Economy, **14**(4), 435-461.

Grainger, R. and Tolhurst, D. (2005), *Organizational Factors Affecting Teachers' Use and Perception of Information & Communications Technology*, Perspectives in Education, **23**(4), 99-111.

Greene, D. W. and O'Brien, T. (2002), *The Internet's Impact on Teacher Practice and Classroom Culture,* T. H. E. Journal, **29**(11), 44-51.

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

Hallissey, M. (2009), *What should ICT Integration Look Like in a 21Century Education System?* Workshop on Perspectives for North/South Research Partnerships for ICT in Education, Available from GeSCI at: http://www.gesci.org/index.php.

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.

Hayran, M. S. (2011), *A Study of Afghanistan ICT in Education Regional Conference on Promotion of Good Practices in ICT for Education in Central and Western Asia Region,* Ministry of Education, <http://english.moe. gov.af/attachments/084_Afghanistan.

Higgins, S. (2003), *Does ICT Improve Learning and Teaching in Schools?* British Educational Research Association, Nottingham.

Horvati, K. and Moen, A. (2008), *Evolving Knowledge Management Infrastructure,* Presented at the Inter Media Jubilee, Oslo, Norway.

Johnson, C. A., Ariunaa, L. and Britz, J. J. (2005), *Constructing the Pillars of a Knowledge Society: The Challenge of Providing Access to ICTs in Rural Mongolia,* Libri, Germany.

Muntaz, S. (2000), *Factors Affecting Teachers' Use of Information and Communications Technology: A Review of the Literature,* Technology, Pedagogy and Education, **9** (3), 319-342.

Nygaard, C., Courtney, N. and Holtham, C. (2010), *Teaching Creativity - Creativity in Teaching,* Libri Press, Faringdon.

Nygaard, S. and Torbergsen, R. (2010), *Requirements for the Design of ICT Rooms,* Best Practice Document Produced by UNINETT Led Working Group on Physical Infrastructure No UFS121.

Office of Prosecutor General (2010), *East Timor Justice Sector Support Facility-ICT System and Network Support Assistants,* http://easttimorlegal.Blogspotcom/2010/01/east-timor-justice-sector-support.html#ixzz1fFxi6iFo.

Olakulehin, F. K. (2007), *Information and Communication Technologies in Teacher Training and Professional Development in Nigeria,* Turkish Online J. Distance Education, **8**(1), 133-142.

Paul, N. C. (2002), *Literature Review 'The Impact of ICT on Learning and Teaching'.* Western Australian Department of Education, Specialist Educational Services, Perth, Western Australia.

Perraton, H., Robinson, B. and Creed, C. (2001), Teacher Education through Distance Learning: Technology, Curriculum, Evaluation, UNESCO, Cost, Paris.

Plomp, T. and Pelgrum, W. J. (1992), *Restructuring of Schools as a Consequence of Computers,* International Journal of Educational Research, **19**, 185-195.

Postman, N. (1995), *Some New Bods that fail,* in: The End of Education: Redefining the Value of School, Alfred A. Knopf, New York, pp. 37-50.

Pulkkinen, J. (2009), *Preliminary Conclusions and the Way Forward,* in: UN Global Alliance for ICT and Development, Expert Group Web-Forum, http://un-gaid.ning.com/forum/ topics/ preliminary-conclusionsand-1.

Riffel, A. and Levin, B. (1997), *Schools Coping with the Impact of Information Technology,* Educational Management and Administration, **25**(1), 51- 64.

Robinson, B. and Latchem, C. (2003), *Teacher Education: Challenges and Change*, in: Teacher Education through Open and Distance Learning, B. Robinson and C. Latchem, Rout ledge Falmer, London, pp. 1-27.

Schoep, K. W. (2004), *Technology Integration Barriers in a Technology-Rich Environment:* A CBAM Perspective, Unpublished Master's Thesis, University of Calgary, Alberta.

Shafika (2006), *Towards a GeSCI Initiative on Teacher Professional Development in Africa,* Global e-school and Communities Initiative, Founded by UN ICT Task Force, Dublin.

Sicilia, C. (2005), *The Challenges and Benefits of Teachers' Practices in Constructivist Learning Environments Supported by Technology,* Unpublished Master's Thesis, McGill University, Montrel.

Soby, M. (2000), *Innovations and Changes in the Norwegian School Education Systems,* Proceedings of the EDEN fourth open Classroom Conference, November, 19-21, Barcelona, Spain.

Steketee, C. (2005), *Integrating ICT as an Integral Teaching and Learning Tool into Pre-service Teacher Training Courses,* Issues in Educational Research, **15**(10), 101-112.

Tinio, V. L. (2002), *ICT in Education,* Educational Computing Research, **26** (2), 133-153; 149-151.

Tinkler, D., Lepani, B. and Mitchell, J. (1996), *Education and Technology Convergence: A Survey of Technological Infrastructure in Education and the Professional Development and Support of Educators and Trainers in Information and Communication Technologies,* Commissioned Report No.43, Review of Political Economy, **14**(4), 435-461.

Trentin, G. and Scimeca, S. (1999), *The Roles of Tutors and Experts in Designing Online Education Courses,* Distance Education, **20** (1), 144-161.

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Shedding light on stickiness (Polymer Gets Sticky When Hit With Light)

Polymer chemists have long hoped to mimic the adhesive powers of sea creatures such as mussels which exude proteins that allow them to stick to oceanic rocks even in the roughest of seas. Until now, attempts have led only to materials that, while sticky, harden in air very quickly and so are rendered useless in medical and engineering applications where time to position components to be glued is needed. Now, Atsushi Takahara of Kyushu University, Japan and colleagues have synthesized a sticky acrylamide polymer that contains, catechols (which are present in the mussel proteins) protected by o-nitrobenzyl groups to prevent oxidation. They found that when exposed to light this material begins to harden but the process takes about 30 minutes, plenty of time to position two objects to be stuck together, such as tissues or engineering components.

Green light bulbs dim (Casting a shadow over green light bulbs)

Low wattage compact fluorescent light bulbs and light emitting diode (LED) lighting may not be as green as once thought. Researchers in California have analyzed the metal content of CFL, LEDs and conventional incandescent light bulbs and used “a life cycle impact-based method” to compare the potential environmental impact of each. Mercury vapor aside, it turns out that even though they last longer CFLs and LEDs could do more harm to the environment because of their use of a wide range of toxic metals, including lead and copper, which are not present in incandescent bulbs. The study points to the idea that designers and electrical engineers must work towards reducing the overall environmental footprint of lighting products.

Airy, stay-dry material (A material that most liquids won’t wet)

A superomniphobic material that is 95% air can repel most liquids, according to a study at the University of Michigan. Such a material might trivially be used to make stain-resistant fabrics but could have more vital applications as protective gear for scientists handling hazardous substances or military personnel under threat of chemical attack. The material might even be used to coat ships’ hulls to reduce sea-faring drag as well as coating smart phone screens to prevent finger marks.

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Analysis on Personality Dimensions of Student Teachers

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Abstract

This paper reports the personality dimensions of student teachers in terms of gender. The sample consisted of 1080 student teachers of Madurai revenue district. Multi Dimensional Personality Inventory constructed by Manju Rani Agarwal was used for procuring the required data from the student teachers. Percentage analysis, Mean, Standard deviation and't' tests were used for analyzing the data. The results showed that there is no significant difference in personality and its dimensions of student teachers in terms of gender except extroversion-introversion.

Key words: Student teachers, personality dimensions, gender influence

Introduction

Teacher education is intimately connected with society and is conditioned by the ethos, culture and character of a nation. Enlightened teachers lead communities and nations in their march towards better and higher quality of life. They reveal and elaborate the secrets of attaining higher values in life and nurture empathy for fellow beings. No nation can even marginally slacken its efforts in giving necessary professional inputs to its teachers along with the due status to their stature and profession. In the field of education, teachers have a pivotal role at all levels with the shift from knowledge to competencies as backdrop; a corresponding change is evident in the roles of teachers to enable the teachers respond effectively to changing demands, and the institutions of teacher education have major responsibilities to plan and perform accordingly. One is to equip their products - student teachers - with the skills, competencies and necessary training needed to be effective teachers in the changing context.

Personality covers the whole nature of the individual. Psychology does not regard personality as a passive entity but as the dynamic character of the individuals which finds expression through their conduct and activities.

It is interesting to note that quiet a large number of psychologists and teachers have tried to describe personality in terms of traits. These traits are the different "dimensions" or "facts of personality" or "its qualities".

According to Woodworth (1947), "A trait is some particular quality of behaviour which characterizes the individual in a wide range of his activities, and which is fairly consistent over a period of time". For example, a person may display, more or less permanently, in his overt behaviour, such as extroversion-introversion, self concept, dependence-independence, temperament and anxiety at various combinations and patterns.

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Only those traits are called personality traits which are found in an individual's behaviour, more or less consistently, in similar situations. They are generally found in a certain pattern or form or unity. Although the individual changes from year to year as he grows, this trait pattern trends to continue or persevere. Thus, unity, consistency and continuity mark the personality traits and also the behaviour which is the result of one's personality.

Discussion

Review of related studies

Vasuki and Mathurarani (2008) observed that both male and female secondary grade teacher trainees showed similarity in many personality dimensions. Shinija (2002) found no significant difference between male and female prospective teachers in the personality traits - endurance, happy-go-lucky; but observed significant difference in the personality traits - justice, kindness and optimism in them. Rama and Nirmaladevi (2011) noticed that the level of self concept of adolescent students is high in nature (54.2%). Unnisa (2009) found that almost all B. Ed. teacher trainees have moderate self concept. Kalaiselvi (2008) noted that 70% of college students have moderate self concept and the self concept 'mean score' of adolescent students observed significant difference with respect to age and residential area, but not with gender. Baskaran (2008) reported that there is significant difference between male and female teacher trainees in their temperament. Selvaraju and Pazhanivelu (2011) found no significant difference between male and female students in anxiety; while Ramakrishnan (2007) noticed that male and female students differ in their anxiety levels.

Significance of the study

Researchers entertain the view that the level of the personality traits characterizes a person. How and why one differs from another is an important part of the study of personality. In a healthy classroom atmosphere student-teachers are given the opportunity to develop and enhance all the aspects of their levels of personality. When the psychological traits of personality are achieved within the student, one is more likely to be motivated to achieve, cooperate and take on new challenges. One's personality traits play an important role in one's behaviour, even in childhood, and influence not only the goals one sets for oneself but also the ways in which one goes about achieving them. It is important for a teacher-pupil - prospective teacher - to have a sound personality which will reflect upon the students. Against this background, the investigators desired to compare the personality dimensions of male and female student teachers, in a selected sample, and the result is the content of this article.

Objectives

- To assess the level of personality and its dimensions of student teachers
- To find whether there is any significant difference in personality and its dimensions of student teachers influenced by difference in the gender

Hypotheses

- The level of personality and its dimensions of student teachers is moderate
- There is no significant difference in the personality and its dimensions of student teachers differing in gender

Methodology

Survey method of research (Garret and Woodworth, 1969) was adopted for the study.

Population and sample for the study

The population for the present study consists of all B. Ed. students of Madurai revenue district of T. N. State. 1080 B. Ed. students from 20 colleges of education, Madurai revenue district were selected through random sampling technique (Garret and Woodworth, 1969) for the study.

Tools used for the study

For the present study, the investigators used the tool: Multi Dimensional Personality Inventory constructed by Agarwal (1979) to assess the personality factors of the student teachers. The tool consists of 100 items measuring five dimensions of personality: Extroversion-Introversion, Self concept, Dependence-Independence, Temperament and Anxiety. Three possible responses yes, sometimes and no are given. The student teacher has to select the most appropriate one of the three responses. Scores of 3, 2and 1 are given according to their selection of responses in that order. Test-retest method was used to find the reliability of the test; the reliability coefficient was 0.81, satisfying the reliability of the tool and the method. Personal Data Sheet prepared by the investigators for all the respondents contained general personal information about them including gender and name of the college.

Administration of the tool

The investigators approached the heads of institutions and sought permission for data collection. After receiving permission, the investigators, with the help of professor in-charge of the class, administered the prepared personal data sheet to the respondents for selecting the choice of answers. (Before administering the tool to the respondents, the need and purpose of the collection, necessary information required to answer the questionnaire and the confidentiality of the data supplied by them were explained and doubts cleared.)

Data analysis

The collected data sheets were separated into two - of male and female respondents – and analysis on the raw data of the whole and separated ones was done using Percentage, Mean, Standard deviation and ‘t’ test to derive reliable inferences. The results of the analyses are presented in Tables 1-3.

Table 1:
Level of personality and its dimensions of student teachers

Dimensions	Low		Moderate		High	
	N	%	N	%	N	%
Extroversion – introversion	279	25.8	506	46.9	295	27.3
Self concept	275	25.5	510	47.2	295	27.3
Dependence – independence	254	23.5	548	50.7	278	25.7
Temperament	272	25.2	544	50.4	264	24.4
Anxiety	259	24	561	51.9	260	24.1
Personality in total	288	26.7	507	46.9	285	26.4

Table 2:
Level of personality and its dimensions of student teachers in terms of gender

Dimensions	Gender	Low		Moderate		High	
		N	%	N	%	N	%
Extroversion-introversion	Male	61	19.3	159	50.3	96	30.4
	Female	218	28.5	347	45.4	199	26.0
Self concept	Male	87	27.5	140	44.3	89	28.2
	Female	188	24.6	370	48.4	206	27.0
Dependence-independence	Male	81	25.6	155	49.1	80	25.3
	Female	173	22.6	393	51.4	198	25.9
Temperament	Male	68	21.5	160	50.6	88	27.8
	Female	204	26.7	384	50.3	176	23.0
Anxiety	Male	70	22.2	158	50.0	88	27.8
	Female	189	24.7	403	52.7	172	22.5
Personality in total	Male	84	26.6	137	43.4	95	30.1
	Female	204	26.7	370	48.4	190	24.9

Table 3:
Significant difference between male and female student teachers in their personality and its dimensions

Dimensions	Gender	Mean	S. D.	Calculated 't' value	'p' value	Significance at 5% level
Extroversion – introversion	Male	43.53	5.121	3.595	0.000	S
	Female	42.29	5.119			
Self concept	Male	44.93	6.174	0.142	0.887	N S
	Female	44.98	5.763			
Dependence – independence	Male	44.56	5.916	0.683	0.495	N S
	Female	44.83	5.939			
Temperament	Male	41.84	6.868	1.676	0.094	N S
	Female	41.13	6.154			
Anxiety	Male	42.36	6.016	1.295	0.196	N S
	Female	41.86	5.629			
Personality in total	Male	217.22	21.347	1.593	0.112	N S
	Female	215.10	19.217			

It is inferred from the above table that there is no significant difference between male and female student teachers in their personality in total and its dimensions - self concept, dependence-independence, temperament and anxiety, whereas there is significant difference in the dimension - extroversion-introversion - in them.

From the mean value, it is found that male student teachers are better (M, 43.53) in the dimension extroversion-introversion than female student teachers (M, 42.29).

Findings

The analysis and interpretation led to the important findings: 27.3% of student teachers have high level of extroversion-introversion; 27.3% have high level of self concept; 25.7% have high level of dependence-independence; 24.4% have high level of temperament; 24.1% have high level of anxiety and 26.4% have high level of personality in total (Table 1).

30.4% of male respondents have high level of extroversion-introversion, while it is 26.0% of female respondents in that category; 28.2% of male respondents and 27.0% of female respondents have high level of self concept; 25.3% of male respondents and 25.9% of female respondents have high level of dependence-independence; 27.8% of male respondents and 23.0% of female respondents have high level of temperament; 27.8% of male and 22.5% of female respondents have high level of anxiety and 30.1% of male and 24.9% of female respondents have high level of personality in total (Table 2).

There is no significant difference between male and female student teachers in their personality in total and its dimensions - self concept, dependence-independence, temperament and anxiety, whereas there is significant difference between male and female student teachers in the dimension - extroversion-introversion (Table 3).

From the mean value, it is found that male student teachers are better (M, 43.53) in the dimension extroversion-introversion than female student teachers (M, 42.29).

Discussion of results

From the present investigation, it is observed that only 26.4% of the sample has high level of personality in total. While studying in terms of dimensions of personality, very small percentage of the respondents are at high level of extroversion-introversion, self concept, dependence-independence, temperament and anxiety. Moreover, majority of the sample has moderate level of personality and its dimensions. This implies that the student teachers might have been exposed to minimum opportunity in their school and college level.

Gender-wise analysis of the sample revealed that 30.1 % of male student teachers have high level of personality in total, while the percentage is only 24.9 % for the female counter parts in this. In the dimensions - extroversion-introversion, self concept, temperament and anxiety - male student teachers exhibited higher level than female student teachers. This may be attributed to the fact that male student teachers think high about themselves, participate in co-curricular activities and develop anxiety due to pressure of work. In the dimension - dependence-independence - female student teachers showed higher level than their male counterparts. This may be due to the fact that female student teachers are nowadays allowed by the parents to move more freely and encouraged to cultivate and nurture independent views.

The present finding of the study that male and female student teachers do not differ significantly in their personality in total and its dimensions - self concept, dependence-independence, temperament and anxiety - is similar to the findings of Kalaiselvi (2008) on self concept, Selvaraju and Pazhanivelu (2011) on anxiety and contrary to the findings of Baskaran (2007) on temperament and Ramakrishnan (2007) on anxiety. Further, this study pointed to another important and interesting inference that despite the male and female student teachers not differing in their personality in total, the male student teachers exhibited higher mean scores than female ones in extroversion-introversion. This may be due to the fact that male student teachers normally require extra stimulation, can bottle up their emotions and are governed by subjective feelings.

Suggestions

The authors suggest the following for improving the personality of student teachers:
Student teachers must set ideals that are realistic and attainable for them. Otherwise they will inevitably experience failure and feelings of inadequacy, inferiority and even martyrdom, if they shift the blame for their failures to others.

Student teachers must make a realistic assessment of their strength and weakness. A marked mismatch between the actual personality and the ego ideals will lead them to anxiety, uneasiness, unhappiness and the tendency to use defence reactions.

Student teachers must have stable self concepts. The self concept usually becomes increasingly stable as adolescence progresses. This gives teacher educators a sense of inner strength enabling them to develop a firm and consistent approach which in turn increases their self esteem and feelings of adequacy.

Student teachers must enjoy their achievements and be eager to improve in all areas and especially in the deficient ones. Self acceptance leads to behaviour that makes others to like and accept the student teacher. This in turn reinforces the student teachers' favourable behaviour and feeling of self acceptance.

Teacher educators should arrange meditation programs to student teachers. Yoga must be introduced as one of the subjects in the B. Ed. curriculum.

Conclusion

The authors conclude that the gender-wise analysis on personality dimensions revealed that male and female student teachers do not differ significantly in their personality in total and its dimensions, except extroversion-introversion.

References

Agarwal, M. R. (1979), *Multi dimensional Personality,* Kalidass printing press, Agra.

Baskaran, P. (2007), *Relationship between self acceptance and temperament of teacher trainees*, Research and Reflection on Education, **6** (1), 22-24.

Garret, H. E. and Woodworth, R.S. (1969), *Statistics in Psychology and Education*, 5th Ed., Vakils Fefer and Sons Private Limited, Bombay.

Kalaiselvi, R. (2008), *Level of aspiration and self concept among college students*, Edutracks, **7** (10), 12-15.

Rama, C. and Nirmaladevi, S. (2011), *Self concept in relation to achievement motivation among adolescents*, Meston journal of Research in Education, **10** (2), 22

Ramakrishnan, S. (2007), *Effect of anxiety level of M.Ed. students on academic performance*, Edutracks, **7**(4), 35-39.

Selvaraju, R. and Pazhanivelu, G. (2011), *Impact of Anxiety on academic achievement of high school students- A gender wise analysis*, Meston journal of Research in Education, **10** (1), 27-32.

Shinija, K. (2002), *Investigation on Teacher's attitude of Personality of Perspective Teachers*, Indian Educational Review, **31**(1), 37-42.

Unnisa, N. (2009), *Relationship of self concept and academic performance of teacher trainees,* New Frontiers in Education, **42**(4), 43-47.

Vasuki, K. and Mathurarani, V. (2008), *Sex differences in Personality dimensions of secondary grade Teacher trainees*, International Educator, **20** (2), 31-33.

Woodworth, R. S. (1947), *Personality*, 5th Ed., Holt publishers, New York.

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Burnout in Elementary School Teachers of Rayagada Districts of Odisha

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Abstract

Role of teachers in the society is considered to be very important in national development and reconstruction in general, and for realizing the national goals of education in particular. Therefore problems, difficulties and issues related to teachers and teacher education deserve priority consideration. Burnout among teachers is one of the growing issues in the present competitive world. It is a feeling of tiredness, low enthusiasm, low motivation and mechanical completion of assignment and activities in routine manner. It may be due to prolonged exposure of teachers to stressful situations. In the present study an attempt has been made to investigate the level of burnout among elementary school teachers in Rayagada district of Odisha. This study focuses on assessment of the level of burnout among elementary school teachers and also compares the level in male and female teachers. The study is conducted with a representative sample of 300 elementary school teachers from Rayagada Districts. Maslach Burnout Inventory (MBI) was used for collection and analysis of data using descriptive statistics. The study revealed the quantum as well as variety of duties, a teacher has to perform, besides his main teaching work, contributing to the burnout and influencing performance. The important findings of the study, its implications and suggestions to minimize the ill effects of burn out are detailed.

Key words: Burnout, stress, emotional exhaustion, depersonalization, maladjustment, remedy

Introduction

Professional burnout among teachers refers to a set of negative emotions and behavioural maladjustment symptoms. It is well known that education has a great bearing on socio-economic development of an individual. Hence, efforts are always made to provide quality education to all with the help of quality teachers. Teachers provide strategic mechanisms to ensure high performance and good behaviour among children. Though teachers are the key stake holders in guiding the taught to achieve ideal educational goals, they are often not in a favourable mood or supportive atmosphere to do their best and realise the pride and joy of their noble work. While the taught, their guardians, the public and the school administration consider the importance of the role of teachers and their contribution in shaping the young minds, they fail to appreciate the difficulties and unfavourable atmosphere of the teachers by way of over work, lack of proper teaching facilities and appreciation from expected quarters. Many teachers are exposed to prolonged stress which eventually culminates in burnout.

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As a result of burnout the committed teachers become detached from their jobs or continue with the job mechanically mainly to earn money for the living, without feeling the enjoyment of pursuing the noble profession. Teachers experiencing burnout have low commitment and enthusiasm towards their work, reflecting in turn in their personality and performance (Holton and Burnett, 1997). While the professional competition steadily increases, the willingness to match it by performance dwindles due to many negative factors contributing to an unfavourable atmosphere to do the best, with the available facilities and time. Teachers are very sincere and earnest at the beginning of their career, but become less so with time, facing heavy workload, short deadlines, remedial teaching, regular continuous assessments and, above all, lack of sincere systematic learning by the pupils resulting in low productivity. Lack of recognition of the work, poor infrastructure facilities and heavy workload linked to new and novel programmes, competitive but less cooperative support, heterogeneity in the nature and standard of students, etc., are some of the reasons for accelerating burnout among the school teachers.

Discussion

Meaning of burnout

The work of a teacher is physically and mentally challenging. A teacher needs to use a lot of energy in his daily chores in the classroom coupled with his personal and family commitments. The problem of the teacher may be compounded by the school culture and climate. A teacher's activities may be subjected to critical scrutiny by administrators, colleagues, parents and students. This also mounts additional pressure on the teacher. Teachers are also suffering from interpersonal and psychological strains (Maslach and Jackson, 1982). One can simply say that the task of an ideal teacher is enormous. In an attempt to survive, a teacher may struggle to handle many tasks at a time. The pressure, at times becomes so heavy that he becomes exhausted, emaciated, defensive and offensive. This condition of a teacher is known as burnout.

Burnout is an *emotional state in which the worker loses his beliefs and positive feelings (optimism), his sympathy and his respect for the 'clientele'. This moral exhaustion is often accompanied by physical exhaustion, illness or disorders evolving in a psychosomatic mode* (Maslach, 1999). Burnout is *a syndrome of emotional exhaustion, depersonalization and reduced personal accomplishment* that can occur among individuals who do 'people work' of some kind. Maslach (1982) describes three core aspects of burnout viz. 1, Emotional exhaustion (EE) - The key concept of burnout is increased feelings of 'EE', as emotional resources are depleted, workers feel that they are no longer capable of achieving themselves at the desired psychological level; 2. Depersonalization (DP) - a negative, cynical attitude and feeling about an individual; this callous or even dehumanized perception on others can lead staff members to feel justified their clients, deserving the troubles and 3. Personal accomplishment (PA) - the tendency to evaluate oneself negatively, particularly with regard to one's work with clients; individuals may feel unhappy about themselves and dissatisfied with their accomplishment on the job.

Review of related studies

Job satisfaction can be described as a statistically significant measure of effective schools (Zigarreli, 1996). Job satisfaction is ambiguous due to lack of distinction between what is satisfying and satisfactory and that re-conceptualizing the term into job fulfilment and job comfort, as suggested by Evans (1997). Trusty and Sergiovanni (1966) conducted a study with 223 educators in elementary, middle and high schools in a school district and found teachers' need deficiencies to be greatest during the age range between 25 and 35; concluding that teachers in this range are most dissatisfied with their jobs. They also observed male teachers are less satisfied than female teachers.

With regard to experience, a survey conducted by Mertler (2001) on 969 teachers revealed 23% of them were dissatisfied with their jobs. These teachers represented elementary, middle and high schools in suburban, urban and rural areas. Burnout can be viewed as a process that occurs when workers perceive a discrepancy between their input and expected output. To balance the equation, burned out workers begin to give considerably less to their jobs. For example, teachers who become burned out may be less sympathetic towards students, may have a lower tolerance for frustration in the class-room, may plan for their classes less often or less carefully and in general may feel less committed and dedicated to their work (Farbar and Miller, 1981). Kumar (2002) employing sample teachers from government and private schools of Haryana and teachers working in residential schools from Haryana, Punjab and Delhi conducted a study on level of burnout among school teachers and found that most of the teachers experienced low and medium level burnout. Kahn (1978) noted that lack of motivation among students was the major factor causing stress to the teachers. The core aspect of burnout syndrome is the increased feeling of 'emotional exhaustion' caused by excessive psychological and emotional demands made on people, helping others.

Rational of the study

Teachers are considered to be the most important resource for the country at all levels of education in general and elementary level in particular. Role of teachers has a great bearing on the learning of children and quality of the overall education system. Today's work environment undergoes rapid change by creation of new knowledge and continuous innovation. Accordingly, teachers in the field of school education are also expected to be flexible enough to adapt and keep updated with new knowledge, information and practices. This is a deciding factor to make the teachers competent and develop a feeling of well-being in them. All teachers are expected to develop new knowledge and skills and perform new tasks. Professional stress – burnout - affects the work efficiency of teachers in terms of both quantity and quality, becoming one of the tragedies in modern stressful situation and lifestyle. Most of the teachers find it difficult to meet the challenges and demands of the society. Individuals, associated with educational tasks find it difficult to adjust with their day to day functioning and subsequently develop burnout syndrome at an early stage of professional life. There are various factors that may influence teacher well-being and competence. Increasing incidence of burnout has a detrimental effect on individual teachers which can influence the quality of teaching and learning. Teachers should experience a sense of well-being in every walk of life to feel their competence and level of confidence. This will certainly help to reduce their maladjustment. It is true that the burnout syndrome affects the outcomes of an individual. It leads to deterioration of the quality of work of teachers; they can no longer function normally and maintain their optimum efficiency. Different research studies reveal high stress and burnout among teachers at school level. Studies also brought out the relationship between job stress and burnout among elementary school teachers and the moderating roles of personality and social support in its effect. Detecting and assessing the job stress and burnout of elementary teachers of rural schools is necessary to suggest preventive measures and remedies to improve their efficiency.

Rayagada is one of the rural and remote districts in the state of Odisha. Majority of its population comprises disadvantaged and minority section of the society. It is thus, essential for teachers of rural and remote Rayagada district to ensure that they are free from occupational stress and ready to contribute optimally in their professional tasks for the educational development of their region like other districts of the state. This investigation is to assess the mental status of the elementary school teachers of Rayagada district of Odisha with respect to their level of occupational stress, significant difference in teachers of different genders, and suggest possible measures to help them to overcome the stress by providing a base for designing, developing and improving quality of in-service teacher training programmes, content/areas for professional development and overall improvement in the teaching-learning process.

Objective

The following are the objectives of the study:

1. To assess the level of burnout among teachers at elementary school level
2. To compare the levels of burnout among the male and female teachers under each dimension of burnout
3. To suggest strategies to reduce the level of burnout among teachers at elementary school level

Method of the study

Descriptive survey method was used in this study to assess the current status of the level of burnout among the sample teachers. This method involves collection of data, as answers to chosen questions about the current status of the sample of the study (Yariv, 2011). Descriptive survey method aims to study preferences, attitudes, practices and concerns of target group. The investigators tried to get information on one or more variables and assigned numerical value to those variables also with better understanding of perceptions of stakeholders (Hittleman and Simon, 1997). Through this method information about conditions, situations and events that occur in the present can be obtained (UNESCO, 2005). This research method helps the researcher to understand the nature of the problem and to identify various factors that contribute towards the occurrence of the events. This is an important method of conducting research in the fields of social science. The present study is an attempt taken to understand the level of burnout among the sample teachers and analyse the causes. It would help the authorities to take appropriate measures to eliminate the causes responsible for developing burnout syndrome in teachers. On day one, students were administered pre-test of the achievement to assess their entry level. From second day, the students were subjected to the experiment of learning the unit – Fraction - using activity oriented teaching. As there were five modules in the instructional package, students were given the chance to go through each module, continuously for five days.

Sample

The study was conducted in 10 Blocks (Gudari, Ramnaguda, Rayagada, Kolnara, K. Singpur, Kashipur, Gunupur, Muniguda, Chandrapur, and Padmapur) in the Rayagada district of Odisha. The sample of the study comprised 300 teachers at elementary schools associated with different government schools of Rayagada district. From each block 3 clusters, from each cluster 5 schools and from each school 2 teachers (one male and one female) were selected randomly. Accordingly 300 teachers, with equal number of male and female, were selected as the sample of the study.

Multistage stratified random sampling technique (Best and Kahn, 2011) was adopted for appropriate selection of various samples from the district, blocks, clusters and schools for this study. In multi-stage, sampling is done at various levels such as national, state, district, etc., (Guay et al., 2012). In the present study the researchers are concerned with the same type of sampling unit at each stage - district, blocks, clusters and schools.

Tools

The Maslach Burnout Inventory (MBI), a standardized tool was used to collect the relevant data to determine the level of burnout among the sample teachers. The MBI was designed to measure three dimensions of burnout, namely:

i) Emotional exhaustion (EA) - feelings of being emotionally overextended and exhausted by one's work, **ii) Depersonalization** (DP) - an unfeeling and impersonal response toward recipients of one's service, care, treatment or instruction and **iii) Personal accomplishment** (PA). The Maslach Burnout Inventory (MBI) measures feelings of competence and successful achievement in one's work. This is recognized as one of the leading measure of burnout. The tool (MBI) comprised of 22 items (under three dimensions as mentioned above) with a 7- point scale range – 0 - 6 representing "never" - "every day" (0: never, 1: a few times a year, 2: once a month, 3: a few times a month, 4: once a week, 5: a few times a week and 6: every day). Analysis and interpretation of results are made as per the scoring note in each category.

Statistical technique

Simple statistics like percentage, standard deviation and t-test were used for analysis and interpretation of data (Koul, 1997), in the study.

Analysis and interpretation

The investigators visited the school met the sample teachers in group. Necessary information was given to the teachers with needed clarification. The investigators explained them about the importance of the study. All teachers were assured that the responses shall be kept strictly confidential. They were informed to respond to all items and there is no right or wrong response for each item. The sample teachers were asked not to discuss with each other for giving response to their items. All the tools used in the study were self administering in nature.

Table 1: Level of burnout in elementary school teachers

Level of Burnout in %		
Low	**Medium**	**High**
2.47	50.31	47.20

It is seen that 47.20 %, 50.31% and 2.47% of elementary school teachers are found to be at high, medium and low level of burnout respectively. This shows that almost all teachers are found to be experiencing stress at some level. However, it is surprising to note that 47.20% teachers are suffering from high level of burnout. This is not a desirable sign to ensure smooth and effective functioning of school activities. Again status of teachers suffering from burnout at medium level is found to be above 50.0 %. This indicates continuous increase in level of burnout among teachers at the elementary school level. Overall analysis shows that almost 97% teachers at elementary school level are having medium to high stress. This is certainly a serious concern for administrators and policy makers. This need to be addressed strategically and it should constitute an integral part of the in-service training of teachers. Teachers must be oriented with the ways and means of dealing with occupational stress and reduce the level of burnout to make them fit mentally and emotionally.

Emotional adjustment of teachers particularly at school level is very important to ensure overall development of children, engaging them in meaningful activities in school, both inside and outside classroom.

During the course of collection of data, attempt was made to know the important reasons for this phenomenon of increasing level of burnout among school teachers. Increased pressure of work, high expectations of parents and higher authorities, rigid service conditions, low and unequal salary, lack of motivation, lack of recognition, restricted freedom for innovations, etc., are some of the main reasons to de-motivate them all the time and subsequently to lose their interest and dedication for the novel activities. This situation leads the teachers to concentrate only on typical routine mechanical activities and try to complete their work. They hardly enjoy the work or their part of contribution. This is a serious situation needing priority measures for correction and elimination to ensure a better future for the teachers, pupils and the institution. The initiatives of the GOI under SSA and international organisation like UNICEF, UNESCO, etc., must make serious note of it and put forth suggestions and remedial interventions to sustain and improve quality elementary education to all, under RTE for all citizens of India.

The data on the dimension-wise assessment of teacher burnout is presented in Tale 2.

Table 2: Dimension wise burnout of elementary school teachers

S. No.	Types of burnout	Level of burnout (%)		
		low	medium	high
1	Emotional exhaustion (EE)	2. 30 (N=19)	51. 48 (N=166)	46. 22 (N=115)
2	Depersonalization (DP)	3. 63 (N=22)	50. 20 (N=162)	46. 17 (N=116)
3	Personal accomplishment(PA)	1. 50 (N=24)	49. 28 (N=139)	49. 22 (N=137)

Examination of Table 2 reveals that 46-49% teachers are at high level of burnout in the three dimension of burnout - emotional exhaustion (46.22%), depersonalization (46.17%) and personal accomplishment (49.22%). 49-51 % teachers are at medium level in these dimensions (51.48% in emotional exhaustion, 50.20% in depersonalisation and 49.28% in personal accomplishment). This is in agreement with the data in Table1. This is a serious matter in the implementation of education for all in the near future. In-service training of teachers should focus on minimizing, if not eliminating, teacher burn out with motivation and encouragement to pursue the noble profession with utmost job satisfaction and feeling of fulfilment, avoiding development of occupational stress. Adjustment of teachers with the system is important for reducing the stress and enjoyment of their main work, along with other duties and responsibilities to serve themselves, their pupil and society. This is at an unsatisfactory level in the system of elementary education in our country. There is a mismatch between the original job profile of the elementary teachers and the actual job they do.

Further, the teachers at elementary level are always neglected in terms of getting opportunities to do action research as a means of improving teaching- learning process in their work place. The scope for experimentation and innovations are scarce for them.

The data on the comparison of the level of burnout of male and female teachers are detailed in Table 3.

Table 3: Comparison of levels of burnout among male and female teachers

S. No.	Levels of burnout	Male teachers		Female teachers		't' Value
		Mean	S. D.	Mean	S. D.	
1	Emotional exhaustion (EE)	14. 51 (N=150)	8. 19	16. 64 (N=150)	6. 58	2. 49*
2	Depersonalization (DP)	04. 14 (N=150)	5. 46	05. 89 (N=150)	5. 11	2. 87**
3	Personal accomplishment (PA)	29. 82 (N=150)	7. 83	30. 96 (N=150)	6. 19	1. 40

* Significant at 0.05 level and ** significant at 0.01 level

Table 3 provides the level of burnout in the three dimensions for the male and female teachers. One can observe a significant difference in male and female elementary school teachers' emotional exhaustion and depersonalization; but no such significant difference in their personal accomplishment. Female elementary school teachers exhibit more emotional exhaustion and depersonalization than male ones. This may be due to working women's additional share of house hold responsibilities and thus, increasing the total burden. There is no significant difference in personal accomplishment of elementary school teachers, differing in gender. The difference in the two dimensions (EE and DP) and its absence in third (PA) caused by difference in gender have to be considered while developing individualised plan of action involving remedial measures.

Major findings

Majority of sample teachers (above fifty %) are found at medium level of burnout. It is also observed that female teachers experience various syndromes of burnout at higher level than their male counterparts. There is a significant difference between the male and female teachers with regard to level of emotional exhaustion and depersonalization; female ones exhibiting higher level. This may be due to their responsibilities of maintaining their family and also the mandatory responsibilities at school. Lack of support and encouragement of the family in the official work of a teacher can have more negative impact in female teachers than male ones. The level of personal accomplishment does not seem to be affected significantly by the gender difference. In other words, unsatisfactory personal accomplishment affects both male and female elementary teachers to almost same extent and contributes to personal burnout equally.

Conclusion

Elementary school teachers in Rayagada district of Odisha experience high level of teacher burnout arising from increase in workload, lack of educational resources (human and material resources), lack of support from higher authorities, inadequate cooperation from parents and society towards education of children and other developmental plan. Since burnout attracts negative effects in the instructional system, it is essential to overcome the syndrome with greater awareness and understanding. Teachers must be given opportunity to have more control over their environment and available resources to manage situations effectively and enjoyably in day to day academic and supervisory practices. Though the scope of this study is very limited to make broad generalizations, the findings are informative and extendable to other teacher categories and other regions. It might help the educational administrators to focus on issues of burnout among teachers and develop inbuilt preventive and remedial measures to minimize the ill effects and promote a healthier and happier school atmosphere to achieve education for all early.

Implications

The country and the society owe much to teachers especially elementary teachers in achieving the dream of education for all in the near future. Naturally teachers need healthy and happy atmosphere with opportunities to improve their knowledge and skill continuously and be devoid of the chances of developing teacher burn out to the possible extent. Realization of the syndrome along with its characteristics and symptoms will enable the stake holders of educational improvement to devise plan and implementation to minimize wide spread burn out in the teacher community. There is the need to minimise the level of burnout in every walk of life. In order to maintain this situation the government and teachers' association in collaboration with NGOs and local authority should organise well-planned training/ orientation programmes to help teachers to understand the importance of happy co-existence in the school and society to achieve higher out put at lesser strain.

Special care and consideration have to be shown to elementary teachers in the formative years of their training and employment in developing a favourable personality willing to undertake continuous teaching and learning with pride and satisfaction. School and social atmosphere should be conducive for their horizontal and vertical growth with sufficient encouragement and rewards for execution of duties ideally and for achievement in promotion of social and extracurricular activities. Besides good remuneration and infrastructural facilities for undertaking new and novel teaching methodologies, they deserve recognition and appreciation for every good work done in the promotion of education at elementary level.

Combined efforts by the government, educational authorities, school management, parent-teacher associations and responsive society have to be directed towards the welfare and continuous growth of teachers, to enable them to contribute to education for all most effectively.

References

Best, J. and Kahn, J. V. (2011), *Research in Education*, PHI Learning Pvt. Ltd., New Delhi.

Evans, L. (1997), *Addressing Problems of Conceptualization and Construct Validity in Researching Teachers' Job Satisfaction,* Educational Research, **39**(3), 319-331.

Farber, B. A. and Miller, J. (1981), *Teacher Burnout: A Psycho-Educational Perspective*, Teachers College Record, **83**(2), 235-243.

Guay, F. C. *et al.* (2012), *Predicting Intra-individual Changes in Teacher Burnout: The role of Perceived School Environment and Motivational Factors*, Teaching and Teacher Education, 28, 514-525.

Hittleman, D. R. and Simon, A. J. (1997), *Interpreting Educational Research: An Introduction for Consumers of Research*, Prentice-Hall Inc., New Jersey.

Holton, E. H. and Burnett, M. B. (1997), *Qualitative Research Methods,* Berrett Koehler Publishers, San Francisco.

Kahn, R. (1978), *Job Burnout: Prevention and Remedies*, Public Welfare, **36** (2), 61-63.

Koul, L. (1997), *Methodology of Educational Research,* Vikas Publishing House, Pvt. Ltd. New Delhi.

Kumar, H. (2002), *Burnout Teachers: A study of their Personality, Demographic and Work Related Factors*, Ph. D. Thesis in Education, M. D. University, Rohtak.

Maslach, C. and Jackson, S. E. (1982), *The Measurement of Experienced Burnout,* Journal of Occupational Behaviour, **2**, 99-113.

Maslach, C. (1999), *Progress in Understanding Burnout,* in: Vandenberghe, R. and Huberman, A. M. (Eds.), Understanding and Preventing Teacher Burnout, Cambridge University Press, pp. 211-222.

Mertler, C. A. (2001), *Teacher Motivation and Job Satisfaction in the New Millennium,* http://www.eric.ed.gov/PDFS/ED461649.pdf

Trusty, F. M. and Sergiovanni, T. J. (1966), *Perceived Need, Deficiencies of Teachers and Administrators: A Proposal for Restructuring Teacher Roles*, Educational Administrative Quarterly, **2**(3), 168-180.

UNESCO (2005), *Quantitative Research Methods in Educational Planning,* UNESCO International Institute for Educational Planning, Paris, France.

Yariv, E. (2011), *Deterioration in Teachers' Performance: Causes and Some Remedies,* World Journal of Education (Israel), **1**(1) 81-85.

Zigarreli, M. A. (1996), *An Empirical Test of Inclusions from Effective Schools Research,* The Journal of Educational Research, **90**(2), 103-109.

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Antioxidants - Molecules for healthy long Life

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Abstract

An antioxidant is a molecule that inhibits the oxidation of other molecules. Oxidation is a chemical reaction that transfers electrons or hydrogen from a substance to an oxidizing agent. Oxidation reactions can produce free radicals. In turn, these radicals can start chain reactions. When the chain reaction occurs in a cell, it can cause damage or death to the cell. Antioxidants terminate these chain reactions by removing free radical intermediates, and inhibit other oxidation reactions. They do this by being oxidized themselves; so antioxidants are often reducing agents such as thiols, ascorbic acid or polyphenols. The importance of antioxidants in health, industry, as well as in roles in agents against many diseases, ageing and many conditions connected with memory and other brain functions has been increasing and more and more information or refinements in the understanding of these ubiquitous compounds present in different parts of fresh leaf, fruit and other plant materials are emerging. A short account of their occurrence, structural variation, mode of isolation, explanation of certain important functions in biological system, etc., is presented here.

Key words: Antioxidants, oxidation inhibitors, radical scavengers, health protectors

Introduction

As part of their adaptation from marine life, terrestrial plants began producing non-marine antioxidants such as ascorbic acid (Vitamin C), polyphenols and tocopherols. The evolution of angiosperm plants millions of years ago resulted in the development of many antioxidant pigments – particularly during the Jurassic period – as chemical defences against reactive oxygen species that are by-products of photosynthesis (Benzie, 2003). Originally, the term antioxidant specifically referred to a chemical that prevented the consumption of oxygen. In the late 19th and early 20th centuries, extensive study concentrated on the use of antioxidants in important industrial processes, such as the prevention of metal corrosion, the vulcanization of rubber, and the polymerization of fuels in the fouling of internal combustion engines (Mattill, 1947).

Early research on the role of antioxidants in biology focused on their use in preventing the oxidation of unsaturated fats, which is the cause of rancidity (German, 1999). Antioxidant activity could be measured simply by placing the fat in a closed container with oxygen and measuring the rate of oxygen consumption. However, it was the identification of vitamins A, C, and E as antioxidants that revolutionized the field and led to the realization of the importance of antioxidants in the biochemistry of living organisms (Jacob, 1996; Knight, 1998). The possible mechanisms of action of antioxidants were first explored when it was recognized that a substance with anti-oxidative activity is likely to be one that is itself readily oxidized (Moureu and Dufraisse, 1922).

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Research into how vitamin E prevents the process of lipid peroxidation led to the identification of antioxidants as reducing agents that prevent oxidative reactions, often by scavenging reactive oxygen species before they can damage cells (Wolf, 2005).

A paradox in metabolism is that, while the vast majority of complex life on earth requires oxygen for its existence, oxygen is a highly reactive molecule that damages living organisms by producing reactive oxygen species (Davies, 1995). Consequently, organisms contain a complex network of antioxidant metabolites and enzymes that work together to prevent oxidative damage to cellular components such as DNA, proteins and lipids (Sies, 1997; Vertuani, Angusti and Manfredini, 2004). In general, antioxidant systems either prevent these reactive species from being formed, or remove them before they can damage vital components of the cell (Davies, 1995; Sies, 1997). However, reactive oxygen species also have useful cellular functions, such as redox signalling. Thus, the function of antioxidant systems is not to remove oxidants entirely, but instead to keep them at an optimum level (Valco *et al.,* 2007).

The reactive oxygen species produced in cells include hydrogen peroxide (H^2O^2), hypochlorous acid (HClO) and free radicals such as the hydroxyl radical (•OH) and the superoxide anion ($.O_2^-$) (Stohs and Bagchi, 1995). The hydroxyl radical is particularly unstable and will react rapidly and non-specifically with most biological molecules. This species is produced from hydrogen peroxide in metal-catalyzed redox reactions such as the Fenton reaction (Nakabeppu *et al.,* 2006; Valco *et al.,* 2004). These oxidants can damage cells by starting chemical chain reactions such as lipid peroxidation or by oxidizing DNA or proteins. Damage to DNA can cause mutations and possibly cancer, if not reversed by DNA repair mechanisms, while damage to proteins causes enzyme inhibition, denaturation and protein degradation, (Stadtman, 1992).

An account of antioxidants should provide information on different types of antioxidants, their occurrence, reactions they inhibit or control and the relative merit and specificity of application in biological as well as industrial processes. One can gather lot of information on these by browsing the net (Google / Yahoo search) or from sources like Wikipedia and other Encyclopaedias, many review articles on the subject and a number of websites such as: http://www.winxptrick.blogspot.com (Know about everything), http://www.academicearth.org/ (Lectures and videos on academic matter by international experts), http://www.Fora.tv/ (Some of the best lectures by experts), http://www.learningscience.org (For teachers, students and lifelong learners), http://www.madehow.com (For production and use of any curious items) and special personal blogs from authors, reviewers and friends on specific topics. Using many of the above resources the data collected have been arranged in a convenient format for sensitizing and stimulating further reading and studies on one of the most important type of molecules - *Antioxidants* - present in the leaf, vegetables and fruits of food stuff one consumes and derives benefit of maintaining good health and longevity along with resistance and cure from many diseases.

Discussion

"It is difficult these days to open a popular science magazine or medical journal without seeing an article about the role of free radicals in human diseases" (Gutteridge and Halliwell, 1994). This sentence written in 1994 by the leading scientists in the field of free radicals and antioxidants - John Gutteridge and Barry Halliwell - is true today as well. The same authors' statement that antioxidant is a term widely used but rarely defined (Halliwell and Gutteridge, 1999) also remains unaltered. A Google search for antioxidants' definition shows thousands of entries. Halliwell and Gutteridge (1999) defined an antioxidant as: Any substance when present at low concentration compared with those of an oxidizable substrate, significantly delays or prevents oxidation of that substrate. This definition covers all oxidation processes, both radical and non-radical ones.

A generic definition of an antioxidant is not experimentally constructive unless it is associated with the notion of the oxidant that has to be neutralized (Azzi *et al*., 2004).

The literature of the last decade concerning free radical reactions in vivo shows that our understanding of these processes in the organism, under normal and in pathological situations, has changed considerably. Free radicals and reactive oxygen species in general are no longer seen only as destructive factors but also (and perhaps first of all) as messengers involved in intracellular and intercellular signalling (Bartosz, 2005, 2009; Halliwell, 2006). The revision of the ideas on the role of free radical reactions in the functioning of cells prompted to describe oxidative stress as a modulation of thiol redox reactions, involved mainly in signalling pathways. Therefore, non-radical oxidants (enzymatically generated hydrogen peroxide, other peroxides, quinones, etc.) play a basic role in the oxidation of thiols for the sake of signalling, without the necessity of formation of free radical intermediates (Ghezzi *et al.,* 2005; Jones, 2006, 2008).

Similar changes are taking place with respect to our understanding of the role of vitamin E (α-tocopherol) in living processes. For a long time it was believed that the main function of vitamin E is its antioxidant action in biomembranes. Within the last few years it has become clear that the antioxidant activity of vitamin E is not the only one (and certainly not the most important) of its physiological functions (Ricciarelli et al., 2001; Atkinson *et al.,* 2008; Jones, 2008; Engin, 2009). The common belief of the beneficial health-improving action of plant phenolics has also been revised (Halliwell, 2007).

In view of the substantial changes in the understanding of the role of reactive oxygen species and antioxidants in living systems, a critical re-evaluation of the methods of determination of the antioxidant activity also became necessary.

Also, based on recent work, it is proposed that specific molecules of nutritional interest (in particular polyphenols) may act by their direct interaction with nuclear receptors and by modulation of the signalling pathways of the cell (Virgili and Marino, 2008). Recently, Knasmüller et al. (2008) carefully examined the methods of estimation of antioxidant/antiradical activities at various levels of biological organization and presented conclusions on the merit of each method as well as for the suitability of specific methods for the evaluation of dietary antioxidants.

Some of the most familiar metabolic antioxidants are: ascorbic acid (Vitamin C), glutathione, lipoic acid, uric acid, carotenoids [especially β-carotene and retinol (Vitamin A)], α -tocopherol (Vitamin E) and ubiquinol (coenzyme Q). Antioxidants are found in vegetables, fruits, grain cereals, eggs, meat, legumes and nuts. Some, such as lycopene and ascorbic acid, can be destroyed by long-term storage or prolonged cooking (Prior, Wu and Schaich, 2005; Xianquan *et al.,* 2005). Other antioxidant compounds are more stable, like the polyphenolic antioxidants in foods such as whole-wheat cereals and tea (Rodriguez-Amaya, 2003; Baublis, Lu, Clydesdale and Decker, 2000). The effects of cooking and food processing are complex, as these processes can also influence the bioavailability of antioxidants, such as some carotenoids in vegetables (Rietveld and Wiseman, 2003). Processed food contains fewer antioxidants than fresh and uncooked foods, as preparation exposes food to oxygen (Maiani, Castón and Catasta, 2008).

One can survey a large variety of plants and their parts as sources of plant antioxidants useful for natural health maintenance and protection against diseases. Ascorbic acid, tocopherol, tocotrienol, polyphenols - especially flavonoids and resveratrol- and carotenoids (β-carotene, lycopine, lutein) form the important antioxidants from plant parts. Most bioactive food constituents are derived from plants; those so derived are collectively called phytochemicals. The large majority of these phytochemicals is redox active molecules and therefore defined as antioxidants.

Antioxidants can eliminate free radicals and other reactive oxygen and nitrogen species that contribute to most chronic diseases. It is hypothesized that antioxidants, originating from foods, may work as antioxidants in their own right in vivo, as well as bring about beneficial health effects through other mechanisms, including acting as inducers of mechanisms related to antioxidant defense (Kensler, Wakabayashi and Biswal, 2006: Jeong, Jun and Kong, 2006), longevity (Baur et al., 2006; Wood et al., 2004), cell maintenance and DNA repair (Astley *et al.,* 2004).

Other compounds in the diet can alter the levels of antioxidants by acting as pro-oxidants. Here, consuming the compound causes oxidative stress, to which the body responds by inducing higher levels of antioxidant defences such as antioxidant enzymes (Hail *et al.,* 2008). Some of these compounds, such as isothiocyanates and curcumin, may be chemopreventive agents that either block the transformation of abnormal cells into cancerous cells, or even kill existing cancer cells (Hail et al., 2008; Wu *et al.,* 2004).

Antioxidants are used as food additives to help guard against food deterioration. Exposure to oxygen and sunlight are the two main factors in the oxidation of food; so food is preserved by keeping in the dark and sealing it in containers or even coating it in wax, as with cucumbers. However, as oxygen is also important for plant respiration, storing plant materials in anaerobic conditions produces unpleasant flavours and unappealing colours (Pan and Ho, 2008). Consequently, packaging of fresh fruits and vegetables is in ~8% oxygen atmosphere. Antioxidants form an especially important class of preservatives as, unlike bacterial or fungal spoilage, oxidation reactions still occur relatively rapidly in frozen or refrigerated food (Kader, Zagory and Kerbel, 1989). These preservatives include natural antioxidants such as ascorbic acid and tocopherols, as well as synthetic antioxidants like propylgallate, tertiarybutylhydroquinone, butylated hydroxyanisole and butylated hydroxytoluene (Zallen, Hitchcock and Goertz, 1975; Iverson, 1995).

The most common molecules attacked by oxidation are unsaturated fats; oxidation causes them to turn rancid (Robards, Kerr and Patsalides, 1988). Since oxidized lipids are often discoloured and usually have unpleasant tastes such as metallic or sulphurous flavours, it is important to avoid oxidation in fat-rich foods. Thus, these foods are rarely preserved by drying; instead, they are preserved by smoking, salting or fermenting. Even less fatty foods such as fruits are sprayed with sulphurous antioxidants prior to air drying. Oxidation is often catalyzed by metals, which is why fats such as butter should never be wrapped in aluminium foil or kept in metal containers. Some fatty foods such as olive oil are partially protected from oxidation by their natural content of antioxidants, but remain sensitive to photo-oxidation. Antioxidant preservatives are also added to fat-based cosmetics such as lipstick and moisturizers to prevent rancidity.

Extraction of antioxidants

Conventional methods for extraction of antioxidants are usually based on solvent extraction using ethanol or methanol as solvent. For extraction of less polar antioxidants, like carotenoids, solvents such as chloroform or dichloromethane are commonly applied (Ishida *et al.,* 2001) to achieve an efficient extraction. Conventional extraction methods are performed at ambient temperature or at the boiling point of the solvent, and are usually both laborious and time-consuming. Recently, alternative methods have gained increasing interest, to allow for more environmentally sustainable and faster extraction. Thus, extraction at elevated pressure and temperature (i.e. pressurised fluid extraction, PFE) gives promising results in terms of fast and efficient extractions (Richter *et al.,* 1996). Piñeiro *et al.* (2004) showed that pressurised methanol at 100 °C and 101.3 bar gave significantly higher yields of catechin and epicatechin from grape seed at shorter extraction time than ultrasound-assisted extraction and stirring-assisted extraction using the same solvent (water, methanol, ethanol and ethyl acetate) at two different temperatures, 10 and 60 °C. Piñeiro et al. did not test higher extraction temperatures for ultrasound-assisted and stirring-assisted extraction, since the boiling point of methanol, ethanol and ethyl acetate was in the range of 65–80 °C.

The boiling point (at ambient pressure) of the extraction solvent restricts the temperature range that can be employed in the extraction process. By applying a pressure to the extraction vessel, higher temperatures can be reached. It has also been shown that pressurised hot water (subcritical water) can be used to extract polar to average-polar antioxidants from plant materials (Ollanketo *et al.,* 2002) by tuning the extraction temperature. For non-polar compounds, supercritical carbon dioxide (SC-CO_2) can replace organic solvents such as chloroform and dichloromethane, resulting in faster and more selective extractions from complex food and agricultural matrixes (Ollanketo *et al.,* 2002). There are a number of advantages working with pressurised hot solvents; for instance, their solvent properties can easily be tuned by merely changing temperature, which in turn affects the dielectric constant, diffusion rate, viscosity and surface tension of the solvent. This results in a fast and efficient extraction. Finally, PFE with hot ethanol or hot water as solvent enables a pertinently environmentally sustainable extraction process, which complies well with the Twelve Principles of Green Chemistry (Anastas and Warner, 1998; Co *et al.,* 2012).

Estimation of antioxidant activity (EC_{50} Assay)

1,1-Diphenyl-2-picrylhydrazyl (DPPH) is a stable free radical. On accepting hydrogen from a corresponding donor, its solutions lose the characteristic deep purple (λmax 515–517 nm) colour. DPPH is very popular for the study of natural antioxidants (Villano *et al.,* 2007). This radical has been employed in many studies since 1969. The antiradical activity of tested compounds is expressed as a relative or absolute decrease of concentration of DPPH or as EC_{50} (concentration of a compound decreasing the absorbance of a DPPH solution by 50%). The rate of reaction of various antioxidants with DPPH differs (Janaszewska and Bartosz, 2002). Very often the assay is performed according to the method described by Bondet *et al.* (1997). In spite of the wide use of DPPH, this test system in some cases gives incorrect results and recommendations for the proper application of the method have been formulated (Nenadis and Tsimidou, 2002; Molyneux, 2004; Sharma and Bhat, 2009). Carlsen *et al.* (2010) have reported the assay information on the antioxidants of several food items and claim that their antioxidant database is an essential research tool to further elucidate the potential health effects of phytochemical antioxidants in diet.

DPPH is an N-centred stable radical. Galvinoxyl, an O-centred stable radical is a preferred one for measuring free radical scavenging (antiradical) activity as it is more closely related to the physiologically acting oxygen centred stable radicals than DPPH (Tirzitis and Bartosz, 2010). This stable radical is commercially available; its solutions have the absorbance maximum in the visible region (λmax: 432 nm) and it is recommended for studies with electron and hydrogen donating compounds (Shi *et al.,* 2001). Compared to DPPH, galvinoxyl is more reactive towards phenolics. Quideau *et al.* (2011), while reviewing plant polyphenols describe evaluation methods of antioxidant capacity of these types of compounds and recommend measurement based on directly or indirectly the decay of radical species and on determining the rate constants for radical scavenging.

Measurement of antioxidant activity using biologically relevant assays is important in the screening of fruits for potential health benefits. The cellular antioxidant activity (CAA) assay quantifies antioxidant activity in cell culture and was developed to meet the need for a more biologically representative method than the popular chemistry antioxidant capacity measures (Edward, 2009).

Identification of the Antioxidant molecule

For the identification of the antioxidant molecule they are further purified employing suitable chromatographic techniques.

HPLC is the most favoured as it can, in addition to separation, give an idea about the comparative nature of the molecule with other known compounds and, spiking facilitating the comparison of experimental compound with the known one easily. A new compound has to be subjected to more vigorous chemical and spectroscopic examination and on line HPLC associated with UV/ NMR/MS can help in the identification and further confirmation. Co *et al.* (2012) have detailed the isolation, separation and identification of stilbene glucosides (isorhapontin, piceid and astringin – glucosides of isorhapontigenin, resveratrol and astringinin respectively) employing novel extraction procedures, HPLC separation, ^{1}H and ^{13}C NMR as well as HPLC-ELSD and LCMS. Nair *et al.* (1999) observed significant antioxidant activity for the highly oxygenated flavonol glycoside (2'- C-methyl- 5-O-galloylmyricetin-3-O-α-L-rhamnopyranoside from leaves of *Syzygium samarengense* (Rose apple tree).

Health benefits of antioxidants

The health benefits of antioxidants have been precisely reported by Edward (2009). As already understood oxidative damage plays a huge role in many of our modern-day diseases, such as muscle and tissue degeneration, heart disease, diabetes, cancer, as well as many other health problems. We are exposed to free radicals as a normal bi-product of regular bodily processes like breaking down the food we eat, taking toxic medicines, as well as through exposure to pollutants. In addition, over-exposure to the sun (sunburn) and smoking can also increase our body's need to oxidize and create free-radicals. Antioxidants stop this cellular chain reaction of oxidation by neutralizing the free radicals.

Many plants and animals keep large amounts of antioxidants on hand, due to their role in preventing cell damage, as well as their ability to repair damaged cells. Studies have shown that antioxidants can play a role in reducing the cell-damage of free radicals. Further, the National Cancer Institute has stated that preliminary research in lab animals has shown that antioxidants help prevent the free radical damage that is associated with cancer. Many experts feel that increased antioxidants in the body can also help slow the process of aging, and may even increase longevity (Edward, 2009).

Conclusion

Study and research on antioxidants provide a never exhausting mine of new compounds, new techniques, newer explanations and possibilities of offering health and longevity as well as relief from many serious conditions like memory loss, cancer etc. Measurement of antioxidant activity using biologically relevant assays is important in the screening of fruits for potential health benefits. The cellular antioxidant activity (CAA) assay quantifies antioxidant activity in cell culture and was developed to meet the need for a more biologically representative method than the popular chemistry antioxidant capacity measures. Let the combined efforts of biochemists, pharmacologists, nutritionists and clinical professionals succeed in suggesting most suitable gene based application of antioxidants in the prevention and cure of many ailments caused by uncontrolled oxidative processes taking place in the human body.

References

Azzi, A., Davies, K. J. A. and Kelly, F. (2004), *Free radical biology - terminology and critical thinking,* FEBS Lett, **558**, 3–6.

Astley, S. B., Elliott, R. M., Archer, D. B. and Southon, S. (2004), *Evidence that dietary supplementa tion with carotenoids and carotenoid-rich foods modulates the DNA damage: repair balance in human lymphocytes, Br J Nutr*, **91**, 63-72.

Atkinson, J., Epand, R. F. and Epand, R. M. (2008), *Tocopherols and tocotrienols in membranes: a critical review,* Free Radic Biol Med, **44**, 739–764

Bartosz, G. (2005), *The other face of oxygen,* in: Free radicals in nature, Polish Scientific Publishers, Warsaw (in Polish).

Bartosz, G. (2009), *Reactive oxygen species:* Destroyers or messengers? Biochem Pharmacol, **77**, 1303–1315.

Baublis, A., Lu, C., Clydesdale, F. and Decker, E. (2000), *Potential of wheat-based breakfast cereals as a source of dietary antioxidants,* J Am Coll Nutr, **19** (3 Suppl), 308S–311S.

Baur, J. A. *et al.* (2006), *Resveratrol improves health and survival of mice on a high-calorie diet,* Nature, **444**, 337-342.

Benzie, I. (2003), *Evolution of dietary antioxidants,* Comparative Biochemistry and Physiology, **136** (1), 113–26.

Carlsen *et al.* (2010), *Antioxidant food data base,* Nutrition Journal 2010, **9**(3): http://www.nutritionj.com/content/9/1/3.

Co, M., Fagerland, A.,Engman, L., Sunnerheim, K., Sjoberg, P.J.R. and Turner, C. (2012), *Extraction of Antioxidants from Spruce (Picea abies) bark using echo friendly solvents,* Phytochemical Analysis, **23**(1), 1-11.

Davies, K. J. (1995), *Oxidative stress: The paradox of aerobic life*, Biochemical Society Symposia, **61,** 1–31.

Edward, F. (2009), *The health benefits of antioxidants,* Blog published by Dr. Edward F. Group III, DC, ND.

Engin, K. N. (2009), *Alpha-tocopherol: looking beyond an antioxidant*, Mol Vision, **15**, 855–860.

German, J. B. (1999), Food *processing and lipid oxidation,* Advances in experimental medicine and biology, **459**, 23–50.

Ghezzi, P., Bonetto, V. and Fratelli, M. (2005), *Thiol-disulfide balance: from the concept of oxidative stress to that of redox regulation,* Antiox Redox Signal, **7**, 964–972.

Gutteridge, J. M. C. and Halliwell, B. (1994), *Antioxidants in nutrition, health and Disease,* Oxford University Press, Oxford.

Hail, N., Cortes, M., Drake, E. N, and Spallholz, J. E. (2008), *Cancer chemoprevention: a radical perspective,* Free Radic Biol Med, **45** (2), 97–110.

Halliwell, B. (2006), *Reactive species and antioxidants: Redox biology is a fundamental theme for aerobic life*, Plant Physiol, **141**, 312–322.

Halliwell, B. (2007), *Dietary polyphenols: Good, bad, or indifferent for our health?* Cardiovasc Res, **73**, 341–347.

Halliwell, B. and Gutteridge, J. M. C. (1999), *Free radicals in biology and medicine,* Oxford University Press, Oxford.

Iverson, F. (1995), *Phenolic antioxidants: Health Protection Branch studies on butylated hydroxyanisole,* Cancer Lett, **93**(1), 49–54.

Jacob, R. A. (1996), *Three eras of vitamin C discovery,* Sub-cellular biochemistry, **25**, 1–16.

Jeong, W. S., Jun, M. and Kong, A. N. (2006), Nrf2: *a potential molecular target for cancer chemoprevention by natural compounds,* Antioxid Redox Signal, **8**, 99-106.

Jones, D. P. (2006), *Redefining oxidative stress,* Antiox Redox Signal, **8**, 1865–1879.

Jones, D. P. (2008), *Radical-free biology of oxidative stress,* Am J Physiol Cell Physiol, **295**, C849–C868.

Kader, A., Zagory, D. and Kerbel, E. (1989), *Modified atmosphere packaging of fruits and vegetables, Crit Rev Food Sci Nutr,* **28** (1), 1–30.

Kensler, T. W., Wakabayashi, N. and Biswal, S. (2007), *Cell survival responses to environmental stresses via the Keap1-Nrf2-ARE pathway,* Annu Rev Pharmacol Toxicol, **47**, 89-116.

Knasmüller, S. , Nersesyan, A., Nišik, M., Gerner , C., Mikulits, W., Erlich, V., Hoelzl , C., Szakmary, A. and Wagner, K. H. (2008), *Use of conventional and -omics based methods for health claims of dietary antioxidants: a critical overview,* Brit J Nutr, 99E(Suppl 1), ES3–ES52.

Knight, J. A. (1998), *Free radicals: Their history and current status in aging and disease,* Annals of clinical and laboratory science, **28** (6), 331–46.

Maiani, G., Castón M. J. P. and Catasta, G. (2008), *Carotenoids: Actual knowledge on food sources, intakes, stability and bioavailability and their protective role in humans,* Mol Nutr Food Res, **53**, S194–218.

Mattill, H. A. (1947), *Antioxidants*, Annual Review of Biochemistry, **16**, 177- 92.

Moureu, C. and Dufraisse, C. (1922), *Sur l'autoxydation: Les antioxygènes* (in French), Comptes Rendus des Séances et Mémoires de la Société de Biologie, **86**, 321–322.

Nair, A. G. R., Krishnan, S., Ravikrishna, C**.** and Madhusudanan, K. P. (1999), *New and rare flavonol glycosides from leaves of Syzygium samarangense*, Fitoterapia, **70**, 148-151.

Nakabeppu, Y., Sakumi, K., Sakamoto, K., Tsuchimoto, D., Tsuzuki, T. and Nakatsu, Y. (2006), *Mutagenesis and carcinogenesis caused by the oxidation of nucleic acids*, Biological Chemistry, **387** (4), 373–9.

Pan, M. H. and Ho, C. T. (2008), *Chemo preventive effects of natural dietary compounds on cancer development,* Chem. Soc Rev, **37** (11), 2558–74.

Prior, R., Wu, X. and Schaech, K. (2005), *Standardized methods for the determination of antioxidant capacity and phenolics in foods and dietary supplements*, J Agric Food Chem, **53**(10), 4290–302 .

Quideau, S., Deffieux, D., Douat-Casassus, D. and Pouys_gu, L. (2011), *Plant Polyphenols: Chemical Properties, Biological Activities, and Synthesis,* Angew. Chem. Int. Ed., **50**, 586 - 621.

Ricciarelli, R., Zingg, J. M. and Azzi, A. (2001), *Vitamin E: Protective role of a Janus molecule,* FASEB J, **15**, 2314–2325.

Rietveld, A. and Wiseman, S. (2003), *Antioxidant effects of tea: evidence from human clinical trials*, J Nutr, **133** (10), 3285S–3292S.

Robards, K., Kerr, A. and Patsalides, E. (1988), *Rancidity and its measurement in edible oils and snack foods, A review,* Analyst, **113** (2), 213–24.

Rodriguez-Amaya, D. (2003), *Food carotenoids: analysis, composition and alterations during storage and processing of foods,* Forum Nutr, **56**, 35–37.

Shi, H., Noguchi, N. and Niki, E. (2001), G*alvinoxyl method for standardizing electron and proton donating activity*, Methods Enzymol, **335**, 157–166.

Sies, H. (1997), *Oxidative stress: Oxidants and antioxidants*, Experimental physiology **82** (2), 291–5.

Stadtman, E. (1992), Protein *oxidation and aging,* Science, **257** (5074), 1220 - 24.

Stohs, S. and Bagchi, D. (1995), *Oxidative mechanisms in the toxicity of metal ions,* Free Radical Biology and Medicine, **18** (2), 321–36.

Tirzitis, G. and Bartosz, G. (2010), *Determination of antiradical and antioxidant activity*, Acta Biochimica Polonica, **57**(1), 139-142.

Valko, M., Izakovic, M., Mazur, M., Rhodes, C. J. and Telser, J. (2004), *Role of oxygen radicals in DNA damage and cancer incidence,* Molecular and Cellular Biochemistry, **266** (1–2), 37–56.

Valko, M., Leibfritz, D., Moncol, J., Cronin, M., Mazur, M. and Telser, J. (2007), Free *radicals and antioxidants in normal physiological functions and human disease,* The International Journal of Biochemistry and Cell Biology, **39** (1), 44–84.

Virgili, F. and Marino, M. (2008), *Regulation of cellular signals from nutritional molecules: a specific role for phytochemicals beyond antioxidant activity,* Free Radic Biol Med, **45**, 1205–1216.

Vertuani, S., Angusti, A. and Manfredini, S. (2004), The *Antioxidants and Pro-Antioxidants Network: An Overview,* Current Pharmaceutical Design, **10** (14): 1677–94.

Wolf, G. (2005), *The discovery of the antioxidant function of vitamin E: The contribution of Henry A. Mattill,* The Journal of nutrition, **135** (3), 15735063 - 64.

Wood, J. G. *et al.* (2004), *Sirtuin activators mimic caloric restriction and delay ageing in metazoans,* Nature, **430**, 686-689.

Wu, G., Fang, Y. Z., Yang, S., Lupton, J. R. and Turner, N. D. (2004), *Glutathione metabolism and its implications for health*, J Nutr, **134** (3), 489 - 92.

Xianquan, S., Shi, J., Kakuda, Y. and Yueming, J. (2005), Stability *of lycopene during food processing and storage, J Med Food,* **8** (4), 413 - 22.

Zallen, E., Hitchcock, M., Goertz, G. (1975), *Chilled food systems: Effects of chilled holding on quality of beef loaves,* J Am Diet Assoc, **67** (6), 552–7.

Tail piece: Be it a short trip to the supermarket, or a visit to the local vegetable market, here is a list of foods that are packed with antioxidants, and making you feel the double benefit of 'two birds at one shot' – both nutrient and antioxidant together in your chosen delicacy items - like Tomatoes, Corn, Spinach, Berries, Bell peppers and Garlic. One might also agree with the conclusion of Quideau et al. (2011) on red wine, containing unique and pleasing-to-the-taste cocktail of polyphenols, a large dose of proanthocyanidins (and anthocyanins), a squeeze of flavonols and ellagitannins and a zest of resveratrol. After having read about all of the health promoting effects apparently expressed by these different polyphenols, one could be tempted to view wine as the universal remedy offered to humankind by Panacea and Dionysos.

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The coating is an electrospun blend of polydimethylsiloxane and fluorodecyl polyhedral oligomeric silsequioxane."Virtually any liquid you throw on it bounces right off without wetting it," explains research leader Anish Tuteja.

Getting the needle (Use for Old Christmas Trees? Douglas Fir Needles May Sterilize Nano Devices for Medical Applications)

The Christmas tree is the focus of many a household in December but come January 6, it's time for baubles and tinsel to be packed away and the needle-ridden evergreen to be given the chop. However, chemists in India have demonstrated that an extract of Pseudotsuga menziesii, commonly known as the Douglas fir, can be used to help make shape silver nanoparticles for use in the sterilization of medical devices,

Pink diamond (Pink diamond's behavior solved)

The photochromic behavior of pink diamonds can be explained by competing photoionization processes at multiple defect centers in response to an applied optical pump, according to research by Keal Byrne of the University of Western Australia, Perth, and colleagues. "Coloration in diamonds is due to crystalline defects in the crystal lattice, which are also known as color center as they induce color," Byrne explains. "The color center responsible for pink coloration is unknown." However, he and his colleagues have modeled the pink diamond photochromic process as 'an optically-driven electronic transition between two (or more) separate defect trap states. They explain that one of these acts as a ground state for the 390 and 550 nanometer absorption bands. "Defects introduce energy level transitions into this band gap that absorb invisible frequencies," Byrne explains.

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