Vineeta Garg
IT Head, SRDAV Public
School, Dayanand Vihar,
New Delhi, India

Gunjan Tomar
Activities Coordinator and
Learning Support Facilitator,
DPS International School,
Sector 50, Gurugram,
Haryana, India

Resilient and coherent technology solutions in a pandemic situation

Vineeta Garg and Gunjan Tomar

Abstract
The coronavirus pandemic isn't the first to hit the human civilization. Ever since humans started to live in groups forming communities, the world has seen numerous diseases spread like wildfire. With the improved technology that we have had in the past few decades, the preparedness to address education and adopt technology-enabled teaching-learning platforms could be administered and evolved further exponentially at very short notice during COVID 19 time. In the process of finding ways to provide education on a virtual platform during the pandemic, the resilience and coherence aspect of education was compromised.

A well-rounded and effective educational practice is needed to overcome the educational challenges and to accelerate the thinking on how to best support quality education for all.

This paper focusses on using NOISE analysis to build a resilient and coherent model that can effectively be used in future pandemics, crisis and in hybrid learning. A NOISE analysis done on a group of teachers provides insights on using different strategies and solutions for private and government school teachers depending upon the need, opportunities, improvements, strengths and challenges.

Keywords: Human civilization groups forming communities, coherent technology

Introductions
Pandemics are diseases that break out on a global scale and lead to social disruption, economic loss, and general hardship on a wider scale. Pandemics are not new and have been a part of our life for centuries. From Europe's Black Death during the middle Ages to the present-day worldwide spread of Covid-19, pandemics have always terrorised the world and changed the course of society for many years to come. When a pandemic, conflict or natural disaster happens, education is particularly the first service halted and the last to be resumed.

The current pandemic, COVID-19, has had an unprecedented impact and resulted in schools shut all across the world. As per UNESCO, in India alone, more than 32 crore students have been affected due to the closure of schools, colleges and other educational institutions. This resulted in exploring digital options and the distinctive rise of e-learning, whereby teaching is undertaken remotely and on digital platforms.

It has become important to explore new pedagogical strategies and educational plans to cope with these trying times so that education is not disrupted. A multi-pronged strategy is necessary to manage the crisis and build a resilient Indian education system in the long term.

Literature review
COVID-19 is not the first pandemic that has doomed the human community across the globe. Earlier pandemics (Refer Fig 1) like the Plague of Justinian (541-542 A.D.), Bubonic plague (1347-51 A.D.), Spanish Flu (1918-19), AIDS (ongoing), SARS (2002-03), Swine Flu (2009-10), Ebola (2013) etc. too had profound and lasting effects on societies [4].

The influenza pandemic of 1918-1919 infected 25% of the world's population and killed at least 50 million people globally. Some influenza pandemics, such as Asian influenza (H2N2, 1957–1963, 2–4 million deaths) and Hong Kong influenza (H3N2, 1968–1970, 1–2 million deaths), were proven to be less dangerous. Transmitted through respiratory droplets, the Spanish Flu pandemic was particularly notable for having two waves, with the first occurring in the spring of 1918 and the second occurring in the fall of that year. In 2013, in West Africa, the Ebola epidemic resulted in five million children to be out of school [5]. According to reports from Centers for Disease Control and Prevention (CDC), Swine flu pandemic affected approximately 60.8 million people globally.

Corresponding Author:
Vineeta Garg
IT Head, SRDAV Public
School, Dayanand Vihar,
New Delhi, India

The history of pandemics has already taught us that social distancing and quarantine measures are mandatory to help curb the spread. Based on the idea that a pandemic could strike every 30–50 years, health professionals have recommended more readiness and improved government strategies [7].

COVID-19, with high fatality rate and fast spread is no different from the above-mentioned pandemics. Advancements in science and technology could not stop the spread of COVID-19 virus in the initial stages and led to millions of deaths, total shut down of socio-economic activities, educational and religious institutions with people locked down to their homes across the globe [4].
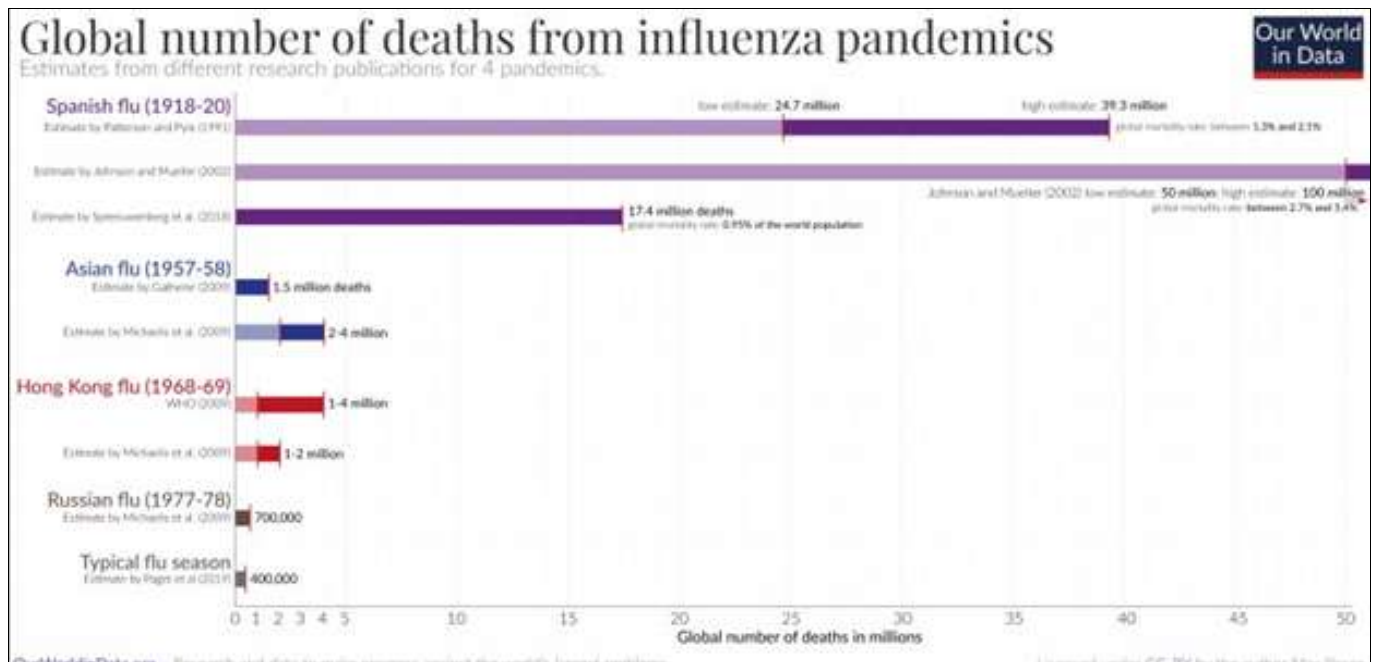

Fig 1: Chart showing global number of deaths from influenza pandemics (Source: OurWorldinData.org)

World-wide schools' closure due to Covid-19 has bought significant learning loss and disruptions to the education sector. With the unprecedented spread of Covid-19, education has particularly been hit hard. According to study released on March 30 by UNESCO "87 per cent of the world's students – that is 1.5 billion learners – have been affected by school closures. The bulk of these students are enrolled in primary and secondary schools, but there are also millions of students affected at the pre-primary and tertiary education levels as more than 180 countries have shut school doors nationwide, while others have implemented localized school closures" [1].

Although physical classrooms are replaced by online mode of teaching learning and different technology tools have been adopted by teachers and students to minimise the learning loss yet the aim to have a resilient and coherent education system could not be fulfilled. The unprecedented challenges faced due to Covid-19 in the education sector is pushing policymakers to devise ways to accelerate the thinking on how to best support quality education for all and tackle the digital divide.

Methodology
Sources of Data Collection
- Questionnaire was developed
- Reports and Research papers were referred

Thus, the combination of data was collected from primary as well as secondary sources.

Sample Design: Convenience Sampling
Sample Size: 61 Respondents
Respondents were the educators teaching classes K- 12 from government schools, NGOs, semi-government schools, private schools and a few freelancers.

The survey was based on NOISE (Need, Opportunity, Improvement, Strength and Exception) analysis. The list of Exceptions of 'E' of NOISE is the areas of NOIS that are already happening even just a little. While analysing the survey data it was observed that NOISE requirements differed for government schools, NGOs and Private Schools, Semi Governments schools. Options chosen and suggested by the educators provided an insight into the components of education delivery and reception during COVID 19 stated in NOISE analysis graphic (refer Fig 2).
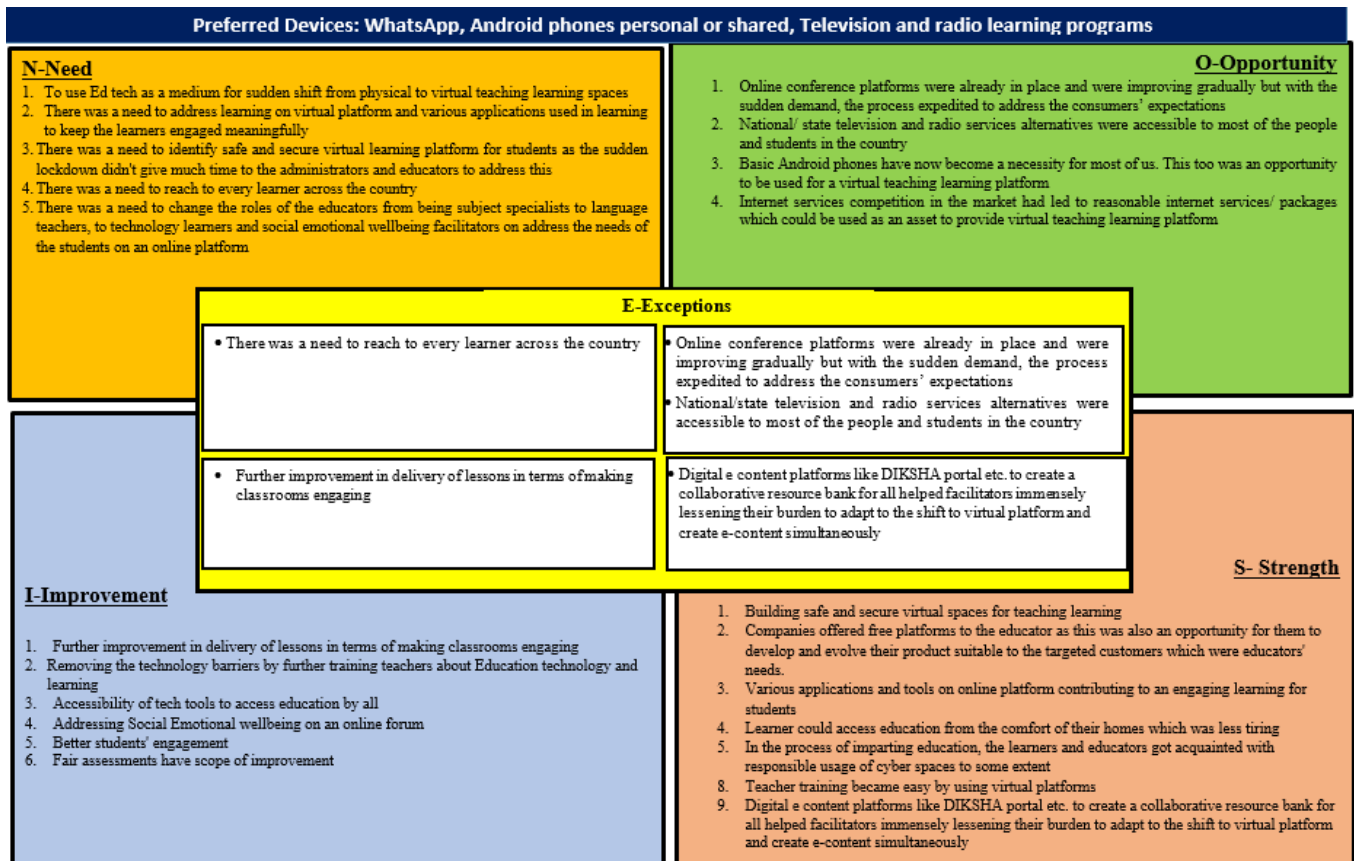
Fig 2: NOISE Analysis graphics

Data Analysis and Interpretation
Government Schools and NGOs Survey results
Types of Devices Used
According to the survey conducted governments school students either had android shared devices, WhatsApp, Android personal phones or TV or radio as a platform for virtual learning (refer Fig 3). The teaching learning was also dependent on the availability of the devices so the teaching model here was primarily Asynchronous.
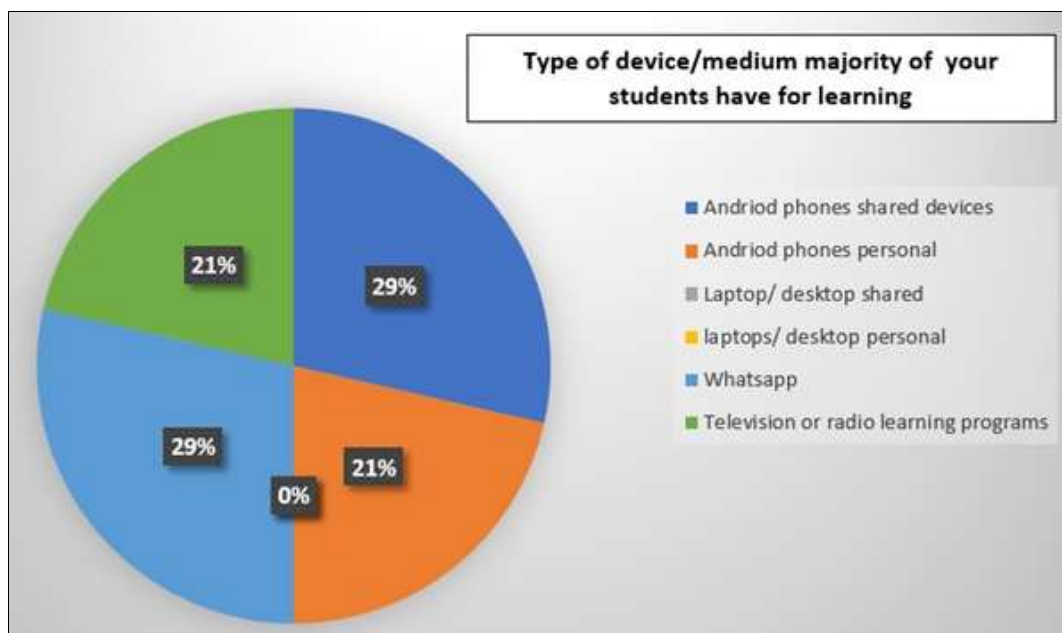
Fig 3: Graphical Analysis of Types of devices/medium Government Schools and NGO students had for learning

N- Need
Respondents' responses for the given question were (Refer Fig 4)-
Urgent need to shift from physical to the virtual learning platform which is safe and secure – 24%

Need for a virtual platform integrated with various applications to make learning engaging for students – 18%
Need to reach learners across the country and educators roles changed from being subject teachers to language and

technology teachers and social-emotional learning teachers   – 17%

Fig 4: Graphical Analysis of Need for Education Technology for Teaching-Learning during Covid-19 Pandemic for Government Schools and NGO students

O- Opportunity

Respondents' responses for the given question were (refer Fig 5)-
Necessity of android phones – 38%
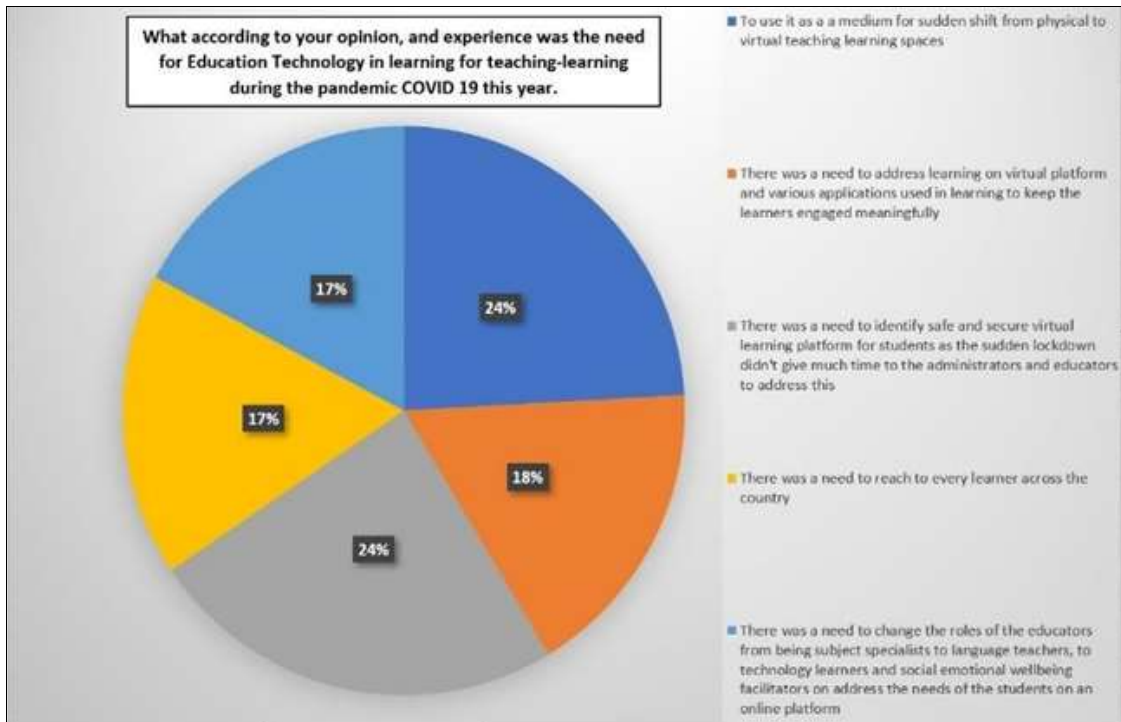Online conference platforms showed considerable improvement to address the consumers' expectations and national TV and radio medium was accessible to the majority of the population which could be used as an alternative for the delivery of education – 24%
Providing internet at cheaper rates which led to exploring it for education purpose – 14%.
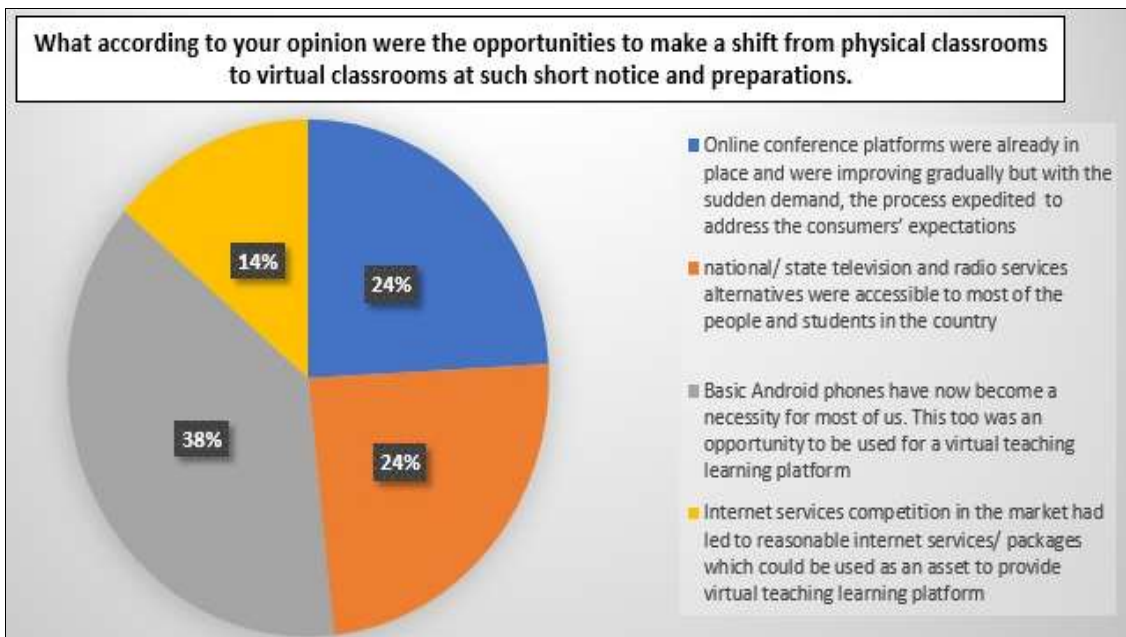
Fig 5: Graphical Analysis of Opportunities to Make a Shift from Physical to Virtual Classroom during Covid-19 Pandemic for Government Schools and NGO students

I-Improvement

Respondents' responses for the given question were (refer Fig 6)- Need to improve the delivery of lessons to make virtual classrooms engaging – 26%. Need for accessibility of tech tools to access education by all – 20%. Improvement in teacher training to effectively run this learning model during and after the pandemic – 18%. Fair assessments on online learning have a lot of scope of improvement -10% Improvements in addressing social-emotional learning in virtual classrooms - 8%.
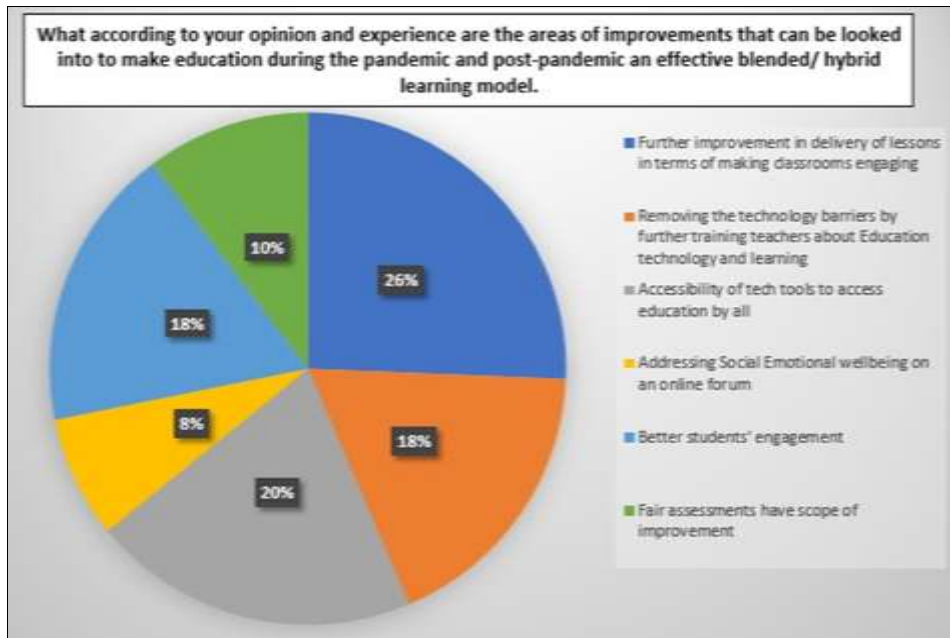
Fig 6: Graphical Analysis of the Areas of Improvements to make Education during & Post Pandemic an effective Model for Government Schools and NGO students

S- Strength
Respondents' responses for the given question were (refer Fig 7)-- Availability of government digital e-content like DIKSHA as the greatest strengths to address learning during the pandemic – 20% Building a safe and secure virtual teaching-learning environment and on accessing education from the comfort of home – 14%. Teacher training becoming easy on the online platform – 11% Online teaching-learning has made educators and students to some extent a responsible user of cyberspace, educators shared that the proposal of offering a free online platform for learning helped companies to evolve their products – 9% Maximized global interactions and easier assignment check – 7%.

Fig 7: Graphical Analysis of Strengths of Education Technology during Covid for Addressing the learning and SEL needs for Government Schools and NGO students

Findings
Based on the majority of choices made in the SURVEY for NOISE and devices can be summarized as follows (Refer Fig 8):

N-Need
1. To use Ed tech as a medium for sudden shift from physical to virtual teaching learning spaces
2. There was a need to address learning on virtual platform and various applications used in learning to keep the learners engaged meaningfully
3. There was a need to identify safe and secure virtual learning platform for students as the sudden lockdown didn't give much time to the administrators and educators to address this
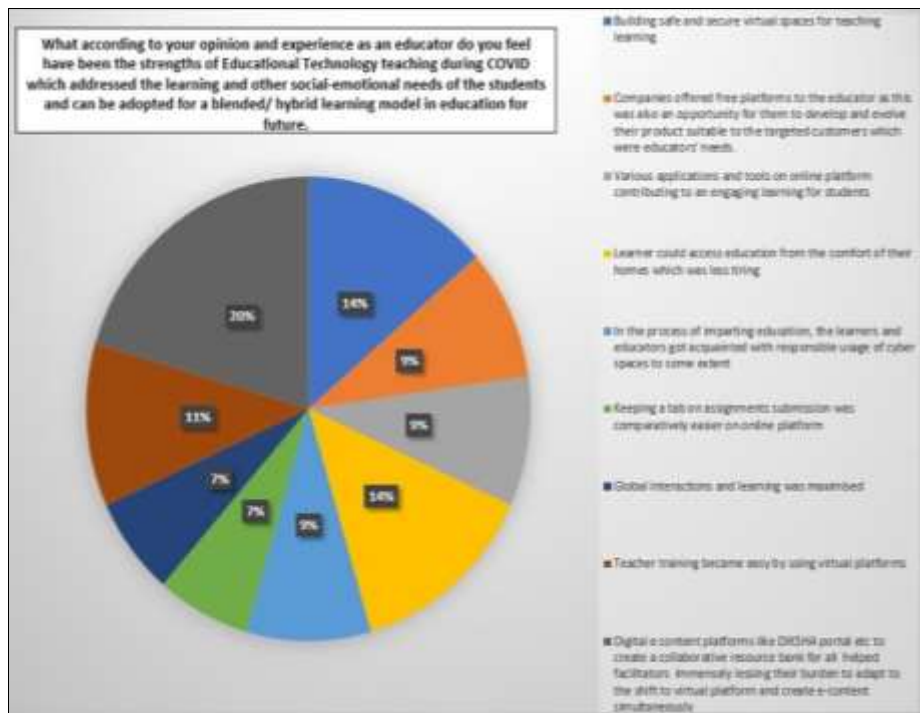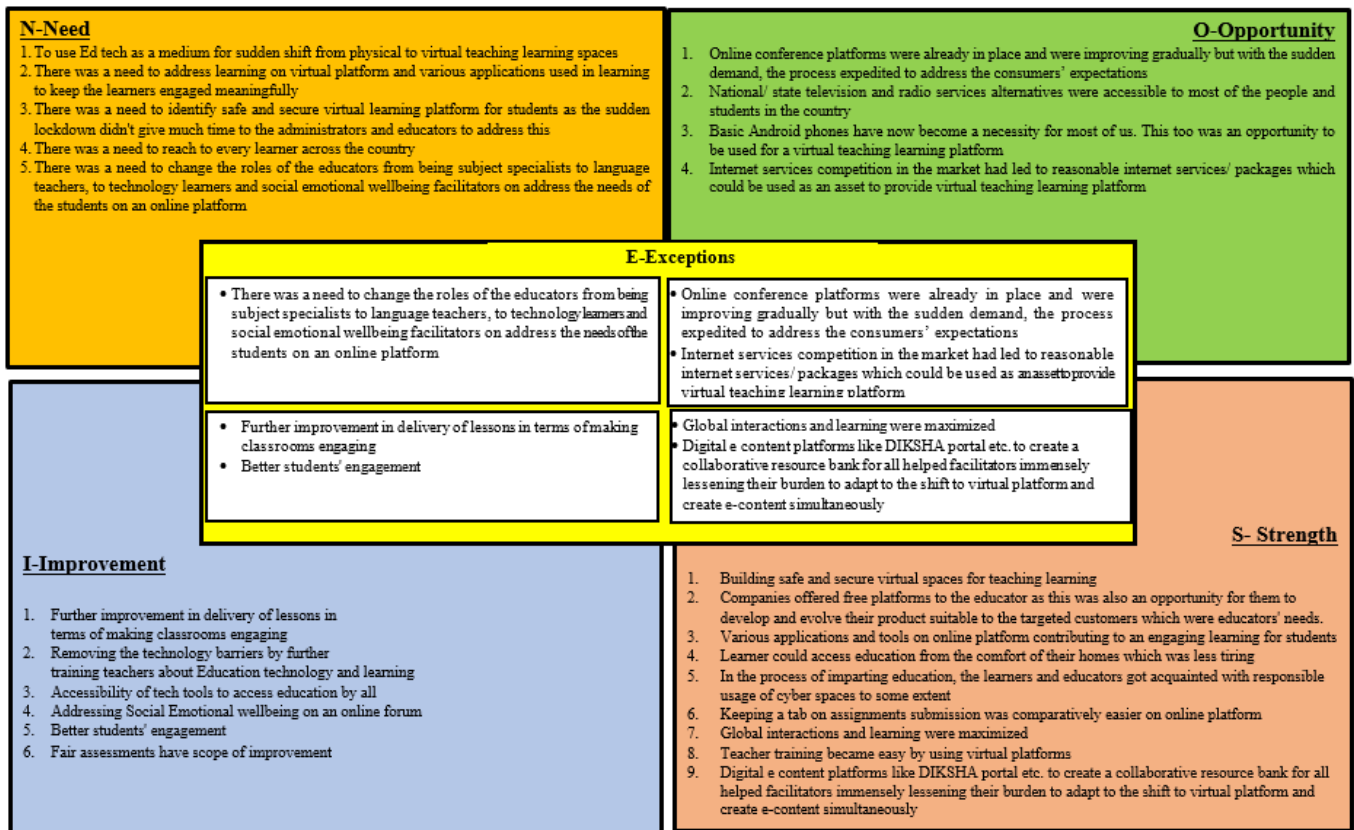4. There was a need to reach to every learner across the country
5. There was a need to change the roles of the educators from being subject specialists to language teachers, to technology learners and social emotional wellbeing facilitators on address the needs of the students on an online platform

O-Opportunity
1. Online conference platforms were already in place and were improving gradually but with the sudden demand, the process expedited to address the consumers' expectations
2. National/ state television and radio services alternatives were accessible to most of the people and students in the country
3. Basic Android phones have now become a necessity for most of us. This too was an opportunity to be used for a virtual teaching learning platform
4. Internet services competition in the market had led to reasonable internet services/ packages which could be used as an asset to provide virtual teaching learning platform

E-Exceptions

- There was a need to change the roles of the educators from being subject specialists to language teachers, to technology learners and social emotional wellbeing facilitators on address the needs of the students on an online platform

- Online conference platforms were already in place and were improving gradually but with the sudden demand, the process expedited to address the consumers' expectations
- Internet services competition in the market had led to reasonable internet services/ packages which could be used as an asset to provide virtual teaching learning platform

- Further improvement in delivery of lessons in terms of making classrooms engaging
- Better students' engagement

- Global interactions and learning were maximized
- Digital e content platforms like DIKSHA portal etc. to create a collaborative resource bank for all helped facilitators immensely lessening their burden to adapt to the shift to virtual platform and create e-content simultaneously

I-Improvement

1. Further improvement in delivery of lessons in terms of making classrooms engaging
2. Removing the technology barriers by further training teachers about Education technology and learning
3. Accessibility of tech tools to access education by all
4. Addressing Social Emotional wellbeing on an online forum
5. Better students' engagement
6. Fair assessments have scope of improvement

S- Strength

1. Building safe and secure virtual spaces for teaching learning
2. Companies offered free platforms to the educator as this was also an opportunity for them to develop and evolve their product suitable to the targeted customers which were educators' needs.
3. Various applications and tools on online platform contributing to an engaging learning for students
4. Learner could access education from the comfort of their homes which was less tiring
5. In the process of imparting education, the learners and educators got acquainted with responsible usage of cyber spaces to some extent
6. Keeping a tab on assignments submission was comparatively easier on online platform
7. Global interactions and learning were maximized
8. Teacher training became easy by using virtual platforms
9. Digital e content platforms like DIKSHA portal etc. to create a collaborative resource bank for all helped facilitators immensely lessening their burden to adapt to the shift to virtual platform and create e-content simultaneously

Fig 8: NOISE Analysis graphics for Government Schools and NGO

Suggestions
Suggestions for developing and resilient and coherent technology solutions in pandemic situations based on NOISE developed for govt schools and NGOs are as follows-
▪ Designing a need-based model depending on the needs and availability of resources for the schools and students. For some schools concept of Mohalla teaching works while for others learning is possible on android phones and other such devices if there is internet connectivity. WhatsApp video call can be an option to carry on teaching-learning in small groups.
▪ Making internet and affordable devices available by adding the same in the education budget for each school as this situation can arise anytime. This pandemic has revolutionized the teaching-learning process and in the process, many educators have enhanced their technical skills, which should continue as professional development. This can only happen if the learning environment is technology-enabled.

▪ As android phones have played an instrumental role in providing teaching-learning platform for students and teachers of govt schools, making them available at subsidized rates can help to establish stable online learning platform in case of the sudden closure of a school in crises like a pandemic or any other reasons.
▪ Online learning platforms along with physical classrooms can still be used to address students' needs such as extra classes after school hours or classes on Saturdays etc. This way both students and educators will stay apprised with the latest technologies to be able to incorporate them in their teaching-learning to make classrooms learning more meaningful and engaging.

Private and Semi Govt Educational Institutions' Survey results
•**Types of Devices Used**
According to the survey conducted school students had either their laptops/desktops/ android phones or had it on sharing basis (Refer Fig 9).
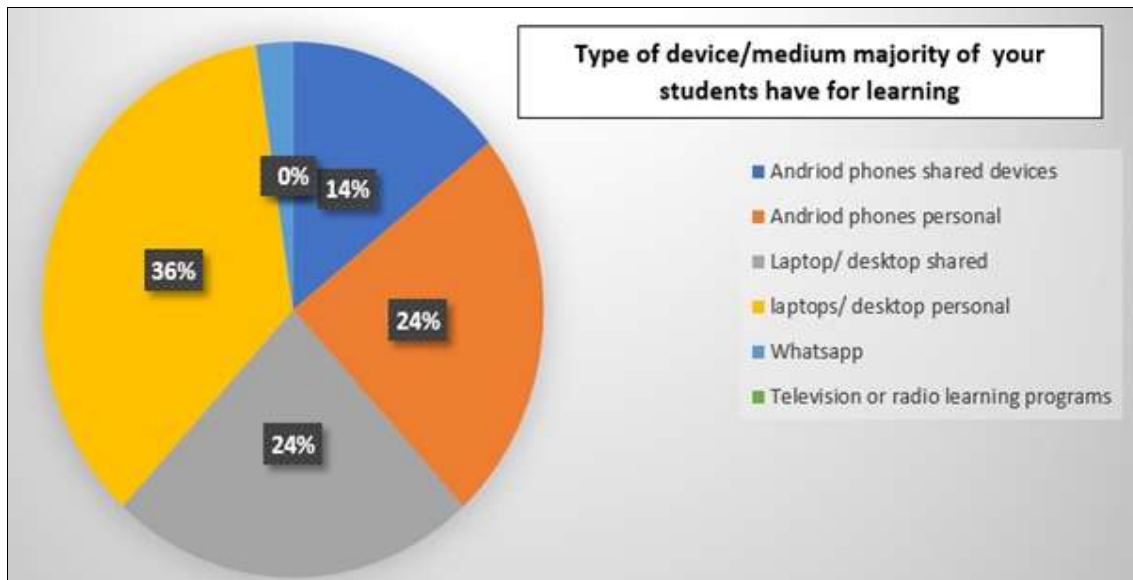
Fig 9: Graphical Analysis of Types of devices/medium Private and Semi Government Schools' students had for learning

N- Need
Respondents' responses for the given question were (Refer Fig 10)- Need to identify and adopt a safe and secure virtual learning environment – 23%. Urgent need to shift from physical to the virtual learning platform – 21%. Need to make learning engaging and meaningful and educators' roles changed to being subject teachers to language and technology teachers and social-emotional learning teachers – 19% Need to reach every learner across the country – 18%.
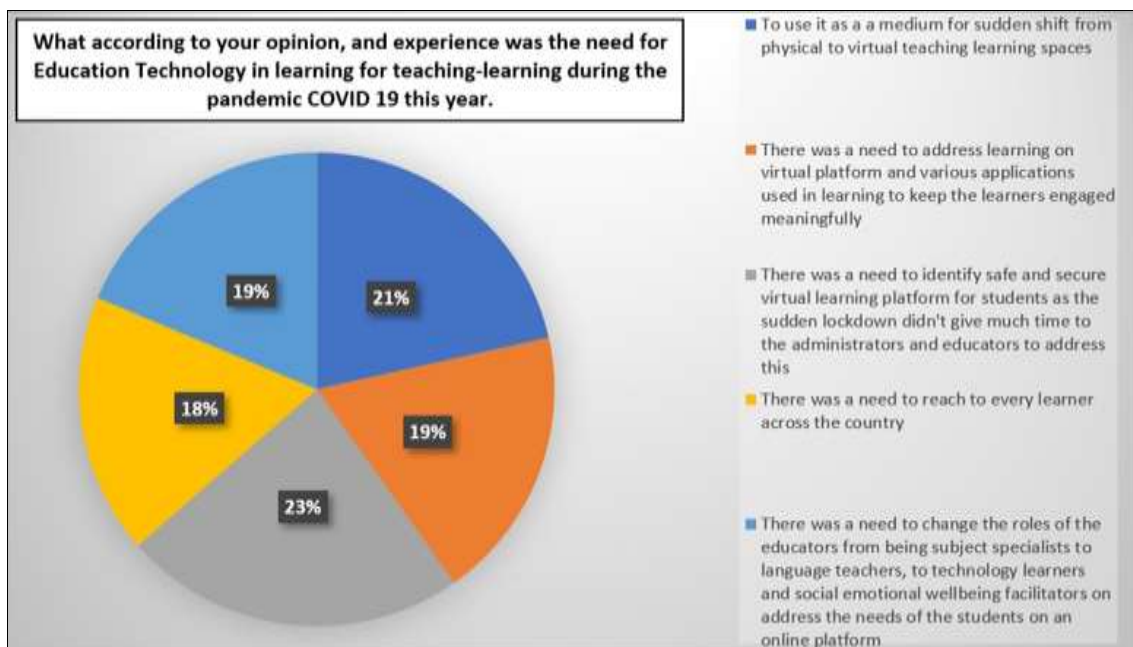
Fig 10: Graphical Analysis of Need for Education Technology for Teaching-Learning during Covid-19 Pandemic for Private and Semi Government Schools' students

O- Opportunity
Respondents' responses for the given question were (Refer Fig 11)- Online conference platform turned into the opportunity to impart education on a virtual platform 39% Android phones have become a necessity for most of us which turned into an opportunity to use it as a medium for virtual learning – 32% Internet could be provided at cheaper rates which led to exploring it for education purpose – 23% National TV radio medium was accessible to the majority of the population – 6%.
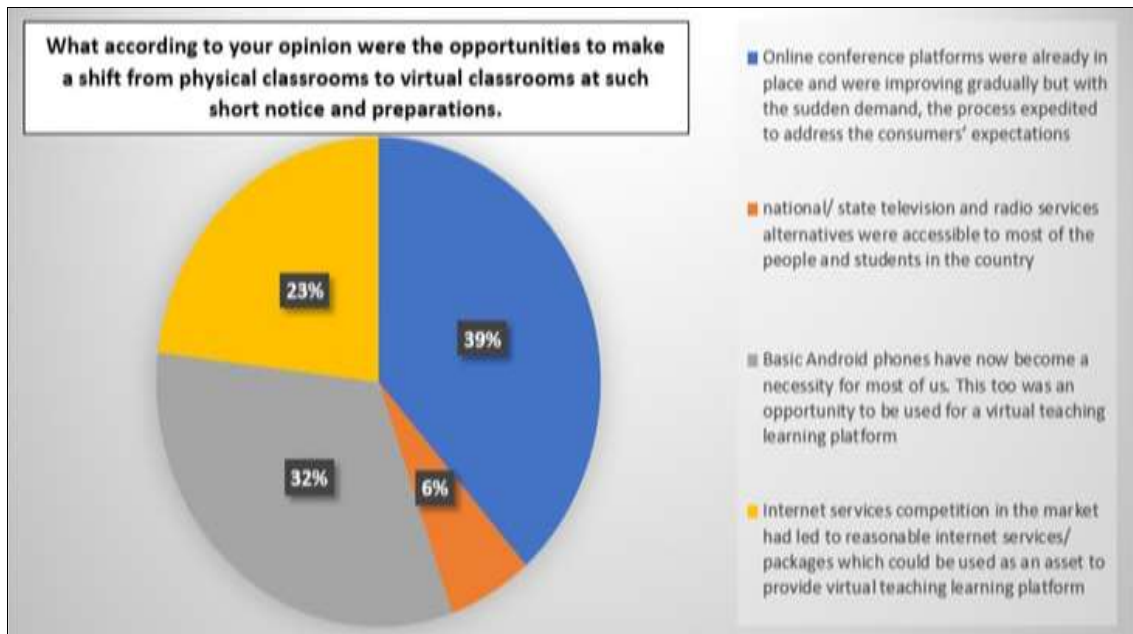
Fig 11: Graphical Analysis of Opportunities to Make a Shift from Physical to Virtual Classroom during Covid-19 Pandemic for Private and Semi Government Schools' students

I-Improvement
Respondents' responses for the given question were (Refer Fig 12)- Need for accessibility of tech tools to access education by all - 20%. Improvement in teacher training to effectively run this learning model during and after the pandemic – 18% Need to improve the delivery of lessons to make virtual classrooms engaging – 17% Fair assessments on online learning have a scope of improvement – 16% Social-emotional learning domain on an online platform can be further improved – 15% Conducting fair assessments on an online learning platform needs improvement – 14%.
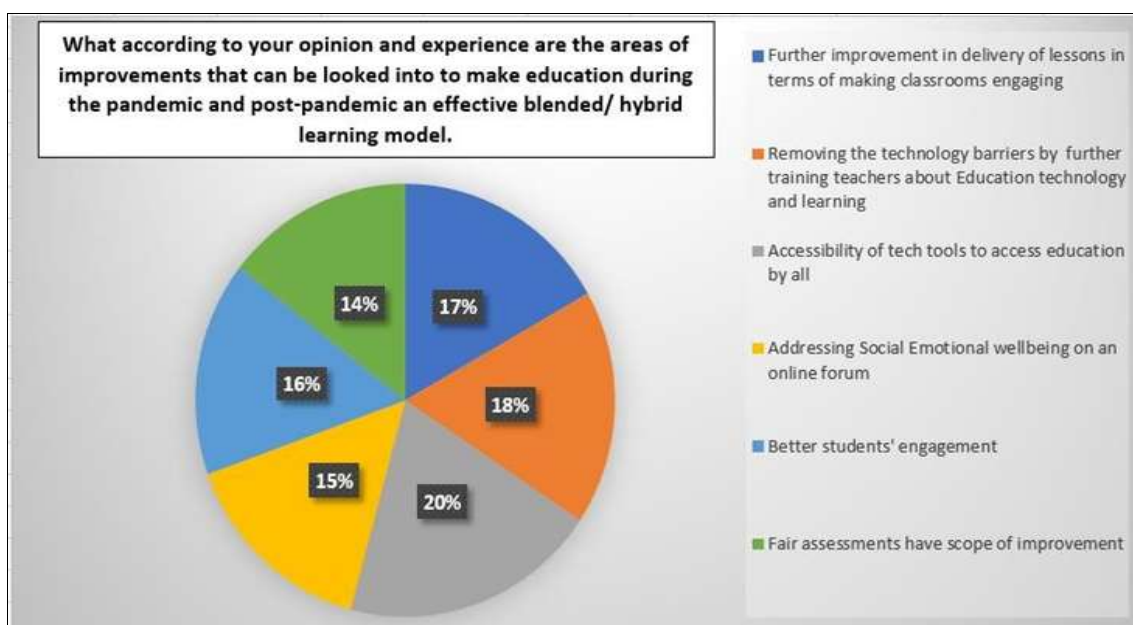
Fig 12: Graphical Analysis of the Areas of Improvements to make Education during & Post Pandemic an effective Model for Private and Semi Government Schools' students

S- Strength
Respondents' responses for the given question were (Refer Fig 13)-
Contribution of the online platform to engaging learning and Govt e-content platforms like Diksha as key tools – 15%
Building a safe and secure virtual teaching-learning environment – 14%

Offering a free online platform for learning helped companies to evolve their products and also on accessing education from the comfort of their homes – 11%
Online teaching-learning has made educators and students to some extent a responsible user of cyberspace, maximized global interactions and easy teacher training – 10% Easy to keep a tab on assignments – 4%
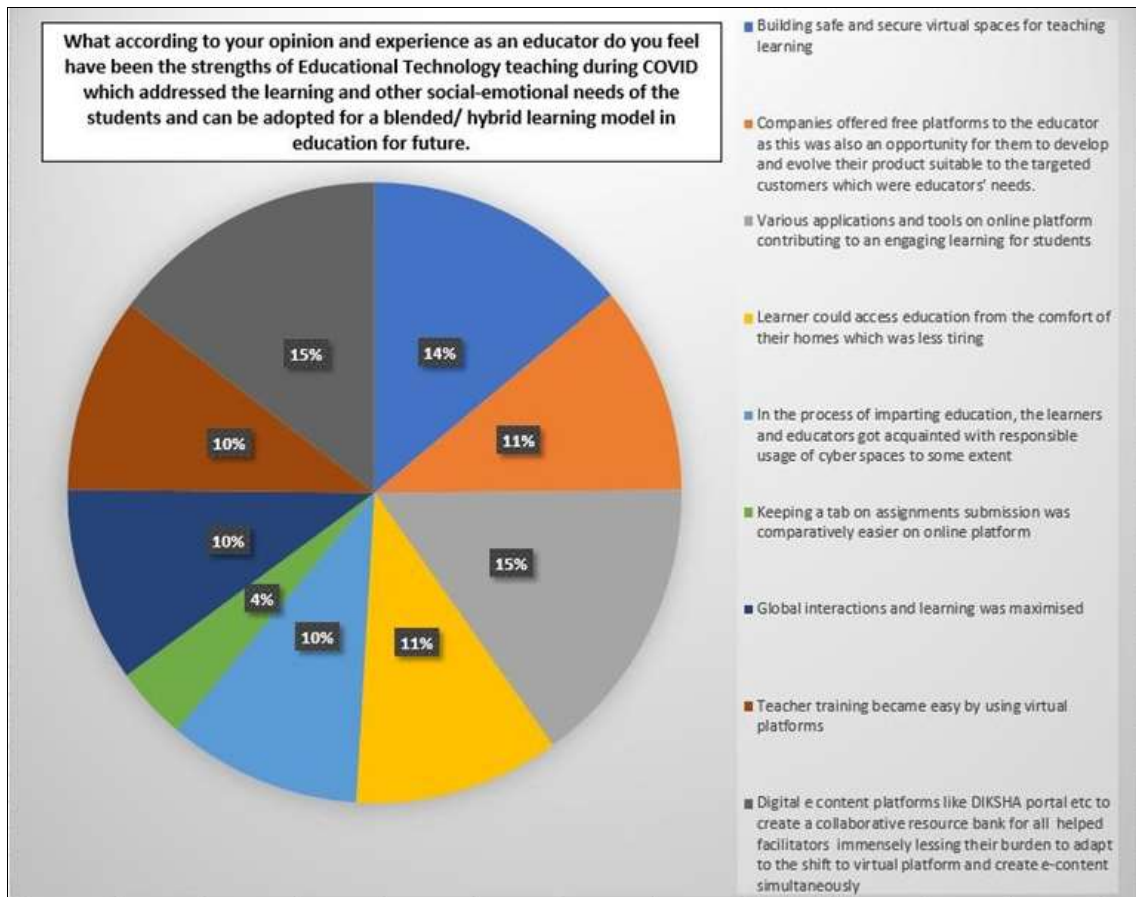
Fig 13: Graphical Analysis of Strengths of Education Technology during Covid for Addressing the learning and SEL needs for Private and Semi Government Schools' students

Findings
Based on the majority of choices made in the SURVEY for

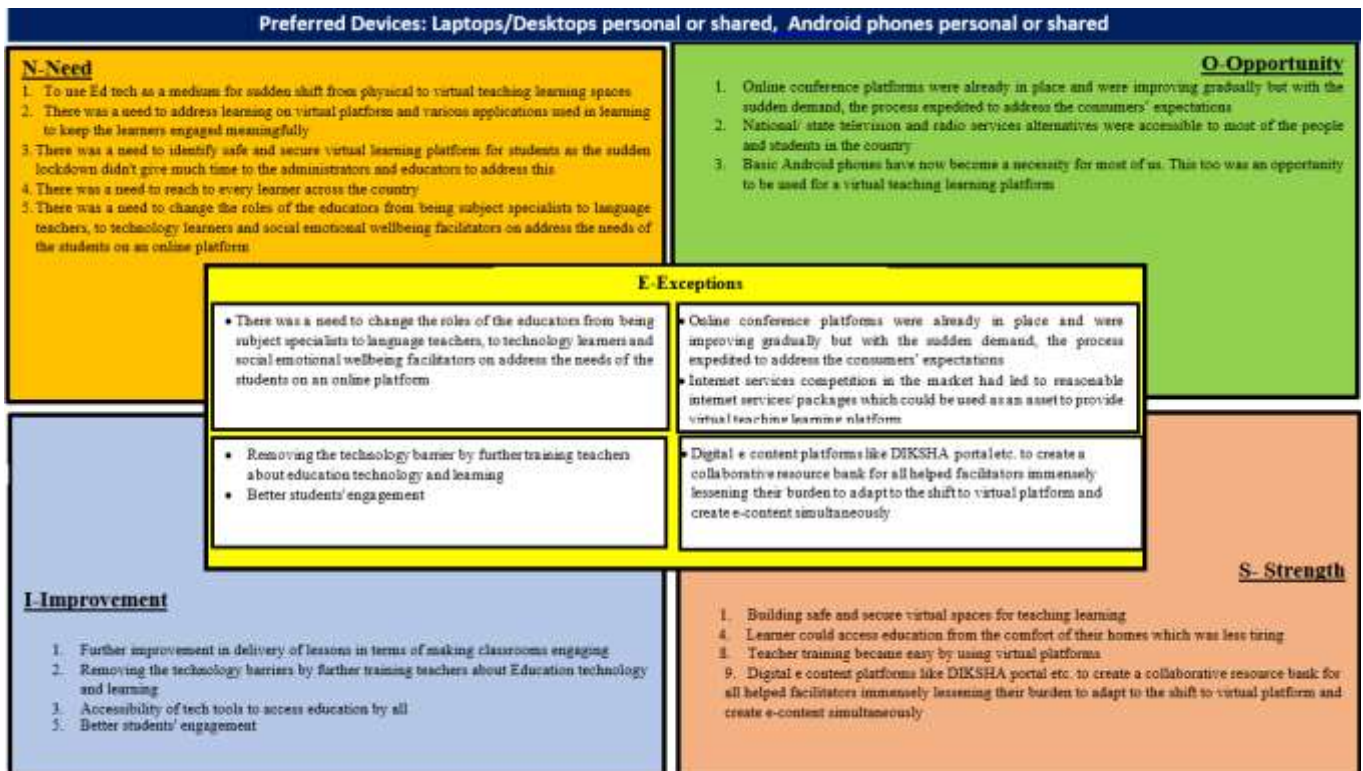NOISE and devices can be summarized as follows (Refer Fig 14):

Fig 14: NOISE Analysis graphics for Private and Semi Government Schools

Suggestions

Suggestions for developing resilient and coherent technology solutions in pandemic situations based on NOISE developed for Private and Semi govt schools are as follows- Keeping online teaching-learning an integral part of the physical learning environment too. Online learning integrated with various teaching-learning apps helps in addressing the diverse needs of students in classrooms which may at times not be possible in physical classrooms.

- Online teaching-learning is a platform for making learning accessible for all learners, thus an integrated model of physical and online learning can aid in creating equitable classrooms where each learner has the freedom to learn his/ her way.
- Continuing online teaching-learning will provide opportunities to the educators to explore various tools and strategies to make learning accessible and engaging for learners and in the process will help them develop professionally in teaching with technology.
- The online platform can be used to stay in touch with students to understand and address their social-emotional learning needs. For addressing the same students don't have to be physically present in school. Face to face interactions can also be done using online platforms.
- Concept of PTMs can be addressed using online platforms. Giving dedicated time to parents to know about their ward's progress can, on one hand, reduce waiting time for parents and on the other hand, can eliminate the hassle to find time from offices and spend hours to reach school for PTMs.
- Online platforms can be used to make learning more enriching by gaining perspectives of others around the world through global interactions to proceed towards making a peaceful world of global citizens.

Result and Discussion
One shoe doesn't fit all. In the same way, one education model doesn't suffice the needs of all but education model based on NOISE and availability of types of devices with the learners can be used as a framework to further develop Resilient and Coherent Technology Solutions in a Pandemic Situation and post-pandemic situations.

The innovations and creations to provide a safe and secure virtual learning environment for meaningful and engaging learning experiences for the learners had been at peak during the pandemic and every stakeholder has risen to the occasion to provide a pillar to lay a strong foundation for the virtual learning environment.

Our model of Government schools, NGOs and Private Schools, Semi Govt schools can be adopted and modified based on the requirements of the institutions to develop and address teaching-learning needs. This model can be used to develop hybrid models for post COVID learning too. Hybrid learning is about finding the right mix for creating an education model out of all the possibilities in learning, offline or online.

Here are some suggestions for developing Hybrid learning model using school type-specific NOISE analysis strategy-

- Strength and Opportunity of NOISE can be integrated into the post-pandemic hybrid model to benefit from the systems and practices which are already working very well in the present system and have shown better results than a physical learning environment.

- Formulating a plan to address needs and improvements can help develop a more evolved hybrid learning model for institutions.
- Online learning platforms can be utilized and optimized to address learning in case of sudden school closures due to unforeseen reasons. This will reduce the chances of loss of learning due to school closures
- Technology will come handy in times of social distancing norms which will still be there for a considerable amount of time post COVID too.
- Classroom learning accessed from homes via live transmissions can also benefit students who miss classes on account of being unwell or other such reasons.
- The best practices of physical and online learning can be adopted in the hybrid model to address the weaknesses of physical and online learning platforms. This way an effective learning model can be devised.

These models will not only take teaching-learning to another level but will also contribute towards environmental wellbeing as blended learning or hybrid learning will be an initiative to learn from the comfort of home at times to minimize our carbon footprint in the environment.

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