IMPLEMENTATION OF SMART CLASS TECHNOLOGY AT SECONDARY TEACHER EDUCATION LEVEL: A STUDY OF READINESS, ADAPTABILITY, PERCEPTIONS AND TRAINING NEEDS OF STAKEHOLDERS

PRE- PhD PRESENTATION SUMMARY
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SUMMARY

1.0.0 INTRODUCTION

The present study is entitled “IMPLEMENTATION OF SMARTCLASS TECHNOLOGY AT SECONDARY TEACHER EDUCATION LEVEL: A STUDY OF READINESS, ADAPTABILITY, PERCEPTIONS AND TRAINING NEEDS OF STAKEHOLDERS”. The study is related to the area of Information and Communication Technology in education.

In today’s information age, ICT forms the foundation of a successful organisation. With the Government of India launching the Digital India initiative, there has been a transformation of our country into a digitally empowered society and knowledge economy. With easily available smartphones and even computers within reach of the common man what is needed is the right know-how of its usage. Another milestone in the IT revolution has been its influence on education. Be it school management systems or classroom teaching learning, ICT is a boon for all concerned. The advent of Smart Class Technology has added yet another feather to the cap of ICT in education.

1.1.0 WHAT IS SMART CLASS TECHNOLOGY

Smart class technology is the technology related to digitally equipped classrooms used in teaching-learning. It fosters opportunities for teaching and learning by integrating learning technology, such as computers, specialized software, audience response technology, assistive listening devices, networking, and audio/visual capabilities. Smart class is a digital initiative, which has rapidly changed the approach and methodology that teachers use to teach and students to learn in an innovative manner using technology. The SMART class has made its impression on the whole educational environment.

An example is the *Sampark Smart class programme*, a three-year research project, for primary government schools. The Sampark Foundation has signed a MoU with the government of Chattisgarh and Uttarakhand wherein the government provides funds for teacher training and school monitoring and in turn, gets help from the foundation's trained personnel in pedagogy, innovative smart learning material, onsite support and ICT monitoring platform (Malur, 2015)

"Smart class technology" is a common term in the educational technology dictionary, but educators and tech developers say it has more to do with how teachers use emerging technologies than the sheer amount of tools at their disposal.

1.1.1 EVOLUTION OF SMART CLASS TECHNOLOGY

A SMART Board is an interactive white board that was created in 1991 by David Martin and Nancy Knowlton. The name "smart board" refers to an interactive white board which requires software and tools in order to work properly. The phrase smart classroom had been used since 1995 in San Diego State University when they built the first smart classroom with the aim to enhance learning in big classroom by integrating technologies, like clickers, sympodium, multichannel audio system,etc. (Frazee et al. 2006). In the following years until 2012, researchers investigated various technologies, like multimedia communicational supporting platform (Shi et al.2003), Ambient intelligence (Augusto 2009), Internet of things (Temkar et al. 2016), etc. to make either physical classroom or virtual classroom smart.

Department of School Education & Literacy, MHRD, GOI's report (2013) on Education Solutions Implemented In Private Schools In India, shows that on average, teachers having experience over 5 years, with the school, are well versed with Smart-boards, Projectors, MIS manual reporting, preparing online material, assignments.

COVID-19 marked the turning point in the evolution of the teaching-learning ecosystem. The sudden closure of schools led to the hurried beginning of online learning to ensure continuity. The two years of hiatus led to a drastic change and the educational universe rapidly accelerated into digitization (Jha 2022). The magnitude of this phenomenal growth can be gauged by a recent report released by MarketResearch.com that estimates the EdTech and smart classroom market size globally to be at USD 333.327 billion by 2027 as per the data culled from EdTech & Smart Classroom Market Intelligence Report – Global Forecast to 2027. Along similar lines, Smart Classroom Market in India has gained momentum in recent years, and it is expected to grow at a CAGR of 4.05 per cent and reach USD 16.11 billion by 2026.

1.1.2 COMPONENTS OF SMART CLASS TECHNOLOGY

Smart class technology is related to digitally equipped classrooms used in teaching-learning. A Smart class technology-enabled classroom has mainly two groups of components i.e. hardware and software. The basic hardware components of this technology include equipment listed as follows:

1. Desktop, laptops, tablets, Smartphones
2. LCD projector
3. Cordless Microphone/ collar mics
4. Amplifier and Speaker
5. Digital Podiums
6. Pen drive / External hard drive
7. Document Camera
8. Smart Boards or Interactive Whiteboards
9. Smart LCDs or LED Interactive Displays

To run the above-mentioned hardware various software are used, some of them are listed below

1. Operating system (windows/ Linux / Macintosh)
2. Basic office software (MS Office, G Suite etc)
3. interactive whiteboard software (EDUCOMP, EDUMAAT, TATA class edge)
4. collaborative whiteboard software(Google Jamboard, Miro, Lucidspark)
5. Learning management system (Moodle, Google Classroom, MS Teams)
6. Video conferencing software applications (ZOOM, MEET, WEBEX, SKYPE)
7. Social media and sharing platforms

With the evolution of technology newer and better equipments are being introduced as a part of this technology depending upon availability. A key component of 'smart classroom technology' is the flexible use of technology hardware and software, coupled with teacher professional development that allows learning in a variety of ways. Technology training and mentoring is the major factor that could help teachers develop positive attitudes toward technology and increase the likelihood that they use technology to enhance and support classroom instruction (Berson, 1996;

U.S. Department of Education, 2005; Reynolds & Morgan, 2001; Yildirim & Kiraz, 1999; Yildirim, 2000, U.S. Department of Education, 2005; NCES, 2010). Charalambos Vrasidas & Gene V. Glass (2007) think that "old curricula and pedagogical approaches should be reformed, and if necessary replaced, to take advantage of the affordances of the new media."

1.2.0 RATIONALE OF THE STUDY

A strategy is required about engaging the digital generation, improving individualized learning opportunities, sparking innovation in learning, enhancing teachers' digital pedagogy and getting the best from schools' ICT investment in the form of the smart classrooms that are being or have been set up. In the Manual for Self-appraisal of Teacher Education Institutions by NAAC, it has been mentioned that the institutional framework and the activities reflect its commitment to the integration of technology to enhance student learning. The provision for inclusion of knowledge and skills related to ICT are reflected throughout the curriculum, instructional practices, field experiences and practice teaching, assessment and evaluation systems of the institution. Several exemplar materials and media products are necessary to create and provide the right kind of learning experiences and are also used and developed by the students and teachers. The faculty extensively employs technology in developing such instructional material. Reports published by BECTA (2008) suggest that IWBs can be effective teaching tools regarding the contents of science. Department of School Education & Literacy, MHRD, GOI's report (2013) on Education Solutions Implemented In Private Schools In India, shows that on average, teachers having experience over 5 years, with the school, are well versed with Smart-boards, Projectors, MIS manual reporting, preparing online material, assignments. Improving competence and confidence in integrating current technology into pre-service teachers' curriculum is dependent on college faculty requiring their students to use technology in simulated teaching experiences (Kumar & Vigil, 2011).

Alazzam et al (2012) conducted a study on the Effects of Demographic Characteristics, Educational Background, And Supporting Factors on the ICT Readiness of Technical and Vocational Teachers in Malaysia. Al-Faki and Khamis (2014) in their study titled Difficulties Facing Teachers in Using Interactive Whiteboards in Their Classes found that English language teachers face challenges when they use Interactive Whiteboard (IWB) due to a lack of computer competency, breakdown in the common understanding of the schools' goals among those who hold the decision-making power, ongoing technical support is insufficient and the learners are more

familiar with technology than their teachers. Alharbi (2013) conducted a study on "Teacher's Attitudes Towards Integrating Technology: Case Studies in Saudi Arabia and the United States to identify several factors that challenge teachers and schools to adopt or integrate technology. Arslan and Akcay (2015) in the study on Teachers' Attitudes toward Using Interactive White Boards investigated high school teachers' attitudes towards using the Interactive Whiteboard in the classroom in Turkey. Teachers indicated that professional development for teacher training to use IWB was not satisfactory. Smart class technology must be encouraged in the current education system. E-learning and smart class technology provide the students as well as teachers to learn through new techniques differently and interestingly (Ashfaque 2014). Now the focus is on employing artificial intelligence techniques, and remote sensing to promote e-learning and developing many Smart tools and environments centred on the learner.

Balta and Duran (2015) studied the Attitudes of Students and Teachers towards the Use of Interactive Whiteboards in Elementary and Secondary School Classrooms along with differences in attitudes resulting from some demographic factors. This study includes some implications for policymakers, educators and researchers. Positive feelings of students towards the boards may encourage teachers from all over the world to use these devices and to engage students with interactive whiteboards in their courses. Interactive White Boards can be effective teaching tools regarding the contents of science as new classroom resources are developed. Educators strive to incorporate digital media advancements into their curriculum to provide an enriched learning experience for students with exceptional intelligence, as well as students in need of supplementary instruction. Though the resources exist, their effective use in the classroom is currently lacking (Becta 2008). Department of School Education & Literacy, MHRD, GOI's report (2013) on Education Solutions Implemented In Private Schools In India, shows that on average, teachers having experience over 5 years, with the school, are well versed with Smart-boards, Projectors, MIS manual reporting, preparing online material, assignments.

Dun & Bradstreet Information Services India Pvt. Ltd Research and Advisory Services (2010) researched the Usefulness and Effectiveness of the Educomp Smart Class Programme for enhancing students' academic performance and teachers' productivity in the classroom. Muhanna and Nejem (2013) conducted a study on the Attitudes of Mathematics Teachers toward Using Smart Board in Teaching Mathematics. Smart classrooms provide an interesting technical solution that does not necessarily guarantee improved student learning based on grades measured. Students

want more engaging ways to learn and are open to technology in their classrooms as it seems like a natural progression. It is necessary to support the technology with appropriate learning styles and pedagogies and then assess the appropriateness of the technical solution (RajaRajeswari 2013). The use of technology as a learning tool can make a measurable difference in student achievement, attitudes, and interaction with teachers and other students. Interactive, self-directed learning and higher-order thinking can be fostered by technology, and that technology can have the greatest benefit when the environment is conducive to such experiences (Sathishkumar and Karthikeyan 2014). The generation which has grown up on technologies such as Google, Face book etc there has been a shift in the 'neo millennial' learning style where passive textbook teaching of 'what' has shifted to a more dynamic approach of 'why and how'. The objective of smart class technology is to increase the excitement of education and make it comfortable and understandable; therefore it has to be introduced positively in institutions (Seetha 2013). Its overall effectiveness needs to be enhanced by better planning and implementing soft skills of multiple intelligences (SelvaKumari and Denisia 2013). The co-existence of a learning organizational culture in school, side by side with a high level of teachers' technological-content pedagogical knowledge plays a pivotal role in generating positive attitudes towards the changes that innovative technologies bring and in improving the implementation's success (Avidov-Ungar and Eshet-Alkakay 2011).

Studies related to the effect of smart class technology on the achievement of students in mathematics, Chemistry and Sanskrit by Jena (2013), Mali (2013), Menon (2015), Srivastava (2015) suggested the effectiveness of smart class technology as a learning tool.

Studies related to the usage of smart class technology in higher education included a comparative study of the Effects of a SMART Board on Nursing Students' Academic Performance, Group Learning Processes and User Satisfaction (Howse et al 2000), a study of the Utility of Interactive Whiteboards in Second Language Classrooms at Bachelor of Engineering level (Maheswari and Jeyanthi 2013), a study titled “Does the Smart Board Improve Skills of the First Year Medical Students in Learning Biochemistry?” (2009).

Studies related to the usage of smart class technology in teacher education and training included Smart Classrooms: A Survey of Faculty and Student Reactions at Northern Illinois University by Barnard (2002) which revealed that additional training in the use of smart classroom technology would be beneficial to allow faculty to feel more comfortable in equipment operation. Additional

technological training would address articulated student concerns regarding equipment failure, etc. Clark and Boyer (2015) conducted A Phenomenological Study of Pre-Service Teachers Regarding 21st Century Technology Integration Training to understand how in-service teachers with 3-5 years of experience perceived their pre-service training regarding the integration of 21st-century technology into instruction. Cox et al. (2003) concluded that interactive SMART whiteboards allow teachers to gain a deeper understanding of their student's needs, and students are better able to learn through collaboration with each other. It has a positive effect on class control. Kumar & Vigil (2011) say that Improving competence and confidence in integrating current technology in pre-service teachers' curriculum is dependent on college faculty requiring their students to use technology in simulated teaching experiences. Garba et al (2013) studied Integrating Technology in Teacher Education Curriculum and Pedagogical Practices and the Effects of Web-based Technology Resources on Pre-service Teachers' Achievement in Teacher Education Training, using the inquiry approach, in social studies teacher education curriculum in line with the TPACK framework (Technology, Pedagogy and Content Knowledge) theory. According to Husain (2010) Using ICT as a didactical tool implies using it to establish dynamic and powerful instructional strategies and environment. An interesting finding of this study is that teachers need to develop two main social ICT competencies on a priority basis i.e. demonstrating knowledge and skills for using technology in ethical, legal and safe ways and the ability to use humour and good manners during the teaching and learning process.

In their Study of Professional Development - Current Trends In Teacher Education, Latha and Joshi (2014) revealed that Teacher education is concerned with the aspects such as, who (Teacher Educator), whom (Student teacher), what (Content) and how (Teaching Strategy). It empowers the student teachers with the skills (teaching and soft skills) that would enable them to carry on the functions most efficiently and effectively. In their paper on Modelling, Training, and Mentoring Teacher Candidates to Use SMART Board Technology, Oigara and Wallace (2012) reports on research by two higher education instructors who provided SMART board training to teacher candidates to help them become competent in the use of interactive technology and to integrate instructional technology into their student teaching experience. The instructors modelled effective use of SMART boards during course instruction, offered training on the appropriate use of technology for the K-8 classroom, and provided ongoing mentoring of teacher candidates' emerging use of technology during student teaching field experience in a Professional

Development School (PDS). The results of this study suggest that Schools of Education must continue to collaborate with and provide support to partnership schools through the preparation of teacher candidates and in professional training of faculty to ensure that teacher candidates are placed with mentor teachers proficient in the use of technology like smart boards for instruction with the ultimate and mutual goal of improving student learning in schools.

Park (2014) studied Pre-Service and In-Service Teachers' Perceptions of White Board System Before Actual Experience and suggested that the participants' current perceptions toward the use of IWB may shift to positive if granted the opportunity to operate IWB in their local school's real life since perceptions are transitioned through rather real-life experience.

After a detailed review of related lite, rather it was concluded that a major scope for research in Smart Class technology lies in the areas of training of teachers, curriculum transaction, Infrastructure, adaptability of the existing system, development of instructional and learning material, media culture in education, evaluation patterns and modes of evaluation and classroom management strategies. The effect of smart classes on the achievements of students in various subjects has been studied by various researchers. Even though studies have been conducted on the usage, importance and effectiveness of Smart classes at school and higher education level in India but no studies have been conducted on the readiness of Faculty of teacher education institutions and teacher trainees towards usage of smart class technology and training of teacher trainees in concerning teacher education program. Thus an urgent need was seen to study the readiness for implementation of this technology in colleges of education with respect to the ICT Infrastructure, Human Resources, Financial, Psychological readiness and Content readiness. Also by finding out the adaptability of the existing system of colleges of education for implementation of smart class technology, the technology can be seamlessly integrated into the teacher training program. It is imperative to assess the training needs of faculty members and students in smart class technology to ensure an enhancement in the overall quality of education and updating of the real level of students and faculty members. The knowledge of Perceived barriers to the implementation of Smart Class technology in colleges of education needed to be found to ensure a reduction of gap in awareness, encourage investments, increase technology training courses and promote Smart education in secondary teacher education institutions, for grooming future teachers.

1.3.0 STATEMENT OF PROBLEM

The title of the present study reads as follows-

IMPLEMENTATION OF SMARTCLASSSMART CLASS TECHNOLOGY AT SECONDARY TEACHER EDUCATION LEVEL: A STUDY OF READINESS, ADAPTABILITY, PERCEPTIONS AND TRAINING NEEDS OF STAKEHOLDERS

1.4.0 OPERATIONAL DEFINITIONS

1.4.1 Smart class technology:-

It is technology related to digitally equipped classrooms used in teaching-learning. The basic hardware components of this technology include equipment like desktops, Laptops, Tablets, LCD projectors, Digital Podiums, Document cameras, Smart Boards or Interactive Whiteboards, and Smart LCD or LED Interactive Displays.

To run the above-mentioned hardware various software are used. Basic office software (MS Office, G Suite etc), interactive whiteboardClassroom software (EDUCOMP, EDUMAAT, TATA class Edge), collaborative whiteboard software(Google Jamboard, Miro, Lucidspark), Learning management system (Moodle, Google Classroom, MS teams), Video conferencing software applications (ZOOM, MEET, WEBEX, SKYPE), Social media and sharing platforms are few commonly used software in smart class technology.

1.4.2 Readiness - Readiness means the willingness or a state of being prepared for something. In this study readiness is the preparedness of the secondary teacher education institutions to implement Smart class Technology, in terms of ICT Infrastructure, Human Resources, Financial, Psychological and Content readiness.

a) **ICT Infrastructure readiness** – It refers to the preparedness of the institution in terms of the information and communication technology equipment and related facilities necessary for smart class technology.

b) **Financial readiness**: - When an institution has funds earmarked for smart class equipment and its installation, software installation and updating and expenses incurred on periodic maintenance of this equipment, it is said to be financially ready.

c) **Human Resources readiness**: - It refers to the availability of trained and skilled staff that is capable of carrying out teaching and learning through smart class technology along with experts

who can provide technical assistance for the upkeep and maintenance of the smart class equipment.

d) **Psychological readiness**: - It refers to motivational, emotional and professional values and state of mind that provide willingness for any professional activity e.g. use of smart class technology.

e) **Content readiness**: - Content readiness means the preparedness of an institution in having teaching learning material in the form of audiovisual material, presentations, assignments and assessments that can be delivered using smart class technology, to assist students in high-quality instruction to improve their comprehension and mastering of a skill.

1.4.3 **Adaptability** – It refers to the degree to which an organization (or a group of collaborating organizations) i.e. secondary teacher education institutions, can adjust its structure and academic processes and successfully achieve its goals, by the peculiar characteristics of dynamic environments by improvisation. This research work dealt with the present ICT setup in secondary ter education institutions and tried to find out the least means required to upgrade to a Smart class technology technology-enabled setup for the teacher trainees.

1.4.4 Perception - Perception is the act or faculty of perceiving or apprehending by musings or mind, cognition, understanding, intuitive recognition or appreciation.

1.4.5 Barriers to Implementation

Barriers may be defined as the challenges that affect the execution of a plan, strategy or tool effectively. Taking into account all aspects of smart class technology the following barriers may hinder its effective implementation:-

Financial barriers – when the cost of smart class equipment and its installation, software installation and updating, internet connection and expenses incurred on periodic maintenance of this equipment make it difficult to install and maintain they are called financial barriers.

b) Technological barriers - These barriers include device issues, internet-related problems, power failure, scarcity of technical expertise for maintenance, ICT illiteracy of users and lack of quality software and hardware.

c) Training barriers- These include problems related to a lack of knowledge about smart class technology and its use. It also takes into account little or no technology training of teacher trainees during their pre-service teacher training.

d) Pedagogical barriers- These are barriers related to effective teaching learning in classrooms using smart class technology i.e. lack of alignment between technology, curriculum and instruction, lack of learning, time-consuming lesson preparation and misuse of technology by students.

e) Psychological barriers- they may be defined as barriers related to human behaviour i.e. to state the and of mind, emotions of teacher trainees and faculty members that can limit their ability to use smart class technology.

f) Cyber security barriers- these barriers are related to problems that users face when using the internet which is an integral part of smart technologies.

1.4.6 Proficiency: - It may be defined as having the skill, ability and experience for doing something.

1.4.7 Need – It is the assessment of the gap or discrepancy between a present state (what is) and a desired state (what should be) in an organization. The need is neither the present nor the future state; it is the gap between them. In this study, the assessment of the training needs of stakeholders in secondary teacher education institutions was carried out by assessment of their current level of proficiency in the usage of smart class technology.

1.4.8 Stakeholders **–** All participants involved in any process or an institution and its affairs are called stakeholders. The stakeholders in this study included the principals and Faculty members of secondary teacher education institutions. The teacher trainees undergoing B.Ed and M.Ed training in secondary teacher education institutions are also a part of the study.

1.5.0 OBJECTIVES OF THE STUDY:

The objectives of the research work are as under:

1. To assess the Readiness for Implementation of Smart Class Technology in different secondary teacher education institutions from the point of view of Heads/Principals in

terms of ICT Infrastructure, Financial, Human Resources, Content and Psychological readiness.

2. To find out the Adaptability of the existing ICT system in secondary teacher education institutions to the inclusion of smart class technology in the training curriculum and as a training tool.

3. To compare the mean scores of Proficiency in the usage of Smart Class Technology, among the Faculty Members with respect to

(a) Type of secondary teacher education institution where working (Non-private institutions / private institutions).

(b) Highest research qualification (Research Degree /No Research Degree).

(c) Academic streams / highest qualification (science /social science/arts /others)

(d) Work Experience (Less than 3 years/3-10 years/more than 10 years).

4. To assess the Training needs of the Faculty Members of secondary teacher education institutions in the usage of Smart Class Technology.

5. To compare the mean scores of Perception about Barriers in the Implementation of Smart Class Technology, among the Faculty Members with reference to

(a) Type of secondary teacher education institution where working (Non-private institutions / private institutions).

(b) Highest research qualification (Research Degree /No Research Degree).

(c) Academic streams /highest qualification (science/ social science/arts/others).

(d) Work Experience (Less than 3 years/3-10 years/more than 10 years).

6. To compare the mean scores of Proficiency in the usage of Smart Class Technology, among teacher trainees with reference to

(a) Type of secondary teacher education institution where undergoing training (University department/ government college / private college).

(b) Academic streams /highest qualification (science/ social science/arts/commerce/others).

(c) Prior Teaching Experience (Yes / No).

7. To assess the Training needs of the teacher trainees of secondary teacher education institutions in the usage of Smart Class Technology.

8. To compare the mean scores of Perceptions about Barriers in the implementation of Smart Class Technology, among teacher trainees with reference to

(a) Type of secondary teacher education institution where undergoing training (University department/ government college / private college).

(b) Academic streams /highest qualification (science/ social science /arts/ commerce/others).

(c) Prior Teaching Experience (Yes / No).

1.6.0 HYPOTHESES

The hypotheses of the research work are as under:-

1. There is no significant difference in the mean scores of Proficiency in the Usage of Smart Class Technology, among the Faculty Members with reference to

(a) Type of secondary teacher education institution where working (Non-private institutions / private institutions).

(b) Highest research qualification (Research Degree /No Research Degree).

(c) Academic streams /highest qualification (science/ social science/arts/others).

(d) Work Experience (Less than 3 years/3-10 years/more than 10 years).

2. There is no significant difference in the mean scores of Perception about Barriers in the Implementation of Smart Class Technology, among the Faculty Members with reference to

(a) Type of secondary teacher education institution where working (Non-private institutions / private institutions).

(b) Highest research qualification (Research Degree /No Research Degree).

(c) Academic streams /highest qualification (science/ social science/arts/others).

(d) Work Experience (Less than 3 years/3-10 years/more than 10 years).

3. There is no significant difference in the mean scores of Proficiency in the Usage of Smart Class Technology, among Teacher Trainees with reference to

(a) Type of secondary teacher education institutions where undergoing training (University department/ government college / private college).

(b) Academic streams /highest qualification (science/ social science/arts /commerce/others).

(c) Prior Teaching Experience (Yes / No).

4. There is no significant difference in the mean scores of Perception about Barriers in the Implementation of Smart Class Technology, among Teacher Trainees with reference to

(a) Type of secondary teacher education institutions where undergoing training (University department/ government college / private college).

(b) Academic streams /highest qualification (science/ social science/arts /commerce/others).

(c) Prior Teaching Experience (Yes / No).

1.7.0 DELIMITATIONS

The delimitations of the study were as follows;

1. In this study the population comprised principals/ heads, faculty members and teacher trainees of secondary teacher education institutions affiliated with Devi Ahilya Vishwavidyalaya only.

2. The study was conducted in cities where secondary teacher education institutions affiliated to Devi Ahilya Vishwavidyalaya were located i.e. Indore, Mhow, Dhar, Khandwa, Badnawar, Dhamnod, Borawan, Khargone.

3. In this study was delimited to only the proficiency in usage and perception about barriers in implementation of smart class technology, of the faculty members and teacher trainees.

4. The study only the readiness and adaptability of the secondary teacher education institutions.

1.8.0 SAMPLE

The population of this study was the stakeholders of secondary teacher education institutions i.e. principals/heads of department, faculty members and teacher trainees of secondary teacher education institutions affiliated with Devi Ahilya Vishwa Vidyalaya, Indore(M.P.).

The sample consisted of 25 college principals/ heads, 98 faculty members and 500 teacher trainees belonging to secondary teacher education institutions affiliated with Devi Ahilya VishwaVidyalaya selected using a convenient sampling method. Both male and female respondents in the case of Principals / heads of departments, faculty members and teacher trainees were taken in the sample. The sample of faculty members included the assistant professors and associate professors of the secondary teacher education institutions, having different specializations in the field of education. The sample of teacher trainees consisted of B Ed and M Ed Students of the affiliated institutions.

1.11.0 TOOLS

In the present study, the researcher developed three 5-point rating scales, namely a Readiness and Adaptability Scale for Principals / Head of Secondary teacher education institutions, a Proficiency Scale in Usage of Smart Class Technology for Faculty Members/Teacher Trainees of Secondary Teacher Education Institutions and a Perception Scale For Faculty Members/ Teacher Trainees Of Secondary Teacher Education Institutions about barriers in the implementation of smart class technology.

1.11.1 CONSTRUCTION OF TOOLS

In the present study for collection of the data related to the implementation of smart class technology in secondary teacher education institutions the following tools were used:-

Table 1.2: Title of Tools Used for the Study and Respondents

Ser. no.	Title of the tool	Respondents
1.	Readiness And Adaptability Scale For Principal / Head Of Secondary teacher education institutions	Principal of the Institution / Head of Department

2.	Proficiency Scale In Usage Of Smart Class Technology For Faculty Members/Teacher Trainees Of Secondary Teacher Education Institution	Faculty Members And Teacher Trainees
3.	Perception Scale For Faculty Members/ Teacher Trainees Of Secondary Teacher Education Institutes About Barriers in Implementation Of Smart Class Technology	Faculty Members And Teacher Trainees

The tools for the present study were developed by the researcher after conferring with experts several times. The initial draft of the tools was shown to the experts from time to time and was modified according to their suggestions. The final draft of the tool was converted into Google Forms for online data collection by the researcher. The summary of the final draft of the tools has been discussed as follows:

1.11.2 READINESS AND ADAPTABILITY SCALE FOR PRINCIPAL / HEAD OF SECONDARY TEACHER EDUCATION INSTITUTIONS

The researcher made a Readiness and Adaptability Scale for Principal / Heads of Secondary teacher education institutions. It was made in English and consisted of four sections. The first section was about the basic information regarding the Name of the institution, the institute's Website, the Level of teaching in the Institution (Undergraduate, Post Graduate or Doctoral) and the Type of Training Institution (University Department, Government College or Private College). Section B was about Institutional Readiness for Smart Class Technology. It consisted of five sub-sections. The details of the final draft of the scale are as follows.

The first subsection was about ICT and Infrastructure Readiness and it consisted of 11 items related to Hardware, 16 Items related to software and 2 items related to Security and Maintenance. The respondents had to respond on a Five point scale i.e. sufficiently available, somewhat sufficient, neutral, insufficient but plan to procure more and not available at all.

The second subsection is about Financial Readiness and consisted of 4 Statements. The respondents had to respond on a five-point scale i.e. available and fully utilised, available but partly utilized, neutral, not available but planned and not available.

The third subsection was about Human Resource Readiness. It consisted of 6 statements out of which 4 were positive and 2 negative statements (no 2, 6). The respondents had to respond on a five-point scale i.e. strongly agree, agree, neutral, disagree and strongly disagree.

The fourth subsection was about Content Readiness. It consisted of 4 statements out of which 3 were positive and 1 negative (no. 2). The respondents had to respond on a five-point scale i.e. strongly agree, agree, neutral, disagree and strongly disagree.

The last subsection was about Psychological Readiness. It consisted of 6 statements out of which 4 were positive and 2 negative (no. 3, 5). The respondents had to respond on a five-point scale i.e. strongly agree, agree, neutral, disagree and strongly disagree.

1.11.3 PROFICIENCY SCALE IN USAGE OF SMART CLASS TECHNOLOGY FOR FACULTY MEMBERS/TEACHER TRAINEES OF SECONDARY TEACHER EDUCATION INSTITUTION

The researcher made a Proficiency Scale in the Usage of Smart Class Technology for both Faculty Members and Teacher Trainees of Secondary Teacher Education Institutions. The statements for both faculty members and teacher trainees were the same. The only difference between them was the basic information asked at the beginning of the scale. The faculty members were asked to provide their name, e-mail ID, name and type of the institution (Non-private Institution/ private institution) where the respondent is working, state where the institution is located, highest research qualification (Research degree/No research degree), Academic stream/ highest qualification (Science/Social science/ Arts / Others), Work Experience (Less than 3 years/3-10 years/more than 10 years).

The Teacher trainees were asked to provide their name, e-mail ID, name and type of the institution where the respondent is undergoing training(University department/ government college/ private college), state where the institution is located, academic stream/ highest qualification (science/social science/arts/commerce/others), prior work experience(yes/no).

The initial draft of the proficiency scale in Usage of Smart Class Technology for Faculty Members/ Teacher Trainees of Secondary Teacher Education Institutions consisted of 25 statements in total out of which 6 statements were about hardware (configurations, connections and functioning) and the remaining 19 were pertaining to software. The respondents had to respond to a five-point scale i.e. Expert level (I can use it very well), Advanced User level (I can use it well), Intermediate User level (I can use it satisfactorily), Basic User level (I can use it to some extent) and Non-user level (I can’t use it). However, after perusal by experts, it was revised and a few items were added.

The final proficiency scale had a total of 30 statements. There were 9 statements about hardware and 21 related to software.

1.11.4 PERCEPTION SCALE FOR FACULTY MEMBERS/ TEACHER TRAINEES OF SECONDARY TEACHER EDUCATION INSTITUTIONS ABOUT BARRIERS IN IMPLEMENTATION OF SMART CLASS TECHNOLOGY

The researcher made a Perception Scale for Faculty Members/ Teacher Trainees of Secondary Teacher Education Institutions about Barriers in the Implementation of Smart Class Technology. The statements for both faculty members and teacher trainees were the same. The difference between them was the basic information asked at the beginning of the scale. The faculty members were asked to provide their name, e-mail ID, name and type of the institution (Non-private Institution/ private institution) where the respondent is working, the state where the institution is located, highest research qualification (Research degree/No research degree), Academic stream/ highest qualification (Science/Social science/ Arts / Others), Work Experience (Less than 3 years/3-10 years/more than 10 years).

The Teacher trainees were asked to provide their name, e-mail ID, name and type of the institution where the respondent is undergoing training, the state where the institution is located, academic stream/ highest qualification (science/social science/arts/commerce/others) and prior work experience(yes/no).

The Initial draft of the perception scale consisted of 33 statements which were divided into 6 sub-sections namely financial barriers, technological barriers, training barriers, pedagogical barriers, psychological barriers and cyber security barriers. The experts advised a few changes in the tool and accordingly the tool was edited.

The final draft of the tool had 39 statements in all. The respondents had to respond on a five-point scale i.e. strongly agree, agree, neutral, disagree and strongly disagree.

1.12.0 PROCEDURE OF DATA COLLECTION

For data collection, the researcher first contacted the Principals/Heads of selected secondary teacher education institutions and informed them about the objectives of the present study and then permission from Principals/Heads was obtained to collect the data. After obtaining permission from the Principals/Heads of institutions, the researcher got contact numbers of the faculty

members and teacher trainees from them and then informed them about the objectives of the present study.

After this, tools were sent either individually or in groups by the researcher and instructions were also given to students to fill out the sent tools. Similarly, related tools were also sent on the Email/Whatsapp number of Principals/Heads of Secondary teacher education institutions and necessary instructions related to tools were given. After providing tools, the researcher informed the respondents that if any question was not understood by them, they can seek clarification before giving a response on the item of the tool. The researcher thanked them for providing the data. The scoring was done as per the nature of the tool.

1.13.0 STATISTICAL TECHNIQUES

The perception and proficiency scores were analysed using Independent T-Test and one-way ANOVA. Before applying the tests the assumptions underlying the tests i.e. assumptions of normality and the assumption of homogeneity of variances was tested. For the readiness, adaptability and training need assessment, percentages were used for data analysis.

1.14.0 FINDINGS

The findings that emerged from the study are as follows:

1.14.1 Major Findings related To the Implementation of Smart Class Technology at the Secondary Teacher Education Level

1. The detailed analysis of Infrastructure readiness responses showed that most of the secondary teacher education institutions had sufficient hardware i.e. Computers and Laptops, Digital projection systems, amplifiers/speaker systems, Cordless microphones/ collar mics, distance learning cameras, Network access with good bandwidth/speed. However, the institutions were found lacking in Smartboards or interactive whiteboards, Smart LCDs or LED interactive displays, document cameras and lecture capture devices and digital podiums.
2. The responses related to software showed that Basic office software (MS Office, G Suite etc), Video conferencing software applications (ZOOM, MEET, WEBEX, SKYPE) and Social media and sharing platforms were sufficiently available. However, the institutions

were found lacking in Interactive White Board Software, Collaborative whiteboard software and Learning management system (Moodle, Google Classroom, MS Teams).

3. The security and maintenance aspect of infrastructure readiness was found adequate as Support for maintenance and repair of the hardware and software resources/services was sufficiently available. Adequate software and procedures to protect privacy and organisational data were in place.

4. The detailed analysis of financial readiness responses showed that a sufficient budget was available for cyber security concerns. However adequate funds to install smart class technology equipment and its periodic up- gradation, funds for conducting training in the usage of Smart class technology and Funds for digital content development or purchase were not sufficient.

5. The detailed analysis of responses to human resource readiness items showed that Faculty members were skilled in using Smart Class technology for teaching and learning however they did not receive regular training to update them in the use of Smart Class Technology. It was also found that there is adequate technical staff to help and support faculty members and teacher trainees in using Smart Class technology effectively and the institution has dedicated staff for content development and execution of Smart Class Technology. Also, the Faculty members trusted the support received from support staff while developing and delivering the courses. The skill levels of IT staff members in providing the needed support to faculty members were satisfactory.

6. The detailed analysis of responses to content readiness items showed that there was support available for the creation of digital multimedia content in the institution (e.g. production of e-courses, audio and video materials, presentations, Animation, etc.). Faculty members were trained to organise learning content appropriately using smart class technology and had adequate access to the online systems to develop courses for Smart Class Technology. However, no instructional designers were available in the institution to develop content for teaching using smart class technology.

7. From the detailed analysis of responses to psychological readiness items it was found that Faculty and staff members were willing to learn about Smart Class Technology in the organization and supported each other easily while using smart class technology. The faculty members were comfortable with the use of Smart class technology for teaching their

subject and were interested in undergoing further training in the usage of smart class technology. However, it was found that there was no culture of knowledge creation and sharing in the organisation with regards to Smart Class Technology.

1.14.2 Major Findings Related to the Adaptability of the Existing ICT system to the Inclusion of smart class technology in the training curriculum and as a training tool

The analysis of responses to readiness revealed that the secondary teacher education institutions had basic infrastructure for implementation of smart class technology. This included Computers and Laptops, Digital projection system, amplifiers / speaker systems, Cordless microphones/ collar mics, distance learning cameras and internet access. The institutions were highly adaptable to the inclusion of smart class technology equipment like Smart boards or interactive whiteboards, Smart LCDs or LED interactive displays, document cameras, lecture capture devices and digital podiums which were not available in the most of the institutions. The stakeholders were found to be psychologically ready and willing to undergo training, in usage of the smart class technology, to improve their ability in using it as a training tool. However the institutions were financially not ready for inclusion of this technology.

1.14.3 **Findings Related To Proficiency in the Usage of Smart Class Technology among Faculty Members**

1. The Type of secondary teacher education Institution where the faculty members are working does not significantly influence their Proficiency scores.

2. The highest Research Qualification of the faculty members does not significantly influence their Proficiency scores in usage of Smart Class Technology.

3. The academic streams/ Highest Qualification of Faculty members do not significantly influence their proficiency scores in usage of Smart Class Technology.

4. It was found that the Work Experience does not influence scores of Proficiency in usage of Smart Class Technology of Faculty members.

1.14.4 Major Findings Related to the Training needs of the Faculty Members of secondary teacher education institutions in the usage of Smart Class Technology

1. The analysis of proficiency scores of faculty members revealed that more than 70 percent faculty members had intermediate to expert level of proficiency in usage of desktops, laptops, smartphones, tablets, digital projection system, microphones and document cameras. Thus they had a very low need for any training about the above equipment.

However the proficiency was found to be less in case of usage of smart boards, smart LCD/ LED displays and digital podiums. Thus it was concluded that training was needed to improve the proficiency of faculty members in the usage of these equipments.

2. The proficiency scores of faculty members in items related to the software revealed that a substantial percentage of respondents had very little or no proficiency in usage of Interactive Whiteboard Software (like EDUCOMP, EDUMAAT, TATA class edge), Collaborative Whiteboard Software(Google Jamboard, Miro, Lucidspark), Multimedia packages (installation and use), Educational games/simulations , e-Learning Content Design (Script Writing, Graphics, Animation, Audio-video) Online Testing (software like Google forms, Kahoot, classmarker etc.), Lecture capture tools through computer, web-camera and smart phone (Loom, Screencast-O-Matic, Quicktime etc.) and Open Source Softwares for education (OpenSIS, TUX paint, TUX typing Nextcloud, Chamilo etc.). Thus the training needs for these domains were high.

3. Operating system (windows/Linux/Macintosh), Learning management system, Video conferencing applications, Social media and sharing platforms, Word Processors, Presentations, Spreadsheets, Databases in educational contexts, Digital media(Graphics, photographs, animation, audio and video), Websites with educational content, Communication through the web, use of web based utilities and E Books/e-Text books (searching, saving) were the aspects of software that needed intermediate level of training to further add-on to the proficiency of the faculty members.

1.14.5 Findings Related To Perception of Barriers in the Implementation of Smart Class Technology among the Faculty Members

1. It was found that the Type of secondary teacher education Institution where faculty members are working does not significantly influence the scores of Perception of Barriers in the Implementation of Smart Class Technology.

2. It was found that the Highest Research Qualification does not significantly influence scores of Perception about Barriers in the Implementation of Smart Class Technology of Faculty members.

3. It was found that the academic streams/ highest qualifications of faculty members, does not influence their scores of Perception about Barriers in the Implementation of Smart Class Technology.

4. It was found that the Work Experience of Faculty members do not influence scores of Perception about Barriers in the Implementation of Smart Class Technology.

1.14.6 Major Findings Related To Proficiency in the Usage of Smart Class Technology among Teacher Trainees

1. It was found that there exists a significant difference in the mean scores of Proficiency in Usage of Smart Class Technology among Teacher Trainees with reference to their Type of secondary teacher education Institution where they are undergoing training. It was found that the teacher trainees undergoing training in university department are more proficient in usage of smart class technology relative to those of Government Colleges. The teacher trainees undergoing training in Private Colleges are more proficient in usage of smart class technology relative to those of Government College.

2. It was found that the academic streams/ highest qualifications of Teacher Trainees do not significantly influence the scores of Proficiency in usage of Smart Class Technology.

3. It was found that the teacher trainees having prior teaching experience have more proficiency in usage of smart class technology relative to teacher trainees having no prior teaching experience.

1.14.7 Major Findings Related to the Training needs of the teacher trainees of secondary teacher education institutions in the usage of Smart Class Technology

1. The analysis of proficiency scores of **teacher trainees** revealed that they had intermediate to expert level of proficiency in usage of desktops, laptops, smartphones, tablets, digital projection system, microphones and document cameras. Thus they had a very low need for any training about the above equipment.

However the proficiency was found to be less in case of usage of smart boards, smart LCD/ LED displays and digital podiums. Thus it was concluded that rigorous training was needed to improve their proficiency in the usage of these equipments.

2. The proficiency scores of teacher trainees in items related to the software revealed that a substantial percentage of respondents had very little or no proficiency in usage of Interactive Whiteboard Software (like EDUCOMP, EDUMAAT, TATA class edge), Collaborative Whiteboard Software(Google Jamboard, Miro, Lucidspark), Multimedia packages (installation and use), Educational games/simulations , e-Learning Content Design (Script Writing, Graphics, Animation, Audio-video) Online Testing (software like Google forms, Kahoot, classmarker etc.), Lecture capture tools through computer, web-camera and smart phone (Loom, Screencast-O-Matic, Quicktime etc.) and Open Source Softwares for education (OpenSIS, TUX paint, TUX typing Nextcloud, Chamilo etc.). Thus the training needs for these domains were high.

3. Operating system (windows/Linux/Macintosh), Learning management system, Video conferencing applications, Social media and sharing platforms, E Books/e-Text books (searching, saving), Word Processors, Presentations, Spreadsheets, Databases in educational contexts, Digital media(Graphics, photographs, animation, audio and video) and Websites with educational content, Communication through the web and use of web based utilities. Thus these were the aspects of software that needed intermediate level of training to further add-on to their proficiency.

1.14.8 Findings Related To Perception of Barriers in the Implementation of Smart Class Technology among the Teacher trainees

1**.** It can be concluded that the Type of secondary teacher education Institution where undergoing training does not influence scores of Perception about Barriers in the Implementation of Smart Class Technology of Teacher Trainees.

2. It was found that the academic streams/ highest qualifications of Teacher Trainees do not influence their scores of Perception about Barriers in the Implementation of Smart Class Technology.

3. It was found that the teacher trainees having no prior teaching experience perceived more barriers in implementation of smart class technology relative to teacher trainees having prior teaching experience

1.15. 0 EDUCATIONAL IMPLICATIONS

The findings of this study have the following implications:

1. Implications for Administrators - The present study revealed that the minimum infrastructure requirements of setting up smart class technology enabled teaching learning, in secondary teacher education institutions already exist. Thus the institutions are infrastructure ready and can seamlessly adapt to the changes in IT equipment and software. The institutions must be encouraged to upgrade this technology to improve the quality of training being imparted there to keep up with the continuously changing IT world. The administration must have funds earmarked for smart class equipment and its installation, software installation and updating and expenses incurred on periodic maintenance of this equipment. The Psychological readiness of the faculty members and staff must be taken into account and they must be trained periodically to enhance their smart class technology related skills. The institutions can conduct seminars and workshops specifically for the faculty with regard to smart class technology.

2. Implications for Principal/ Head of department - The principals and heads of the secondary teacher education institutions, lead the institutions of learning for the future teachers of our next generations. Thus they need to encourage technology integration by encouraging their team members to take every opportunity to learn the various aspects of smart class technology. They can carry out the assessment of training needs of their staff and provide the best training for proficiency enhancement.

3. Implications for faculty members and teacher trainees - The faculty members are dealing with the new generation of teacher trainees who are technologically savvy. Also these trainees are going to handle even more technologically sound school students. As revealed by the above study the academic background, research qualifications or type of institution does not have any significant influence on the proficiency in usage or perception

about the barriers in implementation of smart class technology. Thus the faculty members must make themselves well verse with all the aspects of smart class technology and its smart and flexible usage in teaching learning.

1.16.0 SUGGESTIONS FOR FURTHER RESEARCH

1. The study can be done on a larger sample.
2. Present study is restricted only to the secondary teacher education institutions affiliated to Devi Ahilya Vishwavidyalaya (MP). It can be extended to other universities.
3. This study can also be carried out on other institutes of higher education for streams like management, fine arts, science etc.
4. This study can also be done at primary and secondary education levels also.

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