Pedagogical Use Of Web-Based Technology In Teaching At Secondary And Senior Secondary Level Schools Of Delhi:an Exploratory Study

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The applications of Information and Communication Technology (ICT) have a great potential to improve teaching and learning alike. The emergence of Internet has further revolutionised the education process. Integrated use of technology in educational institutions has received an unprecedented attention within the last decade in the developed countries. The Internet has lately become the focus of attention especially with regard to its significance as an instructional tool and has become top priority for educators and policy makers. The Web-Based Technology (WBT) is viewed as more ideally suitable than other technologies in student-centered learning.

The Information and Communication Technology (ICT) has entered and enriched all walks of human life in this modern 'information age'. Applications of ICT in pedagogy for enhancing academic performance has become the main centre of attraction in educational research for promotion of quality and excellence of instruction with a view to meeting the challenges emerging before the society, and enhancement of human potential beyond capacity has become the main focus of modern educational system.

In an information society, teachers can no longer be regarded as the sole repository of knowledge that they have only to pass on to the younger generation. They become partners in a collective fund of knowledge, which they have to organise, positioning themselves firmly in the vanguard of change. The Web-Based Technology can go a long way in this endeavour. It brings a wealth of knowledge including primary resources previously unavailable into our classroom.

In this new millennium, the traditionally modeled schools of industrial age must indulge in fundamental and systemic change in order to prepare students as per the call of this 'information age'. The introduction of ICT in school system is a force that can serve as a catalyst for this change. Its introduction in pedagogical process is essential for successfully harnessing the capabilities of the students.

RATIONALE OF THE STUDY

The review of literature shows that lot of work has been done abroad on pedagogical use of WBT in classroom. Different variables ranging from attitude of students, teachers and administrators; issues and problems being faced by different functionaries; and use of software for computer assisted teaching, to staff development issues, have been studied at length at different times. In case of the Indian reported studies, it is observed that a number of studies are available in the area of computer assisted instruction at different student levels. However, there is not a single study which pays attention to the use of WBT for instructional purposes. The reason for this is that the Internet and World Wide Web are a new phenomenon. Their use in education in India will gain momentum slowly. Some of the private schools have already made a beginning in this direction and have

made Internet a part of their school curriculum.

In the light of the revolution being brought by the Web-Based Technology in all spheres of life, and efforts made by the Government from time to time to harness various resources and prepare them for assimilation of the latest communication and information technology, it is high time to have a re-look on the pedagogical process in secondary and senior secondary schools in the country vis-à-vis use of Web-Based Technology in order to make it sustainable with the rapidly changing needs of the 'information society'. While in foreign countries, lot of work has already been done in this area, it is still being subjected to extensive research there. Keeping in view the above state, the investigator found the topic, mentioned below, quite relevant and appropriate, in order to study (i) the extent and ways of actual use of WBT components in teaching in secondary and senior secondary classes and (ii) suggest ways and means of effective use of WBT in these settings.

TITLE OF THE STUDY

Pedagogical Use of Web-Based Technology in Teaching at Secondary and Senior Secondary Level Schools of Delhi: An Exploratory Study

OBJECTIVES OF THE STUDY

The present study was undertaken keeping the following objectives into consideration:

To analyse the information available on the Web related to Secondary and Senior Secondary School Science subjects for ascertaining availability of the relevant material;

To ascertain the status of Internet usages for teaching Science in Secondary and Senior Secondary Schools of South and West Zones of Delhi;

To assess the competency level of the Secondary and Senior Secondary School Teachers in the use of WBT for teaching;

To ascertain the extent and frequency of use of WBT by the Secondary and Senior Secondary School teachers for pedagogical purposes;

To find out the problems in using WBT for Secondary and Senior Secondary class teaching;

To suggest ways and means of effective use of WBT in classroom setting.

METHODOLOGY

Since this was an exploratory study, descriptive and documentary methods of research were used for this study. The design mainly used the survey technique. Appropriate tools in the form of questionnaires were designed to collect the data from the science teachers and principals and tested before administering on the sample. The data was

subjected to descriptive analysis using appropriate statistical techniques.

SAMPLE

In all, questionnaires were distributed to 375 science teachers and 75 principals in 75 schools. After a great amount of efforts, persuasion and giving fresh questionnaires time and again, personal visits and phone calls, the researcher could get only 211 questionnaires from the teachers and 50 from principals.

TOOLS

The following tools were developed and used keeping in view the objectives of the study:

Questionnaire for Science Teachers
Questionnaire for Principals

RESULTS AND DISCUSSION

The discussion based on an exploration made in the use of WBT in teaching of Science subjects at secondary and senior secondary levels in private schools of Delhi mainly concentrates on the availability of relevant material on the Web related to Science Subjects as per the CBSE curriculum, infrastructural facilities available in these schools, competency of teachers in use of WBT for teaching purposes, frequency and extent of use of WBT, different barriers, issues and problems in effective implementation of WBT in schools for teaching, and suggestions for effective use of WBT. Before the above discussion, an overview of the salient characteristics of the sample has also been presented.

It was revealed that majority of respondents were females (teachers 75.82% and principals 54%). Teachers in majority were having graduation degree with B Ed. However, majority of principals (86%) were Postgraduates. 20 % principals did not posses any professional qualification like B Ed/ M Ed.. Large number of female (38.75%) and male (31.37%) teachers had experience of only 1-5 years. However, large number of principals (42%) had experience of 21-25 years. Majority of female teachers (60.63%) had Internet connection at home whereas majority of male teachers (58.82%) did not have Internet connection at home. Majority of principals (86%) had Internet at home. While majority of teachers were able to use Internet in the classroom for 1-3 hours a week, majority of female (69.38%) and male (60.79%) teachers were using Internet outside class also. In majority of the cases (90.62% females and 92.14% males) teachers did not have their own websites. Only 14% principals had their own websites out of which 71.43% were males. The analyses of the demographic data of the teachers and principals revealed that public school education system was dominated by feminine gender since perhaps the females are easily available on lesser salary than their counterparts. It was also observed during the data collection stage that there was a high rate of teacher turn-over in these schools since in many cases, the Science teachers to whom questionnaires were distributed in the first instance, had already left the job before the second visit of the researcher.

The information related to secondary and senior secondary Science subjects based on

CBSE curriculum was analysed to ascertain its availability on the Web and its relevance for these classes. The information on these aspects was also sought from the teachers. Discussion on availability of relevant material on the Internet, usefulness of the content, interactiveness of the material and websites usually being visited by teachers has been presented in the following paragraphs.

The private vendors, non-profit groups, governmental and quasi-governmental agencies have begun to provide a great deal of curriculum based material over the Internet. While material provided on the Internet by the private vendors might be priced, majority of institutions and agencies mentioned above develop and provide the educational software and other material free of cost for the benefit of larger population of the world. It is this viewpoint that enables the school administrators to provide access to this material and stuff incurring onetime expenditure on IT infrastructure.

In order to ascertain the availability of free material on the Internet which could be used by the teachers in the classroom, the researcher searched the Web for availability of the curriculum content topic-by-topic for 9th to 12th classes. The '*Google*' search engine was used for this purpose. It was observed that plenty of websites were available on each '*keyword*' provided to the '*search engine*' which ranged from hundreds to millions in many cases. The researcher prepared a representative list of websites as a sample which is given at Appendix -1. It is worth mentioning here that all the websites listed by the '*search engine*' may not be useful since the '*search engine*' lists all sites where the given '*keyword*' figures in one way or the other. The usefulness of the search will commensurate with the proficiency of the teacher in framing the '*keywords*' for the '*search engine*'. It is, therefore, revealed that enough free material is available on the Web pertaining to Science subjects of secondary and senior secondary classes which can be used by teachers in the classroom setting.

With the above background, opinion of the teachers was sought in which it was revealed that majority of teachers were able to get relevant and useful material on the Internet. In addition to this, the material available on the Internet was found to be quite interactive by majority of teachers (80.95% Physics, 70% Chemistry, 78.43% Biology and 79.02% Math teachers). It was revealed that 18% teachers never ascertained the need for applying the WBT to a particular topic. 24.17% teachers never ascertained the authenticity of the material available on the Internet before its use. 21.32% teachers never matched the Web material with their class curriculum. Majority of teachers (65.55%) sometimes gave Internet based assignments to their students.

It was also revealed that the '*Science education related*' websites were visited by majority of the teachers (86.73%). Other popular websites among the teachers were related to '*entertainment*', '*jobs*', '*sports*', '*home products*' and '*business*'. The study shows that the teachers had varied interests and they usually visited different types of websites in addition to Science education related websites.

The information on the status of infrastructural facilities in the schools was sought from the principals only. The analysis revealed that large number of schools (50%) had provided the computers at different places. However, 22% schools had provided the

computers at both the placed i.e. in computer laboratories and other places also. 50% schools each had provided the stand-alone printers and networked printers respectively in the schools. It was revealed that dial-up connection was much popular in schools since majority of schools (92%) had dial-up Internet connection. In majority of cases (60%), the Internet facility was accessible to both teachers and students. Majority of schools were well equipped and different peripherals like scanner (76%), CD Writer (70%), colour printer (80%) and multimedia equipment (78%) were available for use by the teachers. Majority of schools had their own websites (66%) and UPS System (100%). However, Web servers were installed only by 26% schools. 24% schools were ready to share their Internet facilities with other schools on request. The above findings reveal that adequate infrastructure was provided by the schools for pedagogical use. However, the schools were not ready to share their facilities with other schools who might request them so. It shows that possessing different types of computer-related facilities in the schools is their private affair which they do not want to share with other schools.

In the present study, an attempt was made by the researcher to assess the competency level of secondary and senior secondary school teachers in the use of WBT for teaching. It was revealed that large number of teachers (37.20%) had undergone pre-service short term training programmes pertaining to use of computer/Internet. It was also found that majority of teachers (73.40%) had undergone no technical in-service training. The teachers who had undergone training, fell in the age group of 31-40 years and had Internet related experience of 1-5 years only. This shows an inclination of younger generation towards IT finding it comfortable while using WBT. However, the teachers were strongly of the view that ongoing periodical training should be provided to them as it would improve quality of classroom teaching.

In case of principals it was found that majority of males principals possessed no special qualification pertaining to use of computer/WBT but majority of female principals had acquired some kind of formal qualification pertaining to this area. However, majority of principals had good exposure of this technology and had an experience of at least 1-5 years. All the principals agreed that training should be imparted to teachers who were using WBT in their classroom for teaching purposes. Majority of principals (80%) had arranged the technical training for teachers, 80% principals had also arranged pedagogical training for their teachers. In majority of cases (56%), training was sponsored by the schools concerned.

Majority of Science teachers (73.46%) in the present study, were not having knowledge of any authoring tool but they could use e-mail (28.79%) and Web for designing class resources (20.98%). The teachers were also comfortable in using the Web for *keeping track of web-usage by students,* issuing and receiving *home assignments* and conducting *interclass quizzes*. Though, principals and teachers were strongly of the view that ongoing periodical training should be provided to the teachers as it would improve quality of classroom teaching.

The principals and teachers were firmly of the opinion that in the course of their interaction with WBT, students would develop various skills like '*problem solving',* '*critical thinking', 'navigation', 'analytical abilities', 'collaborative'* and '*written*

communication' which would enrich their learning experience. In this case, a comparison of the means of the two groups using *t-Test* was made and it was revealed that though principals had negligible special qualification pertaining to computer/WBT, but due to their exposure towards technology, their belief was stronger than teachers that use of WBT would develop problem solving, critical thinking, analytical abilities and collaborative skills in students. This shows that they are more optimistic about the uses of WBT in schools. However, the opinion of teachers can be taken as more realistic since their views are reflections of their practical experiences with the use of this comparatively new technology.

The present study also aimed at assessing the extent and frequency of WBT in teaching at secondary and secondary schools. The analysis of data revealed that large number of teachers (40.78%) used Internet for '1-3 hours' a week in school. The weekly time allowed to the students in computer labs for hands-on experience also ranged between '1-3 hours'. Though it was recommended by the principals that Internet downloaded material should be distributed to the students, class-wise and subject-wise analysis of data revealed that large number of teachers teaching 9th (41.98%) and 10th (40%) classes and Chemistry (43.68%) and Math (44.87%) subjects separately, never distributed such material to their students. However, large number of the teachers teaching Physics (43.33%) and Biology (48.94%) and 11th (45.13%) and 12th (48.51%) classes separately, sometimes distributed Internet downloaded material to their students.

Large number of teachers teaching Physics (22.22%) used '*Lecture'* and '*Group Discussion'* methods in the conventional class teaching. The conventional teaching methods have been taken as all the methods which are being used by the teachers without the help of WBT. However, Chemistry teachers (21.67%) used '*Lecture'*, '*Demonstration'* and '*Group Discussion'* methods, whereas Biology (25.49%) and Math (30.86%) teachers used only '*Lecture'* method. Also, there were quite a few teachers who used different '*Teaching Aids'* e.g. CD-ROM, OHP and teaching methods like '*Question and Answer session'*, '*Apply Concept on Board and explain'*, '*Induction'* method*, and '*Brainstorming and Investigation'* methods. Physics (46.77%), Chemistry (47.46%) and Biology (44.90%) teachers sometimes used '*Conventional'* teaching methods via Internet. However, Math teachers (54.32%) in majority never tried these teaching methods via Internet. Perhaps Maths subject does not necessitate the teachers to seek help of alternative means to enhance the impact of their teaching on the students thereby enriching their learning experience.

While exploring the use of different WBT components by the teachers for teaching purposes, it was revealed that majority of teachers (76.31%) were using the text and graphics, and e-mail (81.52%) facility on the Web. But, majority of teachers never used audio streaming (55.93%) and chat (47.41%) on the Web. Also a very low use of video streaming was reported by teachers. However, teachers frequently used search engines for different purposes like '*planning their classroom lecture'*, research and gathering information on different class topics. The analysis also revealed a low use (36.97% teachers only) of simulation on the Internet.

Rarely used features on the Internet by the teachers as revealed by the present study,

were animations, other multimedia components, Web publishing, library resources and collaborating with other teachers and students. The present study revealed that Internet was rarely used for *accessing object diagrams and different types of models, online group discussion, administrative recording, creating instructional material for students* and *accessing model lesson plans*. As has been explained earlier, teachers were capable of using different Web components comfortably and were, therefore, competent enough to take advantage of WBT in classroom setting. However, they were not utilizing the potential of WBT to its full. It might be due to various issues, barriers and problems which the teachers might be facing as explained in the foregoing paragraphs.

Most of the schools were not found to be involved in online research projects. Only 20% schools were found involved in online research projects. Some schools had completed projects on '*game programming*', '*population*', '*consumer behaviour*', '*earthquakes*', '*volcano*' and '*coal*' etc. Some principals reported that they had completed projects on '*solar system*', '*environment*', '*music and art*', '*Indo-Pak relations*', '*choice of career and job opportunities*' and '*Computer Science*'. Even the students were also generally not found involved in online collaborative projects except in a few schools (22%) who were involved in the projects on '*galaxies and black holes*', '*elementary particles*', '*Planet Vidya*', '*online gaming*', '*computer related competition*'etc.

The principals reported the benefits of using WBT in the classroom as '*virtual reality*' (28%) at the first rank, '*better understandability*' (18%) at the second rank, '*basic concepts become more clear to the students*' (22%) at the third rank, '*knowledge of diverse nature*' at the 4th rank and '*sharing of content over the Internet with other teachers and students*' at the 5th rank. However, at the 1st Rank, 25.01% teachers mentioned '*Better understandability*' while 22.12% teachers placed benefits of '*Virtual reality*' at this rank. At the 2nd rank, 26.45% teachers kept the benefit of '*Better understandability*'. At the 3rd rank, 22.23% teachers placed the benefit of '*Getting the knowledge of diverse nature from Internet*' while 14.50% reported '*students could be easily motivated*'. As many as 19.33% teachers mentioned '*Sharing of content*' at the 4th rank while 14.01% teachers considered '*Group discussion over wider area*' at this rank. At the 5thrank, 18.13% teachers chose '*Sharing of content*' while 14.21% teachers placed '*Effective feedback*' as the benefit of use of WBT at this rank. Though, there was a great difference in ranking of the benefits of WBT as given by the teachers and principals, but they were unanimous that there were many benefits of use of WBT in class room setting.

Attitude of people relating to a particular technology plays an important role in spreading of the technology. In the present study efforts were made to know the mindset of students and teachers towards to use of WBT in classroom. It was revealed that majority of teachers (69.80%) agreed that use of WBT makes the students understand a topic better. A positive impact of WBT on students was noticed by the teachers (93.33% Physics, 100% Chemistry, 97.92% Biology and 94.87% Math teachers) who reported an improvement in receptivity and motivation of the students with use of WBT. They also reported a positive attitude of students towards use of WBT for pedagogical purposes. Majority of teachers agreed that now-a-days Internet is

considered essential for classroom teaching. In the present study, the principals reported that their teachers had a positive attitude towards use of WBT in the classroom. They also visualised a change in the role of teachers in the new environment involving WBT for classroom teaching.

Most of the principals (80%) did not have any incentive policy in the schools. A very few principals (20%) reported that they used to give some kind of incentive to their teachers like issuing appreciation letters and merit certificates, making computer lab/Internet more accessible and giving free computer to such teachers in schools. The practice of giving incentive could act as a motivating factor for teachers and it could definitely enhance the use of different components of Web for teaching.

The Science teachers in general reported that their students had Internet connection at home. Other students who did not have Internet connection at home, arranged to work from other sources e.g. *school computer laboratory, father's office, friends' houses* or *copy the material from other students*. Like teachers, principals also gave more or less similar options for the students who did not have Internet connection at home in case Web-Based home assignments were given to them. In certain cases, teachers used to circulate the material to the students. However, some Math teachers (1.23%) reported that such students were not able to complete their home assignments. It was also reported by the majority of the principals (86%) that parents had a '*positive*' view and supported the idea of issuing Internet based home assignments. However, they were of the opinion that providing the Internet facility is the responsibility of the school and students should be allowed to complete their assignments in school itself.

Barriers in effective implementation of WBT in classroom as identified by the teachers and principals were '*limited bandwidth and slower Internet connection*', '*lack of computers with Internet connection*', '*poor audio/video components*', '*pressure of curriculum on teachers*', '*lack of teacher motivation*', '*lack of student motivation*', '*lack of technical expertise*' and '*insufficient allocation of school budget on IT*'.

Key Issues in effective implementation of WBT in classroom as suggested by teachers and principals were '*active participation of teachers in implementing WBT*', '*advocating and propagating WBT at appropriate platforms*', '*selecting appropriate WBT components*', '*promoting interaction through WBT in teachers and students*', '*enriching student experiences through the use of WBT*', '*development of online mechanism of student evaluation*' and '*encouraging utilization of free resources available on the Internet*'.

In addition to the above barriers and issues in successful implementation of WBT for teaching in classroom, the teachers mentioned some of the other problems which they might be facing in the use of WBT in their day-to-day class teaching. The problem of *not getting the desired information quickly* and *long downloading time* distracted attention of the teachers substantially. *Regular power cuts* also were pointed out by the teachers. *Large class size, obsolete technology, not finding specific answers, lack of knowledge of good sites and no integration of WBT with class curriculum* were other

hindrances for teachers in effective implementation of WBT in classroom situation. Interestingly, there was a separate group of teachers who reported that they did not face any problem since they had *round-the-clock Internet connectivity, technical expertise* and *sufficient number of latest computers with required accessories* etc. However, the principals specifically reported stereotyped mind set of teachers since they preferred 'talk and chalk' method and lack of proper integration of WBT in class curriculum as the problems being faced in implementing WBT in schools for pedagogical purposes.

Majority of principals reported a pressure on schools to enhance Internet facilities in their schools and different steps were being taken by them in this direction like upgradation of technology through acquisition of latest equipment in the computer labs and provision of 24 hour cable Internet in the schools.

Regarding the means of effective use of WBT, the teachers were unanimous on '*designing interactive exercises based on student performance'*, '*informing the students about various instructional strategies'*, '*creating activities for collaborative problem solving'* and '*using different approaches of instruction using WBT'*. Chemistry, Biology and Math teachers were unanimous in mentioning '*using different approaches of instruction with WBT,* while Physics teachers suggested '*designing interactive exercises based on the student performance'* for effective use of WBT in the classroom.

The teachers were asked to suggest a new Web-Based Instructional Model for teaching Science. It was reported that an animation and voice-based interactive Web-Based Instructional Model would be ideal for teaching Science. Virtual experiments should be conducted on the Web and extensive practical oriented examples, simulation of experiments, interactive tests and scientific presentation should be used through Web. The exclusive Internet laboratories should be established in schools where extensive use of Web resources could be made. Some topics of the curriculum could be made totally Web-based with ideal integration of WBT in class curriculum thereby making WBT compulsory for teaching and learning. Self-assessment modules could be developed for evaluation where students could grade themselves based on their responses.

In order to improve the use of Internet in teaching of Science, the Internet should be made available in each classroom. Government can think of announcing special and cheaper packages for schools and students. Curriculum workload on teachers should be reduced substantially and WBT should be integrated with the curriculum as a compulsory component so that student and teacher participation on the Internet increases. Web-based lessons covering the curriculum should be prepared where performance of the students could be evaluated online through assignments, quizzes and feedback mechanisms. Proper training of teachers and students for use of different Web-based components/ tools should be organized regularly and they should be encouraged to use Internet. In order to take full advantage of WBT in a class, student-teacher ratio should be reduced to 20:1.

Inter-School forum should be formed for collaboration among students and teachers of different schools on different aspects of WBT. A directory of different Web-based

educational resources should be prepared and made available to all the class teachers so that they could easily locate the desired information on the Internet thereby avoiding wastage of their valuable time in searching the same. The schools should share their Web resources with other schools to increase the option and minimize the duplication of efforts and expenditure. A substantial share of school budget should be dedicated to IT so that upgradation of technology becomes a regular feature in schools. Web-based projects should be conducted in order to enable the students and teachers to get more exposure. WBT should be introduced in schools in close collaboration and coordination with other interested schools and they should launch their own websites and teachers should be encouraged to develop their own material and post the same on the Web.

The teachers reported their perception regarding the future of WBT in teaching and learning Science. Majority of teachers mentioned that the future of WBT for Science teaching would be very bright. Some other teachers explained that the future of WBT in Science teaching would be bright if adequate IT infrastructure is provided in the schools, proper training is imparted to teachers, and students are able to afford this technology at home. Quite a few teachers were apprehensive about the future of WBT since pressure of curriculum on teachers prevented them to extensively use Internet in the present situation. The required technical expertise is also not available. At the same time, technology is so costly that every student cannot afford it at home which is a must to give the students a free hand on this technology.

DELIMITATIONS

Due to time and financial constraint, the study was delimited as under:

The study was confined to South and West Zones of Delhi only.

The study was limited to private Secondary and Senior Secondary Schools only.

The study was restricted to Science subjects i.e. Physics, Chemistry, Biology and Mathematics of 9th to 12 classes only.

SUGGESTIONS FOR FURTHER RESEARCH

Since there was no specific study in the Indian setting on pedagogical use of WBT, the present work was undertaken as an exploratory study, though it was delimited to teaching of secondary and senior secondary Science subjects only. The findings have revealed that WBT is being used in private schools for many pedagogical activities though its full potential is yet to be exploited. While infrastructure is already available and teachers are using the same, it is high time to experiment the use of WBT at different class levels. Learner characteristics and personality variables could be investigated. Studies could be carried out on different learning styles of students when taught through WBT. The application of WBT to other areas of humanities and social sciences also make good cases to be investigated. Such studies could also be conducted not only at regional levels but also at national level on teaching and learning at the same

time in government, aided and private schools. Specific studies could be conducted on utilization and effectiveness of each of the WBT components. Such studies would pave the way for variegated use of WBT with its utmost potential.