# IMPACT OF SMART CLASSROOM ON IMPROVING TEACHING LEARNING PROCESSES AT SECONDARY LEVEL IN WEST BENGAL

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# PREFACE

The Information and Communication Technology (ICT) has been used in different activities of daily life because of its speed and efficiency. ICT can also contribute for the quality improvement of education at all levels. Realizing the potentialities of ICT, Government of India and different state Governments have taken lot of initiatives for using it in the teaching learning processes. One such initiative is equipping schools with Smart Classroom. Smart class is a digital initiative, which is rapidly changing the approach and methodology that teachers use to teach and students learn in an innovative manner using Technology. It has revolutionized and brought a complete transformation in the traditional rote methods of learning. The system understands the student's requirement and provides innovative learning solutions using digital instruction material, through the use of projectors, whiteboards, and computers making the learning process engaging for the students and simpler for the teachers. The Government of West Bengal has implemented the Smart Classroom project in selected secondary schools. These schools are equipped with computers, projectors and other devices and applications for teaching learning. In this backdrop, this research study was undertaken to examine the availability and condition of digital devices and its use by teachers and students for teaching learning.

This report consists of four chapters. The chapter-I gives theoretical background of ICT in education, concept of smart classroom, initiatives taken by the Government for use of ICT in education and research base of ICT in education. The chapter-II explains methodology such as need of the project, objectives, method, sample, tools, and process of data collection and analysis. The chapter-III presents detailed data analysis in tabular form followed by qualitative descriptions. The chapter-IV gives major findings and educational implications of the study.

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# EXECUTIVE SUMMARY

*The modern trends and paradigms in education are moving forth in a path embracing technology and using technology regularly in classroom. The Government of India has a mission to devise, catalyst, support and sustains ICT and ICT enabled activities and processes in order to improve access, quality and efficiency in the school system. ICT@school is such a great initiative taken by Govt. of India to provide opportunities to secondary stage students with a purpose to build their capacity on ICT skills and make them learn through computer aided learning process. Government in West Bengal in 2007-08 has taken up the initiative or the implementation of computer education in schools. 'KYAN' (Vehicle of Knowledge) was launched with an objective to introduce computer based learning system in schools. Till date no comprehensive research study is available on impact of smart classroom on students learning in West Bengal. Hence, it is relevant to study the impact of Smart classroom on improving teaching learning processes at secondary level in West Bengal.*

*The main objective of the project is to; study the availability and condition of equipments and software in smart classroom, examine the process of use of smart classroom by teachers and find out the impact of smart classroom in terms of students learning in school subjects. Survey method was adopted with the sample of 25 schools, 25 HMs, 73 teachers and 175 students. These samples were selected from two administrative divisions of Bengal i.e. Burdwan and Jalpaiguri. Further three districts from these two divisions were selected i.e. Hooghly, Darjeeling (Siliguri Educational District) and Jalpaiguri. The data was collected by using self developed checklist, observation schedule, focus group discussion and a proforma for collecting the achievement of students in 10$^{th}$ Board examination.*

*The study found that i) all schools have desktops and 88% of schools do not have laptops ii) all schools have projectors and 66% of schools do not have wireless microphone iii) 84% of schools have scanner and 72% of schools have modem. 88% schools have UPS, printer and multimedia pen iv) 50% of teachers*

*in Science, Mathematics, Social Science and English are not trained for taking classes in Smart classroom. v) 88% of schools do not use Smart classroom everyday for teaching Science, Mathematics and English. 68% of schools never use Smart classroom for teaching Social science. vi) 75% of teachers write important points on the screen but 43% of teachers do not draw and label the relevant diagram on the screen. vii) Around 43% of teachers do not use internet to search topic related materials. viii) 83% of teachers do not assign learners to make PowerPoint presentation on the topic and 79% of teachers do not use different software for assessment of the lesson taught in the Smart classroom. viii) All schools have KYAN projector, multimedia pen and mouse but do not have interactive board. ix) The students feel enthusiastic and energetic to learn in Smart classroom. x) Majority of teachers schedule Smart classes according to their convenience for Science, Mathematics and English. xi) Around 40% of teachers do not pause the videos and help students to do hands-on activities. xii) Speed of the Mathematics lecture in the KYAN projector is very fast which creates a hindrance in understanding the content. xiii) the percentage of AA, A+ and A grade has decreased in the year 2018 whereas an increase in the percentage of B+, B and C grade is observed in the year 2018. xiv) the effect of smart classroom on student's achievement in class X board examination is not visible as the smart classroom project has been implemented in the schools in 2017.*

*The study has suggested following educational implications for effective use of Smart classrooms at secondary level in West Bengal; i) The HM along with other teachers should regularly check the conditions of digital devices and take necessary actions. Government of West Bengal may take initiative to provide materials like interactive board, microphone to all schools and ensure thoroughly that all these materials are used by the teachers in the teaching learning process. ii) The school authority should take necessary actions to set the projectors they received in two separate rooms for imparting lessons regularly with the help of available technology. iii) The Government may provide all schools some digital screen for teachers to write, draw and display*

*digital contents to students. This screen will protect the multimedia pen from getting damaged. iv) The HM of the schools should specify the Smart classroom periods in the timetable so that all classes get equal opportunity and all subjects could be taught everyday or at least thrice in a week with the help of technology. v) Government of West Bengal may take initiative to recruit full time computer teachers for training, teaching and maintaining the Smart classroom. vi) The school authority may include some educational CD/DVD in their library so that important educational contents could be shared in the Smart classroom. Other than the content available in KYAN projector subject specific software should be used in the Smart classroom. vii) The lesson in Smart classroom needs to be delivered in a way in which the teacher uses the available digital devices and create a gap between traditional methods and modern digitized technology so that utmost learning outcomes could be generated. viii) Initiatives may be taken by SCERT to organize programmes for capacity building of graduate teachers for integrating ICT in education. ix) Special and immediate measures should be taken to install or provide some e-content or e-resources for teaching Social Science, Hindi and Nepali. Moreover, all e-content needs to be translated in English for English medium schools and other vernaculars like for Hindi medium and Nepali medium schools in West Bengal. x) Teachers and HMs must be familiar with the initiatives taken by NCERT and MHRD for the use of ICT in school education such as e-pathshala, NROER and SWAYAM.*

*It is high time to orient teachers and HMs of all secondary schools on use of ICT and digital pedagogy. The vision and mission of digital education could only then be accomplished in this digital era.*

## CHAPTER-I
## INTRODUCTION

### 1.1. Conceptualisation of Information and Communication Technology in Education

Information and Communication Technology with its immense potentiality has made possible to step forward in this digital era. Any information becomes powerful when it is communicated through technology. Technology is very important in today's world because it serves a variety of purpose in the most important aspects of society like communication, education, scientific progress, healthcare and business. The technological changes have generated a modern global economy that is hopped-up by technology, charged and nourished by information and driven by knowledge. New technological advances make our daily life and work easy and simple. The emanation of this new global economy has serious implications on the education system. Countries, all over the world have identified the role and importance of Information and Communication Technology (ICT) in educational institutions as a universal tool for imparting education.

In common parlance, ICT has been defined as "the forms of technology that are used to create, transmit, process, store, display, share or exchange information by electronic means" (UNESCO, 2010). According to British Computer Society, ICT connotes "the scientific, technological and engineering disciplines and the management techniques used in information handling, processing and disseminating; their applications; computers, networking and communication and their integration with men and machines; and associated social, economic and cultural matter". It is a field of study that " includes technologies such as desktop and laptop computers, software, peripherals, and connections to the Internet that are intended to fulfill information processing and communications functions" (Statistics Canada, 2008).

ICT has brought forth a revolutionary change which has made possible to communicate with the distance places ignoring the barriers. The concept of traditional library to "Storehouse of books to an intellectual information centre"

has been revolutionized with the global access of e-documents or information crossing the geographical limitations (www.lisbdnet.com). ICT acts as a major tool for building knowledge society.

ICT in education refers to systematic application of different technological tools and devices in the field of admission, teaching learning, assessment, management etc. ICT can be divided into two main approaches in education such as; ICT for education and ICT in education. ICT for education implies the development of information and communication technology for learning and teaching purposes. On the other hand, ICT in education involves the adoption of general components of information and communication technology in practical use in teaching and learning processes.

An eLearning Action Plan was developed by the European Commission for promoting the use of ICT in learning processes that aims "to improve the quality of learning by facilitating access to resources and services as well as remote exchange and collaboration" (Commission of the European Communities, 2001).Thus ICT in education is computer-based, interactive, digitized for facilitating communication between the students and the teachers and students and peer groups. ICT can either be synchronous or asynchronous. Thus the constraint of time for learning is negated with the advent of ICT in asynchronous way of communication. In majority schools where Smart classrooms has been launched follows the synchronous way of communication.

ICT in schools is an important component of the RMSA. It was launched in December, 2004 and revised in 2010 to provide opportunities to secondary level students for capacity building on ICT skills and make them learn through computer aided learning process. The ICT scheme was envisioned to bridge the gap or digital divide amongst students of socio-economic and geographical barriers. ICT in education is, therefore, an integration of hardware and software technology for processing information.

In teaching learning process, use of ICT has become imperative to improve the efficiency and effectiveness at all levels of school education. The development of ICT in the form of mobile devices such as, laptop, electronic pads and smart phone together with the development of interactive Web 2.0 and cloud applications, can enhance both teaching and learning. It is considered as one of the pillars upon which quality education for all can indeed become a reality, because of its unique capacity to bring the world together, even the most remote and disadvantaged communities.

ICT can be used to provide digital materials and web facilities for experimentation and exploration of the content knowledge, provide quick access to difficult topics in a learner centered education system, facilitate communication for pupils with special needs, use the online resources like, email, chat, discussion forum to support collaborative writing and sharing of information, facilitate video-conferencing or other form of tele conferencing to involve wide range of students from distant geographic areas, provide Blended learning by combining conventional classroom learning with e-learning systems, help students to develop various intellectual skills i.e. reasoning and problem solving, learning how to learn, help students to develop broader co-operation among individuals within and beyond school in a technology enabled system, help teachers to gain information on new instructional resources required in teaching through ICT, interact more with the pupils and guide positively, rather than transferring information from teacher to student, create a learning environment which is free from any fear, trauma and anxiety and helps to transform learning from being only text oriented process to a continuous research than a body of facts.

Different ICT tools are used to generate maximum benefit in the teaching learning processes in school education. ICT tools are digital infrastructures such as: Desktop/Laptop, Smart phones, Printer, Scanner, Speakers, Microphone Projector, Interactive whiteboard/ Smart board and Modem used for teaching learning. Some other specific tools that can be used in education are audio editing, animation, screen casting, quiz generators, video editing and graphic tools.

**1.2. Initiatives for Use of ICT in Teaching and Learning**

In the post Independence period the spirit of nationalism as well as global impact and desire for national progress steered the Government to form different committees to review the contemporary education system in the country at different points of time.

During 1971, the Government of India in the Ministry of Education and Social Welfare realized the importance of Educational Technology (ET) for qualitative improvement of education and included the ET Project in the fifth five year plan. The project aims for setting up of an Educational Technology Unit in the Ministry of Education and Social Welfare, establishing a centre for Educational Technology in the NCERT, assisting states in setting up Educational Technology Cell on 100% basis and strengthening a few educational institutions for undertaking ET programmes. Accordingly, steps were taken to implement various schemes at the states and national levels.

In 1975, ET cells were set up in 6 States of Andhra Pradesh, Bihar, Karnataka, M.P, Odisha and Rajasthan, and started functioning with local AIR and Doordarshan stations for production of suitable programmes on radio and TV, production of educational films for all stages of education and organization of training courses for better scriptwriting and effective utilization of these programmes.

The 1986 National Policy on Education has observed, "Educational Technology will be employed in the spread of useful information, the training and retraining of teachers, to improve the quality, sharpen awareness of art and culture, and inculcate abiding values etc., both in the formal and non-formal sections." During eighties, computers were introduced in the secondary schools under Computer Literacy and Studies in Schools (CLASS) project paving the way more comprehensive centrally scheme- ICT@ Schools in 2004. This policy emphasizes on using ICT to visualize mathematics and to achieve it. It proposed that the methods used in teaching mathematics need to be reinvented by enabling ICT

based teaching and learning. Although the initial coverage was modest with 2,598 schools, it has generated increasing awareness of computer literacy among the students, teachers and parents.

The Government of India (GoI) envisions that the ICT Policy in school Education aims to prepare youth to participate creatively in the establishment, sustenance and growth of a knowledge society leading to all round socio-economic development of the nation and global competitiveness. The GoI have a mission to devise, catalyst, support and sustain ICT and ICT enabled activities and processes in order to improve access, quality and efficiency in the school system. The GoI has ascertained certain policy goals in order to achieve the above mentioned visions and missions. The ICT Policy in School Education will endeavor to: (i) Create an environment to develop a community knowledgeable about ICT, ICT literate communities which can deploy, utilize, benefit from ICT and contribute to nation building and an environment of collaboration, cooperation and sharing is required for optimal utilization on the potentials of ICT in education. (ii) Promote-equitable, universal, open and free access to a state of the art ICT and ICT enabled tools and resources to all students and teachers, development of quality content and to enable students and teachers to partner in the development and use of digital resources, development of regular orientation for teachers, resource persons and support resource sharing, upgradation and continuing education for teachers, administrators, utilization of the potentials of ICT in school education specifically through research, evaluation and experimentation and a critical understanding of ICT, its advantages, dangers and limitations. (iii) Motivate and Enable- wider participation of all sections of society in order to strengthen the school education process through the appropriate utilization of ICT.

The GoI has initiated initiatives like ICT@school, which have been subsumed in the Rashtriya Madhyamik Shiksha Abhiyan (RMSA). The ICT in Schools was launched in December, 2004 and revised in 2010 to provide opportunities to secondary stage students to mainly build their capacity on ICT skills and make them learn through the computer aided learning process. The

Scheme is really a major catalyst for social transformation and developing quality education across the country.

NCERT-CIET has taken a great initiative to bring together all the digital and digitisable resources across all stages of teacher and school education in the National Repository of Open Educational Resources (NROER). Now, resources are available in all subject domains and in about 29 different languages including Tribal languages (Limboo, Lepcha, Bhutia from Sikkim, Kokborak from Tripura, Santhali and Khortha from Jharkhand, Methei from Manipur, AO and tenyidie from Nagaland, Garo and Khasi from Meghalaya, Galo from Arunachal). E-contents were developed and validated in the workshops organized for identification of themes, development of concept maps, meta data, transcription and translation, and the resources were uploaded on NROER.

ICT curriculum in education has been developed by CIET for teachers and students that revolve around the following six strands such as connecting with the world, connecting with each other, creating with ICT, interacting with ICT, possibilities in education, reaching out and bridging divides. This curriculum for teachers is designed to award a two year diploma in ICT in Education. The resources received from the constituents of NCERT were converted to web resources and uploaded on day to day basis on the website: ncert.nic.in, ciet.nic.in, ictschools.gov.in, nroer.gov.in, ictcurriculum.gov.

ePathshala (epathshala.gov.in), a joint initiative of Ministry of Human Resource Development (MHRD), Govt. of India and National Council of Educational Research and Training (NCERT) has been launched in order to showcase the digital resources which includes textbooks, audio, video, periodicals, and a variety of other print and non print materials for all the stakeholders and ensures its access free at anytime and anywhere. This application addresses the dual challenge of reaching out to a diverse population and bridging the digital divide (geographical, socio-cultural and linguistic) offering comparable quality of e-contents. It was designed in such a way that students, teachers, educators and

parents can easily access e-books through multiple technology platforms such as smart phones and tablets and on web through laptops and desktops

Based on the three cardinal principles of education- access, equity and quality, the Govt. of India in the year 2017 has launched a MOOC (Massive Open Online Courses) platform called SWAYAM (Study Webs of Active Learning for Young Aspiring Minds). SWAYAM aims to bridge the digital gap for the students from unprivileged sections of the society who are not able to join the mainstream of the knowledge economy as they are untouched by the digital revolution. SWAYAM facilitates to take the best teaching learning materials to all and ensure lifelong learning.

## 1.3. Smart Classroom Project in West Bengal

Smart class is one of the unique and innovative discoveries of the 20th century. Smart was actually founded by David Martin in the year 1987 with the purpose to combine the smart interactive white board with the power of a computer. Smart class contains each subject content materials with a real teacher in virtual classroom, teaching chapters in an interesting way which makes studies as exciting as watching movies along with distinctive features like quiz, multiple choice questions series and mind map for revision purposes. The smart classroom and e-learning is a one stop resource for learners to get diverse ideas related to their interest and subject enquiries. Web-based multimedia e-learning environments has added new dimensions in designing course content as well as generating new dimensions in the teaching learning processes at school level.

In common parlance, a smart classroom is a traditional classroom with multi-technology and media systems installed. It emphasizes monitoring and coordinating features in infrastructure; the installed technologies are expected to make the classroom environment sensitive to meet the teaching learning needs. "Smart learning environment can be regarded as the technology supported learning environment that make adaptations and provide appropriate support (e.g., guidance, feedback, hints or tools) in the right places and at the right time based on

individual learner's needs, which might be determined via analyzing their learning behaviours, performance and the online real world. Digital pedagogy is a new way of working and learning with ICT to facilitate quality learning experiences for 21st century learners. Digital pedagogy moves the focus from ICT tools and skills, to a way of working in the digital world" (Wadhwani, 2016). As a new paradigm in education, Smart learning bases its foundation on smart tools and technological devices (Lim et.al., 2015). Smart classrooms are generally technologically and electronically enhanced classrooms in which teaching learning practices are manifested by the method of e-Learning. "e-Learning refers to the use of Internet technologies to deliver a broad array of solutions that enhance knowledge and performance. In smart classrooms potential opportunities are created for active cognitive and social participation (Hennessey, 2007). Smart class teaching is a step towards development where student's achievement is highlighted. (Menon, 2015, pp. 115-150).

At the Smart Learning Korea Forum (2010) the concept of Smart Learning was proposed as an effective, intelligent tailored-learning based on advanced IT infrastructure. MEST (The Korean Ministry of Education, Science and Technology) defined Smart Learning as Self-directed, Motivated, Adaptive, Resource-enriched, and Technology-embedded.

S: Self-Directed, which aims that the education system is progressing toward a self-learning system more than ever. It points out the transition of student's role from knowledge adopters to knowledge creators and the role of teacher as a facilitator of learning.

M: Motivated implies that education is now more experience oriented and aims at learning by doing and problem solving.

A: Adaptive implies the strengthening of the education system's flexibility and tailoring learning for individual preference and future careers.

R: Resource-enriched implies that smart learning expands the scope of learning resources to include collective intelligence and social learning.

T: Technology-embedded implies that there is no certain limitation of learning space called classroom as the learners can learn anywhere and at any time through the use of advanced technologies.

A smart classroom is a classroom that has an instructor equipped with computer and audio-visual equipment, allowing the instructor to teach using a wide variety of media which includes smart interactive white board, DVD's PPT's and more, all displayed through a projector. With the help of school curriculum, smart classes bring in technology right next to the blackboard for teachers in the classroom. This makes learning an enjoyable experience for the students while improving their overall academic performance in school.

The Smart Class has revolutionized and brought a complete transformation in the traditional rote learning methods. The system understands the student's requirement and provides innovative learning solutions using digital instructional material, through the use of projectors, whiteboards, and computers making the learning process engaging for the students and simpler for the teachers.

Smart class is a digital initiative, which is rapidly changing the approach and methodology that teachers use to teach and students learn in an innovative manner using Technology. Video based classes are more attractive to learners and learning becomes more effective. Web supported text book in a smart classroom helps the students to access more information which could solve the burning issue of the burden of bags. Smart classrooms motivates student learning.

Knowledge construction in a smart classroom is more scientific and specific. It encourages online socialization and information exchange. It gives enough space to develop both the online communication skills and technical skills of the learners. The nature of smart classroom is more flexible than the traditional classroom. Learning through audio-visual demonstration becomes interesting and meaningful.

Smart class in India was launched across a few selected geographical locations in the year 2004 by EDUCOMP which at initial stages was adopted by schools like, Takshila, DPS Pitampura in Delhi and Cambridge-chain of schools. In the following days it was adopted by 1000 schools across India that helped in moving technology into classrooms in India. (Corporate Diary, 2007). Presently majority of urban schools in India have provision of Smart Classrooms.

Government of West Bengal in 2007-08 has taken up the initiative for the implementation of computer education in schools. For this, the department of IT has funded to introduce computer based learning system titled 'KYAN' (Vehicle of knowledge) with a focused objective of bringing the benefits of ICT to the children from under privileged sections and from disadvantaged communities. The project was undertaken in 65 Govt. schools across two districts namely Bardhaman and Bankura of West Bengal covering 500 teachers and 40,000 students mostly from marginalized (SC/ST) sections of the society.

KYAN was developed in collaboration with the Indian Institute of Technology (IIT), Mumbai. KYAN is designed as a device that contains a computer with in-built projector, subject related content, speakers, and has a wireless keyboard mouse and multimedia pen.

In 2008-09, under the Central Scheme for universalizing of Secondary education, the RMSA, five states including West Bengal was selected for implementation of ICT in schools. 1400 schools in west Bengal were provided with equipments such as: 10 computers, 10 UPS, 1 scanner, 1 web camera, 1 projector and 1 printer at a cost of INR 0.9 billion.

Implementing KYAN projector in schools is a revolutionary step by the Government of West Bengal for shaping the dynamic future of digital literacy. The Govt. of West Bengal has issued the hardware equipments through ICT projects. In different phases each parts of a district is selected and the equipments were distributed. To elaborate the fact, the schools which have not received any equipment in any such scheme were identified and distributed KYAN projectors.

But some schools received equipments from all such schemes. Some schools of each blocks were selected and the equipments were distributed. One school from each block is selected as training centre and all kinds of training related to the general operation of the KYAN projector was imparted. In the recent scenario, most of the districts have received KYAN projectors and other equipments for imparting education in Smart classrooms. KYAN was one of the major initiatives that have been devised almost in all districts of West Bengal for enhancing quality education to the students.

## 1.4. Research Base of the Study

The investigator reviewed the related research studies on different aspects of the Smart classroom in the following pages:

**Kathuria (2018)** explored on ICT resources for education of Sensory Disabled Children in Inclusive set up. The study revealed that despite ICT tools have greater potential to foster and actualize inclusive practices in schools, their uses is still limited due to various reasons like lack of positive attitude, inadequate resources, lack of knowledge, time and institutional support.

**Kumar and Kumar (2017)** conducted a comparative study of computer-aided teaching and traditional teaching in science and mathematics subjects and found that computer-aided teaching has enabled the teacher to innovate instructional design by presenting the educational content in an interactive and multi-sensory manner rather than the traditional single media format. This infusion of computer aided teaching into teaching and learning has altered instructional strategies in educational institutions.

**Amin (2016)** studied the role of teachers in the digital era which has shifted from mere preacher to a mentor for student's learning and overall development as a balanced citizen and a motivator for both slow learner and fast learner in a digital environment. The study identifies the role of the teacher is to keep watch on the learner's utilization of optimum e-resources.

**Shenoy and Jha (2016)** explored the aspects of digitization of Indian Education process and revealed that the use of digital technology is usually more successful as a supplement rather than as a replacement for traditional teaching. The study proposed a hybrid model- a combination of physical presence of teacher and technology enabled online education as the most appropriate way for Indian students.

**Dhrakshayani (2015)** explored a comparative study of traditional and smart classrooms related to teaching strategies and the learning outcomes of grade 1 students in Govt. aided schools and international schools of Chandigarh. The results of the study seem to indicate that the instructional delivery method and the nature of instruction appear to make significant difference in student learning and eventually the performance. The study reported that smart class is a comprehensive solution designed to assist teachers in enhancing student's academic performance with simple, practical and meaningful use of technology.

**Kamruddin and Arafat (2014)** studies the impact of Smart Teacher Smart Class Portal in enhancing secondary school English teacher's English language teaching knowledge in Bangladesh. The findings of the study clearly displayed a significant improvement of the teacher's knowledge of effective teaching approaches for the classroom. The results revealed that this improvement was possible not only for the Smart Teacher Smart Class Portal but also for the setting up of other necessary devices and also due to training for the operation of the portal.

**Sharma and etal. (2014)** studied the role of e-learning in India and observed that Virtual Learning Environment integrates the full range of electronic enhancement into the classroom setting. The study identified that lack of course content is a major problem with e-learning in India.

**Anvekar and Rajeswaran (2014)** studied the e-learning factors that determine the effective knowledge delivery by teachers at secondary level in CBSE schools and found that 82% of teachers have been using Digital Classroom Solutions for less than 2 years and 96.8% of teachers have been using Digital Classroom Solutions

for less than 4 years which helped in overall learning as well as knowledge delivery to children as it enabled in better understanding of concepts, better attention in class and created an excitement about learning.

**Jena (2013)** conducted a study to examine the effect of smart classroom learning environment on academic achievement of rural high achievers and low achievers in Science in Jalandhar district of Punjab. The study found that smart class learning helped to develop cognitive dimension and reinforcement given to all students on every improvement. The result of the study reveals that smart classroom learning environment is better to teach both low achievers and high achievers than traditional class.

**Singh (2013)** studied the impact of digital e-learning in Indian perspective and observed that ICT integrated curriculum fosters an audio-visual mode of learning that automatically develops retentive memory of students. The study expressed the concern that technology must not lead to young students being deprived of life's essential learning experiences in a natural world as it contribute immensely to all-round development of the individual.

**Kalashankar and Prasad (2012)** studied an innovative future classroom with an intelligent autonomous system in an transdisciplinary approach identified that even in the present education scenario, many schools are not open to technologies which create the gap between the student and the world.

**Oommen (2012)** studied on teaching English as a global language in Smart classrooms with PowerPoint presentation. The study revealed that the lesson with PowerPoint was interesting holding the student's attention throughout the lesson and the students followed and understood the lesson with active class participation. The study concluded that PPT enhances the effectiveness of teacher presentations by highlighting keywords in the presentation and displaying pictures and diagrams and has also stressed that the goal of the teacher should be to create a PPT in order to communicate messages easily.

**Safdar (2011)** studied the effectiveness of teaching mathematics through ICT as compared to traditional method of teaching. The findings of the study in public schools was that it was least effective for students in the academic achievement for mathematics at secondary level due to non-availability of the technological facilities at school or at home or due to lack of knowledge/ interest in using the technology. It was found that in the private schools was that ICT was effective in the academic achievement of students in mathematics at secondary level because of available technological facilities both at school and at home.

**Eadie (2001)** studied the impact of ICT on schools in Australia. The study found that ICT develops various intellectual skills i.e. reasoning and problem solving, learning activities increases when students use ICT, ease of access to information sources develops the research spirit and teachers gain information on new instructional resources and a different outlook of assessment of learning outcomes.

The above research studies indicate that many researches has been done on ICT and its use in teaching learning across different levels of school education and teacher education. It also reveals that ICT tools foster attention, skills, creativity and quality of teaching learning. However, no comprehensive research study found in the area focusing on the impact of smart classroom on students learning in India and West Bengal.

## 1.5. Conclusion

In Chapter- 1, the investigator focused on the importance of ICT reflecting the uses of different ICT tools used in teaching learning process from the extensive viewpoint of the recommendations of different commissions and fostered on the ICT initiatives taken by Govt. of West Bengal. The investigator has also reviewed the related studies on the different aspects of integrating ICT in education and the importance of Smart classrooms along with the required equipments necessary for the teaching learning process for setting a base for the present study. The details of rationale, objectives and methods are presented in Chapter-II.

## CHAPTER-II
## METHODOLOGY

**2.0 Introduction**

This chapter deals with the methodology followed for undertaking the research project. The methodology has been decided as per the objectives and the nature of the study. The investigator has given a detailed account of the need of the project, objectives, scope of the project, method, sample, tools and process of data collection and techniques of data analysis in the following pages.

**2.1. Need of the Project**

The Information and Communication Technology (ICT) has been used in different activities of daily life because of its speed and efficiency. It can contribute for the improvement of education at all level. Realizing its potential, the Govt. has initiated initiatives like ICT@school, which have been subsumed in the Rashtriya Madhyamik Shiksha Abhiyan (RMSA). Now, ICT in Schools is a component of the RMSA. The ICT in Schools was launched in December, 2004 and revised in 2010 to provide opportunities to secondary stage students to mainly build their capacity on ICT skills and make them learn through computer aided learning process. The scheme is a major catalyst to bridge the digital divide amongst students of various socio economic and other geographical barriers. The schools has taken initiatives and made their classes as smart class.

A smart classroom is a classroom that has an instructor equipped with computer and audio-visual equipment, allowing the instructor to teach using a wide variety of media. These include smart interactive white board, DVD's, PPT's and more, all displayed through a projector. With the help of school curriculum, smart classes bring in technology right next to the blackboard for teachers in the classroom. This makes learning an enjoyable experience for the students while improving their overall academic performance in school.

The Smart Class has revolutionized and brought a complete transformation in the traditional rote methods of learning. The system understands the student's

requirement and provides innovative learning solutions using digital instructional material, through the use of projectors, whiteboards, computers making the learning process engaging for the students and simpler for the teachers. Smart class is a digital initiative, which is rapidly changing the approach and methodology that teachers use to teach and students learn in an innovative manner using Technology.

Use of Smart board makes the teaching easy for the teachers and learning the concept easy for the students. Students become more interactive and volunteering in the classes. In a smart classroom enabled schools, the classrooms are connected to what is known as the knowledge centre where all the digital contents are linked to the server. Teachers can access the lessons they want to teach during their teaching periods, they can use it to demonstrate; take learners through an audio-visual journey and above all help them to learn better.

Many researchers have been done to examine the effectiveness of smart classroom in improving quality of teaching learning. Some of them are discussed in following paragraphs.

Varghes (2017) reported that there is significant effect of Smart Class on academic achievement. Students learn well by using technology and doing hands-on activities. Interactive whiteboards promote active student engagement in the learning process and have been described as being one of the most revolutionary and powerful teaching techniques using technology. Ban (2016) revealed that smart classroom learning positively affects the performance of first grade students in Science. Chachra (2015) indicated that the teaching through smart classroom is more effective at all the three intelligence levels. Menon (2015) revealed that students achieved higher score when taught in smart classes as compared to conventional mode of instruction.

In West Bengal, computer education was introduced in 757 Schools and School Education Department has covered 543 schools under the Centrally Sponsored Scheme of Information  and Communication Technology in Schools benefitting 35,751 students with 286 full time teachers recruited through S.S.C in 2007-08. In 2008-09, the State Government is implementing ICT @ School

scheme for the secondary stage through West Bengal Board of Secondary Education and 1400 schools will be covered under ICT Scheme as approved by MHRD, GOI. Computer Technology is applied as Learning Aid for the learners at Upper Primary School Level. Under Computer Aided Learning (CAL) Programme, 610 schools have been provided computers with educational CDs and 1512 teachers have been oriented. Recently the government of West Bengal has equipped selected secondary schools with smart classroom across the state. It is natural to examine how Smart classroom enhances quality of teaching and learning. Hence this study is relevant.

## 2.2. Objectives

1. To study the availability and condition of equipments and software in smart classroom.
2. To examine the process of use of smart classroom by teachers and students.
3. To find out the impact of smart classroom teaching on students achievement.

## 2.3. Scope of the Project

This research project is limited to 25 secondary schools selected from three districts of West Bengal i.e. Hooghly, Darjeeling (Siliguri Educational District) and Jalpaiguri.

## 2.4. Method

The present study was conducted on the secondary schools of three districts of West Bengal in order to know the impact of Smart classroom on improving teaching learning processes at secondary level. The aim of the study is to find out the availability and conditions of equipments and software in smart classroom, the process of use of smart classroom by teachers and students and achievement of students. Considering the nature of the problem, the investigator used survey method of the study which is commonly used in educational research to study the existing condition or the phenomenon. This method was preferred because

information is readily obtainable from subjects in their natural environment, concerning their views on certain issues about the use of Smart classroom in the teaching learning process at secondary level in schools.

## 2.5. Sample

The sample for the study consists of 25 schools, 25 HMs, 73 Teachers, and 175 students from three districts of West Bengal. Initially three districts such as Hooghly, Darjeeling (Siliguri Educational district) and Jalpaiguri were selected randomly from total 23 districts of West Bengal. Further, all 25 HM, three teachers from each school (could not get response from two teachers) and seven students from each school selected as sample. The detail of schools involved in the study is presented in the table-2.1.

**Table-2.1: Distribution of Sample**

| Sl No. | Name of the Administrative Division | Name of the District | Name of Municipal Corporation/ Block | No. of Schools |
|--------|-------------------------------------|----------------------|--------------------------------------|----------------|
| 1 | Burdwan | Hooghly | Uttarpara Kotrang | 2 |
| | | | Tarakeshwar | 3 |
| | | | Jangipara | 3 |
| | | | Khanakul-I | 1 |
| | | | Pursurah | 1 |
| 2 | Jalpaiguri | Darjeeling (Siliguri Educational District) | Siliguri Municipal Corporation | 7 |
| | | | Matigara | 2 |
| | | | Phansidewa | 2 |
| | | Jalpaiguri | Jalpaiguri Municipality | 4 |
| Total | 2 | 3 | 9 | 25 |

The list of schools involved in the study is attached in the Appendix-A

**2.6. Tools**

The following self developed tools were used to collect data.

- Checklist for studying the availability and condition of equipments and softwares in Smart classroom
- Observation schedule on uses of Smart classroom by teacher and students
- Focus group discussion for students on uses of Smart classroom
- Proforma for achievement in class X board examination for school

**2.6.1. Checklist for Studying Availability of Equipments in Smart Classroom**

This checklist is intended to examine the availability of facilities/ equipments both hardware and software in Smart classroom and its utilization in teaching learning process. The checklist is developed by the investigator and later in the workshop it was modified on the basis of comments and suggestions of experts.

This tool consists of eight components and each component has many indicators. The first component in the checklist contains 11 items or sub components and is designed in such order which will help to collect the data regarding the availability of equipments, the number of items available, the number of items functional, number of items funded by Smart scheme/ School/ others.

The second component deals with the conditions of the digital devices and consists of 11 items. The third component deals with the ICT training of the teachers available in school in different subject. The fourth component deals with the frequency of the teachers using Smart classroom in school which significantly shows the parameters like every day, weekly once, weekly twice, occasionally and never respective of subjects. The fifth component deals with the availability of Computer teacher/ technical assistant with the 7 items.

The sixth component deals with the nature of the Smart classroom and consists of 3 items or sub-component which deals with the size of the Smart classroom, accommodation space and number of Smart classroom in a school. The seventh component deals with the availability of subject specific software for teaching

which also contains 4 items. The eighth component deals with the availability of educational software and applications which deals with 13 items or sub-components.

The validity of the checklist for studying the availability and conditions of equipments and other related issues of teaching and learning were ensured by taking experts comments and suggestions during the workshop.

This tool is used for collecting data of the availability and conditions of the equipments in schools, ICT training of teachers, size and number of Smart classes available in a school, number of periods devoted for smart classroom and the availability of software for teaching learning process in all schools. This tool can be further administered for the purpose of research in ICT in education. The checklist is attached in Appendix-B.

**Table-2-2: Details of the Checklist**

| Sl. No. | Aspects | No. of Items |
|---------|---------|--------------|
| 1 | Availability of Digital Devices | 11 |
| 2 | Conditions of the Digital Devices | 11 |
| 3 | ICT Training of Teachers | 4 |
| 4 | Use of Smart classroom in School by Teachers | 4 |
| 5 | Availability of Trained Teachers/ Computer Teacher | 7 |
| 6 | Nature of the Smart classroom | 3 |
| 7 | Availability of Subject Specific Software for Teaching | 4 |
| 8 | Availability of Educational Software and Applications | 13 |
| | Total | 57 |

### 2.6.2 Observation Schedule for Observing Smart Classroom

The main aim of this tool is to study the teaching learning process followed in Smart classroom by the teachers at secondary level. The tool consists of 50 statements based on teaching learning behavior and activities followed by three

point scales such as Frequently, Occasionally and Never. The tool is based on the three major aspects of teaching in Smart classroom such as Introduction, Presentation, and Assessment and Feedback. The details of each aspect are discussed in following paragraphs.

**Introduction:** In this aspect, the points such as organization of warm up activity by using technology, projection of photograph/ audio/ video related to the topic, engagement of students to create interest, assessment of previous knowledge and declaration of the topic using projector for introducing the topic in Smart classroom.

**Presentation:** In this aspect, the statements focused on the classroom observation on the uses of Smart classroom by the teachers based on the ways by which the teachers shows videos, plays the audio content, pauses the audio- visual content, explains the audio-visual content, involves students in the learning process, use available equipments in the Smart classroom by the teachers, use subject specific software by the teachers in the Smart classroom, clarify of the doubts of the learners, provide any printed material to the students, highlight the main points on the digital screen to summarize at the end of the lesson.

**Assessment and Feedback:** In this third aspect, the main focus on classroom observation is to assess learners understanding throughout the class such as, the teachers ask questions using technology, assign to make Power Point presentation on the topic, create scope for self evaluation of students by using technology, use different technology to give feedback to the students, give online home assignments to the students.

The validity of the observation schedule for examining the process of use of Smart classroom by teachers and students were ensured by taking comments from experts during the workshop. The observation schedule is attached in Appendix-C.

**Table-2.3: Details of the Observation Schedule**

| Sl. No. | Aspects | No. of Items |
|---------|---------|--------------|
| 1 | Introduction | 5 |
| 2 | Presentation | 36 |
| 3 | Assessment and Feedback | 9 |
| | Total | 50 |

### 2.6.3. Focus Group Discussion for the Students

This tool is developed in the workshop by the investigator along with the help of other experts. The tool is developed in order to elicit responses from the students about the functioning of the Smart classroom. Total 10 questions are prepared focusing on several issues related to the equipments used in the Smart classroom, use of those equipments in the Smart classroom, understanding of the topic taught in the Smart classroom, response of the questions asked in the Smart classroom, the difference between Smart classroom and traditional classroom, scope of participation in the Smart classroom, advantages of Smart classroom, problems and issues of Smart classroom, assessment in the Smart classroom, Feedback in the Smart classroom, ways to improve learning in the Smart classroom for discussion with the students. The list of questions is attached in Appendix-D.

### 2.6.4. Format for Students Achievement in Class-X Board Examination

This tool is developed with an intention to collect information about the achievement of the students in Class X board examination in the year 2017 and 2018. The components included in the tool are; total number of students appeared, total number of students passed, total number of students failed. The sub components are such as number of students in AA, number of students in A+, number of students in A, number of students in B+, number of students in B, number of students in C and number of students in D. This tool is attached in Appendix-E.

## 2.7. Data Collection

The investigator and the Junior Project Fellow (JPF) personally visited all twenty five schools of West Bengal. These schools were located in three districts namely Hooghly, Darjeeling (Siliguri Educational District) and Jalpaiguri. During the data collection the JPF confronted some difficulties in the rural areas of Hooghly district. The JPF met all the DIs, HMs/ Teacher-in Charge, teachers and students and collected data with their cooperation and support. It was a great pleasure and a unique experience for the JPF to observe the teaching learning process in the Smart classroom. Data was collected from different schools during September to December 2018.

## 2.8. Techniques of Data Analysis

After the data collection from the field, the Investigator prepared the code for the entire tools for the purpose of entry of data into computer (Excel) for analysis. Accordingly, all data sheets were entered into Excel and calculations were made as per the requirements. The Investigator and the JPF calculated frequency, percentage, average for analysis and interpretations. The SPSS 20 was also used for calculation of the data. On the basis of the analysis, interpretations were drawn.

## 2.9. Conclusion

The present chapter has given detailed account of method, sample, tools, procedure of data collection and analysis. The collected data were entered in MS Excel and analyzed and calculated in SPSS-20 as per the objectives of the study. The detailed analysis and interpretation is presented in the chapter-III.

## 3.0. Introduction

This chapter deals with analysis and interpretation of data. The collected data are analyzed as per the objectives of the study. The investigator used frequency, percentage, average and qualitative descriptions and accordingly interpretations are made. The detailed data analysis is presented in following pages.

3.1. **Availability and Conditions of Equipments and Software in Smart Classroom**

The first objective is to study the availability and condition of equipments and software in smart classroom. For this the Investigator has collected data from schools by using checklist, which is presented in terms of frequency, percentage and average in following tables.

**Table-3.1: Availability of Digital Devices**

| Sl. No. | Digital Devices | Availability (F &%) | Funded by Smart Scheme (Average) | Funded by School (Average) | Funded by others (Average) |
|---|---|---|---|---|---|
| 1. | Desktop | 25 (100%) | 7.16 | 5.52 | 1.4 |
| 2. | Laptop | 3(12%) | | 0.12 | |
| 3. | Interactive whiteboard | 0 | | | |
| 4. | Scanner | 21(84%) | 0.16 | 0.8 | 0.12 |
| 5. | Printer | 23(88%) | 0.28 | 1.12 | 0.08 |
| 6. | Projector | 25(100%) | 1.84 | 0.12 | 0.24 |
| 7. | Speakers | 20(80%) | 1 | 1.24 | |
| 8. | Wireless Microphone | 11(44%) | 0.04 | 0.56 | |
| 9. | Modem | 18(72%) | 0.12 | 0.44 | 0.04 |
| 10. | UPS | 22(88%) | 3.2 | 4.68 | 1.48 |
| 11. | Multimedia Pen | 22(88%) | 1.64 | | |

The table 3.1 reveals the availability of digital devices. It indicates that all schools have desktops and in average 7.16, 5.52 and 1.4 desktops are funded by Smart Scheme, school and other organization respectively. Only 12% of schools have laptops which are funded by the school. No school has interactive boards which is an important and essential component in the Smart classroom. 84% of schools have scanner, 88% schools have printer, 100% of schools have projector, 80% of schools have speakers, 44% of schools have wireless microphone, 72% of schools have modem, 88% of schools have UPS and 88% schools have multimedia pens.

It can be said that majority of schools have desktop, scanner, printer, projector, speakers, modem and multimedia pens. On the other hand interactive white board is not available in all schools and only 12% of schools have laptops.

**Table-3.2: Condition of the Digital Devices**

| Sl. No. | Digital Devices | Average of No. of Items | No. of Items in Good Condition (Average) | No. of Items in Manageable Condition (Average) | No. of Items in Poor Condition (Average) |
|---|---|---|---|---|---|
| 1. | Desktop | 14.08 | 10.56 | 1.28 | 2.24 |
| 2. | Laptop | 0.12 | 0.12 | | |
| 3. | Interactive whiteboard | 0 | | | |
| 4. | Scanner | 1.08 | 0.96 | 0.04 | 0.08 |
| 5. | Printer | 1.52 | 1.28 | 0.08 | 0.12 |
| 6. | Projector | 2.2 | 1.92 | 0.12 | 0.16 |
| 7. | Speakers | 2.24 | 2 | 0.12 | 0.12 |
| 8. | Wireless Microphone | 0.6 | 0.56 | 0.04 | |
| 9. | Modem | 0.56 | 0.56 | | |
| 10. | UPS | 9.32 | 6.88 | 1 | 1.44 |
| 11. | Multimedia Pen | 1.6 | 1.56 | 0.04 | |

The table 3.2 reveals that the mean of available desktop in school is 14.08, out of which the mean of the desktops in good, manageable and poor condition is 10.56, 1.28 and 2.24 respectively. The mean of available laptop is 0.12 and the

mean of laptops in good condition is 0.12. The mean of available scanner is 1.08 and the mean of scanner in good, manageable and poor condition is 0.96, 0.04 and 0.08 respectively. The mean of available printer is 1.52 and the mean of printer in good, manageable and poor condition is 1.28, 0.08 and 0.12 respectively. The mean of available projector is 2.2 and the mean of projector in good, manageable and poor condition is 1.92, 0.12 and 0.16 respectively. The mean of available speaker is 2.24 and the mean of speakers in good manageable and poor condition is 2, 0.12 and 0.12 respectively. The mean of available wireless microphone is 0.6 and the mean of wireless microphone in good and manageable condition is 0.56 and 0.04 respectively. The mean of available modem is 0.56 and the mean of modem in good condition is 0.56. The mean of available UPS is 9.32 and the mean of UPS in good, manageable and poor condition is 6.88, 1 and 1.44 respectively. The mean of available multimedia pen is 1.6 and the mean of multimedia pen in good and manageable condition is 1.56 and 0.04 respectively.

It can be said that more than 50% of the equipments available are in good condition in all schools.

**Table-3.3: ICT Training of Teachers**

| Sl. No. | Subject | Average Number of Teachers in the Subject | Average Number of teachers Trained in ICT |
|---------|---------|-------------------------------------------|-------------------------------------------|
| 1. | Science | 6.12 | 3.2 |
| 2. | Mathematics | 2.08 | 1.4 |
| 3. | Social Science | 4.4 | 2.12 |
| 4. | English | 3.4 | 1.8 |

The table 3.3 indicates the ICT training of the teachers and it reveals that the mean of teachers in Science in a school is 6.12, in Mathematics is 2.08, in Social Science is 4.4 and in English is 3.4. The table further reveals that the mean of the teachers trained in ICT in a school in Science is 3.2, in Mathematics is 1.4, in Social Science are 2.12 and in English is 1.8.

 It can be said that only 50% of teacher teaching different subjects are trained in ICT or using smart classroom in teaching learning.

**Table-3.4: Use of Smart Classroom by Teachers**

| Sl. No. | Subject | Every day | Weekly Once | Weekly Twice | Occasionally | Never |
|---------|---------|-----------|-------------|--------------|--------------|-------|
| 1. | Science | 12 | 32 | 36 | 20 | 0 |
| 2. | Mathematics | 12 | 32 | 36 | 16 | 4 |
| 3. | Social Science | 8 | 32 | 8 | 20 | 32 |
| 4. | English | 12 | 36 | 28 | 20 | 4 |

The table 3.4 reveals that the percentage of schools in which teachers use Smart classroom for teaching Science every day, weekly once, weekly twice and occasionally is 12%, 32%, 36%, 20% respectively. The percentage of schools in which teachers uses Smart classroom for teaching Mathematics every day, weekly once, weekly twice, occasionally and never is 12%, 32%, 36%, 16% and 4% respectively. The percentage of schools in which teachers uses Smart classroom for teaching Social Science every day, weekly once, weekly twice, occasionally and never is 8%, 32%, 8%, 20% and 32% respectively. The percentage of schools in which teachers uses Smart classroom for teaching English every day, weekly once, weekly twice, occasionally and never is 12%, 36%, 28%, 20% and 4% respectively.

It can be concluded that all teachers are not using smart classroom every day for teaching and learning. In average, 12% of schools use smart classroom for teaching every day where as 36 % schools use smart classroom once in a week. It can be said that available facilities of smart classroom is not regularly used by teachers. Further, social sciences teachers are using smart classroom very less in comparison of other subjects.

**Table-3.5: Availability of Trained Teachers/ Computer Teacher/ Timetable for Smart Class/Access of all Students/ Educational CD/DVD**

| Sl. No. | Items | Yes (F & %) | No (F & %) |
|---|---|---|---|
| 1. | Availability of Trained teachers to take classes in Smart classroom | 25 (100%) | 0 |
| 2. | Computer teacher/ Technical assistant in School | 8 (32%) | 17 (68%) |
| 3. | Type of Computer teacher/ Technical assistant (Full Time) | 4 (16%) | 21(84%) |
| 4. | Type of Computer teacher/ Technical assistant (Part Time) | 4 (16%) | 21 (84%) |
| 5. | Reflection of Smart Class in the timetable | 0 | 25 (100%) |
| 6. | Students of all Class get chance to access Smart Classroom | 18(72%) | 7 (28%) |
| 7. | Availability of Educational CD/DVD | 0 | 25 (100%) |

The table 3.5 reveals that 100% of schools have trained teachers to take classes in Smart classroom. It reflects that 32% of schools have Computer teacher/ technical assistant and 68% of schools do not have Computer teacher/ technical assistant. 16% of schools have full time Computer teacher/ technical assistant and 84% of schools do not have full time Computer teacher / technical assistant. 16% of schools have part time Computer teacher/ technical assistant and 84% of schools do not have part time Computer teacher / technical assistant. In 100% of schools there is no reflection of Smart class in the timetable. 72% of schools provide access to students of all class in Smart Classroom and 28% of schools do not provide access to students of all class in Smart Classroom. In 100% of schools there is no availability of Educational CD/ DVD.

It can be said that all school has ICT trained teachers but no school has any educational CD/DVD. On the other hand, it can be said that majority of schools do not have full time and part time computer teacher. Moreover, no school has reflected the schedule of the Smart classes in the timetable.

**Table-3.6: Size of Smart Classroom**

| Sl.No. | Items | Average |
|---|---|---|
| 1 | Number of Smart Classroom in a School | 1.28 |
| 2. | Number of students can be accommodated in a Smart Classroom | 65.6 |

Table 3.6 reveals that the mean of the number of students who can be accommodated in a Smart Classroom is 65.6 and the mean of number of Smart Classroom in a school is 1.28. Hence, it can be said that every school has a smart classroom and most of smart classrooms are big in size which can accommodate 65 students.

**Table-3.7: Availability of Subject Specific Software for Teaching**

| Sl.No. | Subjects | Yes | No |
|---|---|---|---|
| 1. | Science | 4 (16%) | 21 (84%) |
| 2. | Mathematics | 3 (12%) | 22 (88%) |
| 3. | Social Science | 1 (4%) | 24 (96%) |
| 4. | English | 3 (12%) | 22 (88%) |

The table 3.7 points out that only in 16% of schools subject specific software for teaching science is available and in 84% of schools subject specific software for teaching science is not available. 12% of schools have subject specific software for teaching Mathematics and 88% of schools do not have subject specific software for teaching Mathematics. Only in 4% of schools subject specific software for teaching Social Science is available and in 96% of schools subject specific software for teaching Social Science is not available. Only in 12% of schools subject specific software for teaching English is available but in 88% of schools subject specific software for teaching English is not available.

Thus, it can be concluded that the majority of schools do not have subject specific software for teaching Science, Mathematics, Social Science and English.

**Table-3.8: Availability of Educational Software and Applications**

| Sl. No. | Name of Software/ Application | Availability of Software/Application | | Use of Software/Application | |
|---|---|---|---|---|---|
| | | Yes | No | Yes | No |
| 1. | English Mentor | 0 | 25(100%) | 0 | 25(100%) |
| 2. | Educomp | 0 | 25(100%) | 0 | 25(100%) |
| 3. | e-Pathshala | 0 | 25(100%) | 0 | 25(100%) |
| 4. | K Class | 1(4%) | 24(96%) | 1(4%) | 24(96%) |
| 5. | Discovery & Crocodile Simulation | 0 | 25(100%) | 0 | 25(100%) |
| 6. | BYJU's | 0 | 25(100%) | 0 | 25(100%) |
| 7. | SWAYAM | 0 | 25(100%) | 0 | 25(100%) |
| 8. | EDUSAT | 0 | 25(100%) | 0 | 25(100%) |
| 9. | Excel Infocom | 0 | 25(100%) | 0 | 25(100%) |
| 10. | Eframe Infomedia | 0 | 25(100%) | 0 | 25(100%) |
| 11. | Classmates | 0 | 25(100%) | 0 | 25(100%) |
| 12. | Teachertube | 0 | 25(100%) | 0 | 25(100%) |
| 13. | Khan Academy | 1(4%) | 24(96%) | 1(4%) | 24(96%) |

The table 3.8 indicates that the enlisted educational software and applications like English Mentor, Educomp, e-Pathshala, Discovery & Crocodile Simulation, BYJU's, SWAYAM, EDUSAT, Excel Infocom, Eframe Infomedia, Classmates, Teachertube are not available in any school. Only 4% of schools have K Class and 4% of schools have Khan Academy.

It can be said that majority of the schools do not have educational software and applications like English Mentor, Educomp, e-Pathshala, Discovery and Crocodile Simulation, BYJU's, SWAYAM, EDUSAT, Excel Infocom, Eframe Infomedia, Classmates, Teachertube. On the other hand 96% of schools do not have K Class and Khan Academy.

3.2**. Process of Use of Smart Classroom by Teachers and Students**

The second objective is to examine the process of use of smart classroom by teachers and students. The investigator has collected data by using observation schedule, which is presented in following tables.

**Table-3.9: Introducing Topic in Smart Classroom**

| Sl No. | Items | Frequently (F & %) | Occasionally (F & %) | Never (F & %) |
|---|---|---|---|---|
| 1. | Organizes warm up activity by using technology | 26 (35.6) | 27 (37) | 20 (27.4) |
| 2. | Projects photograph or plays audios/videos related to the topic | 31(42.5) | 27(37) | 15(20.5) |
| 3. | Engages students to create interest/ motivation towards the photograph/audio/video presented | 37(50.7) | 31(42.5) | 5(6.8) |
| 4. | Assesses previous knowledge using digital devices | 38(52.1) | 28(38.4) | 7(9.6) |
| 5. | Declares the topic on screen by using projector | 53(72.6) | 16(21.9) | 4(5.5) |

The table-3.9 reveals that 35.6% of teachers frequently, 37% of teachers occasionally and 27.4% of teachers never organize warm up activity by using technology at the time of introduction. 42.5% of teachers frequently, 37% of teachers occasionally and 20.5% of teachers never projects photograph or plays audios/videos related to the topic. 50.7% of the teachers frequently, 42.5% of teachers occasionally and 6.8% of teachers never engage students to create interest/ motivation towards the photograph/audio/video presented. It further indicates that 52.1% of teachers frequently, 38.4% of teachers occasionally and 9.6% of teachers never assess previous knowledge using digital devices. 72.6% of teachers frequently, 21.9% of teachers occasionally and 5.5% of teachers never declare the topic on screen or using projector.

It can be said that more than 50% of teachers use technology during introduction to engage students for motivating, assess previous knowledge and declares the topic by using digital devices. Further, it can also be said that

around 20% of teachers never use technology to organize warm up activities and project photographs during introduction stage of teaching.

**Table-3.10: Presenting Lesson in Smart Classroom**

| Sl No. | Items | Frequently (F & %) | Occasionally (F & %) | Never (F & %) |
|---|---|---|---|---|
| 1. | Shows videos relevant to the topic | 67 (91.8) | 6(8.2) | 00 |
| 2. | Pauses the video and explains the topic | 52(71.2) | 19(26) | 2(2.7) |
| 3. | Plays audio relevant to the topic | 64(87.7) | 9(12.3) | |
| 4. | Pauses the audio and explains the content | 47(64.4) | 24(32.9) | 2(2.7) |
| 5. | Pauses the audio/video/slide and encourage learners to ask questions | 24(32.9) | 35(47.9) | 14(19.2) |
| 6. | Pauses the videos and helps student to do hands-on activities | 13(17.8) | 30(41.1) | 30(41.1) |
| 7. | Involves all students while exploring the topic | 41(56.2) | 24(32.9) | 8(11) |
| 8. | Allows students to touch, draw and write on the interactive board/ Smart board | 8(11) | 22(30.1) | 43(58.9) |
| 9. | Allows CWSN to use suitable digital devices | 1(1.4) | 2(2.7) | 70(95.9) |
| 10. | Adapts technology/ digital devices to the need of the CWSN | 2(2.7) | | 71(97.3) |

The table 3.10 reveals that 91.8% of teachers frequently and 8.2% of teachers occasionally show video relevant to the topic. 71.2% of teachers frequently, 26% of teachers occasionally and 2.7% of teachers never pauses the video and explains the topic. 87.7% of teachers frequently and 12.3% of teachers occasionally play audio relevant to the topic. 64.4% of teachers frequently, 32.9% of teachers occasionally and 2.7% of teachers never pauses the audio and explains the content. Further, it indicates that 32.9% of teachers frequently,

47.9% of teachers occasionally and 19.2% of teachers never pauses the audio/ video/slide and encourages learners to ask questions. 17.8% of teachers frequently, 41.1% of teachers occasionally and 41.1% of teachers never pauses the video and help students to do hands-on activities. 56.2% of teachers frequently, 32.9% of teachers occasionally and 11% of teachers never involves all students while exploring the topic. 11% of teachers frequently, 30.1% of teachers occasionally and 58.9% of teachers never allow students to touch, draw and write on the interactive board/ Smart board. Only 1.4% of teachers frequently, 2.7% of teachers occasionally and 95.9% of teachers never allows CWSN to use suitable digital devices. Only 2.7% of teachers frequently and 97.3% of teachers never adapts technology/ digital devices to the need of the CWSN.

It can be said that majority of teachers show video content related to the topic during presentation stage. Moreover, it can be said that more than 60% teachers pause the video and audio and explain the content and play audio relevant to the topic. More than 50% of teachers involve all students while exploring the topic. Further it can be said that around 40% teachers occasionally pause the audio/video to encourage learners to ask questions and helps students to do hands-on activities. It can be concluded that majority of teachers do not allow students to touch draw and write on the screen using multimedia pen and more than 90% of teachers never allows CWSN to use digital devices.

**Table-3.11: Digital Presentation of the Lesson by the Teacher**

| Sl No. | Items | Frequently (F & %) | Occasionally (F & %) | Never (F & %) |
|---|---|---|---|---|
| 1. | Shows different slides/text relevant to the topic | 35(47.9) | 16(21.9) | 22(30.1) |
| 2. | Pauses each slide and explains the content relevant to the text | 29(39.7) | 23(31.5) | 21(28.8) |
| 3. | Writes down important points on the digital screen and asks students to note down | 29(39.7) | 26(35.6) | 18(24.7) |
| 4. | Draws and labels the relevant diagram on the digital screen | 15(20.5) | 26(35.6) | 32(43.8) |
| 5. | Shows different digital images and asks students to use them in writing a story in English language | 7(9.6) | 8(11) | 58(79.5) |
| 6. | Shows flow chart/ story map/ timeline using digital devices | 6(8.2) | 14(19.2) | 53(72.6) |
| 7. | Clarifies doubt of the learners by playing the videos/ texts whenever it is required | 28(38.4) | 39(53.4) | 6(8.2) |
| 8. | Explains the concept/ new words with examples using digital devices | 32(43.8) | 37(50.7) | 4(5.5) |
| 9. | Provides printed materials to the students | 6(8.2) | 19(26) | 48(65.8) |

The table 3.11 indicates that 47.9% of teachers frequently, 21.9% of teachers occasionally and 30.1% of teachers never show different slides/ text which is relevant to the topic. 39.7% of teachers frequently, 31.5% of teachers occasionally and 28.8% of teachers never pauses each slide and explain the content relevant to the topic. 39.7% of teachers frequently, 35.6% of teachers occasionally and 24.7% of teachers never writes down important points on the digital screen and asks students to note down. 20.5% of teachers frequently, 35.6% of teachers occasionally and 43.8% of teachers never draw and label the

relevant diagram on the digital screen. 9.6% of teachers frequently, 11% of teachers occasionally and 79.5% of teachers never shows different digital images and asks students to use them in writing a story in English language. 8.2% of teachers frequently, 19.2% of teachers occasionally and 72.6% of teachers never show flow chart/ story map/ timeline using digital devices. 38.4%of teachers frequently, 53.4% of teachers occasionally and 8.2% of teachers never clarify doubt of the learners by playing the videos/ texts whenever it is required. It indicates that 43.8% of teachers frequently, 50.7% of teachers occasionally and 5.5% of teachers never explain the concept/ new words with examples using digital devices. 8.2% of teachers frequently, 26% of teachers occasionally and 65.8% of teachers never provide printed materials to the students.

It can be concluded that around 40% teachers show different slides/text, pause each slide and explain the content and write down important points on the screen using digital devices during presentation of the topic. Around 50% of the teachers occasionally clarify doubts of the learners by playing the videos whenever required and explain the concept with examples using digital technology. It can be said that more than 60% teachers do not show different digital images and asks students to use them in writing a story in English language, show flowchart/ map/ timeline using digital devices, provide printed materials to the students.

**Table-3.12: Uses of Digital Devices in the Smart Classroom**

| Sl No. | Items | Frequently (F & %) | Occasionally (F & %) | Never (F & %) |
|---|---|---|---|---|
| 1. | Uses the subject specific software | 67(91.8) | 6(8.2) | |
| 2. | Uses laptop while teaching | | 1(1.4) | 72(98.6) |
| 3. | Uses projector/ SMART board while teaching | 69(94.5) | 3(4.1) | 1(1.4) |
| 4. | Uses microphone while teaching | | 1(1.4) | 72(98.6) |
| 5. | Uses scanner while teaching | | | 73(100) |
| 6. | Uses digital camera to record documentary for the teaching-learning process | | 1(1.4) | 72(98.6) |
| 7. | Uses different colors from pen tray on the digital/ Smart board | 22(30.1) | 30(41.1) | 21(28.8) |
| 8. | Uses DVD/ VCD/ Speakers to play the previously recorded documentary | | | 73(100) |

The table 3.12 reflects that 91.8% of teachers frequently, and 8.2% of teachers occasionally uses the subject specific software. Only 1.4% of teachers occasionally and 98.6% of teachers never uses laptop while teaching. 94.5% of teachers frequently, 4.1% of teachers occasionally and 1.4% of teachers never use projector/ SMART board while teaching. 1.4% of teachers occasionally and 98.6% of teachers never use microphone while teaching. 100% of teacher never use scanner while teaching. 1.4% of teachers occasionally and 98.6% of teachers never use digital camera to record documentary for the teaching-learning process. It further indicates that 30.1% of teachers frequently, 41.1% of teachers occasionally and 28.8% of teachers never use different colors from pen tray to write on the screen. 100% of teachers never use DVD/ VCD/ Speakers to play the previously recorded documentary.

It can be said that majority of teachers use the subject specific software and projector while teaching in Smart classroom. It can be concluded that majority of teachers never uses laptop, microphone, digital camera for teaching. Further it can be said that no teacher uses scanner for teaching and never uses DVD/VCD to play the previously recorded documentary.

**Table-3.13: Elaboration by Using Technology in Smart classroom**

| Sl. No. | Items | Frequently (F & %) | Occasionally (F & %) | Never (F & %) |
|---|---|---|---|---|
| 1. | Clicks photograph from the textbook using Smart phone/ camera to display it through projector | 00 | 12(16.4) | 61(83.6) |
| 2. | Uses projector to display Maps on the digital screen/board to discuss | 00 | 3(4.1) | 70(95.9) |
| 3. | Uses projector to display different figures for classroom discussion | 9(12.3) | 19(26) | 45(61.6) |
| 4. | Arranges for interactive session on grammar activities to develop communication skills | 12(16.4) | 10(13.7) | 51(69.9) |
| 5. | Takes students for a virtual walk through the civilizations/ incident/ field realities while teaching Social Science | 1(1.4) | 1(1.4) | 71(97.3) |
| 6. | Uses internet to search the topic/concept whenever required | 6(8.2) | 36(49.3) | 31(42.5) |
| 7. | Give web reference to the students for further reading | 3(4.1) | 20(27.4) | 50(68.5) |
| 8. | Highlights the main points on the digital screen/ board to summarize at the end of the lesson | 20(27.4) | 31(42.5) | 22(30.1) |
| 9. | Uses web technology to share the important points discussed | 5(6.8) | 16(21.9) | 52(71.2) |

The table 3.13 reveals that only 16.4% of teachers occasionally and 83.6% of teachers never clicks photograph from the textbook using Smart phone/ camera to display it through projector for effective learning. It points out that only 4.1% of teachers occasionally and 95.9% of teachers never uses projector to display Maps on the digital screen/board to discuss. 12.3% of teachers frequently, 26% of teachers occasionally and 61.6% of teachers never uses projector to display different figures for classroom discussion. 16.4% of teachers frequently, 13.7% of teachers occasionally and 69.9% of teachers never arranges for interactive session on grammar activities to develop communication skills. It indicates that only 1.4% of teachers frequently, 1.4% of teachers occasionally and 97.3% of teachers never takes students for a virtual walk through the civilizations/incident/ field realities while teaching Social Science. 8.2% of teachers frequently, 49.3% of teachers occasionally

and 42.5% of teachers never uses internet to search the topic/concept whenever required. 4.1% of teachers frequently, 27.4% of teachers occasionally and 68.5% of teachers never give web reference to the students for further reading. 27.4% of teachers frequently, 42.5% of teachers occasionally and 30.1% of teachers never highlight the main points on the digital screen/ board to summarize at the end of the lesson. Only 6.8% of teachers frequently, 21.9% of teachers occasionally and 71.2% of teachers never uses web technology to share the important points discussed in the class.

It can be said that majority of teachers never click photograph using smart phone or camera to display it through projector, use projector to display Maps on the digital screen, take students for a virtual walk through civilizations for effective learning in the Smart classroom. More than 50% of teachers never uses projector to display figures for mathematics class, arranges interactive session to develop communicative skills, give web reference to the students for further reading and uses web technology to share the important points discussed in the class. However, around 40% teachers occasionally uses internet to search the topic whenever required and highlights the main points using digital technology.

**Table-3.14: Assessment in the Smart Classroom**

| Sl. No. | Items | Frequently (F & %) | Occasionally (F & %) | Never (F & %) |
|---|---|---|---|---|
| 1. | Pauses the audio/ video/ slide and ask questions to the students | 23(31.5) | 41(56.2) | 9(12.3) |
| 2. | Assigns learners to make PowerPoint presentation on the topic | 6(8.2) | 6(8.2) | 61(83.6) |
| 3. | Writes down questions on the digital screen/ Smart board | 21(28.8) | 30(41.1) | 22(30.1) |
| 4. | Writes down answers on the digital screen/ Smart board | 20(27.4) | 33(45.2) | 20(27.4) |
| 5. | Asks quizzes/ multiple choice questions using the digital screen/ Smart board | 27(37) | 27(37) | 19(26) |
| 6. | Creates scope for self evaluation of students by using technology | 1(1.4) | 30(41.1) | 42(57.5) |
| 7. | Uses different software for assessment | 2(2.7) | 13(17.8) | 58(79.5) |
| 8. | Uses technology to give feedback to the students | 00 | 11(15.1) | 62(84.9) |
| 9. | Gives online home assignments to the students | 00 | 00 | 73(100) |

Table 3.14 reveals that 31.5% of teachers frequently, 56.2% of teachers occasionally and 12.3% of teachers never pauses the audio/video slide and ask questions to the students. Few teachers i.e. 8.2% frequently, 8.2 of teachers occasionally and the majority i.e. 83.6% of teachers never assign learners to make PowerPoint presentation on the topic. 28.8% of teachers frequently, 41.1% of teachers occasionally and 30.1% of teachers never writes down questions on the digital screen/ Smart board. 27.4% of teachers frequently, 45.2% of teachers occasionally and 27.4% of teachers never writes down answers on the digital screen/ Smart board. Only 1.4% of teachers frequently, 41.1% of teachers occasionally and 57.5% of teachers never create scopes for self evaluation of students by using technology. Only 2.7% of teachers frequently, 17.8% of teachers occasionally and 79.5% never uses different software for assessment. 15.1% of teachers occasionally and 84.9% of teachers

never uses technology to give feedback to the students. 100% of teachers never assign online home assignments to the students.

It can be said that majority teachers occasionally pause the audio visual content and asks questions to the students whereas majority teachers never assign PowerPoint presentation to learners, create scope for self evaluation by using technology, use different software for assessment, uses technology to give feedback to the students. Moreover, it can be said that around 40% teachers occasionally writes questions and answers on the digital screen whereas no teacher gives online home assignments to the students.

### 3.2.1. Process of Smart Classroom Use of Teachers as Responded by Students

1. The tools/ equipments used in the Smart classroom by the teacher while teaching the lesson are KYAN projector, multimedia pen, mouse. The teacher writes with the pen on the wall/ white screen while projecting materials from the KYAN projector. Sometimes, the teacher plays the video and then pauses and explains the audio visual content and then plays again till the completion of the topic. The tools are used for teaching and demonstrating. The teacher makes the lesson easily comprehendible by displaying videos that explain the content in simple language with pictures.

2. The students feel good, energetic, and happy to be a part of the Smart Class. It is because of the availability of the audio-visual content in the Smart class the students are very excited to learn through technology. Learning is hassle free as no student talks in the class. Topics are taught in an interesting way. The teacher explains after showing the videos and so the chapters are clearer, ideas about the topic are constructed in a better way. The students do not have to look on book but can watch the videos and can learn through it.

3. The students can understand the topic taught in the Smart class. Whenever they feel it difficult they clarify their doubts from the teacher. Most of the times all questions are answered positively but the teacher rectifies the incorrect answers in the classroom.

4.  Smart classes are different from routine classes because it brings automatic concentration as all things are displayed audio-visually and the students feel energetic to read and learn new things. In some schools routine classrooms are shadowy, proper daylight is not available. Whereas smart classes are conducted in a newly made room with proper daylight available. In some schools the KYAN projector is installed in regular classroom. All subjects are taught through audio-visual content except Hindi, History and Geography. It is very interesting to watch. For example, Cell demonstration is displayed on the larger screen and all small units become visible and it helps in better/ clear understanding. The seating arrangement in Smart classes is different from routine classes. In some schools the students sit on chairs and in some others they sit on the floor mat. The discussion revealed that routine classes are very monotonous, but smart classrooms are very purposeful as the topics learnt after watching the audio-visual content retains in memory for a longer time.

5.  The discussion revealed that the students in most schools get scope for participation in Smart Classroom. It further revealed that in majority schools Science, Mathematics and English is being taught weekly once in Smart classrooms. As there is no content uploaded for Social Science, therefore, in some schools Social Science is taught occasionally and in some it is never taught in Smart classrooms.

6.  In Smart classes the understanding of the topic is very clear and even critical subject matter is very easy to comprehend as it is discussed in an easy way. Good communication skill development with voice modulation is also achievable. Listening habit develops in Smart classes. Careful listening helps in clear understanding of the concept. The topics once learned retains in the memory for longer time so there is no need to rote memorize.

7.  Speed of the lecture in the KYAN content is fast. No content of History, Geography, Hindi and Nepali are available in the KYAN projector provided in schools. In English literature the stories are explained only in English language which creates difficulty for Bengali/ Hindi/Nepali medium students. Some topics in Mathematics are explained in very fast speed. Regular power cut puts hindrance in Smart classes.

8. Sometimes the teachers conduct some test like multiple choice questions, short answer type questions, one word answer, and fill in the blanks after the completion of the lesson. But in most schools no such test are conducted to properly assess the student's learning outcome.

9. No such feedback is given to students about their own learning performance. A few teachers after completion of the lesson takes test and those students can answer correctly are praised in the classroom.

10. The audio-visual content may be modified in order to slow the pace of the lectures, more questions or test paper should be included for proper assessment. The school authority should make use of two smart classrooms as most of the schools are provided two KYAN projectors by Govt. of West Bengal so that all students could access the Smart classroom frequently. History, Geography, Hindi and Nepali content needs to be uploaded. Mistakes in English content needs rectification. Proper seating arrangement should be taken care of along with a white screen should be used instead of using the wall as screen for projection.

### 3.3. Impact of Smart Classroom on Students Achievement

The last objective is to find out the impact of smart classroom in students learning. The investigator collected students achievement from the school records for the year 2017 and 2018, which is presented in the table-3.15.

**Table-3.15: Achievement of Students in Class-X Board Examination**

| Sl. No. | Aspects | 2018 | 2017 |
|---|---|---|---|
| 1 | Total Number of students appeared | 156.2 | 152.36 |
| 2 | Total Number of Students Passed (Average) | 134.72 | 129.88 |
| | Percentage of Pass | 86.24 | 85.24 |
| 3 | Total Number of Students Failed (Average) | 21.88 | 22.48 |
| | Percentage of Fail | 14 | 14.75 |
| 4 | Total Number of Students in AA (Average) | 4.4 | 5.2 |
| | Percentage of AA | 3.2 | 4 |
| 5 | Total Number of Students in A+ (Average) | 8.52 | 10.84 |
| | Percentage of A+ | 6.32 | 8.3 |
| 6 | Total Number of Students in A (Average) | 17.64 | 22.64 |
| | Percentage of A | 13.09 | 17.43 |
| 7 | Total Number of Students in B+ (Average) | 27.32 | 25.88 |
| | Percentage of B+ | 20.27 | 19.92 |
| 8 | Total Number of Students in B (Average) | 35.36 | 29.72 |
| | Percentage of B | 26.24 | 22.88 |
| 9 | Total Number of Students in C (Average) | 41.52 | 36.12 |
| | Percentage of C | 30.81 | 27.81 |

The table 3.15 reveals the mean of the total number of students appeared in the year 2018 and 2017 is 156.2 and 152.36 respectively. It also reveals the mean of the total number of students passed in the year 2018 and 2017 is 134.72 and 129.88 respectively. The percentage of students passed in the year 2018 is 86.24% and the percentage of students passed in the year 2017 is 85.24. The mean of the total number of students failed in the year 2018 and 2017 is 21.88 and 22.48 respectively. The percentage of students failed in the year 2018 is 14% and the percentage of students failed in the year 2017 is 14.75. The mean of number of students in AA in the year 2018 and 2017 is 4.4 and 5.2 respectively. The percentage of students passed with AA grade in the year 2018 is 3.2% and the percentage of students passed with AA grade in the year 2017 is 4%. The mean of the number of students in A+ in the year 2018 and 2017 are 8.52 and 10.84 respectively. The percentage of students passed with

A+ grade in the year 2018 is 6.32% and the percentage of students passed with A+ in the year 2017 is 8.3%. The mean of number of students in A in the year 2018 and 2017 is 17.64 and 22.64 respectively. The percentage of students passed with A grade in the year 2018 is 13.09% and the percentage of students passed with A grade in the year 2017 is 17.43%. The mean of number of students in B+ in the year 2018 and 2017 is 27.32 and 25.88 respectively. The percentage of students passed with B+ grade in the year 2018 is 20.27% and the percentage of students passed in the year 2017 is 19.92%. The mean of number of students in B in the year 2018 and 2017 is 35.36 and 29.72 respectively. The percentage of students passed with grade B in the year 2018 is 26.24% and the percentage of students passed with grade B in the year 2017 is 22.88%. The mean of number of students in C in the year 2018 and 2017 is 41.52 and 36.12 respectively. The percentage of students passed in C grade in the year 2018 is 30.81% and the percentage of students passed in C grade in the year 2017 is 27.81%.

Thus it can be concluded that the percentage of students passed in the year 2018 has increased when compared with the year 2017 whereas the percentage of students failed in the year 2018 has decreased when compared with the year 2017. It can also be said that the percentage of students passed with the grades AA, A+ and A has decreased in the year 2018. But significant changes can be observed with the increase of percentage of students passed with B+, B and C grades in the year 2018.

## CHAPTER-IV
## MAJOR FINDINGS AND EDUCATIONAL IMPLICATIONS

**4.0: Introduction**

This chapter deals with major findings and educational implications of the study. The major findings are drawn on the basis of the analysis of the data. The educational implications are suggested on the basis of the findings.

**4.1: Major Findings**

The following major findings are drawn from the data analysis and interpretation and presented as per the objectives of the study.

**4.1.1. Availability and Condition of Equipments and Software in Smart Classroom**

- All the schools have desktop but no school has interactive/ Smart board. 88% of schools do not have laptops and only 10.56 desktops in average are in good condition.

- All the schools have projector but 20% of schools do not have speakers and 66% of schools do not have wireless microphone.

- 84% of schools have scanner and 72% of schools have modem. 88% of schools have UPS, printer and multimedia pen.

- 50% of teachers in Science, Mathematics, Social Science and English are not trained for taking classes in Smart classroom.

- All teachers are taking classes in Smart classroom but no school has reflected the schedule of the smart class in the timetable.

- 88% of schools do not use Smart classroom everyday for teaching Science, Mathematics and English. 68% of schools never use Smart classroom for teaching Social Science.

- 68% of schools do not have computer teacher and 84% of schools do not have full time computer teacher.

- 28% of schools do not facilitate or give chance to students of all classes to access the Smart classroom and no school has educational CD/DVD relating to different subjects.

- 84% of schools do not have subject specific software for teaching Science. 88% of schools do not have subject specific software for teaching Mathematics. 96% of schools do not have subject specific software for teaching Social Science. 88% of schools do not have subject specific software for teaching English.

- Most of the schools do not use educational software and applications such as English Mentor, Educomp, e-Pathshala, K class, BYJU's, SWAYAM, Classmates, Teachertube, Khan Academy for teaching different subjects in Smart classroom.

### 4.1.2. Process of Use of Smart Classroom by Teachers and Students

- Around 28% of teachers do not organize warm up activity by using technology in the process of introduction in Smart classroom and around 20% of teachers do not project photograph or play audios or videos related to the topic. Most of the teachers declare the topic on screen by using projector.

- Around 40% of teachers do not pause the videos and help students to do hands-on activities and around 60% of teachers never allow students to touch, draw and write on the screen.

- 56.2% of teachers always involve all students while exploring the topic in the Smart classroom.

- Around 30% of teachers do not show any slide presentation relevant to the topic and 28% of teachers do not pause each slide and explains the content installed in KYAN projector.

- 24.7% of the teachers do not write important points on the screen and never asks students to take down notes in the class. 43% of teachers do not draw and label the relevant diagram on the screen.

- Around 80% of teachers do not show different images on the screen as cues for writing and never asks students to write a story in English language on the basis of the given pictorial hints. Around 72% of teachers do not show flow chart or timeline of a period for teaching different subjects using technology.

- 65% of teachers do not provide printed materials to the students for further reference of the topics taught in the Smart classroom.

- 83% of teachers do not click photograph from the textbook using Smart phone or camera to display it through projector for effective learning.

- Around 60% of mathematics teachers do not use projector to display different figures for classroom discussion and around 70% of teachers never arranges for interactive sessions on grammar activities to develop communication skills.

- 95% of teachers do not use projector to display maps on the screen for teaching geography in the Smart classroom. 97.3% of teachers do not take students for a virtual walk through the civilizations while teaching Social Science.

- Around 43% of teachers do not use internet to search the topic/ concept whenever required in the Smart classroom and around 72% of teachers do not use web technology to share the important points with the students discussed in the Smart classroom.

- 83% of teachers do not assign learners to make PowerPoint presentation on the topic and 79% of teachers do not use different software for assessment of the lesson taught in the Smart classroom.

- No teacher gives online home assignment to the students for assessment of the students. 85% of teachers do not use technology to give feedback to the students about their performance in the Smart classroom.

- All schools have KYAN projector, multimedia pen and mouse but do not have interactive board. The tools are used for teaching and demonstrating which makes the lesson easily comprehendible by displaying videos that explain the content in simple language with pictures.

- The students feel good, energetic and happy to be a part of the Smart classroom. Most of the teachers explain after showing the videos and so the chapters are clearer, ideas about the topic are constructed in a better way.

- All subjects are taught through audio-visual content except Hindi, History, Geography and Nepali. The seating arrangement in Smart

classes is different from the routine classes. In some schools the students sit on chairs and in some others they sit on the floor mat.

- Majority school teachers schedule Smart classes according to their convenience for Science, Mathematics and English. But as there is no timetable for Smart classes so the students get classes only once in a week. Very few teachers take Social Science classes in the Smart classroom as no content is installed in the KYAN projector.

- Speed of the Mathematics lecture in the KYAN projector is very fast which creates a hindrance in understanding the content. The English content installed in the KYAN projector is completely orated in English which creates difficulty in understanding many topics. Regular power cuts put hindrance in Smart classes.

- No feedback is given to students about student's learning performance. Majority teachers do not evaluate the student's performance in the Smart Classroom.

- The percentage of AA, A+ and A grade has decreased in the year 2018 whereas an increase in the percentage of B+, B and C grade is observed in the year 2018.

- The effect of smart classroom on students achievement in class-X board examination is not visible as the smart classroom project has been implemented in the schools in 2017.

## 4.2 Educational Implications

- The study reveals that all schools have desktop, projector, printer scanner. But no school has interactive board which plays an essential role in the teaching learning process in Smart classroom in this digital era. Most of the schools do not use wireless microphone for teaching in the Smart classroom. Many hardware components are found in poor condition. The HM along with other teachers should regularly check the conditions of those equipments and take necessary actions. Government may take initiative to provide materials like interactive board, microphone to all schools and ensure thoroughly that all these materials are used by the teachers in the teaching learning process.

- All schools received at least two projectors. But only one projector has been installed in majority schools which is a reason behind irregularity of classes in Smart classroom. It is necessary for the school authority to set up both the projectors along with other necessary equipments in two rooms for imparting lessons regularly with the help of available technology.

- All schools do not have a proper surface to display or use the multimedia pen. So in this case some schools are using multimedia pen on rough surface where it is difficult to write, some use it on putty wall in which the multimedia pen might get damaged. So, therefore the Government may provide a screen on which the teachers can display the digital contents to the students.

- Initiatives may be taken by the Government to train all teachers to take classes in Smart classroom. The head of the institution should specify the Smart classroom periods in the timetable so that all classes get equal opportunity and all subjects could be taught ever day or at least thrice in a week with the help of technology.

- Government of West Bengal may take initiative to recruit full time computer teachers for training, teaching and maintaining the Smart classroom. The school authority may include some educational CD/DVD in their library so that important educational contents could be shared in the Smart classroom. Other than the content available in KYAN projector subject specific software should be used in the Smart classroom.

- The lesson in smart classroom needs to be delivered in a way in which the teacher uses the available digital devices and create a bridge between traditional methods and modern digitized technology so that utmost learning outcomes could be generated.

- The smart devices need to be fully utilized by the teacher while imparting the lesson. For example, the teacher through diagrams, pictorial story line, virtual walk through civilizations, and satellite view

of locations, geometrical figures, digital flowchart and digital hints for creative writing can impart teaching for better learning outcomes.

- Majority of teachers do not show any PowerPoint presentation or provide any printed material to students. It is very important for students to develop a habit of following a reference. This habit of following a reference should be inculcated by the teacher at school level by providing necessary printed materials as well as web links. It is very necessary for a teacher to be habituated with web technology in this digital era so that they could teach and assign online assignments to the students. Initiatives may be taken by SCERT to organize programmes on capacity building of teachers for integrating ICT in education.

- The content installed in KYAN projector needs to be modified in some specific areas such as some errors in English lessons needs correction, the Logarithm chapter in Mathematics needs more simple, slow and elaborate explanation for better learning outcome.

- Special and immediate measures should be taken to install or provide some e-content or e-resources for teaching Social Science, Hindi and Nepali. Moreover, all e-content needs to be translated in English for English medium schools and other vernaculars like for Hindi medium and Nepali medium schools in West Bengal.

- Teachers and HMs must be familiar with the initiatives taken by the NCERT and MHRD for the use of ICT in school education such as ePathshala, NROER and SWAYAM etc. Teachers must be oriented on the use of different free online resource materials for teaching and learning.

- Teachers must be sensitized in the role of ICT for professional development by getting enrolled in MOOC and SWAYAM. Teachers may be encouraged to complete ICT related MOOC from different Institutions and Universities.

**4.3. Conclusion**

ICT has great potential for the improvement of quality of teaching and learning. This study has found that smart classroom project has been implemented in the secondary schools of West Bengal and some digital devices are provided to these schools. But 50% of teachers are not oriented to use smart classroom for teaching different subjects. Further, majority of teachers are not aware about the free online resource material available on different subjects. The initiatives of NCERT and MHRD like ePathshala and NROER etc are not being used by the teachers and students. Hence, it is high time to orient teachers and HMs of all secondary schools on uses of ICT tools for teaching learning. Further, students of higher classes must be sensitized and encouraged to use free online resources including text, audio and video relating to school subjects.

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**LIST OF SCHOOLS INVOLVED IN THE STUDY AS SAMPLE**

| Sl. No. | Name and Address of Schools |
|---|---|
| 1 | Uttarpara Union Girls High School (H.S.), 102/A, R.S. Verma Road, Uttarpara Kotrang, Hooghly |
| 2 | Uttarpara Girls High School, 20, Banerjeepara Street, Uttarpara Kotrang, Hooghly |
| 3 | Biraj Mohini High School, Goborhanda, Basuri, Tarakeshwar, Hooghly |
| 4 | Mozepur Bharati Vidyamandir, Mozepur, Duttapur, Tarakeshwar, Hooghly |
| 5 | Kshudrarampur High School (H.S.) Champadanga, Tarakeshwar, Hooghly |
| 6 | Rajbalhat High School, Rajbalhat, Jangipara, Hooghly |
| 7 | Rajbalhat Girls High School, Rajbalhat, Jangipara, Hooghly |
| 8 | Rahimpur Nabagram High School, Rahimpur, Hooghly |
| 9 | Balipur Melatala High (H.S.), Balipur, Khanakul-I |
| 10 | Kailash Chandra Sadhukhan High School, Ankri, Sreerampur, Pursurah, Hooghly |
| 11 | Siliguri Girl's High School, Ashutosh Mukherjee Road, College Para, Siliguri |
| 12 | Siliguri Boy's High School, Kachari Road, Siliguri |
| 13 | Bagha Jatin Vidyapith (H.S.), Pradhan Nagar, Siliguri |
| 14 | Rabindranagar Girl's High School, Promotesh Barua Sarani, Ward-21, Siliguri |
| 15 | Siliguri Deshbandhu Hindi High School (H.S.), Siliguri |
| 16 | Dr. I.B. Thapa Nepali Vidyalaya, Pradhan Nagar, Siliguri |
| 17 | Siliguri Baradakanta Vidyapith (H.S.), Rathkhola, Rabindra Sarani, Siliguri |
| 18 | Kabi Sukanta High School (H.S.) Pati Colony, Siliguri |
| 19 | Matigara Harasundar High School, Matigara, Darjeeling |
| 20 | Nazrul Satavarshiki Vidyalaya (H.S.) Rabvita, Leusipukri, Phansidewa Darjeeling |
| 21 | Phanshidewa Govt. Sponsored Ashram Type Girl's high School, Jyoti Nagar, Phansidewa, Darjeeling |
| 22 | Govt. Girl's High School, Club Road, Jalpaiguri |
| 23 | Central Girl's High School, Beguntari, Jalpaiguri |
| 24 | Fanindra Deb Institution, Babupara, Jalpaiguri |
| 25 | Sonali Girl's High School, Pandapara, Jalpaiguri |

**CHECKLIST FOR STUDYING THE AVAILABILITY AND CONDITION OF EQUIPMENT AND SOFTWARE IN SMART CLASSROOM**

**(To be filled by the Headmaster/ In-charge of Smart classroom)**

**Instructions:**

The checklist contains items relating to availability of facilities/equipment both hardware and software in the smart classroom and its utilization in teaching learning process. The Head teacher/ In-charge of Smart classroom will fill up each item of the checklist as per the requirements. He/She may show and share the information with the filed investigator regarding the availability and use of facilities and gadgets.

**General Information:**

Name of the School:

School Code:

Address of the School:

School Website

Contact email:

District:

Name of the Head Master/ Teacher In-charge:

Date:

**Thanking you in advance for your cooperation**

**Dr Ramakanta Mohalik,**
Principal Investigator & Associate Professor
Regional Institute of Education (NCERT) Bhubaneswar-751022
Email:mohalikrk@gmail.com

## 1. Availability of Digital Devices in the SMART Classroom

| Sl. No. | Items/ Digital Devices | Available (1 for Yes/ 2 for No) | If available | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | No. of items | No. of items functional | | | Funded/Supplied by | | |
| | | | | Good 1 | Manageable 2 | Poor 3 | SMART scheme 1 | School 2 | If others, specify 3 |
| 1. | Desktop | | | | | | | | |
| 2. | Laptop | | | | | | | | |
| 3. | Tablet | | | | | | | | |
| 4. | Video Recorder | | | | | | | | |
| 5 | Dictaphone/ Voice recorder | | | | | | | | |
| 6. | Smart phone | | | | | | | | |
| 7 | Interactive Whiteboard | | | | | | | | |
| 8. | Digital Camera | | | | | | | | |
| 9. | Scanner | | | | | | | | |
| 10. | Printer | | | | | | | | |
| 11. | Overhead Projector | | | | | | | | |
| 12. | Speakers | | | | | | | | |
| 13. | Wireless Microphone | | | | | | | | |

| 14. | Television (LCD/LED) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 15. | Digital Podium | | | | | | | |
| 16. | Video Conferencing Equipment | | | | | | | |
| 17. | Modem (Internet connection inside the classroom | | | | | | | |
| 18. | UPS (electrical infrastructure) | | | | | | | |
| 19. | Digital Pointer | | | | | | | |
| 20. | Multimedia Pen | | | | | | | |
| 21. | DVD/VCD dual deck player | | | | | | | |
| 22. | Headphone/ Head set | | | | | | | |
| 23. | Any other | | | | | | | |

2. Whether teachers are trained in ICT to take class in SMART classrooms?

1 for Yes/2 for No

3. If Trained in ICT , kindly give details:

| Subject | No. of teachers in the subject | No. of teachers trained in ICT |
|---|---|---|
| Science | | |
| Mathematics | | |
| Social science | | |
| English | | |

4. If trained in ICT, please give the details related to the training programme:

| Sl. No. | Name of the teacher | Subject | Content | Duration | Venue | Name of the Organizer |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

5. How frequently do the teachers use SMART classroom in school?

| Subject | Everyday 1 | Weekly once 2 | Weekly twice 3 | Occasionally 4 | Never 5 |
|---|---|---|---|---|---|
| Science | | | | | |
| Mathematics | | | | | |
| Social | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Science | | | | | |
| English | | | | | |

6. Do you have any Computer teacher/ Technical assistant who help in maintenance of SMART class? 1 for Yes/2 for No

   If Yes, 1 for Full time/ 2 for Part time

7. Size (length X breadth) of the SMART Classroom in terms of the guideline provided by the Dept. of School Education, West of Bengal _____

8. How many students can be accommodated in the SMART classroom of your school?   _____

9. Is the smart class period reflected in the timetable? 1 for Yes/ 2 for No

10. If Yes, Please give a copy of the timetable

11. How many SMART classrooms are there in your schools? _____

12. Whether students of all classes get chance to access the SMART classroom? 1 for Yes/ 2 for No

13. Please give subject specific details

| Number of classes per week in | | | | |
|---|---|---|---|---|
| Class | Science | Mathematics | Social Science | English |
| IX | | | | |
| X | | | | |

14. Do you have any software for teaching the following subjects?

| Sl. No. | Subjects | 1 for Yes/ 2 for No |
|---|---|---|
| 1 | Science | |
| 2 | Mathematics | |

| | | |
|---|---|---|
| 3 | Social Science | |
| 4 | English | |

15. If yes, then please mention the name of the software :

| Sl. No. | Software /application | Software /application Available 1 for Yes/2 for No | Software/application Used 1 for Yes/ 2 for No |
|---|---|---|---|
| 1. | English Mentor | | |
| 2. | Educomp | | |
| 3. | e-Pathshala | | |
| 4. | K Class | | |
| 5. | Discovery & Crocodile simulation | | |
| 6. | BYJU's | | |
| 7. | SWAYAM | | |
| 8. | EDUSAT | | |
| 9. | Excel Infocom | | |
| 10. | Eframe Infomedia | | |
| 11. | Classmates | | |
| 12. | Teachertube | | |
| 13. | Khan Academy | | |

| 14. | Any other software/application | | |
|-----|-------------------------------|---|---|

16. Does your school have any educational CD/DVD? 1 for Yes/ 2 for No

17. If yes, please give the details:

| Subjects | Title of DVD/CD | Developed/published by | Details | |
|----------|-----------------|------------------------|---------|---------|
| | | | Class IX | Class X |
| Science | | | | |
| Mathematics | | | | |
| Social Science | | | | |
| English | | | | |

**CLASSROOM OBSERVATION SCHEDULE ON USES OF SMART CLASSROOM**

**(To be filled by the Investigator)**

**Instructions:** The observer will examine the timetable of the school and seek the permission of the Head of the school to observe the smart class. The observer would be there for the whole class and record his/her observation point by point as per the pro forma. He/she may probe further to complete the information as sought for in the pro forma in consultation with the teacher/Head teacher after the class. The subject specific information may be filled up as per the requirement of the class. The observation would be objective, precise and focused as per the schedule.

**General Information:**

Name and Address of the School:

Name of the District:

 School Code:

Date of Observation:

Subject: English/Social Science/Science/ Mathematics

Class:                               Topic:                               Class

Duration:

Name of the Teacher:

Qualification of the Teacher:General: UG/PG

Professional: D.ElEd/B.Ed/M.Ed

Trained in SMART Class*:* Yes/ No

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**1 for Frequency-F; 2 for Occasionally-Q; 3 for Never-N**

| Sl. No | Items | F | O | N | Remark |
|---|---|---|---|---|---|
| | Introduction | | | | |
| 1 | Organizes warm up activity by using technology | | | | |
| | Projects photograph or plays audios/ videos related to the topic | | | | |
| | Engages students to create interest/ motivation towards the photograph/ audios/ videos presented | | | | |
| | Assesses previous knowledge using digital devices | | | | |
| | Declares the topic on screen or using projector. | | | | |
| 2 | Presentation | | | | |
| | Shows videos relevant to the topic | | | | |
| | Pauses the video and explains the related content | | | | |
| | Plays audio relevant to the topic | | | | |
| | Pauses the audio and explains the content | | | | |
| | Shows different slides/ text relevant to the topic | | | | |
| | Pauses each slide and explains the content relevant to the text | | | | |
| | Involves all students while exploring the topic | | | | |
| | Uses the subject specific software | | | | |
| | Writes down the important points on the digital screen and asks student to note down | | | | |
| | Draws and labels the relevant diagram on the digital screen/SMART Board | | | | |
| | Pauses the audio/ video/ slide and encourages learners to ask questions | | | | |
| | Pauses the videos and help students to do hands-on activities | | | | |
| | Uses laptop while teaching | | | | |
| | Uses projector/SMART Board while teaching | | | | |
| | Uses microphone while teaching | | | | |
| | Uses scanner while teaching | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | Uses digital camera to record documentary for the teaching- learning process | | | | |
| | Uses DVD/VCD/speaker to play the previously recorded documentary | | | | |
| | Clarifies doubts of the learners by playing the videos/ texts whenever it is required. | | | | |
| | Explains the concept/ new words with examples using digital devices | | | | |
| | Shows flow chart/ story map/ timeline using digital devices | | | | |
| | Clicks photograph from the textbook using SMART phone/ camera to display it through projector for effective learning. | | | | |
| | Uses projector/SMART board to display Maps on the digital screen/ board to discuss. | | | | |
| | Uses projector to display different figures for class room discussion | | | | |
| | Shows different digital images and asks students to use them in writing a story in English. | | | | |
| | Arranges for interactive sessions on grammar activities to develop communication skills | | | | |
| | Takes students for a virtual walk through the civilizations/incident/field realities while teaching Social Science | | | | |
| | Allows students to touch, draw and write on the interactive board/SMART Board | | | | |
| | Allows CWSN to use suitable digital devices. | | | | |
| | Adapts technology /digital devices to the need of the CWSN | | | | |
| | Uses internet to search the topic/concept whenever required. | | | | |
| | Uses different colors from the pen tray on the digital/SMART board | | | | |
| | Gives web references to the students for further reading | | | | |
| | Provides printed materials to the students | | | | |
| | Highlights the main points on the digital board/screen to summarize at the end of the lesson | | | | |
| | Uses web technology to share the important points discussed | | | | |
| 3 | Assessment/ Evaluation/ Feedback | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | Pauses the audio/ video/ slide and ask questions to the students | | | | |
| | Assigns learners to make Power Point presentation on the topic | | | | |
| | Writes down questions on the digital/SMART board | | | | |
| | Writes down answers on the digital/SMART board | | | | |
| | Asks quizzes/multiple choice questions using the digital/SMART board | | | | |
| | Creates scope for self evaluation of students by using technology | | | | |
| | Uses different software for assessment | | | | |
| | Uses technology to give feedback to the students | | | | |
| | Gives online home assignments to the students | | | | |

**FOCUSED GROUP DISCUSSION FOR STUDENTS ON USES OF SMART CLASSROOM**

**Instructions:** The FGD will be conducted by the Field Investigator immediately after the SMART class on a small group of 5-7 students preferably in the SMART class itself. The students would form a half circle and questions will be raised by the investigator one by one. Each student in the group will be given scope to answer each question. The medium of question- answer will be Bengali. The FGD will be video recorded for qualitative analysis. The teacher concerned will not be there in course of FGD. The field investigator would ask sub questions to supplement the main question in order to elicit answer from the students and jot down all answers in the field note.

Date:

Class:

Name of the District:

Number of students:

Name & Address of the School:

Duration of the discussion: 20-25 minutes

**Items**

1. Which tool/ equipment have been used in your class? How was it used?

2. How did you feel to be a part of the SMART class? Give your answer with reasons.

3. Could you understand the topic taught in SMART class? Can you answer all questions related to the topic?

1. How is the SMART class different from other routine classes?

2. Do you get any scope for participation in the SMART classroom? If yes, How?

6. What are the advantages of SMART class?

7. What are the problems and issues you faced in the SMART class?

8. Do you feel that you have been properly assessed in the SMART class?

9. Did you get some feedback in course of the class about your own learning performance? How was it?

10. What better could have been done in SMART Class to improve your learning?

**STUDENTS ACHIVEMENT IN CLASS-X BOARD EXAMINATION**

**(To be filled by the Investigator)**

Name and Address of School:

School Code:

Name of the district:

Total No. of Students Appeared**: 2018_____ 2017_____**

Total No. of Students Passed:    **2018_____ 2017_____**

Total No. of Students Failed:    **2018_____ 2017_____**

| Year | 2018 | 2017 |
|---|---|---|
| No. of students in AA | | |
| No. of students in A+ | | |
| No. of students in A | | |
| No. of students in B+ | | |
| No. of students in B | | |
| No. of students in C | | |
| No. of students in D | | |
| Total | | |