Technology Advancement, Teachers' Efforts, and Know - How as Key Factors to Improve Students' Creativity for Excellence in Education Management

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Abstract

Through this paper, we have made an attempt to prove how innovation in teaching could be effectively used in attaining better understanding of the subjects, promoting academic excellence, and enhancing quality among the students. The present paper suggested innovative teaching as the need of the present age of globalization and examined in brief how such innovation in teaching could make learning more interesting and enjoyable. This paper further compared the traditional method of teaching with the modern methods, where technology has taken the front seat. This article further explored an innovative pedagogical method incorporating the teaching resources of the present age as per the students' creativity that naturally differ from person to person, though the living environment is the same. Further, we attempted to explain the quality of different teaching methods, deriving an appropriate mathematical model and compared it hypothetically with the proposed innovative method which incorporated the effect of the students' creativity as well.

Keywords : **teachers' efforts, know-how, traditional teaching method, students' creativity, excellence, brain storming ability, student's learning**

JEL Classification : H5, I2, O3

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Education is basically a sort of training that imparts knowledge and skills by which one stands on his or her own feet. It is a light that shows mankind the right direction to move. Education brings in elements of rational thinking, knowledge, and self-sufficiency. The purpose of education is to integrate people in the

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society through three-fold functions of teaching, preparing, and qualifying them for performing the works with excellence and for valuing the morals of the society. The role of education is a means of socializing individuals and to keep the society stable. Education in society prepares youngsters for adulthood so that they may form the next generation of leaders. It will yield strong families and strong communities (Aggarwal, 1992; Education, n.d. ; Sivaswaroop, 2004).

The present-day education system has gone down to a level that demands immediate change. It does not empower students to realize their inner self and potentiality. This is creating disinterest among the students. Besides, teachers also lack the capability to teach the students what would enable them to have interests with the subjects. In order to create interests among the students, the teachers of different subjects should experiment new things. Innovation in teaching is now required so that the meaningless teaching methods that have been existing for a long time can be removed and teaching according to the needs and requirements of the present generation can be taken up to show the efficacy of such studies. Innovative teaching is one way of improving education and creating interest in subjects with the students. So, the question is : What is innovation and innovative teaching ? What special characteristics can be seen in innovative teachers that carry the capability of transforming the teaching - learning process?

According to Wikipedia and Merriam-Webster's Learner's Dictionary, innovation is defined simply as a "new idea, device, or method." (Innovation, n.d. ; Merriam - Webster.com, n.d.). However, innovation is often also viewed as the application of better solutions that meet new requirements, unarticulated needs, or existing market needs. Similarly, Dictionary.com (n.d.) defines innovation as the act of innovating; introduction of new things or methods. Thus, it can be said that innovation in education involves creative teaching that fosters students' creative potential or creativity.

According to Reference.com (n.d.), innovative teaching is a proactive approach to integrate new teaching strategies and methods into a classroom. Research on education supports in developing certain processes, tools, and methods that benefit learning. Innovative teachers implement new methods in giving quality education within the system which may attract others of the same profession to adopt innovative methods in today's context. It is worthy to quote here that Brandon (2004) viewed innovative teaching as a constructivist, social-constructivist, and student-centred process. In this, he considered students to be active learners in a supportive environment who are engaged in authentic and relatable problem-solving activities to stimulate learning (Brandon, 2004).

Zhu, Wang, Cai, and Engels (2013) emphasized on four indispensable competencies for innovative teaching which are learning, social, educational, and technological. These competencies encompass respectively a willingness and readiness to learn, communication with students from different backgrounds, passion and knowledgeability, and a use of technology to further students' understanding. Thus, innovative teaching practices can be considered as an intentional series of student-focused actions that an invested educator can take to stimulate students' ability to meaningfully and creatively engage with the material in order to stimulate interest and advance their knowledge.

Choudhury (2016) pointed out that in academic institutions, a sustainable research culture should be included that would improve and support quality achievements through an effective learning environment that would be supported by proactive involvement and participation of students in such endeavours.

It may be more appropriate to consider innovative teaching as a construct, comprised of a cluster of qualities that includes effective interaction with learners, openness to change, persistence, reflective practice, specificity of approach, and discipline - embedded pedagogy. Innovative teaching is more than the light bulb that comes on when innovation occurs; moving in the new direction which no one has thought of earlier. The inventors of new ideas may be exciting, but innovative teachers do not show any excitement unless they test them, and persist until their students are involved and their teaching is transformed (Lunde & Wilhite, 1996).

Likewise, innovative teachers are one who are passionate about teaching. Innovative teachers understand and

recognize the need for freedom to learn. Such figures in the society understand their role, and so, they are always ready to take risks with the new ways of teaching. Innovative teachers help students and take responsibility on their own learning, usually rely on active learning strategies, create a safe classroom environment, work with their students as mates, often measure their success by the success of their students, and seek out colleagues who also value teaching. Innovative teachers are the ones who carry the essence of humanistic approach to teaching as individual requirements of students differ from one another. They understand such needs, and so, their teaching approach is shaped accordingly. Teachers working as mates help the students feel comfortable in the classroom environment and this makes the learning more effective.

Innovative teachers use their creativity to explore the creative side of the individual student. In these efforts, technology plays a key role in making teaching and the subjects more interesting and thereby making the teaching - learning process to be undertaken in a more supportive environment. The main idea behind such innovative teaching is to encourage students and allow them to be more participative in the learning process. Such interactive learning allows the students to enrich themselves with more practical experience which ultimately helps in retaining information for long.

Sternberg and Lubart (1998) suggested that divergent thinking, embracing alternative solutions to problem solving, and demonstrating sensitivity of the problems could help educators achieve these goals. Further, it has also been suggested that providing opportunities for active learning and stimulating learning interests could also help foster innovative practices in the classroom.

Present Scenario of Education in India

In today's world, studies are the biggest competition. Education is not what it is supposed to be. Education is "preparing a person to face everyday life." Education today doesn't prepare one for the normal problems faced by a person in life. Our education system has to change fully, and only teach what is necessary. Today's education system in India is challenging, but needs some changes. Today's education produces only money-making machines. We are imparting theoretical knowledge based education.

Education must make the students THINK. The education system in India puts more emphasis on theoretical knowledge than the practical knowledge. However, at the same time, students should not concentrate only on the things that are going to be useful in life later on. The system is there just to keep students occupied; nowadays, we rarely learn new skills. Today's education system is in the hands of the government. Today's education system in India is just like a bird without wings or a man without a brain. The education system provides qualifications, but not experiences. Education in India spoon - feeds the students ; thus, in their later life, they are unable to produce what is needed by our country.

The education system of India is academic oriented and is dependent on marks and grades. Foreign countries respect and value the true and distinctive talent of an individual. Taking bribes and offering seats has become so common in this world. For more money, private institutions offer a global exposure. The quality of teachers and the quality education found in various universities differs drastically. According to one of UNESCO's Institutions, "25% teacher absenteeism in India is among the highest in the world." Politics in teacher appointments and transfers is a major reason. Teachers also believe highly in private tutoring, a practice identified by UNESCO as unethical. It does not complement learning at school and leads to corruption the report said. Teachers' mismanagement in institutions is another gray area identified in the Indian education system.

What is the purpose of education in India ? Answering the question, an example is given below to explain how the minds of the students change: In first year, 'A' dreams of being an economist. 'B' wants to take up a career in organic chemistry. 'C' wants to attend linguistic classes under Noam Chomsky. In the final year, 'A' writes MBA exam. 'B' writes MBA exam. 'C' writes MBA exam. This is our present education system. Why ?? Because . . .

students have been disillusioned by the education they receive in college. They are sick of subjects that are strictly confined to the classroom. They know that it will be impossible to make a living with their skills and knowledge. Our colleges devote their entire time and resources teaching syllabus, but never concentrate on departing skills. This is mainly due to the parental interference in the education of the children. Parental guidance is necessary, but it should not interfere in the creativity or individuality of the students. In spite of the obsolete type of education system, some are achieving wonderful feats in sports, music, dance, painting, sciences, and technology.

Ancient and Modern Methods of Teaching

Figure 1 and Figure 2 show how the traditional and modern methods of teaching work. The Figure 3 represents a situation which shows the incorporation of students' creativity in the teaching - learning process along with pedagogical and information and communication technology (ICT) knowledge. The Figure 1 shows the situation in case of traditional methods of teaching. It is mostly a one - way flow process. The teacher here acts as a sender and students are the receivers. It can be seen that the teacher is the person who possesses the pedagogical knowledge and he/she imparts his/her knowledge to the students. The study can be said to be more of theoretical type, but it is also agreed that such a rough study also provides sound knowledge and lays a strong foundation. Some may defer in this as the retaining capacity of students vary. Here, the quality of teachers matters, who through their teaching style can make the subjects interesting.

Traditional methods are now being influenced by technology enabled teaching - learning (Aggarwal, 2017). Now is the age of information, and it demands for change from the teachers' side to update themselves as per the ICT getting all around, striking the education sector strongly. This is also needed as the students of the new age have to compete with the students of the other developed parts of the world in order to be successful. As such, teachers are required to improve themselves according to the changing environment due to ICT besides possessing pedagogical knowledge of the subjects (Figure 2). If teachers are able to achieve this, then students can expect good teaching from the teachers. This type of ICT enabled learning is said to be an interactive sort of teaching - learning process.

However, it is now felt that this is also not sufficient as teachers in most parts of the country are not finding it comfortable enough, and are going through stages of fear. The prime reason for this is that they are not getting

Figure 1. Ancient Methods of Teaching

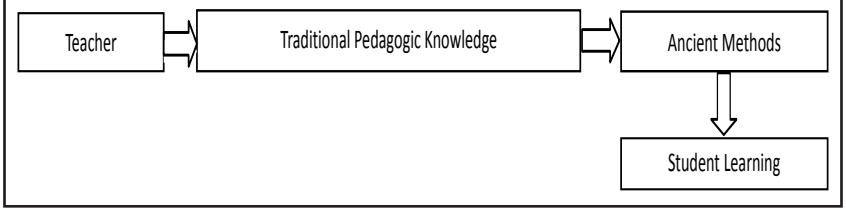
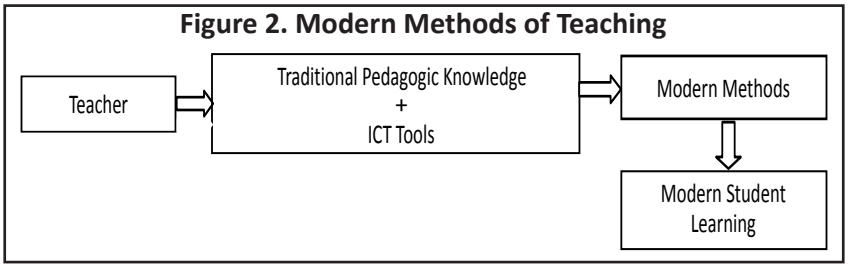
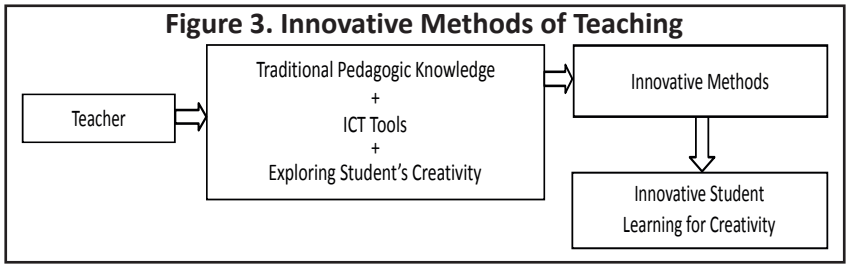


Figure 2. Modern Methods of Teaching





proper training in this. Lack of infrastructure in the remote parts of the country is not allowing a large section of the teacher community to make use of the information technology and make the learning more interesting. Even where teachers are getting the training, they are facing tough competition in the information age to make their students competent enough to face the world. Now, the teachers are required to be more creative in teaching to enable students to discover their talents, realize their physical and intellectual potentialities to the fullest, and to develop character and desirable social and human values to function as responsible citizens (Figure 3).

Each student differs in his/her capability, talent, and creativity. Each student needs some special attention so that his/her creativity finds wings to fly. Each student needs proper nurturing to come out with flying colours. Three factors that can definitely make this happen are : parent participation and encouragement, teachers' strength to discover the creative minds and provide them the wings to fly through their teaching styles and encouragement, and students' personal zeal and strength to become and do something different in life. Now, the zeal in students can be developed with teachers' efforts at the first place and then due to the support and encouragement provided by the parents.

Approach for Assessing Education Quality

The quality of education may vary not only with respect to the era or time, which is always associated with advancement of ICT tools, but also with institutions that adopt modern technology. Therefore, it is essential to assess the quality of education given by certain institutions as a part of appraisal of an institution.

System analysis is the first step to develop any model or formula for analysis and interpretation of the situation of any system. The quality of education, $Q(t)$ at time (t) is directly proportional to the brainstorming ability, $\lambda(t)$ of the students. Let us first understand - what is brainstorming ? It is nothing but the problem-solving technique of a group that involves the spontaneous contribution of ideas from all members of the group or the mulling over of ideas by one or more individuals in an attempt to devise or find a solution to a problem. In the context of students, brainstorming ability is nothing but the ability of the students of a particular institution for brainstorming. The second factor, namely, the students' creativity integrates the quality of the students such as sound knowledge of the subjects, ability to think innovatively, and capability to apply concepts in the real world. It is obvious to say that the brainstorming ability of the students at a particular time can be measured as the ratio of the product of two factors, namely, teachers' efforts and teachers' know-how by technological advancement at that time.

It is essential to analyze these commonsensical terms by listing out the possible influencing factors in order to convert them into numerical values using suitable methods. The teacher's effort depends upon three factors - dedication for students, dedication for the institution, and dedication for imparting quality teaching which stands as a feature to represent a traditional teaching method as the ancient teachers were dedicated towards students, the institution, and quality education; the teacher's know-how depends upon two factors - sound knowledge of the subject and ability to handle latest technology and the technology advancements based on the quality of civilization which can be carefully indexing the available learning and teaching tools of that time.

The numerical measures of teachers' efforts and teachers' know-how have to be simultaneously increased with

the increase in the measure of technological advancement with course of time. The teachers have to be trained to adopt modern ICT tools as teaching aids in the classrooms. One may agree that the brainstorming ability of the students decreases with the technological advancement in a particular era. For instance, the ancient students had memorized the multiplication tables of ¼ , ½ , and ¾ and whole numbers up to 20 or more than this. Today's students have lost such a skill after the invention of calculators. However, no one can conclude that the technological advancements will minimize the brainstorming ability of the students because the advancements in technology in this modern era have enabled us to resolve the complex problems with the help of super computers within minimum time. Therefore, the brainstorming ability of the students has to be maintained with course of time through updating the teachers' know-how and efforts to explore the appropriate teaching methods for knowledge transfer so that the students can apply their brain in other steps of problem-solving-tasks instead of wasting time in working out steps, which could be accomplished promptly with the application of modern tools. The exploring skill of humanity for resolving problems through technology developments with the course of time cannot minimize the brainstorming ability of the students.

However, mathematically, all these three factors can be put together to relate the brainstorming ability of the students. If $T_e(t)$, $T_a(t)$, and $T_k(t)$ denote the teachers' efforts index, technological advancement index, and teachers' know-how index, respectively, then the students' brainstorming ability index at time t, $\lambda(t)$ is directly proportional to the product of $T_e(t)$ and $T_k(t)$, but inversely proportional to $T_a(t)$. That is,

$$\lambda(t)\mu \frac{T_e(t).T_k(t)}{T_a(t)} \quad (1)$$

Thus, the quality of education, $Q(t)$ at time (t) is defined as :

$$Q(t) = \mu(t).\lambda(t) \quad (2)$$

where, $\mu(t)$ is the equating coefficient.

One can agree that quality education is not successful unless and until the educational system considers another factor that has been ignored to be incorporated with the above discussed three factors. The technological advancements will always increase with time, and therefore, quality of education will always increase with time. The teachers' efforts, adoption of technological advancements, and teachers' know-how skills may vary from institution to institution and teacher to teacher. The combined effect of these two factors may either increase or decrease with the increase in technological advancements as teachers' efforts and teachers' know-how depend upon their ethics, dedication, and knowledge updating interests and learning attitudes. The combined effect must increase with increase in technological advancements. Otherwise, the equating factor $\mu(t)$ will increase in order to maintain the equality in equation (2) because the quality of education at any time t will either be constant or increase with respect to time, but will never decrease with the advancement of the ICT tools. If the quality of education is assumed to be constant at time t with particular constant value of technological advancements, then the value of equating coefficient $\mu(t)$ will increase with the decrease in the combined effect of teachers' efforts and teachers' know-how. Thus, the equating factor $\mu(t)$ represents students' creativity.

The highest index value 1 is assigned to advanced technology development and 0 to the lowest one. Hence, evaluating the Technology Advancement Index, T_a is somewhat complex in nature as there is a scope for further advancement and no technology can be claimed to be an advanced one. The technologies of different ages have to be assigned the values between 0 to 1. The expert who evaluates the technology has to assign a greater value to the technology of a particular time than the technology of its earlier time. Therefore, the present technology is assumed to be highly advanced and assigned to 1 and the first technology is assigned 0. Thus, the Technology Advancement Index, T_a at time t_r may be defined as follows :

$$T_a(t_r) = \frac{\sum_{i=1}^{r} s(t_i)}{\sum_{i=1}^{n} s(t_i)} \quad (3)$$

where, t_r represents different time periods for r = 1, 2, 3, …, n and $s(t_r)$ is the score given to a particular technological invention at r^{th} period of the years considered.

Similarly, the Teachers' Efforts Index is also complex to assess. Assessing the efforts of teachers in a particular organization or any other system on a higher scale such as a district, state, or country involves two parts. First, an apt score has to be assigned to each teacher for involving in different activities based on involvement and dedication in educating the students and then it is to be multiplied with appropriate weightage based on the importance of the activity. The product for each activity may be summed up and divided by the sum of the weightages assigned to each activity. Thus, the Teachers' Efforts Index can be obtained for each teacher. Secondly, the Teachers' Efforts Index may be estimated as the arithmetic average of the teachers' efforts indices. Therefore, the Teachers' Efforts Index, T_e may be defined as follows :

$$T_a(t_r) = \frac{1}{n} \sum_{i=1}^{n} \left(\frac{\sum_{j=1}^{m} w_{ij}\, s_{ij}}{\sum_{j=1}^{m} w_{ij}} \right) \quad (4)$$

where, s_{ij} represents score obtained by each teacher, i =1, 2, 3, …, n against different educational activity, j =1, 2, 3, …, m and w_{ij} are the weightages assigned to the activities of the teaching concern according to its importance in today's context.

Again, the evaluation of Teachers' Know- How Index, T_k is a challenging one. It depends upon the know-how about the available technology to educate the students in a system. Sometimes, the teacher may have the talent or have knowledge of know-how of the technology, but the same may not be available in the system. In this case, both the weightage and the score have to be assigned a zero value. Thus, Teachers' Know - How Index, T_k may be defined as follows :

$$T_k(t_r) = \frac{1}{n} \sum_{i=1}^{n} \left(\frac{\sum_{j=1}^{p} w_{ij}\, s_{ij}}{\sum_{j=1}^{p} w_{ij}} \right) \quad (5)$$

where, s_{ij} represents score obtained by each teacher, i = 1, 2, 3, …, n against different know-how about available technology, j =1, 2, 3, …, p and w_{ij} are the weightages assigned to the available technology of the teaching concern according to its importance in today's context.

Computation of the numerical values for the factors - Teachers' Efforts and Teachers' Know- How indices involve more exercise in order to identify all activities and assess the scores for the respective activities. In this article, these factors are assumed to be 1. Thus, the equation (2) can be reduced to :

$$Q(t) = \mu(t) / T_a(t) \quad (6)$$

$$\mu(t) = Q(t).T_a(t) \quad (7)$$

The equation (7) throws some light on the truth that the students' creativity $\mu(t)$ is maintained in increasing trend with respect to the increase in time as the quality of education and technological advancements are increasing with the course of time. It is a fact that technological advancements increase as time goes by. There is only one reason for decrease in the students' creativity in the future, that is, if the standards of teachers' efforts and teachers' know-how are not maintained with adequate updates of technological advancements, know-how, and

dedication with principle of heating the cup from the bottom, that is, identifying the poor students and designing effective student - specific teaching techniques.

The given scoring may vary from person to person, but the user of this model may feel free to judge the quality of that particular invention in comparison to the technological innovation at present period of the years, whose score is kept as maximum of 100. Therefore, the Technological Advancement Index, $T_a(t_n)$ may be assigned 1, which means the technology advancement at current period of years is assumed to be the highest one in the evolution of technologies in comparison with the inventions that took place in the previous periods of years. It is to be noticed that $T_a(t_n) = 1$ when n goes up as current period of years in future ($n \to \infty$). Now defining the value of μ, the creativity of the students, we discuss here the system of education in India in the following section.

From the above discussion, we can define the creativity of students in function of the factors that take account of the personal satisfaction in the course in which he/she got admission to study with respect to his/her ability and skill. The factors such as the institution and place where the student got the admission may seem to be independent of the creativity of a student, but it will bring a downfall in the creativity of the student gradually in the future. The ability and skill may be evaluated from theoretical knowledge and practical skills that he/she has possessed in the subject. For example, a student may have the desire to become a doctor, but he/she may not have adequate theoretical knowledge and practical skill up to the minimum prerequisite level in the concerned subjects such as biology and chemistry, but he/she possesses an excellent knowledge in mathematics and physics. In another case, some students may not be good in mathematics, but excellent in biology and chemistry. In both cases, the creativity of the students is zero if they get admission in medical and engineering, respectively. However, we cannot say that the creativity of the students will be exactly equal to 1 in both cases if they get admission in engineering and medical, respectively. The admission might not be as per the priority list of institutions, places, fee structures that suit them, or their family conditions. Therefore, the creativity of the student may be computed taking all these factors into account as the Creativity Index varies from 0 to 1. In the present study, we do not derive any model for computing the creativity of the student, but we leave it for future research in this regard. Let us assume that the creativity of the student is 1 if the present education system in our country is satisfying the students in all these aspects, otherwise it is 0. It can be noticed that the E_q becomes 0 even if T_a equals to 1 as long as the creativity of the student remains 0 in India.

Application

An attempt has been made to list out the available resources of teaching in different ages from historical evidences. Taking maximum score to the present technological advancement, scores are assigned to different resources based on our opinion assessing how the ancient technology differs from the present technology in quality. The traditional pedagogical aids used in ancient days during the period from 3700 BC to 1970 AD and the information and communication tools (ICT) in the modern age after 1970 have been roughly put in chronological order and have been presented in the Table 1. The Table 1 has been prepared using the teaching ICT aids used in different eras by referring and rearranging the ancient pedagogical aids and modern ICT tools discussed in research articles (Singh, 2011 ; Thakur, 2011). The pedagogical aids presented in items given in Sl. Nos. 1 to 3 of the period from 3700 BC to 300 AD have been assigned the scores, which have been deterministically distributed from the range of 0 - 20. Similarly, the scores from the range of 20 - 30 are given for the items Sl. Nos. 4 to 7 of the period from 300 AD to 1700 AD ; the scores from the range of 30 - 40 are given for the item nos. 8 to 16 of the period from 1700 AD to 1970 AD ; the scores from the range of 40 - 100 are given for the item nos. 17 and 18 of the period from 1970 AD - 1980 AD ; and the scores from the range of 20 - 100 are given for the item nos. 19 - 29 of the period from 1990 AD to 2017 AD. The Technological Advancement indices (T_a) were computed using the equation (3) and are included in the Table 1.

Table 1. Traditional Pedagogical and Modern Teaching Aids (Ancient Mesopotamia - Timeline ; Singh, 2011)

Sl.No.	Teaching ICT Aids	Score	Cumulative Score	Period	T_a
	Traditional Pedagogical ICT Aids (Sl.No. 1 to 17)				
1.	Dropping stones or drawing lines on the walls used to teach and count numbers	4	4	3700 BC - 300 AD	0.0028
2.	Materials made up of clay or pictures drawn on the walls or tablets used as teaching tools	12	16		0.0112
3.	Manuscripts on carved tablets and processed leather-scrolls as teaching tool	20	36		0.0251
4.	Manuscripts carved on processed thicker palm leaves	20	56	300 AD - 1700 AD	0.0391
5.	Blocks made up of clay, wood, or stones to print multiple copies of manuscripts on ancient papyrus paper.	24	80		0.0559
6.	Blackboards & chalks and geometry kits	20	100		0.0698
7.	Paper manufacturing technology	24	124		0.0866
8.	Textbooks	32	156	1700 AD - 1970 AD	0.1089
9.	Maps, atlases, and globes	36	192		0.1341
10.	Flashcards, flip cards, and worksheets	28	220		0.1536
11.	Scientific apparatus, materials, and models used in classrooms and science labs	40	260		0.1816
12.	Crossword puzzles, quizzes, and storytelling etc.	16	276		0.1927
13.	Dramatization and plays	36	312		0.2179
14.	Dictionaries, Encyclopedias, and other reference books	50	364		0.2542
15.	Toys and other objects used as methods of teaching	24	388		0.2709
16.	Use of abacus as a teaching aid	40	428		0.2989
	Modern Teaching ICT Aids (Sl. No. 17 to 29)				
17.	Primary computers of low speed and low storage capacity as a tool in teaching	60	488	1970AD - 1980 AD	0.3408
18.	Super computers of moderate speed and storage capacity with electronic memory chips as a tool in modern teaching	92	580		0.4050
19.	Modern computers of higher speed and improved storage capacity with capability of executing multi-tasks and improved electronic memory chips as a tool in teaching	100	680	1980 AD - 2017 AD	0.4749
20.	Transistors as teaching tool - Transmission of experts' talks through broadcasting with audio impact	68	748		0.5223
21.	Film / slideshow /overhead projector without audio impact	72	820		0.5726
22.	Sunmica laminated writing boards with eco-friendly dry markers	20	840		0.5866
23.	Black and white TV - Telecasting the experts' talks with both audio and visual impacts	76	916		0.6397
24.	Color TV as an attractive tool - Telecasting the experts' talks through both audio and visual impacts	84	1000		0.6983
25.	CDs and DVDs containing information / videos	72	1072		0.7486
26.	Electronic slide projectors, Projector screens as teaching tools	80	1152		0.8045
27.	Resources such as VCRs, VCPs, DVD players, etc.	88	1240		0.8659

28.	Role of Powerpoint slides and games in modern classrooms	92	1332	0.9302
29.	Online books, dictionaries, encyclopedias, picture dictionaries, talking dictionaries, online tests	100	1432	1.0000

Note. Most of the items are in chronological order ; ICT stands for information and communication technology ; T_a stands for technological advancement index.

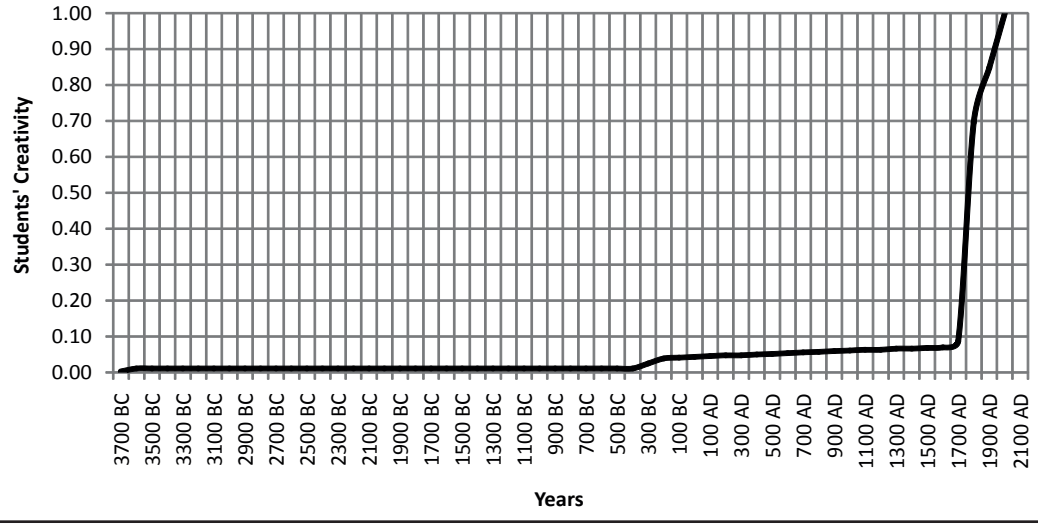
Discussion

If two of the three quality education factors, namely, Teachers' Efforts indices, and Teachers' Know - How indices are assumed to be the optimum of respective age or years, the product of these two factors is 1. Further, if the quality index of education is assumed to be 1 for all the eras, and the values are substituted in equation (7), then the creativity of the students of those years or eras are the Technological Advancement Indices of those respective years. Thus, the students' creativity is plotted for the period starting from 3700 BC to 2017 AD and presented in Figure 4. The graphical representation shows that the students' creativity gradually increased from 3700 BC to 300 BC and suddenly there was a little increase during the period from 300 BC to 1700 AD. After the industrial revolution in 1700 AD in Britain, industrialization spread all over the world, and the creativity of the students significantly hiked afterwards. The results of the study reveal that technological developments have pushed up the quality of education along with the positive effect on students' creativity.

The teaching - learning process could be improved further in more interesting ways if the following suggestions are adopted by the traditional teachers : (a) need to be an expert in pedagogy and child psychology, (b) need to be at home in using modern technology in the classroom, (c) must be a facilitator in the teaching-learning process, (d) must be sensible towards the environment, (e) should possess the skill of adaptability to changing requirements, (f) should possess a strong sense of professionalism, and (g) must be techno-savvy and must be aware of modern arts and sciences.

If these qualities exist in teachers or if they mould themselves as per the needs, then they would stand at the right position to understand the students and their inherent capabilities and accordingly would help them to understand their potential. Encouraging students' creativity and talent would generate creativity in teachers too, who would then use the student strength for making the creativity work. Experts reported that innovative teaching

Figure 4. The Plot of Technological Advancement Indices (T_a) in Different Years



was just the same teaching methods, only it was carried out in a different way to make things work with success and admired by the masses (Cachia, Ferrari, Ala-Mutka, & Punie, 2010 ; Johnson, 2006 ; Loeb, Rouse, & Shorris, 2007 ; Ruhela, 1992).

Innovative teaching takes time, but it works. It demands persistence and change. Innovative teachers prepare students for success by emphasizing 21st century skills such as critical thinking, problem-solving, creativity, and collaboration. They motivate their students by creating authentic learning experiences that are grounded in core academic content and enhanced through technology. Innovative teachers are passionate about teaching, are risk takers, keep themselves vital, and recognize the need for freedom to learn.

Just like teachers have an important role in students' life; teachers' educators have an important part to play in shaping teachers' competencies through proper training as per the changing needs with time. The teacher educators have much to contribute to the development of quality amongst the teachers. The teacher educators will have to delve on specialized skills that add quality to the professional functioning of teachers. The teacher educators will need to envision functions other than teaching by making teacher education degrees/diplomas broad based with respect to changing times. The teacher educators will have to organize their teachings as per the needs of the society and the market forces. The whole nature and process of teacher education will have to be worked out differently. Teacher educator's understanding of the systemic features of the teacher quality movement is essential, particularly if we are to lead efforts to enhance teacher quality with the changing needs. The role of teacher educators today is to mend the existing system with vision to help teacher education grow as a profession and produce quality teachers for institutes. Finally, teachers' educators should make the teachers feel about the innovative ways of teaching that are needed to make the subjects interesting (Liston, Borko, & Whitcomb, 2008).

Conclusion

The present paper is an attempt to relate the teachers' efforts and teachers' know-how and technology advancement with students' creativity. Further, the quality of education is assessed as the product of students' creativity with brainstorming ability. Assuming the quality of education possesses the high quality index 1 as the application of all available pedagogical aids and ICT tools of the era as well as the combined effect of the quality indices of teachers' efforts and know-how is to be 1, the students' creativity was plotted against different eras as well. The results reveal that there was a sudden hike in the students' creativity, which ultimately led to a hike in the quality of education. The Student's Creativity Index was assumed to be 100%. If someone would evaluate and find the actual value of quality of education, say 40% relatively in comparison with the world's highest quality, the present value that lies between 0 to 1 in the Figure 4 must be multiplied by 40 to get the actual result.

Today, students are focused towards their careers, and E-education has become popular as computer based technology has become an important tool in the new age of learning, and it helps to save time to be engaged in other activities. As a result, it affects the quality of education and on the other hand, it helps people to spare time to accomplish other tasks. It's a time for balancing these two effects in career building through setting up of an appropriate educational system to meet the demands of the modern age and accordingly bring changes in syllabus, way of teaching, criteria of promotion, and creating knowledge and skill based employments. The teachers' efforts and teachers' know-how are the two key factors to improve students' creativity besides the technological advancement. According to equation (2), the quality of education in a certain era or time may go down to the worst level unless and until the combined effect of these two key factors is properly cared for, even if the educational institutions possess all kinds of pedagogical aids and ICT tools since the students' creativity cannot improve itself without proper efforts and know-how update of the teachers. Therefore, teachers are needed to be trained to handle ICT tools and need to be prepared to teach in smart classrooms with all kinds of learning infrastructures for the students of the modern age. Improper education system may have serious consequences in the future; it can even totally handicap and spoil the students' creativity and brainstorming ability.

Managerial Implications

The education planners can use the findings of this study and go in for reconstruction in the education system to have equilibrium between teachers, students, and the school/college environment that would support learning. Such innovative approach in education is the need of today as in the present times, instead of mere teaching, learning is facilitated that holds the true promise of achieving a sustainable society and redeeming the democratic vision.

Limitations of the Study and Scope for Further Research

The limitations of the study are that the two of the three quality education factors, namely, Teachers' Efforts indices and Teachers' Know- How indices are assumed to be the optimum of the respective ages or years, the product of these two factors is also assumed to be 1 in the present study to visualize the students' creativity in different eras. The present study takes the whole world and available teaching tools to estimate the Technological Advancement Indices assuming the present age possesses the highest index value of 1.

If appropriate questionnaires are designed separately and used for conducting surveys of teachers individually along with their affiliated institutions for three factors of quality education, the educational institutions whose Technological Advancement Index is high could be easily identified. Assuming the Technological Advancement Index of an institution as 1, the Technological Advancement Indices of other institutions could be normalized to get the relative technological advancement indices of all other institutions. Now assessing the questionnaires using the respective equations, the students' creativity as well as their brainstorming ability could be estimated. Further, the quality of education in each institution could be assessed and then ranked. Further, the creativity and brain storming ability of each student could be evaluated.

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