EFFECTIVENESS OF EDUCATIONAL TECHNOLOGIES IN HIGHER SECONDARY SCHOOLS: A CASE STUDY OF KV-CLRI SCHOOL, CHENNAI

A REPORT

submitted by

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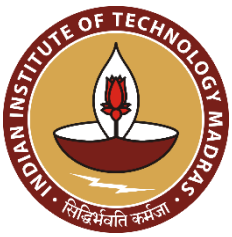
for the award of the degree

BACHELOR OF TECHNOLOGY



DEPARTMENT OF ELECTRICAL ENGINEERING

INDIAN INSTITUTE OF TECHNOLOGY MADRAS

MAY 2016

CERTIFICATE

This is to certify that the report entitled "**EFFECTIVENESS OF EDUCATIONAL TECHNOLOGIES IN HIGHER SECONDARY SCHOOLS: A CASE STUDY OF KV-CLRI SCHOOL, CHENNAI**" submitted by D.V.Sai Charan Reddy to the Indian Institute of Technology Madras for the award of the degree of Bachelor of Technology (B.Tech) is a bonafide record of research work carried out by him under our supervision. The contents of the report, in full or in parts, have not been submitted to any other Institute or University for the award of any degree or diploma.

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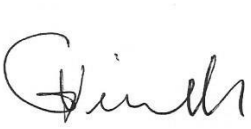

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ACKNOWLEDGEMENTS

This report is the result of a lot of dedicated work, an evolving mind and a colossal amount of learning. As I submit this report I believe, I have put in my sincere efforts and wish to acknowledge many great people without whose help this work would not have been possible.

Foremost, I thank all my **respondents, students and teachers** whose inputs have greatly enriched my research.

I take this as an opportunity to thank Principals of Government Higher Secondary School (G.H.S.S. Velachery, Chennai), KV-IITM and KV-CLRI schools and Vice-Principal of KV-Ashok Nagar who were extremely helpful at every stage of survey. I also wish to thank **Ms. Sai Sandhiya, Mr. Xavier, and Mrs. Bensy of KV-IITM, KV-CLRI and KV-Ashok Nagar** respectively for their huge efforts in making this process easy for us.

I wish to acknowledge the enormous amounts of efforts made by my research guide

Prof. V. R. Muraleedharan who was always there for me supporting in every small effort of mine. Albeit his busy schedule, he always made time to clear all doubts in person. There was a moment when it felt like this project is not progressing any further. That is when he took charge and made this entire work possible. He is more like a mentor than a research guide to me.

It was **Prof. G. Venkatesh**, my co-guide, who had the ability to understand my perspective better than any other which gave me this freedom to express thoughts. Despite his very busy schedule, he too was keen in meeting in person to review the work periodically. I personally think that his unique ability to come up with out of the box ideas has immensely helped me throughout the process.

I believe this report would be incomplete without the mention of **Praneeth** and **Bharath**, my friends, batch mates and project mates. We always have been together throughout the tenure of the project despite all ups and downs. They shared all possible thoughts, resources to bring the best out of us.

I thank **Mr. RVSS Subrahmanyam (Assistant Commissioner-Kendriya Vidyalaya Sangathan)** for permitting us to conduct our survey in KV-IITM, KV-CLRI and KV-Ashok Nagar. On his valuable suggestion, we excluded 7^{th} class from our data set.

I thank **Ms. Pooja Kulkarni, IAS (State Project Director-SSA)** and **Mrs. R. Malathy (Senior Consultant-SSA)** for providing us with much needed permission to conduct our survey in Government Higher Secondary School, Velachery. I also wish to thank **Mr. Balaji, IAS** for introducing us to them.

I thank **Principal, Vana Vani School-IITM** for letting us do our pilot study in their school.

It was the meetings with **Prof. M. Suresh Babu (HSS)** and **Mr. Balaji Sampath (AID-India founder)** and their inputs that re-confirmed our methodology and direction of project. I'm always grateful towards them. I also thank **Prof. Suresh Babu M and Prof. Milind Brahme (DoHSS)** for evaluating this study and providing many valuable suggestions.

I thank **CTaP (Centre for Technology and Policy)** for providing us the most necessary work space. This is where most of our meetings used to happen.

I wish to thank the technologies like SPSS, Excel, Google, Google Scholar, Science Direct etc. which revolutionised the way I could approach my project. Finally to the surroundings in which IIT is set, offered me continuous inspiration.

ABSTRACT

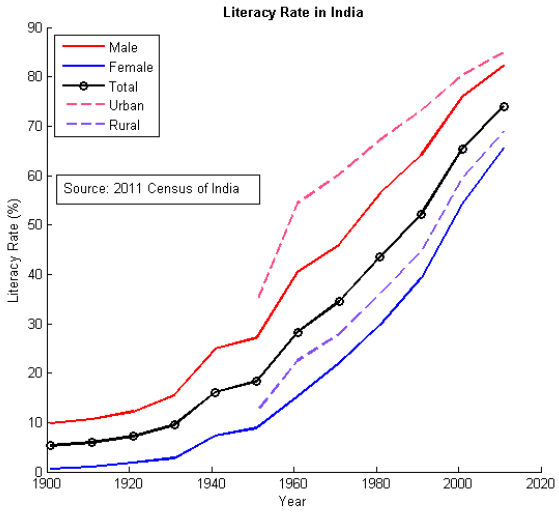
It is well established that Indian education system is not reaching its founding objectives. The reasons are plenty ranging from quality issues to corruption. Technology is one aiding with minimum selectivity which can bring significant change. Multiple countries have established this fact after extensively having tired this as a part of their policy. Also, bearing in mind the importance of a transition from teacher-centred, lecture-based teaching to student-centred, technology-based learning, this study examined students' and teachers' interest to integrate educational technology (INTEREST) in terms of their computer attitude (ATTITUDE), level of proficiency in using technology (PROFICIENCY), their perception of utility of technologies for their academic curriculum (UTILITY) and the professional support to achieve this from school authorities, peers etc. (SUPPORT). These five dimensions are referred to as Education Technology Dimensions (ETDs). Separate questionnaire for students and teachers was developed. The study used a sample of 522 students and 65 teachers from KV-CLRI and G.H.S.S schools. The two groups differed on almost every ETD. Extensive analysis is being carried out on KV-CLRI. Path analysis was done to know effective paths so that school authorities can invest on technologies for better results. Results and discussion and implications are extensively discussed.

CHAPTER 1

INTRODUCTION

1.1 Progress of Education in India

Education in India is provided by both public sector as well as the private sector, with control and funding coming from three levels: Central, State and Local. Under various articles of Indian Constitution, free and compulsory education is provided as a fundamental right to children between ages of 6 and 14. Considering India's long colonial past, this provision of free education as a fundamental right is an enormous achievement.



India has made progress in terms of increasing the primary education attendance rate and expanding literacy to approximately three-quarters of the population in the 7-10 age group, by 2011. As per the Annual Status of Education Report (ASER) 2012, 96.5% of all rural children between ages of 6-14 were enrolled in school. The overall literacy rate has grown from 12% in 1947 to 74.04% in 2011. The country has more than 1.4 million schools with over 227 million students enrolled. The ratio of public to private schools in India is 7:5. India's improved education system is often cited as one of the main contributors to its economic development.

At the primary and secondary level, India has a large private schools system complementing the government run schools, with 29% of students receiving private education in the 6 to 14 age group. It is important to clarify that while there are private schools in India, they are highly regulated in terms of what they can teach, and in what form they can operate. Hence, the word 'private' can be quite misguiding.

1.2 Education System in India

The central and most state boards uniformly follow the "10+2+" pattern of education. This forms the most important, character and intellectual building time period of any child's life. The first 10 years is further subdivided into 5 years of primary education, 3 years of upper primary, followed by 2 years of high school. This pattern is originated from the recommendation of Education Commission of 1964-66.

1.3 School Education and issues

While quantitatively India is inching closer to universal education, the **quality of its education** has been questioned particularly in its government run school system. States of India have introduced tests and education assessment system to identify and improve such schools.

Major issues/reasons:

1. Lack of Infrastructure: Although schools are built, they are not properly maintained so as to enable good education. Approximately 95.2% of schools are not yet compliant with the complete set of RTE infrastructure according to survey conducted in 2010.
2. Poor Global ranking: India ranked second last among the 73 countries that participated in the programme for International Student Assessment (PISA), conducted to evaluate education systems worldwide by OECD (Organisation for Economic Co-Operation and Development) Secretariat.
3. System of Education: Education is information based rather than knowledge based.
4. Social issues: Although not a case in urban areas, there are many rural areas where a lot of discrimination is made based on caste, gender etc.
5. Quantity and quality of teachers and teaching material/content
6. Lot of difference in quality between private and government run schools.

Technology could play a role in addressing some of the above issues

1.4 Role of Technology in School Education

Simple understanding of Indian school education system suggests that the present mode of teaching/learning is not working well or is not able to achieve its objectives. Broadly the issues are Availability (points 2, 3 and 5 above), Accessibility (points 1 and 4 above) and Affordability of quality of education (point 6 above).

If we have to think of one thing which shows the least selectivity in terms of usage and benefits, technology is the first to come to mind. Globally, even a person in the most remote geographical locations can access quality education, thanks to Internet. A person suffering with low understanding can learn concepts better, owing to many videos, presentations. There are multiple cases where technology was, is and will play a major role in shaping a child's career.

Although all technologies are not available, accessible and affordable to everyone, enormous amount of research is being carried out in this space so as to remove all kinds of selectivity (rich-poor, male-female, social class etc.) technology has. This gives us hope, motivation and direction to set things right. Many countries all over the world have gained very good results with the introduction of technology into their curriculums.

1.5 Motivation and Scope for the study

Now that it is established at least intuitively that technology can be helpful for Indian school education system, it is required to see if our intuition makes real sense.

There are many schools in India which are currently using or have previously used educational technologies. So it is necessary to conduct a primary study to know about the

effectiveness of these technologies. This is necessary because to take any further steps in using technology, it is important to know the Status-Quo.

The main purpose is to check for the factors which influence the integration of technology in schools and finding the relations between each of them.

The study is based out in Tamil Nadu and specifically in Chennai. The evidence or results provided from this research will provide directions to policy makers, school authorities and parents to thoughtfully invest in technology.

1.6 Research Questions

Broadly this study addresses four research questions.

- What kinds of technologies are students using and with what levels of skill?
- How are these technologies used with reference to specific class or subject?
- What do students perceive to be the value and advantages of the use of technology
- What are the barriers for effective technology implementation and usage?

1.7 Operational Definitions

Traditional method of teaching: This refers to the method of teaching where the education is teacher centred i.e. teacher will be the controller of the learning environment.

- Giving Lectures
- Text book based teaching
- Using black/white/green boards
- On-paper Assessments

Traditional method of learning:

- Student listens to lectures
- Make notes in notebooks
- Follows text book
- Clarification of subject doubts from peers and teachers through personal interactions.
- Personal feedback from teacher

Educational Technology/ Technology: Since the scope of technology is much more than that has already been covered and a lot of research is being carried out, we wish to define technology in negation. So any technology which helps teaching/learning in supplement to traditional way of teaching/learning is Educational technology/Technology.

Parents: This refers to parents of students studying in the school.

School Management: This refers to school authorities in the school of the respondent. The assumption is that they have the right to take key policy decisions concerning the school.

Peers: In the student questionnaire, this refers to all of respondent's class mates. In teacher questionnaire, this refers to respondent's teacher colleagues.

Subject: This refers to respondent's course subjects. They can be anything like Maths, Science etc.

1.8 Structure of the report

The report progresses as follows:

Chapter 1 deals with introduction so as to set the context for this study

Chapter 2 deals with Literature review which covers all the literature that has primarily been researched to set the context right.

Chapter 3 deals with Methodology which broadly explains the objectives, instruments development, sampling, data collection and data analysis

Chapter 4 deals with Results and Discussion which discusses results of various analyses.

Chapter 5 deals with Implications for Practice which consolidates all findings and makes conclusive observations.

CHAPTER 2

LITERATURE REVIEW

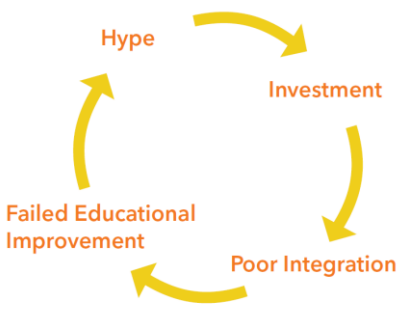
This chapter focuses on the key points/findings and overviews of literature I have read to set the context. Some of the literature was found by searching for key word 'Educational technologies" in website www.sciencedirect.com . A lot of filtering has been done based on the abstracts, its relevance to our basic objectives etc. Some of the literature was specifically chosen to set the context for Indian system in particular. (References and Sources are mentioned in the end.)

2.1 Connection between learning and Technology

- **Students, Computers and Learning-Making the Connection** by **OECD** (report is based out of OECD countries) (2015)
    - Despite the pervasiveness of Information and Communication Technologies (ICT) in our daily lives, these technologies have not been as widely adopted in formal education.
    - The foundation skills required in a digital environment can and should be taught.
    - To reduce inequalities in the ability to benefit from digital tools, countries need to improve equity in education first.
    - Using the computers more intensively than the current OECD average tends to be associated with significantly poorer student performance.

2.2 Investor's Perspective

- **EDUCATION TECHNOLOGY IN INDIA: Designing Ed-Tech for Affordable Private Schools** (Kim Campbell, Hila Mehr, Ben Mayer-2012)
    - A limited knowledge of technology's potential and specific capacities in schools leads to an underutilization of the technology that is present in schools. Clear learning goals for technology in classroom are to be established
    - Inconsistent cash flow from low-income parents makes it difficult for schools to acquire all resources necessary to maintain and maximize the use of educational technology tools.
    - Some implementations are halted because some schools leaders view technology as a marketing tool to be preserved rather than an educational tool to be used.
    - The key issue is lack of integration.
    - Discussed about the Hype Cycle of investment on educational technologies.



2.3 Pupils' Perspective

- **Implementation of Educational Software in Classrooms-Pupil's Perspective** (Zoria Stanisavljevic-Petrovic, Zoran Stankovic, Bisera Jetvic-2014)
    - Almost two-thirds of surveyed pupils prefer learning through educational software and believe that it is the best way of learning at school.
    - Schools should be advised to apply resources of information technologies for educational purposes to a far greater extent.
    - Starting from the attitude that the application of educational software in the process of teaching significantly contributes to the innovation of the teaching process
    - A change in the process of teaching, especially in the segment dealing with individualisation of teaching and learning process is required for which application of educational software can be extremely significant.

2.4 Teachers' Perspective

- **Factors that influence student teacher's interest to achieve educational technology standards** (Dj. Kadijevich, LenniHaapasalo- 2006)
    - To improve interest in using educational technologies, we need to improve attitude towards technologies by means of experience.
    - A desired role of support (positive impact on experience and Attitude) can be achieved when support respects experience.
    - Teacher's understanding of why, when and how to use technology has to be promoted bearing in mind that computer skill should not be taught separately from knowledge structure and pedagogical thinking.
    - A positive direct effect of experience on attitude
    - A positive direct effect of attitude on interest.
    - A positive indirect effect of experience on interest through attitude.

CHAPTER 3

METHODOLOGY

3.1 Overview

Section 3.1 outlines the methodology adopted for this study. Section 3.2 provides the objectives of this study. Conceptual frame work for analysis is presented in section 3.3 and section 3.4 deals with the hypothesis. Section 3.5 deals with the sampling used in different stages in selecting schools, student and teacher respondents. The data collection process used to collect data from schools is mentioned in section 3.6. Data analysis techniques are presented in section 3.7

3.2 Objectives of Study

Very broadly, the study attempts to

- Examine the extent to which technologies are being used in middle level school educational institutions
- Identify the factors that hinder or promote adoption of technologies in school education
- Provide recommendations to policy makers, school authorities and parents for effective use of technologies to enhance learning processes within and outside school environments

3.3 Conceptual Frame work for analysis

This study utilized a similar method used by **Dj. Kadijevich, Lenni Haapasalo, 2006** to measure level of integration educational technologies by teachers. We used this because the logic is similar in both cases. There lies an assumption that most effective way of using the technology is to completely integrate technologies in schools. So the logic is: In order to measure the effectiveness of educational technologies which is almost always synonymous with integration of technology in schools, we considered the following dimensions.

Students' questionnaire:

(Total questionnaires of both students and teachers is mentioned in Appendix)

(Questions for each ETD are presented here with respect to each sub-dimension)

Education Technology Dimensions (referred as ETDs) chosen are:

- **Proficiency:** How familiar you are with the use of technology and how often you use the technology in school

  Proficiency was measured by two questions based on two dimensions. The two dimensions are Familiarity/Expertise in using the technology and Frequency of usage. The respondents were asked to rate their level of proficiency on a scale of 0-4 (Unfamiliar, Beginner, Average, Advanced and Expert) for the first question. For the second question, the respondents were asked to rate the usage of each of the technology on a scale of 0-4 (Never/Very rare, Monthly once, Weekly Once, Weekly Thrice, Daily)

Questions:

Familiarity/Expertise:

- For each technology listed below rate your **proficiency/familiarity** using it on a **scale of 0 to 4**. Mention the number in Table 1 based on Table 2.

Table 1

Computer/Laptop	
Mobile	
Tablet	
Mobile Apps	
Internet	
Programming	
Microsoft Excel	
Microsoft Power Point	
Microsoft Word	

Table 2

Unfamiliar	0
Beginner	1
Average	2
Advanced	3
Expert	4

Frequency of Usage:

- With reference to the **subject chosen above**, indicate **how often** you are using these technologies in **school** on a scale of 0 to 4. Mention the number in Table 3 based on Table 4.

Table 3

Computer/Laptop	
Mobile	
Tablet	
Mobile Apps	
Internet	
Programming	
Projector	
Microsoft Excel	
Microsoft Power Point	
Microsoft Word	

Table 4

Never/Very rare	0
Monthly once	1
Weekly once	2
Weekly thrice	3
Daily	4

- **Attitude:** How do you feel about using the technology

Attitude was measured by 12 questions based on 3 sub-ETDs and 10 dimensions. The three sub ETDs are Technology importance, Technology enjoyment and Adaptability to new things. Out of 12 questions, 6 were presented as statements along a 5-point Likert Scale. Scores were obtained by allocating numerical values to student's responses: Strongly Disagree was scored as 0 and Strongly Agree as 4. Other 6 were presented as multiple choice questions where respondents were asked to pick one. Differential weights were given for each option of each question.

Questions:

Future Job Prospects:

- **Keeping in mind your <u>job prospects</u> in future choose one of the following. [Tick one]**
  - Technology in schools is irrelevant
  - Technology in schools might be relevant but might not play an important role.
  - Technology in schools is necessary

Extent of technology usage:

- **Which of the following best describes your preference with regard to use of technology in your classes. [Tick one]**
  - I prefer taking classes that use no technology
  - I prefer taking classes that use limited technology features (only for some classes).
  - I prefer taking classes that use technology (every class makes use of technology).

Alternatives to Traditional means:

- **When given a choice, I prefer**
  - Playing indoor/outdoor games [ ] or Playing on Mobile/Computer.[ ]
  - Drawing on a paper [ ] or Drawing on a device (Computer/Tablet etc.) [ ]
  - Using Social Media (FB, Twitter) [ ] or Participating in social events. [ ]

Reaction to new technology:

- **When I hear of a new technology [Tick one]**
  - I ignore
  - I try to get some first-hand information
  - I am curious about new technologies and look for trying them out

Learning new things

- I believe that knowledge of technology gives me opportunities to learn new things [ ]

Apart from curriculum

- I believe that knowledge of technical devices (Mobiles/Tablets/Computers) helps a lot in my daily activities. [ ]

Interpersonal skills:

- I believe that I can improve my language skills if I use Internet/Computers[ ]

Attraction:

- Classes became more interesting after technology is introduced since I could now see more images and videos which I could not have seen in traditional classes.[ ]

Application skill:

- When I am presented with a new task, I am able to apply what I have learnt before for doing it. [ ]

Confidence to try out new things:

- I am confident to use technology in front of others without the fear of making any mistakes. [ ]

- **Interest:** Willingness to use technology for academic purposes

  Interest was measured by 6 questions based on 6 dimensions. All the questions were presented as multiple choice questions where respondents were asked to pick one. Differential weights were given for each option of each question.

  Questions:

  Doubt Clarification:
  - **When in <u>doubt</u> about some topic [Tick one]**
    - I ask teacher/classmates in person
    - I talk to classmates/teacher via emails/mobiles etc.
    - Search online for the topic or use a mobile application.

  Learning new things
  - **To learn about new things/topics [Tick one]**
    - I prefer reading a book that contains the topic
    - I prefer reading an e-book/pdf on a device like mobile/tablet/computer etc.
    - I search for it online or use a mobile application.

  Notes making:
  - **In class, to <u>make notes</u> [Tick one]**
    - I prefer doing it on a notebook
    - I prefer doing it on devices like mobile/tablet/computer
    - I prefer taking photocopies of my class mates' notes

  Understanding a concept:
  - **To visualize and better understand a concept [Tick one]**
    - I prefer to watch real demonstration like prototype/live experiment
    - I prefer to watch video demonstrations

  Mode of teaching:
  - **In class [Tick one]**
    - I prefer teaching to be on black/white/green boards
    - I prefer to be taught using projectors(Power Point presentations)

  Exam Process:
  - **I prefer to take <u>exams/assignments</u> [Tick one]**
    - On paper
    - On devices like mobiles/tablets/computers etc.
    - Online (Internet)

- **Support:** Support you get from teachers, school management, parents and peers regarding technology usage.

  Support was measured by 10 questions based on 3 sub-ETDs and 10 dimensions. Out of 10, 6 questions were presented as statements along a 5-point Likert Scale. Scores were obtained by allocating numerical values to student's responses: Strongly Disagree was scored as 0 and Strongly Agree as 4. Other 4 were presented as multiple choice questions where respondents were asked to pick one. Differential weights were given for each option of each question.

Questions:

School management's encouragement:

- **With regard to <u>School Management's(SM) encouragement</u> in using technology, choose the best preference [Tick one]**
  - I am allowed to use technology whenever I have free time.
  - I am allowed to use technology on my own but only during specific class hours/timings.
  - I am allowed to use technology, but only in the presence of a supervisor or teacher.
  - I am not allowed to use technology on my own

Teacher's encouragement:

- **With regard to <u>Teacher's encouragement</u> in using technology, my teacher [Tick one]**
  - insists upon using technology
  - encourages using technology
  - is neutral about the use of technology
  - discourages from using technology

Parents' encouragement:

- **With regard to <u>Parents' encouragement</u> in using technology, choose the best preference [Tick one]**
  - They insist upon using technology
  - They encourage using technology
  - They neither encourage nor discourage using technology
  - They advise me not to use technology but will not restrict me.
  - My parents refrain me from using technology
- My parents are very particular that I have close to 100% attendance in school. [ ]

Assistance:

- **When I make <u>mistakes</u> using technology [Tick one]**
  - My classmates mock me
  - My classmates don't care
  - My classmates assist me in using technology

Technology maintenance:

- My parents keep technology updated at home by software upgrades, hardware repairs etc. [ ]
- My parents always search and install new technology at home. [ ]
- School Management keeps technology updated at school by software upgrades, hardware repairs etc. [ ]
- School Management installs new technology at school whenever available. [ ]

Sharing technology:

- My class mates readily share technology (Mobiles/Tables/Other devices) or information on technology with me. [ ]

- **Utility:** How do you perceive the use of technology w.r.t your academic excellence?

Utility was measured by 10 questions based on 9 dimensions. All the questions were presented as statements along a 5-point Likert Scale. Scores were

obtained by allocating numerical values to student's responses: Strongly Disagree was scored as 0 and Strongly Agree as 4.

Questions:

More time:

- I spend more time engaged in course activities in those courses/subjects that require me to use technology. [ ]

Subject Interest:

- Teacher's use of technology has increased my interest in subject matter. Also mention the specific subject(s). [ ]

Outcome via marks:

- I get better grades/marks in subjects that use technology. Also mention the specific subject(s). [ ]

Comprehension:

- The use of technology in classes has helped me better understand complex/abstract concepts. [ ]

Communication:

- Use of technology has helped me better communicate with teacher and class mates through email, mobile or internet etc. [ ]

Feedback:

- The use of technology has resulted in quick and accurate feedback of my learning. [ ]

Pace of learning:

- Technology enables me to learn at my own pace. [ ]

Self-learning:

- Technology enables me to learn on my own without any help from others.[ ]

Since the study is based out of India, we considered an extra dimension 'Utility' to fit the Indian context.

Teachers' questionnaire:

Dimensions chosen are:

- **Proficiency:** How familiar you are with the use of technology and how often you use the technology in school

  Proficiency was measured by two questions based on two dimensions. The two dimensions are Familiarity/Expertise in using the technology and Frequency of usage. The respondents were asked to rate their level of proficiency on a scale of 0-4 (Unfamiliar, Beginner, Average, Advanced and Expert) for the first question. For the second question, the respondents were asked to rate the usage of each of the technology on a scale of 0-4 (Never/Very rare, Monthly once, Weekly Once, Weekly Thrice, Daily).

  Questions:

  Familiarity/Expertise:

  - For each technology listed below, rate your **proficiency/familiarity in** using it on a **scale of 0 to 4**. Mention the number in Table 1 based on Table 2.

Table 1

Computer/Laptop	
Mobile	
Tablet	
Mobile Apps	
Internet	
Programming	
Microsoft Excel	
Microsoft Power Point	
Microsoft Word	

Table 2

Unfamiliar	0
Beginner	1
Average	2
Advanced	3
Expert	4

Frequency of Usage:

- With reference to your subject, indicate **how often** you are using these technologies in **school** on a scale of 0 to 4. Mention the number in Table 3 based on Table 4.

Table 3

Computer/Laptop	
Mobile	
Tablet	
Mobile Apps	
Internet	
Programming	
Projector	
Microsoft Excel	
Microsoft Power Point	
Microsoft Word	

Table 4

Never/Very rare	0
Monthly once	1
Weekly once	2
Weekly thrice	3
Daily	4

- **Attitude:** How do you feel about using the technology

Attitude was measured by 8 questions based on 3 sub-ETDs and 8 dimensions. The three sub ETDs are Technology importance, Technology enjoyment and Adaptability to new things. Out of 8 questions, 4 were presented as statements along a 5-point Likert Scale. Scores were obtained by allocating numerical values to student's responses: Strongly Disagree was scored as 0 and Strongly Agree as 4. Other 4 were presented as multiple choice questions where respondents were asked to pick one. Differential weights were given for each option of each question.

Questions:

Future Job Prospects:

- **Keeping in mind your <u>job prospects</u> in future choose one of the following. [Tick one]**
  - Technology in schools is irrelevant

- Technology in schools might be relevant but might not play an important role.
- Technology in schools is necessary

Extent of technology usage:

- **Which of the following better describes your preference with respect to use of technology in your classes [Tick one]**
  - I prefer teaching in classes that use no technology
  - I prefer teaching classes that use limited technology
  - I prefer teaching classes that use technology extensively.

Reaction to new technology:

- **When I hear of a new technology [Tick one]**
  - I ignore
  - I try to get some first-hand information
  - I am curious about new technologies and look for trying them out

Learning new things:

- I believe that knowledge of technology gives me opportunities to learn new things [ ]

Apart from curriculum:

- I believe that knowledge of technical devices like Mobiles, Tablets, Laptops and others is very important in my day to day life. [ ]

Curriculum Planning:

- I believe that knowledge gives me Freedom and Flexibility to be creative in developing the curriculum, selecting activities and developing content.[ ]

Confidence to try out new things:

- I am confident to use technology in front of others without the fear of making any mistakes. [ ]

Integration:

- The available technology in school fits my style of teaching [ ]

- **Interest**: Willingness to use technology for academic purposes

Interest was measured by 6 questions based on 6 dimensions. Out of 6, 4 questions were presented as multiple choice questions where respondents were asked to pick one. Differential weights were given for each option of each question. Other 2 questions were presented as statements along a 5-point Likert Scale. Scores were obtained by allocating numerical values to student's responses: Strongly Disagree was scored as 0 and Strongly Agree as 4.

Questions:

Doubt Clarification:

- **I prefer to provide <u>clarification to student doubts</u> [Tick one]**
  - In Person
  - Through emails/mobiles etc.
  - By asking them to refer to an online website.

Preparation:

- **In order to prepare myself for a topic, I prefer to [Tick one]**
  - Read text book or other books
  - Read digital copies on some devices.

- Search online

Exam Process:

- **I wish to conduct <u>exams/assignments</u> [Tick one]**
  - On paper
  - On technology devices like mobiles/tablets/computers etc.
  - Online (Internet)

Mode of teaching:

- **In class [Tick one]**
  - I prefer teaching to be on black/white/green boards
  - I prefer to be taught using projectors(Power Point presentations)

Alternatives to traditional means:

- To teach a topic in better way I prefer video presentations or simulations over conventional methods [ ]

Self-Learning Encouragement:

- I recommend students to lookup content online for better understanding.[ ]

- **Support:** Support you get from school management and peers regarding technology usage.

Support was measured by 7 questions based on 2 sub-ETDs and 6 dimensions. Out of 7, 6 questions were presented as statements along a 5-point Likert Scale. Scores were obtained by allocating numerical values to student's responses: Strongly Disagree was scored as 0 and Strongly Agree as 4. Other question was presented as multiple choice questions where respondents were asked to pick one. Differential weights were given for each option.

School management's encouragement:

- **School Management [Tick one]**
  - Insists on use of technology
  - Encourages use of technology
  - Is neutral about use of technology
  - Discourages the use of technology

Technology maintenance:

- School Management tends to keep technology updated and functional.[ ]

Training:

- School Management offers necessary training to use and apply technology [ ]

Sharing technology:

- Colleagues share their knowledge of technology with me. [ ]

Assistance:

- Colleagues readily assist in using new/unknown technologies [ ]

Colleagues' Encouragement:

- Colleagues encourage me to use technology while teaching. [ ]

- **Utility:** How do you perceive the use of technology w.r.t. your teaching?

  Utility was measured by 8 questions based on 8 dimensions. Out of 8, 7 questions were presented as statements along a 5-point Likert Scale. Scores were obtained by allocating numerical values to student's responses: Strongly Disagree was scored as 0 and Strongly Agree as 4. Other question was presented as multiple choice questions where respondents were asked to pick one. Differential weights were given for each option.

  Productivity:

  - I can teach more in given time if I use technology in classes [ ]

  Control over student learning:

  - I can track students' learning better with the use of technology [ ]

  Better conveying of topics:

  - The use of technology has helped me to teach complex or abstract concepts in a better way. [ ]

  Communication:

  - The use of email, mobile and internet has helped me to communicate in a better way with my students. [ ]

  Feedback:

  - The use of technology has helped me in providing quick and accurate feedback. [ ]

  Preparation:

  - The use of technology has made my class preparation easier as I can explore into different angles from different sources [ ]

  Assessment:

  - I feel I can assess my students in a better way with the help of technology. [ ]

3.4 Hypothesis

3.4.1 ETDs and their relationships

Class to Class trend refers to expected increase or decrease in ETD value with increase in class or standard. For example proficiency is expected to rise with class and hence Increase.

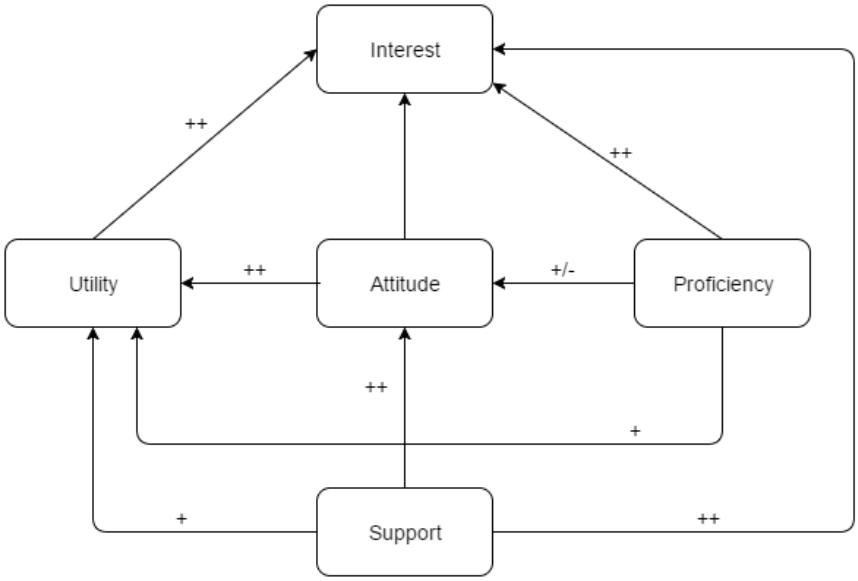
ETD	Class to Class trend	Relationship with other ETDs				
		Utility	Proficiency	Interest	Support	Attitude
Utility	Increase/ Decrease	-	Reverse	Positive High	Reverse	Reverse
Proficiency	Increase	Positive	-	Positive High	Reverse	Positive/Negative
Interest	Increase/ Decrease	-	Reverse	-	Reverse	Reverse
Support	Increase	Positive	Positive High	Positive High	-	Positive High
Attitude	Increase/ Decrease	Positive High	Reverse	Positive	Reverse	-

Positive/Negative refers that either of the two relationships may occur.

Positive High refers that the relationship is a positive relationship and high correlation is expected between them.

3.4.2 Expected Path Analysis

Detailed explanation of Path Analysis is presented in section 3.7



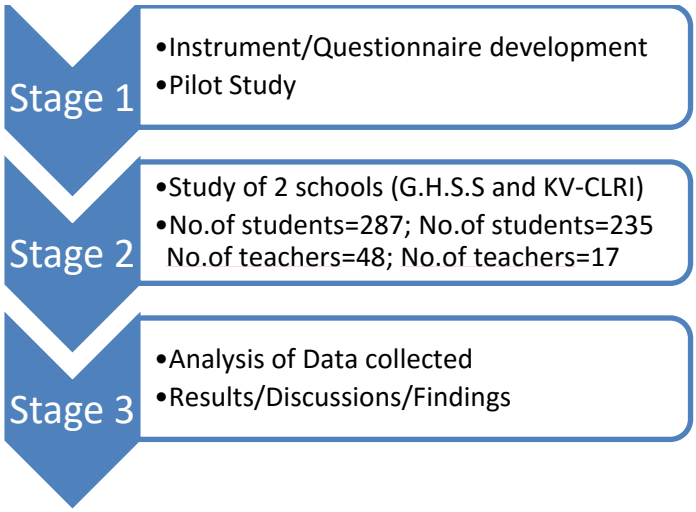
++ refers to Positive High

+ refers to Positive

+/- refers to Positive/Negative

Study outline:

The study was mainly carried out in three stages:



3.5 Sampling

Extensive sampling was done for schools based on different parameters.

3.5.1 School categories chosen

- **Central Government Schools:** KV-IITM, KV-CLRI, KV-Ashok Nagar. This report talks about KV-CLRI and its detailed analysis.
- **State Government Schools**: Schools under Sarva Siksha Abhiyan (SSA).

3.5.2 Logistics

The permission for all the schools has been routed officially.

- **Central Government Schools:** A letter was sent to Assistant Commissioner (AC) via KV-IITM Principal by Prof. V. R. Muraleedharan through Dean, Academics, IITM requesting permission to conduct the survey in KV Schools. After getting the permission from AC-KVS, we sent letters to principals of each school to set the schedule of survey.
- **State Government Schools:** A letter was sent to the State Project Director-SSA requesting permission to conduct survey in SSA schools. After getting the permission, we went in person to meet the principal of G.H.S.S to set the schedule of survey.

3.5.3 Sample

The questionnaires were pilot tested at Vana Vani School-IITM for a sample of 15 students and 6 teachers.

The sample for the main study is from KV-CLRI and G.H.S.S. Actual surveyed number was high. These are the numbers after removing non-response sheets. The non-response number is mentioned in brackets ().

School	Students				Teachers
	8th Class	9th Class	10th Class	12th Class	
KV-CLRI	63 (10)	62 (12)	64 (8)	47 (6)	17 (0)
G.H.S.S	143 (30)	144 (24)	-	-	48 (3)

Two sections from each class have been surveyed in KV-CLRI. Four sections from each class have been surveyed in G.H.S.S

3.6 Data Collection

3.6.1 Logistics

After setting the schedule of survey, we went to the school and distributed questionnaires to the respondents. Respondents were allowed to take the sheets to their homes, fill and return on the next or the following day. No inconvenience to the regular teaching processes was caused.

3.6.2 Voluntary nature of Study

All the respondents were voluntary participants and no one was forced to take this study. Every respondent has to sign the consent form so as to ensure his/her consent for participation.

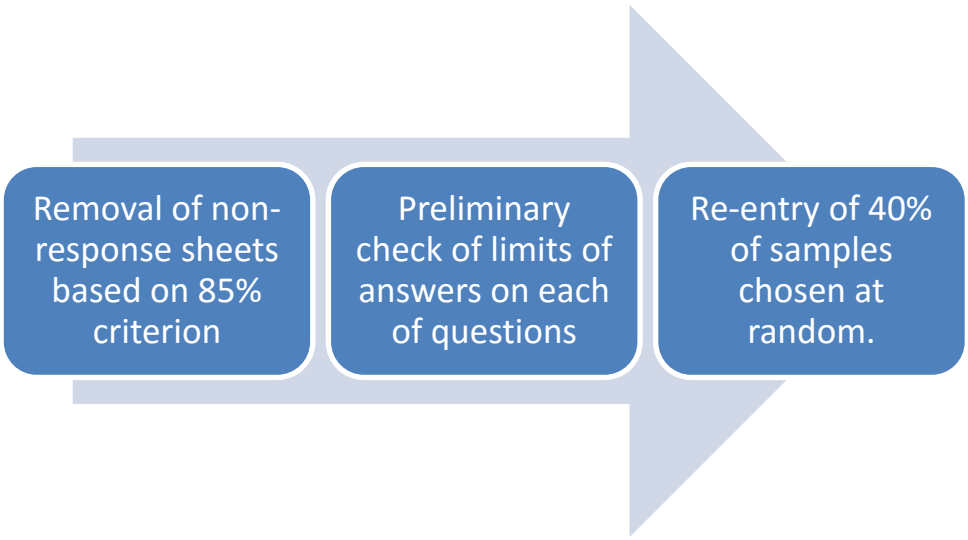
3.6.3 Data Entry

After collecting the questionnaires back from respondents, data has been entered in to Excel Sheets. The data has undergone several stages of filtering for robustness of data.

Firstly, non-response sheets have been removed based on condition that only those questionnaires will be considered which have at least 85% of questions answered. That is 35 questions in students' case and 26 questions in teachers' case.

After the removal of non-response sheets, a preliminary check of limits of answers on each of questions was done using simple functions in excel.

After this preliminary check, more than 40% of samples chosen at random were re-entered for robustness.



3.7 Data Analysis

3.7.1 Reliability of Instruments/Data Set

3.7.1.1 Cronbach's Alpha

Reliability of a measure is the ability of a construct to yield consistent results. Among the several techniques used to determine reliability (test-retest forms, equivalent forms, split-halves, internal consistency method), the internal consistency method was selected as it required only one administration and was considered to be the most effective in field studies (Bendig,1954; Nunnally, 1978). Internal consistency refers to the degree of inter-correlations among the items that constitute a construct. It is estimated using a estimation coefficient

called Cronbach's Alpha. An alpha value of 0.60 or more is considered the criterion for determining internal consistency of a new construct and 0.70 for established constructs.

The Cronbach's Alpha is calculated for each instrument/ETD and for the entire questionnaire. The results are discussed later.

3.7.1.2 T-Test

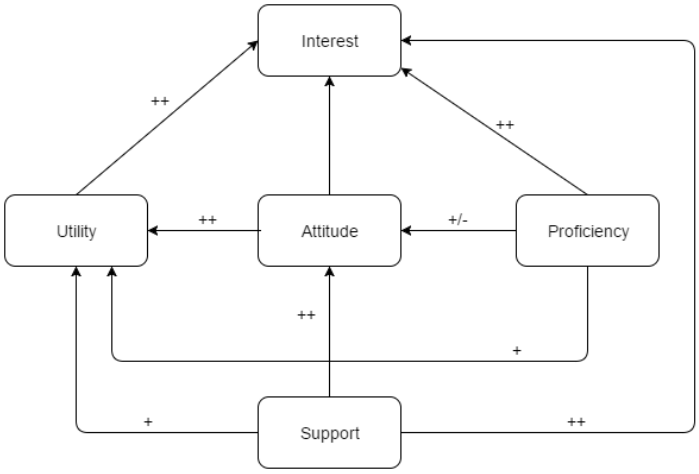
The t-test assesses whether the means of two groups are statistically different from each other. This analysis is appropriate whenever you want to compare the means of two groups, and especially appropriate when the data sets are to be different from each other.

The T-Test is done for the entire data set of one school with other.

3.7.2 Path Analysis

Path Analysis is used to study direct and indirect effects among several dependent and independent ETDs simultaneously. This study used a five-variable path model which wan an extension of a three-variable path model applied in Kadijevich, 2006. In order to estimate parameters in this model and its appropriateness, two parameters had to be made equal. Note that a regression model, where the four predictors (Attitude, Proficiency, Support and Utility) correlate, might also be used. However, such a model could not help us examine the indirect impacts of ETDs on Interest.

Path analysis is a straightforward extension of multiple regression. Its aim is to provide estimates of the magnitude and significance of hypothesized causal connections between sets of variables. This is best explained by considering a **path diagram**.



To construct a path diagram we simply write the names of the variables and draw an arrow from each variable to any other variable we believe that it affects. We can distinguish between input and output path diagrams. An **input path diagram** is one that is drawn beforehand to help plan the analysis and represents the causal connections that are predicted by our hypothesis. An **output path diagram** represents the results of a statistical analysis, and shows what was actually found.

To move from this input diagram to the output diagram, we need to compute path coefficients. A path coefficient is a **standardized regression coefficient** (**beta weight**). We compute these by setting up structural equations, in this case:

In this study Support is considered exogenous variable or variable as an input. Interest, Attitude, Utility and Proficiency are intermediate variables or endogenous variables while Interest is considered the output variable. The focus of this analysis is to find the correlations of other four variables with Interest.

Interest = b_{11}Support + b_{12}Proficiency + b_{13} Attitude + b_{14} Utility + e_1

Utility = b_{21}Support + b_{22}Proficiency + b_{22}Attitude + e_2

Attitude = b_{31}Support + b_{22}Proficiency + e_3
Proficiency = b_{41}Support + e_4

Where $b_{11,}$ $b_{12.....}$ b_{41} are path coefficients.

Values of e_1, e_2, e_3, and e_4 are calculated as the square root of 1-R^2 from the regression equation for the corresponding dependent variable.

This study has Path Analyses at different levels.

- School level (KV-IITM and G.H.S.S, Velachery)
- Gender cut (male vs female in KV-IITM)
- Students with Technology at home vs Students without technology at home

The direct effect of one variable on other is determined by the value of path coefficient between those variables and the indirect effect between two variables is determined by multiplying the path coefficients of paths between both variables.

Path coefficients are standardized versions of linear regression weights which can be used in examining the possible causal linkage between statistical variables in the structural equation modelling approach. The standardization involves multiplying the ordinary regression coefficient by the standard deviations of the corresponding explanatory variable: these can then be compared to assess the relative effects of the variables within the fitted regression model.

Since there are 5 variables in our study with Support as Endogenous variable, 4 regression analysis were done in SPSS in order to determine all the path coefficients.

1st Regression:

First Regression is done between variables Support and Proficiency, where Support is taken as Independent variable and Proficiency is taken as Dependent variable. The values of variables Support and Proficiency are taken for the required sample and regression is done to determine the path coefficients.

The positive value of path coefficient greater than the significance value (5%) says that the increment of independent variable results in the increment of dependent variable. If path coefficient is less than significance level (positive or negative) the variables are independent. If path coefficient is negative then increment of independent variable will result in decrement of dependent variable.

2nd Regression:

Second Regression is done between variables Support, Proficiency and Attitude, where Support and Proficiency are taken as Independent variables and Attitude is taken as Dependent variable. The values

of variables Support, Proficiency and Attitude are taken for the required sample and regression is done to determine the path coefficients.

3rd Regression:

Third Regression is done between variables Support, Proficiency, Attitude and Utility where Support, Proficiency and Attitude are taken as Independent variables and Utility is taken as Dependent variable. The values of variables Support, Proficiency, Attitude and Utility are taken for the required sample and regression is done to determine the path coefficients.

4th Regression:

Fourth Regression is done between variables Support, Proficiency, Attitude, Utility and Interest where Support, Proficiency, Attitude and Utility are taken as Independent variables and Interest is taken as Dependent variable. The values of variables Support, Proficiency, Attitude, Utility and Interest are taken for the required sample and regression is done to determine the path coefficients.

The relationship between the major output variable and all other variables is determined in this regression.

After all 4 Regressions the path coefficients values are used to determine the level of dependencies between variables.

Within a given path diagram, path analysis can tell us which are the more important (and significant) paths, and this may have implications for the plausibility of pre-specified causal hypotheses. But path analysis cannot tell us which of two distinct path diagrams is to be preferred, nor can it tell us whether the correlation between A and B represents a causal effect of A on B, a causal effect of B on A, mutual dependence on other variables C, D etc, or some mixture of these.

In this study Support is considered exogenous ETD or ETD as an input. Interest, Attitude, Utility and Proficiency are intermediate ETDs or endogenous ETD while Interest is considered the output ETD. The focus of this analysis is to find the correlations of other four ETDs with Interest.

3.7.3 ETD Comparison

- ETD Comparison of each class within school.
- ETD Comparison of KV-CLRI with G.H.S.S.
- Gender cut at each level

3.8 Software Used

SPSS and Microsoft Excel are used for Statistical Analysis.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Student Results for KV-CLRI

4.1.1 Cronbach's Alpha

ETD	Cronbach's Alpha
Interest	.817
Proficiency	.878
Utility	.920
Support	.762
Attitude	.842
Total Questionnaire	.914

The value of .60 and above on Cronbach's Alpha is considered reliable. Values of .80 and above are considered very reliable in statistical analysis.

4.1.2 Correlation matrix

This is calculated based on Pearson Correlation method

General rule is that, positive correlation shows direction of relationship and number gives the strength of relationship between ETDs. But this is calculated based on the principle that all the other ETDs are kept constant or it shows only direct relationships between two ETDs without considering interdependence with other ETDs.

ETD	Correlations				
	Utility	Support	Attitude	Interest	Proficiency
Utility	1	.477	.560	.433	.363
Support	.477	1	.387	.068	.369
Attitude	.560	.387	1	.440	.364
Interest	.433	.068	.440	1	.309
Proficiency	.363	.369	.364	.309	1

Anomalies/Anti-Hypothesis found:

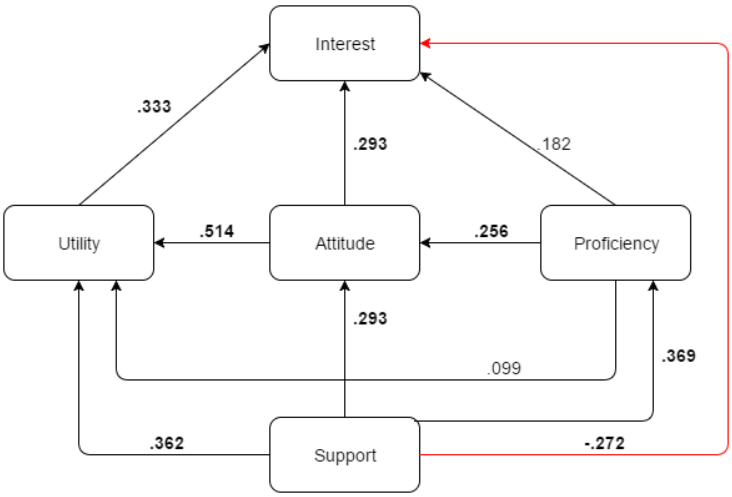
- Support-Interest correlation

4.1.3 Path Analysis

4.1.3.1 KV-CLRI level Path Analysis

Beta Coefficients are found to set the path across ETDs. Expected symbols are put in brackets.

ETD	Beta Coefficients				
	Utility	Proficiency	Interest	Support	Attitude
Utility	-	-	.333(++)	-	-
Proficiency	.099 (+)	-	.182 (++)	-	.256 (+/-)
Interest	-	-	-	-	-
Support	.362 (+)	.369 (++)	-.272 (++)	-	.293 (++)
Attitude	.514 (++)	-	.293 (+)	-	-



Direct Effects	Indirect Effects
Positive direct effect of Support on Attitude, Utility and Proficiency	**Positive** indirect effect of Support on Interest through Attitude, Utility and Proficiency
Positive direct effect of Attitude, Proficiency and Utility on Interest	
Negative direct effect of Support on Interest	

Discussion:

Effective paths to increase Interest are:

- Support-Utility-Interest
- Support-Attitude-Interest
- Support-Attitude-Utility-Interest

So in the first path, Support which directly effects Utility should be encouraged i.e. Support which makes them perceive the usefulness of technology regarding their academic curriculum. The second path tells that, Support should make students more comfortable with technology so as to increase Attitude so that Support has a desired (positive) effect on Interest. The third path tells us that while the students are made comfortable, they have to be made comfortable while using the technologies for academic purposes.

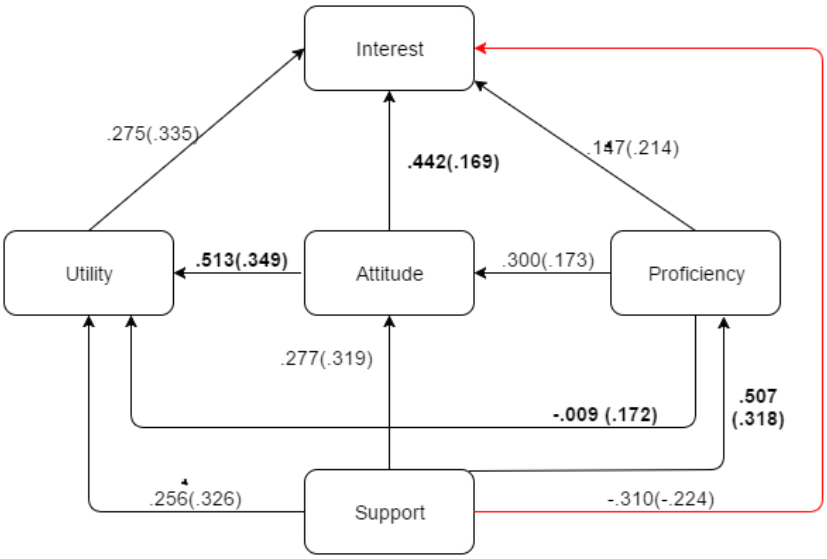
The negative direct effect of Support on Interest can possible mean that, when Support tries to convince/order/insist upon using technologies for academic purposes without actually showing them any results (Utility), making them comfortable (Attitude) or making them proficient (Proficiency), students are bound to behave negatively. So, Support has to go through any of the above paths.

The above two points clearly tells us that the technology cannot be abruptly introduced to students and are to be introduced gradually giving the students ample time to increase on the other ETDs.

4.1.3.2 KV-CLRI level: Male vs Female

ETD	Beta Coefficients									
	Utility		Proficiency		Interest		Support		Attitude	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Utility	-	-	-	-	.335	.275	-	-	-	-
Proficiency	.172	-.009	-	-	.214	.147	-	-	.173	.300
Interest	-	-	-	-	-	-	-	-	-	-
Support	.326	.256	.318	.507	-.224	-.310	-	-	.319	.277
Attitude	.349	.513	-	-	.169	.442	-	-	-	-

Male vs Female: Male in Brackets



Similarities	Differences
Positive Direct and similar effect of Support on Utility and Attitude	Small negative direct effect of Proficiency on Utility (found only for female students)
Positive Indirect and similar effect of Support on Interest through Utility	High positive direct effect of Attitude on Interest (found only for female students)
Negative Direct and similar effect of Support on Interest	High positive direct effect of Attitude on Utility (found only for female students)
Positive Direct and similar effect of Proficiency on Interest	High positive direct effect of Support on Proficiency (found only for female students)

Discussion:

Effective Paths for female students

- Support-Attitude-Interest
- Support-Attitude-Utility-Interest

Effective Paths for male students

- Support-Utility-Interest
- Support-Attitude-Utility-Interest

High direct effect of Attitude on Interest for female students tells that, the major reason for female students not showing Interest in using technologies is that they are not comfortable in using technology.

Small negative direct effect of Proficiency on Utility for female students shows that, they are almost independent. Also this provides us a caution that if Support is provided only to

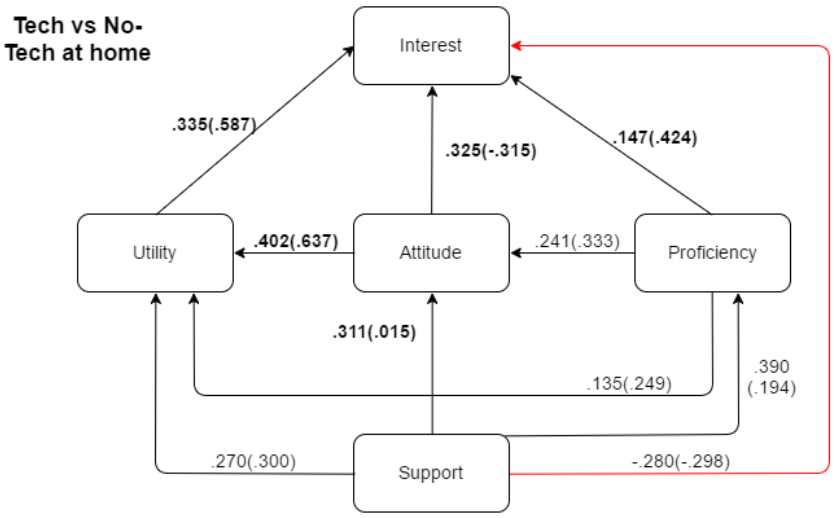
increase Proficiency without any academic orientation to that, female students are bound to lose on Utility.

High direct effect of Support on Proficiency for female students shows that, on an average they react to technologies more than their male counterparts.

4.1.3.3 KV-CLRI level: Technology at Home vs No Technology at Home

Except Mobile, all other are considered technologies only for this analysis.

ETD	Beta Coefficients									
	Utility		Proficiency		Interest		Support		Attitude	
	Tech.	No Tech	Tech	No Tech	Tech	No Tech	Tech	No Tech	Tech	No Tech
Utility	-	-	-	-	.335	.587	-	-	-	-
Proficiency	.135	.249	-	-	.147	.424	-	-	.241	.333
Interest	-	-	-	-	-	-	-	-	-	-
Support	.270	.300	.390	.194	-.280	-.298	-	-	.311	.015
Attitude	.402	.637	-	-	.325	-.315	-	-	-	-



Similarities	Differences
Positive Direct and similar effect of Support on Utility and Proficiency	High positive direct effect of Proficiency on Interest (found only for No-tech students)
Positive Direct and similar effect of Proficiency on Attitude and Utility	High negative direct effect of Attitude on Interest (found only for No-tech students)
Negative Direct and similar effect of Support on Interest	High positive direct effect of Attitude on Utility (found only for No-tech students)
	Low positive direct effect of Support on Attitude (found only for No-tech students)
	High positive direct effect of Utility on Interest (found only for No-Tech students)

Discussion:

Low direct positive effect of Support on Attitude for No-Tech students is because the students are not exposed much to technology at home and when they are introduced to technology at school, they are bound to be less comfortable. This also tells us that Support

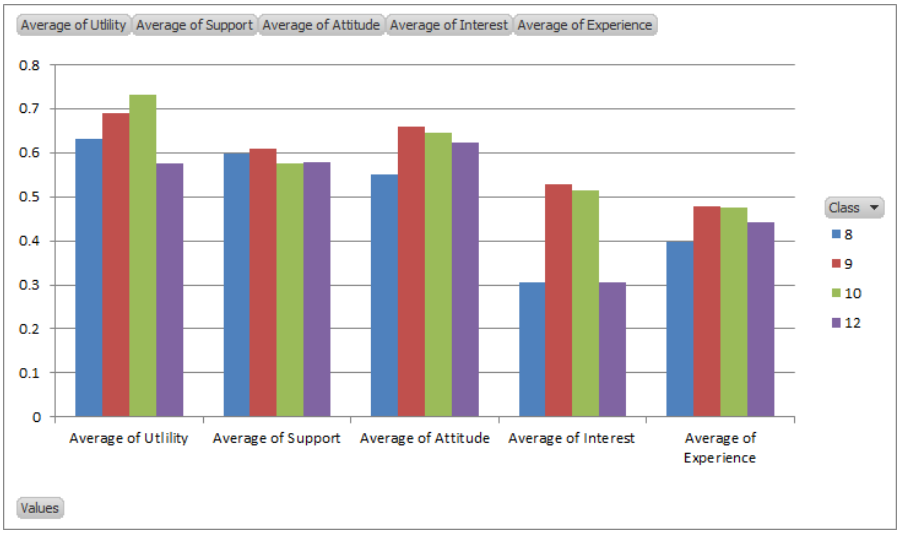
should be careful not to focus directly on Attitude and must go through Proficiency i.e. make them know how to use technology and then make them comfortable.

High positive direct effect of Utility on Interest: A possible explanation can be that Non-Tech are hesitant of having technology at home because they fear that technology might reduce their academic performance and hence will show much Interest if shown the evidence through Utility.

High positive direct effect of Proficiency on Utility for No-Tech students can be seen as follows. Since there is no technology at home, Proficiency can be their main hindering factor to have Interest.

4.1.4 ETD Comparison

4.1.4.1 Class vs Class within KV-CLRI



This deals with average values of ETDs and their comparison across different classes from KV-CLRI.

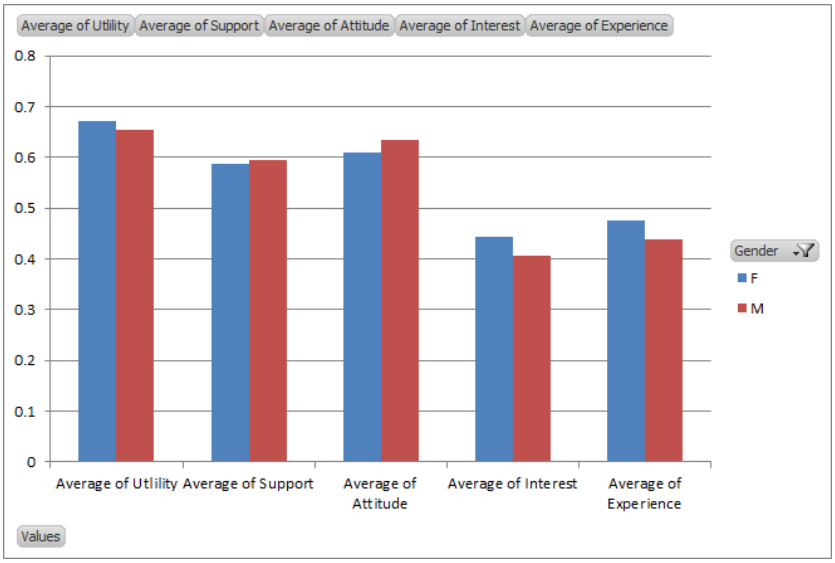
Key Findings
Proficiency drop from 9th to 10th to 12th class
Support drop from 9th to 10th class
Huge drops of Utility and Interest from 10th to 12th class

Discussion:

Proficiency drop from 9th to 10th to 12th class can be seen as mainly due to reduction in usage of technology in school rather than reduction in familiarity. This can be due to many reasons like board exams etc.

The next two findings may also be due to same reasons. In Indian education system, it is an established trend that as one goes higher the standards, student is expected to cut down his time on activities other than academics. Sadly, technology is also considered something not an integral part of academics.

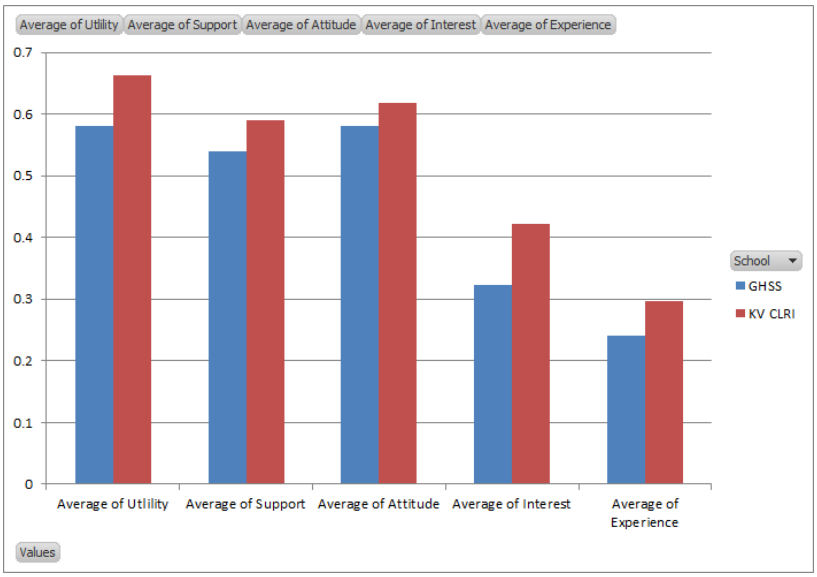
4.1.4.2 KV-CLRI level: Male vs Female



This deals with ETD comparison of Male vs Female at KV-CLRI level

Key Findings
Female Proficiency > Male Proficiency
Female Interest > Male Interest
Male Attitude > Female Attitude

4.1.4.3 KV-CLRI vs G.H.S.S

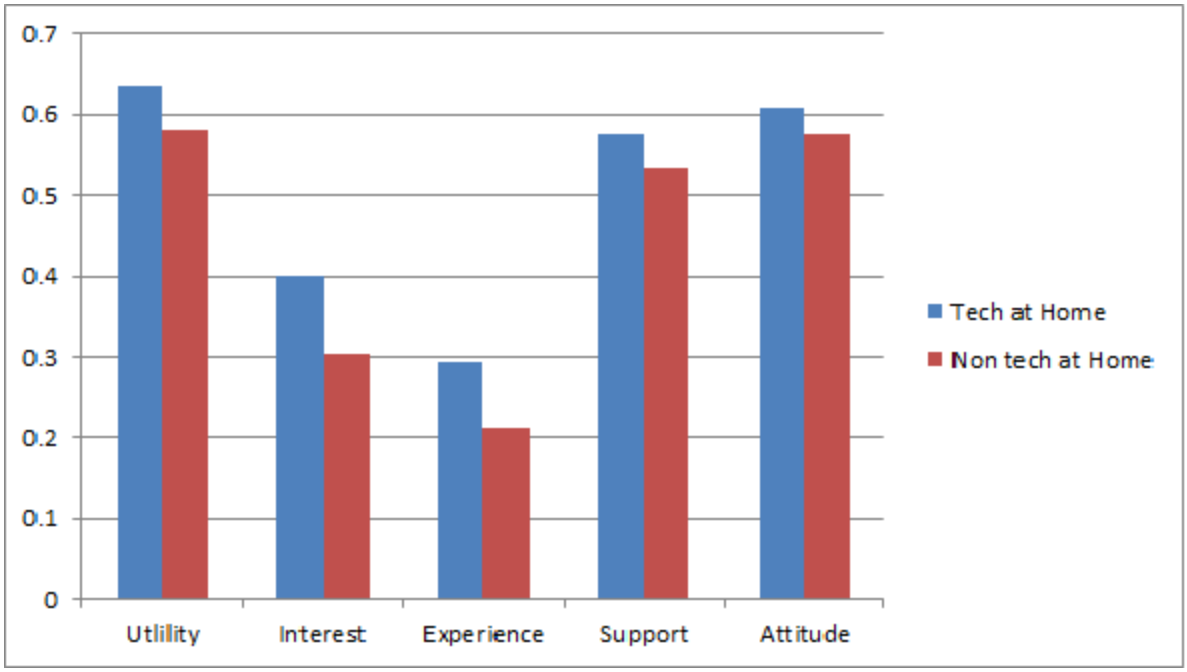


Key Findings
All ETDs in SSA schools < All ETDs in KV schools

Discussion:

Many reasons can be shown here. The financial status of students might not allow them to have previous exposure to technology. Lack of resources for schools might prevent students to have exposure to technology at schools as well. Positive point here is that, Attitude of G.H.S.S. is comparable to that of KV.

4.1.4.4 KC-CLRI level: Tech vs No-Tech at home



Key Findings
All ETDs for Tech at home students > All ETDs for No-Tech at home students

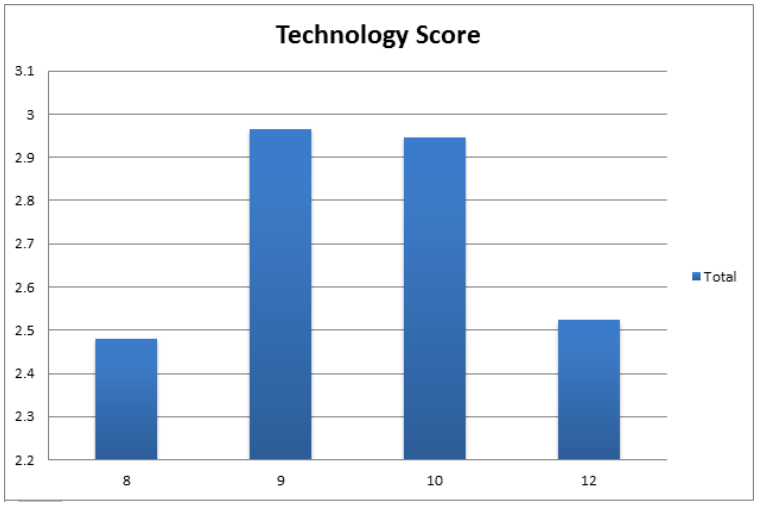
Discussion:

The main reason is the low Experience which leads to low Attitude and low Utility which leads to low Interest. This chain of events is not an established chain, but an event with good probability. This finding also makes a good point that having technologies at home supplements its usage at school.

4.1.5 Technology Score Comparison

Technology Score is defined as sum of all ETDs as a special ETD which can actually get the entire questionnaire's data in ETD. The 'sum' might not represent the actual value as fundamentally by taking sum of ETDs, we are equating the weights of each ETD. The score calculation is debatable and open for further tweaking. Broadly, higher the technology score, higher is the respondent's inclination towards using technology.

4.1.5.1 Class vs Class within KV-CLRI

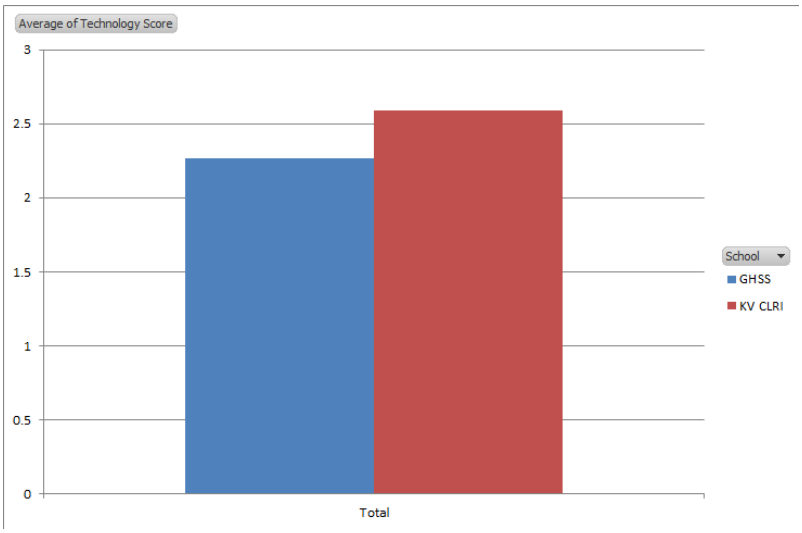


Key Findings
The value of Technology score has significantly dropped from 10th to 12th class

Discussion:

As said previously, scoring low mainly on Support and Proficiency is the main reason. That is a structural issue and not related to any school or student in particular.

4.1.5.2 KV-CLRI vs G.H.S.S

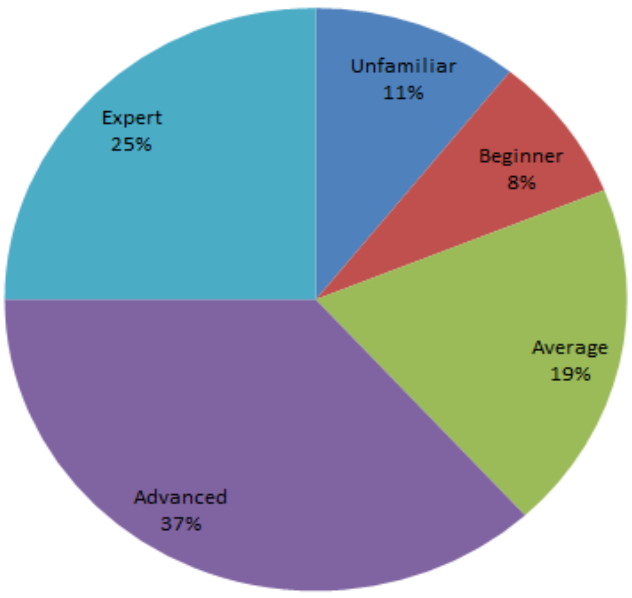


Key Findings
Technology score in SSA schools < Technology score in KV schools

4.1.5 Other Analyses

4.1.5.1 Computer Familiarity Overall

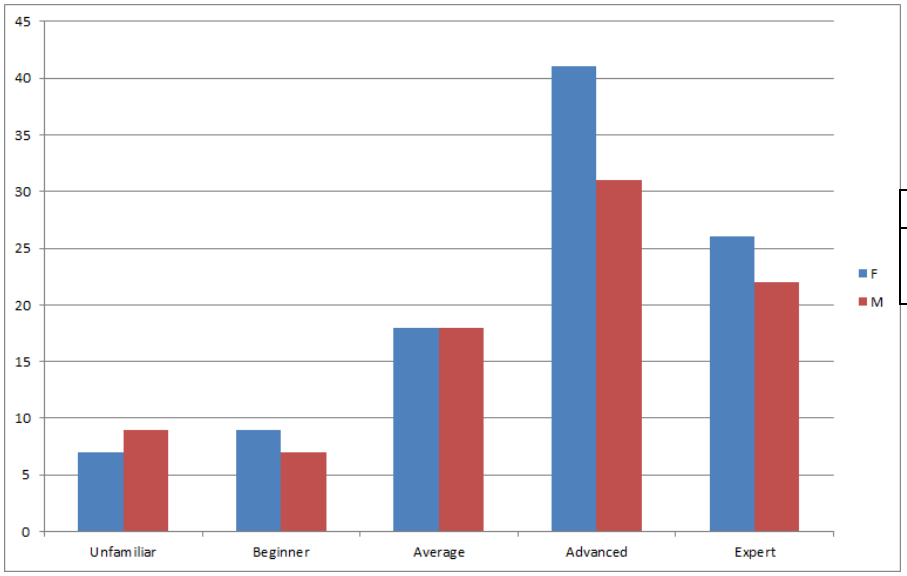
This deals with percentage of students with level of familiarity with computer.



Key Findings
More than 60% of students in KV schools have familiarity more than average.

4.1.5.2 Computer Familiarity Male vs Female

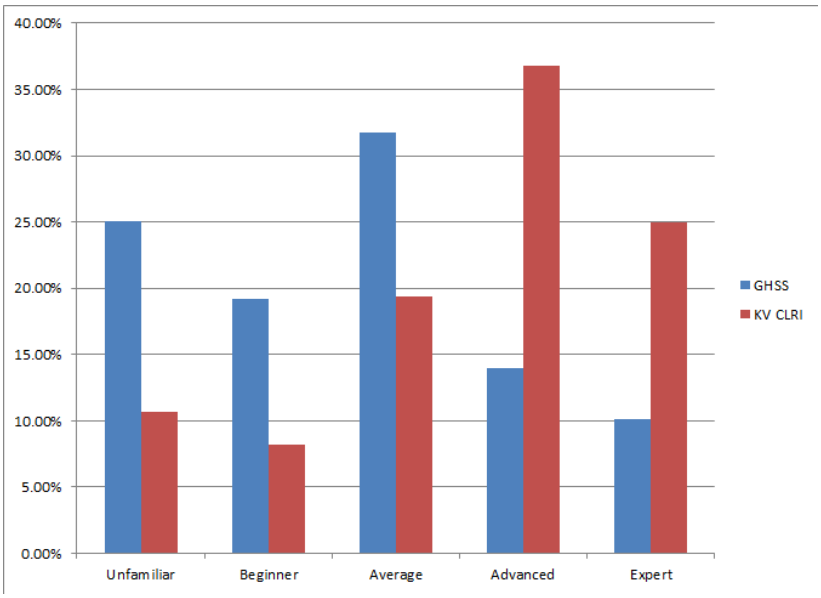
This deals with number of male and female students with each level of proficiency



Key Findings
More female students have proficiency more than average.

4.1.5.3 Computer Familiarity KV-CLRI vs G.H.S.S.

This deals with percentage of students in both schools with each level of familiarity



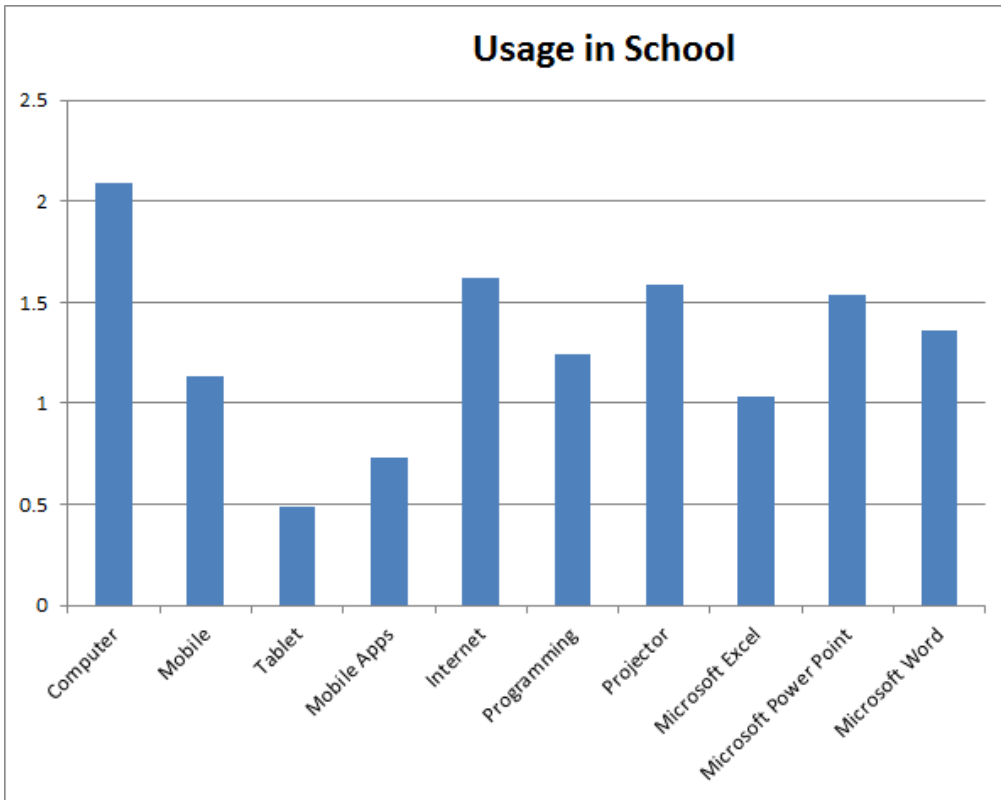
Key Findings
KV CLRI has more percentage of students with level of familiarity more than average.

Discussion:

This is mainly due to lack of access to technology at both home and school. This is an example of selectivity of technology in affordability aspect. More research should happen in this regard to bring down costs of educational technologies.

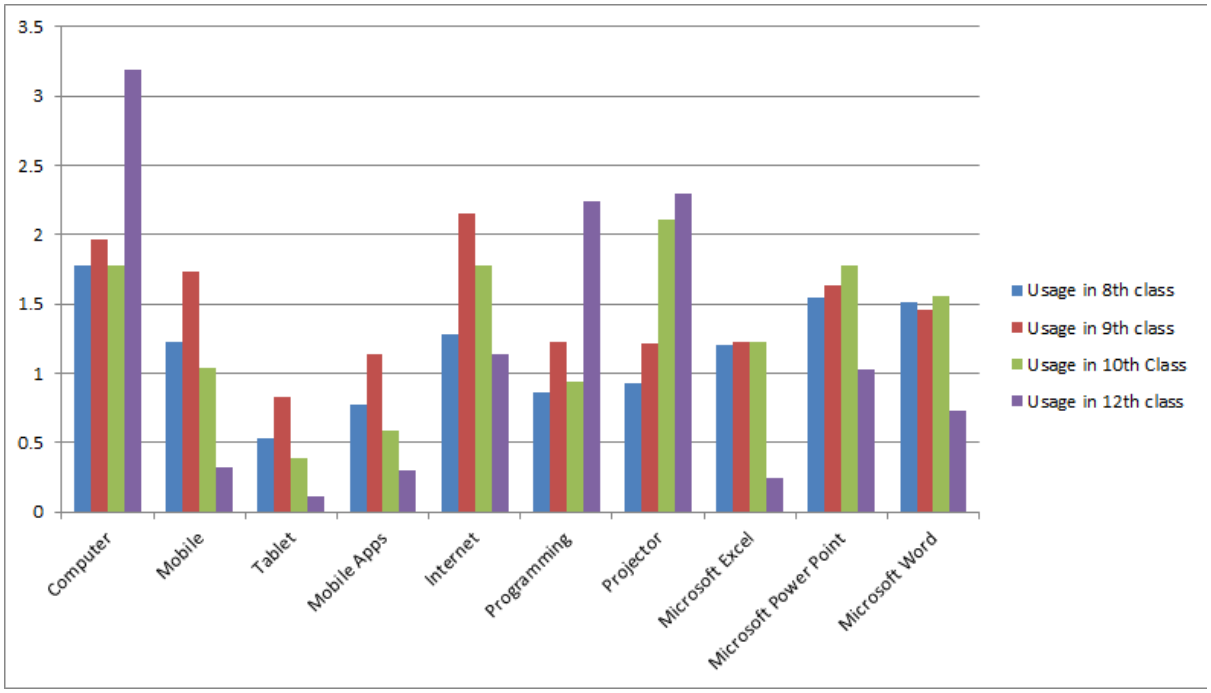
4.1.5.4 Average technology usage: KV-CLRI level

This deals with average usage of each technology. Values of 2 and above show usage of at least weekly once.



4.1.5.5 Technology usage: Class vs Class

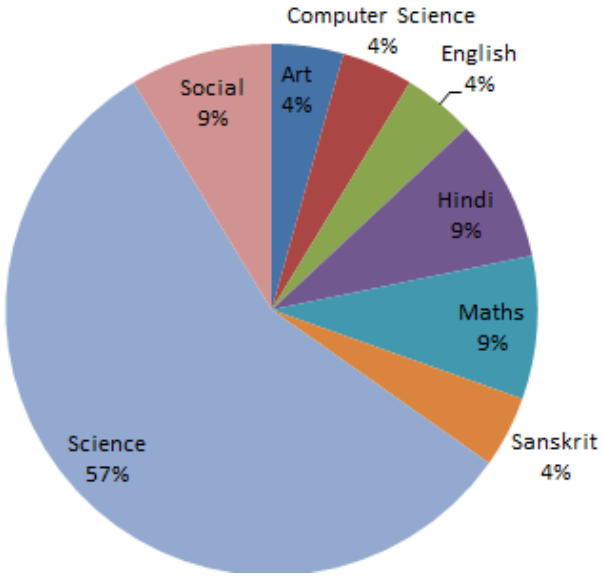
This deals with average usage of each technology in each class of KV-CLRI.



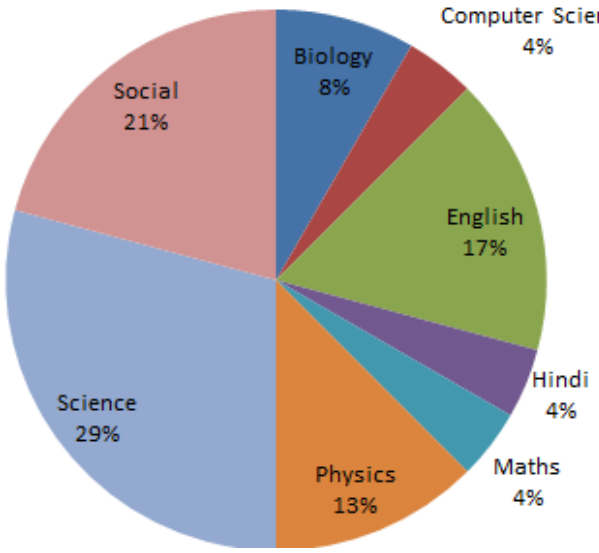
4.1.5.4 Subject Pie: Technology-Grades

This deals with pie chart of subjects with percentage of students for whom the usage of technology has increased grades in that particular subject.

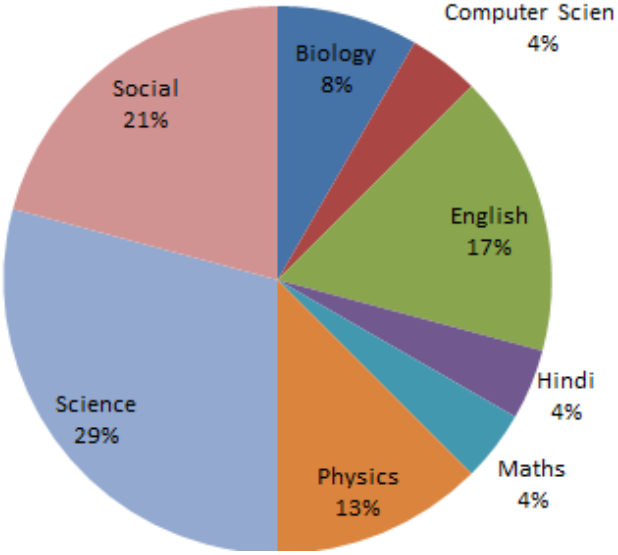
8th class:



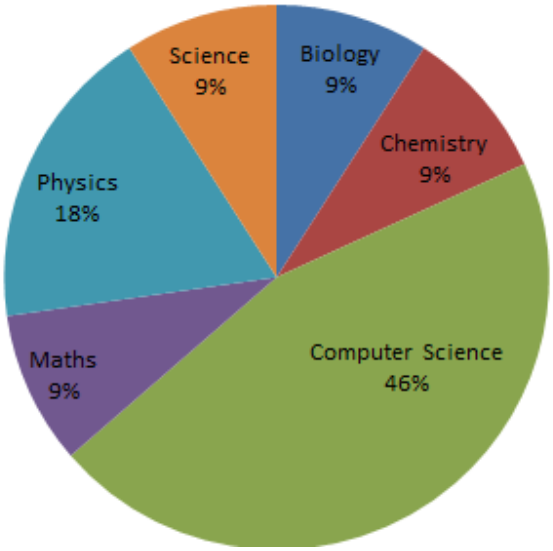
9th Class



10th Class

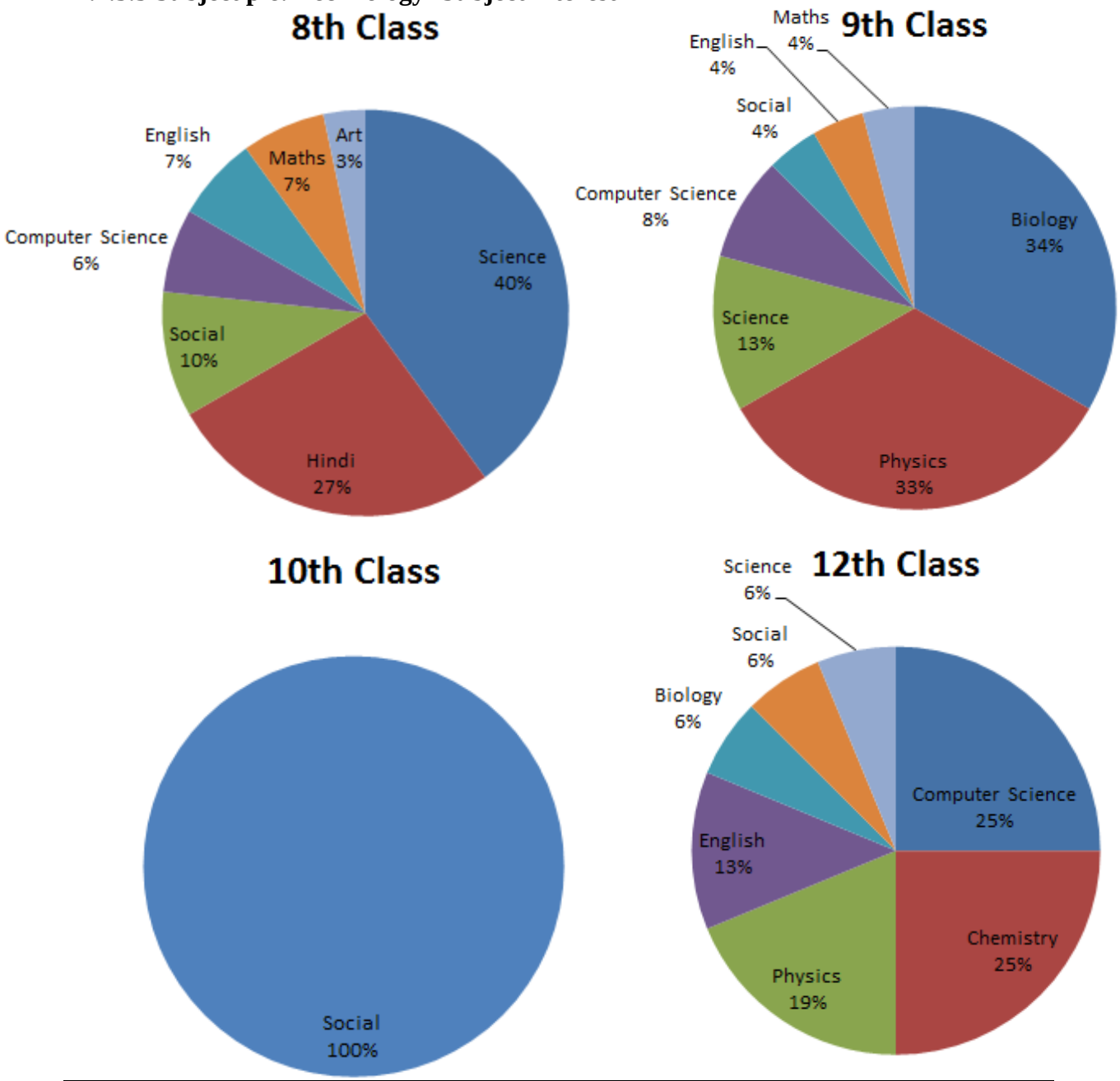


12th Class



Key Findings
Science is almost, most chosen subject by all classes for grade rise due to use of technology.

4.1.5.5 Subject pie: Technology- Subject interest



Key Findings
Science is the most chosen subject for 8th, 9th and 12th classes
Social is equivocally and unanimously chosen for 10th class.

4.1.5.6 Subject Correlation: Grades-Interest

This deals with subjects and percentage of students who have answered that use of technology has increased both interest and grades in a particular subject.

Class/Grade/Standard	Subject
8th Standard	Science (44%)
9th Standard	Computer Science (42.11%)
10th Standard	Social (75%)
12th Standard	Computer Science (75%)

4.1.6 T-Test

T-values and Mean difference for 8th and 9th classes:

ETD	T-Test for Equality of Means			
	T	Df	Sig. (2-tailed)	Mean Difference
Utility	-1.715	103	.089	-.05909
Support	-.502	103	.617	-.01368
Attitude	-4.008	103	.000	-.10872
Interest	-3.886	103	.000	-.22381
Proficiency	-2.036	103	.044	-.08078

Confidence interval and Std.error difference:

ETD	T-Test for Equality of Means		
	Std. Error difference	95% Confidence Interval of Difference	
		Lower	Upper
Utility	.03446	-.12744	-.01925
Support	.02124	-.06771	-.04034
Attitude	.02712	-.16252	-.09493
Interest	.05760	-.33805	-.20958
Proficiency	.03968	-.15947	-.06209

The confidence interval describes the uncertainty inherent in the estimate, and describes a range of values within which we can be reasonable sure that the true effect actually lies. It the confidence interval is relatively narrow, the effect size is known precisely. As is clearly seen, the 95% confidence interval is narrow and hence the estimate is known more precisely.

4.1.7 Barriers for using Education Technologies:

Students were asked to choose the barriers they face in using Education Technologies by providing them a list of potential and possible barriers they could face in their classroom as well as at home. Students were given a chance to select more than one barrier and the results obtained are as shown below. Frequencies represent the number of times each barrier was chosen.

Barriers	Frequencies
It feels like extra work with little connection to course	45
It deviates me from my academic curriculum	30
I don’t have necessary skills	14
It’s too expensive	37
I don’t have technical support I need	36
I don’t have sufficient access to technologies	39
The applications don’t run on my computer/tablet/mobile	18
I don’t have reliable access to Internet	31
Slow internet/computer speed	48
There are no barriers	63

Key Points:

1. From above Table it is clear that many students feel that Slow Internet/Computer speed is the major barrier. Hence, School authorities might check their Computer specifications and update if possible so that this cannot be a barrier to students anymore.

2. Second highest set of students feels that these Education Technologies feels like extra work with little connection to course. Education Technologies must be used as aid to assist students in process of learning. Hence School authorities might recheck the purpose of using Education Technologies and make sure that Education Technologies are more connected to course work and assist them in process of learning.

3. Third highest set feels that students have no sufficient access to technologies. This barrier needs to be addressed by School Management as well as Parents.

4.2 Teacher results- KV-CLRI

4.2.1 Cronbach's Alpha

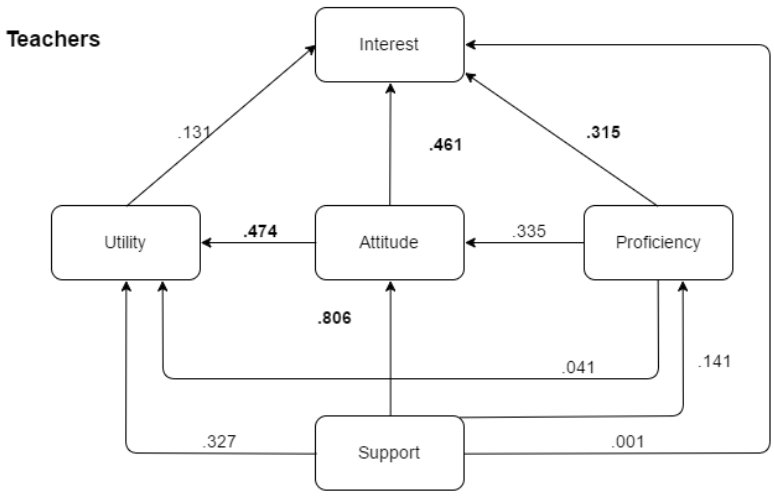
ETD	Cronbach's Alpha
Interest	.841
Proficiency	.775
Utility	.785
Support	.819
Attitude	.866
Total Questionnaire	.943

The value of .60 and above on Cronbach's Alpha is considered reliable. Values of .80 and above are considered very reliable in statistical analysis.

4.2.2 Path Analysis

Beta coefficients are given with hypothesis estimates in brackets.

ETD	Beta Coefficients				
	Utility	Proficiency	Interest	Support	Attitude
Utility	-	-	.131 (++)	-	-
Proficiency	.041 (+)	-	.315 (++)	-	.335 (+/-)
Interest	-	-	-	-	-
Support	.327 (+)	.141 (++)	.001 (++)	-	.806 (++)
Attitude	.474 (++)	-	.461 (+)	-	-



Direct Effects	Indirect Effects
Positive direct effect of Support on Attitude, Utility, Interest and Proficiency	**Positive** indirect effect of Support on Interest through Attitude, Utility and Proficiency
Positive direct effect of Attitude, Utility Proficiency and Support on Interest	
Positive direct effect of Attitude and Proficiency on Utility	Positive indirect effect of Proficiency on Interest through Attitude.

Discussion:

Clearly most effective path is

- Support-Attitude-Interest

  Very high direct effect of Support on Attitude gives us a lot of freedom to increase their comfort with technology without considering their level of Proficiency and perception of Utility.

The inherent advantage of following this path is that, by increasing Attitude, teachers' perception of Utility also increases due to high positive direct effect of Attitude on Utility.

4.3 Limitations of study

Major limitations lie in Sampling. Although the title talks about schools in general, the geographical diversity is not entirely covered owing to logistical problems. The study is broadly based upon Chennai. Also all the categories which were initially planned to cover were not covered. Also, this study focuses mainly on KV-CLRI which further reduces diversity. This puts a major limitation on the scope of the study for generalization and recommendation.

The mode of data collection is also a limitation as students and teachers were asked to take the questionnaires to their homes and fill them up. The possibility that the respondents getting influenced by others cannot be ruled out. I believe this may not change results/outcomes significantly.

CHAPTER 5

IMPLICATIONS FOR PRACTICE

This chapter provides some concluding remarks and observations based on the analysis and results of previous sections. They are presented as observations to each of the key stake holders in teaching/learning processes.

The Key stake holders are:

- Students
- Parents
- Teachers
- School authorities
- Policy makers

Parents and School authorities are facilitators. Students and teachers are consumers.

5.1 Concluding observations for School Authorities

- School authorities may put in efforts so as to let students know about their Utility in using educational technologies. This may include effective feedback system such as frequent technology-related report cards. This has direct effect on Interest.
- Caution to school authorities is that, they should avoid abrupt introduction of technologies and let students improve on all ETDs. The introduction/implementation has to be gradual and with effective feedback loops. Another caution comes from No-Tech at home students who are low on Proficiency and hence any step made has to also try to improve their level of Proficiency.
- School authorities may focus more upon integration of technology. Technology shows more benefits of used as a facilitator to learning rather than as a subject.
- If possible, student authorities may take special care for female students in improving their level of comfort with technology. They can conduct small workshops so as to let them feel good and remove any negative precursors. Also, caution must be maintained in these workshops that these have to be on technologies with an academic orientation in it. This is because female students are prone to lose their perception of Utility which has direct effect on Interest.

5.2 Concluding observations for Policy makers

- Policy makers may include the introduction and installation of technologies in schools as a part of their policy, only then can schools, particularly government schools can have significant development.
- Policy makers may make sure that availability and accessibility of technologies in school is no more a concern. G.H.S.S, an SSA school is low on all ETDs owing mainly to the lack of availability of technologies at school.
- Policy makers can improve the use of technologies at school by providing subsidies on some of the technologies so that school authorities can install them.

5.2 Concluding observations for Parents

- Parents of No-tech at home students may install technologies with an academic orientation at homes. This improves a lot on Proficiency which has high direct effect on Interest.
- Parents may focus on removing any negative feelings/discomfort with using the technology as Attitude can be improved more in homes than in school.

5.3 Further Research

This study tried to first apply a theoretical framework (hypothesis) relating Interest, Attitude, Proficiency, Utility and Support. The framework can be made more robust. Also, the questionnaire can be improved by including more dimensions covering all the heterogeneity of students and teachers. The scope of the study can be improved by increasing the geographical area and categories covered. Further research can also be done so as to check for any potential ETDs missed out in this study but have strong correlations with other ETDs. Also after implementing the recommendations as a pilot project, a new study can be designed so as to measure any change in effectiveness. A strong feedback loop can be formed with schools for refining the study.

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APPENDIX

1. Students Questionnaire.

☼ Which of the following devices do you have at home? Check all that apply. [Multiple Choices]

1) Computer [ ]
2) Mobile [ ]
3) Tablet [ ]
4) Laptop [ ]
5) Other. Mention

_____

☼ Do you have internet access at home? (Yes/No)

_____

☼ With regard to school system in general, I personally don't believe/like to come to school and study. I can even study at home (Strongly Agree/Agree/Neutral/Disagree/Strongly Disagree)

_____

☼ Choose your preference with regard to studying/learning in general
a) I study by myself without anyone forcing me.
b) I will study only when my parents or teachers force me to study.
c) I am not too keen on studies even when forced to study.

Questionnaire:

1) Which of the following technologies do you have (or) use at school? Tick all that apply. [Multiple Response]
   - ☼ Computer [ ]
   - ☼ Mobile [ ]
   - ☼ Tablet [ ]
   - ☼ Mobile Apps [ ]
   - ☼ Projector [ ]
   - ☼ Internet Access [ ]
   - ☼ Programming [ ]
   - ☼ Computer Software
     - Microsoft Excel [ ]
     - Microsoft Power Point [ ]
     - Microsoft Word [ ]
   - ☼ Others. Mention below

   _____

2) For each technology listed below rate your **proficiency/familiarity** using it on a **scale of 0 to 4**. Mention the number in Table 1 based on Table 2.

Table 1

Computer/Laptop	
Mobile	
Tablet	
Mobile Apps	

Table 2

Unfamiliar	0
Beginner	1
Average	2
Advanced	3
Expert	4

Internet	
Programming	
Microsoft Excel	
Microsoft Power Point	
Microsoft Word	

3) Mention a subject with the highest technology usage in your curriculum.

---

4) With reference to the **subject chosen above**, indicate **how often** you are using these technologies in **school** on a scale of 0 to 4. Mention the number in Table 3 based on Table 4.

Table 3 Table 4

Computer/Laptop	
Mobile	
Tablet	
Mobile Apps	
Internet	
Programming	
Projector	
Microsoft Excel	
Microsoft Power Point	
Microsoft Word	

Never/Very rare	0
Monthly once	1
Weekly once	2
Weekly thrice	3
Daily	4

Read the following statements and rate it on a scale of 0 to 4 regarding the technologies you ticked in Question 1. Write number in the box.

Strongly Disagree- 0	Disagree- 1	Neutral- 2	Agree – 3	Strongly Agree- 4

5) When I am presented with a new task, I am able to apply what I have learnt before for doing it. [ ]
6) I believe that knowledge of technology gives me opportunities to learn new things. [ ]
7) I believe that knowledge of technical devices (Mobiles/Tables/Computers) helps a lot in my daily activities. [ ]
8) I believe that I can improve my language skills if I use Internet/Computers. [ ]
9) Classes became more interesting after technology is introduced since I could now see more images and videos which I could not have seen in traditional classes. [ ]
10) I am confident to use technology in front of others without the fear of making any mistakes. [ ]
11) My parents keep technology updated at home by software upgrades, hardware repairs etc. [ ]

12) School Management keeps technology updated at school by software upgrades, hardware repairs etc. [ ]
13) My parents always search and install new technology at home. [ ]
14) School Management installs new technology at school whenever available. [ ]
15) My parents are very particular that I have close to 100% attendance in school.[ ]
16) My class mates readily share technology (Mobiles/Tables/Other devices) or information on technology with me. [ ]
17) I spend more time engaged in course activities in those courses/subjects that require me to use technology. [ ]
18) Teacher's use of technology has increased my interest in subject matter. Also mention the specific subject(s). [ ]
_____
19) I get better grades/marks in subjects that use technology.
Also mention the specific subject(s). [ ]
_____
20) The use of technology in classes has helped me better understand complex/abstract concepts. [ ]
21) Use of technology has helped me better communicate with teacher and class mates through email, mobile or internet etc. [ ]
22) The use of technology has resulted in quick and accurate feedback of my learning. [ ]
23) Technology enables me to learn at my own pace. [ ]
24) Technology enables me to learn on my own without any help from others. [ ]

25) Keeping in mind your <u>job prospects</u> in future choose one of the following. [Tick one]
   a. Technology in schools is irrelevant
   b. Technology in schools might be relevant but might not play an important role.
   c. Technology in schools is necessary

26) Which of the following best describes your preference with regard to use of technology in your classes. [Tick one]
   a. I prefer taking classes that use no technology
   b. I prefer taking classes that use limited technology features (only for some classes).
   c. I prefer taking classes that use technology (every class makes use of technology).

27) When given a choice, I prefer
   a. Playing indoor/outdoor games [ ] or Playing on Mobile/Computer. [ ]
   b. Drawing on a paper [ ] or Drawing on a device (Computer/Tablet etc.) [ ]
   c. Using Social Media (FB, Twitter) [ ] or Participating in social events. [ ]

28) When I hear of a new technology [Tick one]
   a. I ignore
   b. I try to get some first-hand information
   c. I am curious about new technologies and look for trying them out

29) When in <u>doubt</u> about some topic [Tick one]
   a. I ask teacher/classmates in person
   b. I talk to classmates/teacher via emails/mobiles etc.
   c. Search online for the topic or use a mobile application.

30) To learn about new things/topics [Tick one]
   a. I prefer reading a book that contains the topic
   b. I prefer reading an e-book/pdf on a device like mobile/tablet/computer etc.
   c. I search for it online or use a mobile application.

31) In class, to <u>make notes</u> [Tick one]
   a. I prefer doing it on a notebook
   b. I prefer doing it on devices like mobile/tablet/computer
   c. I prefer taking photocopies of my class mates' notes

32) To visualize and better understand a concept [Tick one]

a. I prefer to watch real demonstration like prototype/live experiment
b. I prefer to watch video demonstrations

33) In class [Tick one]

a. I prefer teaching to be on black/white/green boards
b. I prefer to be taught using projectors(Power Point presentations)

34) I prefer to take <u>exams/assignments</u> [Tick one]

a. On paper
b. On devices like mobiles/tablets/computers etc.
c. Online (Internet)

35) With regard to <u>School Management's(SM) encouragement</u> in using technology, choose the best preference [Tick one]

a. I am allowed to use technology whenever I have free time.
b. I am allowed to use technology on my own but only during specific class hours/timings.
c. I am allowed to use technology, but only in the presence of a supervisor or teacher.
d. I am not allowed to use technology on my own

36) With regard to <u>Teacher's encouragement</u> in using technology, my teacher [Tick one]

a. insists upon using technology
b. encourages using technology
c. is neutral about the use of technology
d. discourages from using technology

37) With regard to <u>Parents' encouragement</u> in using technology, choose the best preference [Tick one]

a. They insist upon using technology
b. They encourage using technology
c. They neither encourage nor discourage using technology
d. They advise me not to use technology but will not restrict me.
e. My parents refrain me from using technology

38) When I make <u>mistakes</u> using technology [Tick one]

a. My classmates mock me
b. My classmates don't care
c. My classmates assist me in using technology

39) What do you think of overall utility of technology for academic curriculum [Tick one]

a. The use of technology has reduced my performance
b. It has no effect on my overall performance
c. It has helped me improve my overall performance.

40) Rate the following <u>benefits</u> from using technology on a scale of 0 to 4

a. Improves my learning [ ]
b. Saves my time [ ]
c. Convenience [ ]
d. Helps me manage my class activities (planning, time management etc.) [ ]
e. Others (describe)

41) What are the <u>barriers</u> for you (if any) to use a technology in your class? Check all that apply. [Multiple Response]

a. It feels like extra work with little connection to course
b. It deviates me from my academic curriculum
c. I don't have the necessary skills
d. It's too expensive
e. I don't have the technical support I need
f. I don't have sufficient access to technologies.
g. The applications don't run on my computer/mobile/tablet.
h. I don't have reliable access to internet
i. Slow internet/computer speed
j. There are no barriers
k. Others. Describe briefly

2. Teachers Questionnaire

☼ Which of the following devices do you have at home? Check all that apply. [Multiple Choices]

6) Computer [ ]
7) Mobile [ ]
8) Tablet [ ]
9) Laptop [ ]
10) Other. Mention

_____

☼ Do you have internet access at home? (Yes/No)

_____

Questionnaire

1) Which of the following technologies do you have (or) use at school? Tick all that apply. [Multiple Response]

- ☼ Computer [ ]
- ☼ Mobile [ ]
- ☼ Tablet [ ]
- ☼ Mobile Apps [ ]
- ☼ Projector [ ]
- ☼ Internet Access [ ]
- ☼ Programming [ ]
- ☼ Computer Software
  - Microsoft Excel [ ]
  - Microsoft Power Point [ ]
  - Microsoft Word [ ]
- ☼ Other. Mention below

_____

2) For each technology listed below, rate your **proficiency/familiarity in** using it on a **scale of 0 to 4**. Mention the number in Table 1 based on Table 2.

Table 1

Computer/Laptop	
Mobile	
Tablet	
Mobile Apps	
Internet	
Programming	
Microsoft Excel	
Microsoft Power Point	
Microsoft Word	

Table 2

Unfamiliar	0
Beginner	1
Average	2
Advanced	3
Expert	4

3. With reference to your subject, indicate **how often** you are using these technologies in **school** on a scale of 0 to 4. Mention the number in Table 3 based on Table 4.

Table 3

Table 4

Never/Very rare	0
Monthly once	1
Weekly once	2

Computer/Laptop	
Mobile	
Tablet	
Mobile Apps	
Internet	
Programming	
Projector	
Microsoft Excel	
Microsoft Power Point	
Microsoft Word	

Weekly thrice	3
Daily	4

Read the following statements and rate it on a scale of 0 to 4 based on the technologies you ticked in the Question 1

Strongly Disagree- 0	Disagree- 1	Neutral- 2	Agree – 3	Strongly Agree- 4

4. I believe that knowledge of Technology devices like phones, Tablets, Laptops and others is very important in my day to day life [ ]
5. I believe that knowledge of Technology helps me and gives me an opportunity to learn many new things [ ]
6. I believe technology gives me Freedom and Flexibility to be creative in developing the curriculum, selecting activities and developing content. [ ]
7. I am confident to use technology in front of others without the fear of making mistakes [ ]
8. The available technology in school fits my style of teaching [ ]
9. School Management tends to keep technology updated and functional [ ]
10. School Management offers necessary training to use and apply technology [ ]

11) Colleagues share their knowledge of technology with me [ ]
12) Colleagues readily assist in using new/unknown technologies [ ]
13) Colleagues encourage me to use technology while teaching [ ]
14) To teach a topic in better way I prefer video presentations or simulations over conventional methods [ ]
15) I recommend students to lookup content online for better understanding [ ]
16) I can teach more in given time if I use technology in classes [ ]
17) I can track students' learning better with the use of technology [ ]
18) The use of technology has helped me to teach complex or abstract concepts in a better way. [ ]
19) The use of email, mobile and internet has helped me to communicate in a better way with my students. [ ]
20) The use of Technology has helped me in providing quick and accurate feedback [ ]
21) The use of technology has made my class preparation easier as I can explore into different angles from different sources [ ]
22) I feel I can assess my students in a better way with the help of technology [ ]

23) School Management [Tick one]

a) Insists on use of technology
b) Encourages use of technology
c) Is neutral about use of technology
d) Discourages the use of technology

24) In order to prepare myself for a topic, I prefer to [Tick one]

a) Read a text book or other books
b) Read Digital copies on some devices
c) Search online

25) I prefer to provide <u>clarification to student doubts</u> [Tick one]

a) In Person
b) Through e-mail/mobile

c) By asking them to refer to an online website.

26) In class [Tick one]

a) I prefer teaching to be on black/white/green boards
b) I prefer teaching using projectors(Power-point Presentations)

27) What do you think of overall utility of technology for your academic curriculum [Tick one]

a) The use of Technology has reduced my overall performance
b) The use of Technology has no effect on my performance
c) The use of Technology has improved my teaching performance

28) Keeping in mind your career stability pick one of these [Tick one]

a) Technology in schools is not of significant relevance for me to be a good teacher
b) Technology in schools is relevant but will play only a marginal role
c) Technology in schools is necessary and will play a very important role

29) Which of the following better describes your preference with respect to use of technology in your classes [Tick one]

a) I prefer teaching in classes that use no technology
b) I prefer teaching classes that use limited technology
c) I prefer teaching classes that use technology extensively.

30) When I hear of a new Technology [Tick one]

a) I ignore
b) I try to get some first-hand information
c) I want to learn and try out by myself

31) What are the barriers for you (if any) to using a computer or technology in your class? Check all that apply.[Multiple Response]

a) It feels like extra work with little connection to course
b) I don't have the necessary skills
c) It is too expensive
d) I don't have the technical support I need
e) I don't have sufficient access to computer/tablet
f) The applications don't run on my computer
g) I don't have reliable access to Internet
h) There are no barriers
i) Other. Describe briefly