

# EDUCATION TECHNOLOGY IN INDIA:

## Designing Ed-Tech for Affordable Private Schools

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- Kim Campbell

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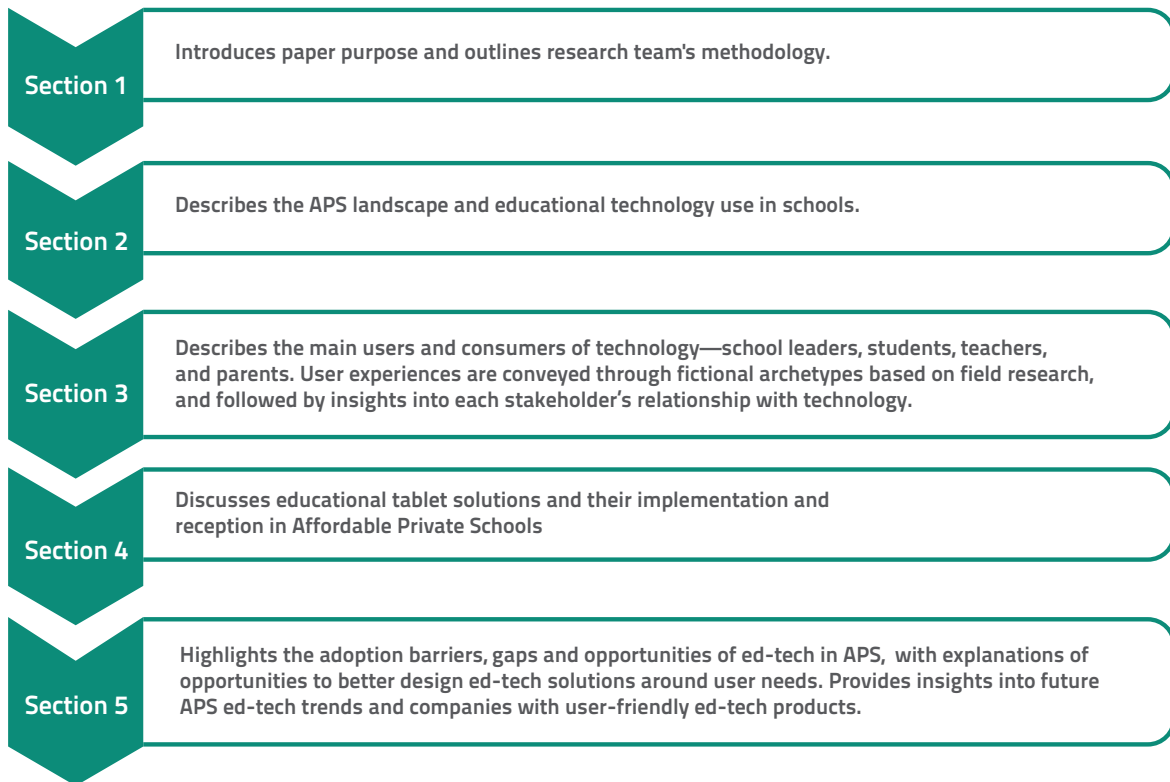
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# EXECUTIVE SUMMARY

This report seeks to understand how education technology solutions can be better designed to serve the needs of stakeholders in Affordable Private Schools (APS) in India. APS provide a low-cost private education to communities in India and throughout the developing world. The report's research explores the trends and opportunities of education technology (ed-tech) in APS, with a special focus on technology users and educational tablets. Insights were garnered from surveys, interviews, and various human-centered design research methods conducted in 2012 and 2013 in Hyderabad, India. The research will be presented in the following manner:



## Affordable Private Schools

With an estimated 300,000–400,000 affordable private schools, the APS market is particularly strong in India. APS serve almost 50% of urban students and 21% in rural areas. APS schools charge monthly fees between \$5.50 and \$14 per student and face several constraints as a result of these low prices. Teacher quality and retention is a major challenge since APS teachers often lack formal training. They are compensated an average salary that is 38% less than what teachers in government schools earn.

Despite these constraints, the research found that technology penetration in APS is very high. 69% of Hyderabad schools have computer labs and 58% have techno-classes. While the APS community is enthusiastic about working with novel technologies

to enhance educational output, many of the schools do not effectively utilize the technology they have invested in. 34% of computers and 13% of techno-classes are in too poor condition to use.

The ed-tech devices most commonly found in APS fall broadly into three categories: computer labs, techno-classes, and administrative technology. APS computer labs commonly have an average of nine computers, a keyboard, a mouse, and run on older versions of Windows. Techno-classes are in-class solutions that display content through some combined form of projection and audio-visuals. They can be smart-classes with interactive surfaces that respond to touch, or projectors that only display the image or video on a surface.



## APS Stakeholders

The research found that APS stakeholders generally embrace using technology to enhance education. Although there are some reservations regarding technology's utility and Internet safety, the majority of users view technology as an integral part of a modern and global education. Each stakeholder's perspective plays a different role in how technology is used and purchased.

School leaders purchase new technology to increase students' learning levels. They also buy technology to remain competitive among other APS schools and to keep their customers—the parents—satisfied. School leaders see technology as a tool that can bridge important gaps in school like improving spoken English, alleviating heavy bags, and connecting students and families globally. Above all, they hope technology will help their students learn more and perform better on exams. Their consumption decisions are largely shaped by the quality of an offering's content, its price, the solution's training structure, and resource requirements.

Students are the primary users of educational technology in APS. They are also very enthusiastic about technology in school. Students have varying levels of technology exposure especially along gender and income parameters. Girls report 40% less internet access and 26% less computer access than their male counterparts. Mobile phones are the most ubiquitous technology being used by students, primarily for games and listening to music. Since

students play a decisive role in convincing their parents of technology's value, ed-tech companies would benefit from leveraging students' technology interests. The stronger students advocate for a technology, the more convinced their parents are of its impact.

As APS consumers, parents create the demand for technology in school. They believe technology will give children the skills they need to be more employable and fulfill their aspirations for upward mobility. Since parents believe computer skills will help secure better futures for their children, 53% of parents use computer classes as a major parameter for deciding which private school they choose. Parents' decision to buy educational technology is largely shaped by its endorsement by school leaders, their children's interest in the device, and what their peers are investing in for their children.

Teachers are the facilitators of technology in the classroom. They must figure out how technology fits into a traditional teacher-centered pedagogy and a school dictated by an exam culture. At its best, teachers see technology as a tool to help them teach more content in less time. Technology also helps teachers reinforce concepts visually, especially in math and science. Additionally, technology can reduce the time and energy spent on assessments. At its worst, technology can be a burden to the teacher's workload and a threat to their authority as teacher in the classroom if they aren't comfortable using it.

## Educational Tablets

Educational tablet solutions--which are tablets with software and applications tailored to the educational needs of their students and staff--are one of the fastest growing education technology trends in the world. Educational tablets are especially prominent in India due to the release of the Aakash, a government subsidized tablet that was celebrated as the cheapest tablet in the world. These solutions comprise of an emerging ecosystem of players made up of hardware manufacturers, content developers, or aggregators.

While tablets are valued for providing one-to-one interaction, they can also require extensive planning to integrate well into the classroom. Based on interviews with two APS schools in Hyderabad that implemented tablets, we found that APS stakeholders were largely excited to acquire tablets. Some stakeholders though expressed concern about the price, functionality, and content.

The two most crucial elements of the tablet's success in APS are its implementation and its accessibility. An overview of basic tablet implementation and payment models that could be used in APS are outlined below:

Implementation Models	
E- book	Digital formats of student textbooks
Assessment	Built-in quizzes and exams that automate assessment scoring and distribution
Study Supplement	Students can use the tablet to independently review curriculum-aligned content and reinforce concepts taught in class
In-class integration	Integrating the tablet and its content into a teacher's lesson plan
Flipped Classroom Model	An inversion of the classic classroom model where students learn lessons at home via tablet content, then reinforce concepts with "homework" in class
Payment Models	
Government Distribution Model	The government pays for the solution and distributes them to schools for free
Government Subsidy Model	The government significantly subsidizes a portion of the tablet cost and parents or schools pay the remaining portion
"Tab Lab" Model	The school leader pays the tablet producer the market price for a bulk of tablets, uses them as technology assets in the school, and recovers cost through fee increases
Parent Ownership Model	The school buys tablets from tablet producers and parents pay for the tablet in installments
School Subsidy Model	School leaders buy tablets from tablet producers and subsidize the tablet cost for students who can't afford it; subsidized students can only use it in school and students whose family can afford the tablet can use it at home

## Major Findings

While field research exposed us to a wide variety of perspectives on educational technology in APS, there were a few ideas that echoed consistently across all stakeholders. These perspectives elucidated some common barriers to successful technology adoption. Below are four major reasons why technology initiatives often fail in APS:

**Knowledge Gaps:** 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 the classroom are not established, and rather than focusing on highly marketable computer literacy skills, students use technology in less impactful ways.

**Resource Limitations:** APS that rely on inconsistent cash flow from low-income parents face cost constraints that make it difficult to acquire all the resources necessary to maintain and maximize the use of ed-tech tools.

**Cultural Barriers:** Some implementations are halted because some school leaders view the technology as a marketing tool to be preserved rather than an educational tool to be used. There is also a reluctance to try new devices in front of students when the teacher-centered pedagogy places her as the expert in the room.

**Logistics Challenges:** Some schools have limited infrastructure and place many academic demands on students. They may have trouble finding a physical room, or adequate time to dedicate solely to the use and adoption of new technology.

Research also revealed a number of opportunities to improve ed-tech for all users in low-income schools in India. These opportunities call for innovations in content development, hardware development, service elements of ed-tech providers, and socio-cultural integration in individuals' lives. These gaps and opportunities include the following needs for:

Technology and 21st Century Skills  
Global Aspirations  
Gender Equality in Technology  
Mimic students' natural technology consumption  
Curriculum alignment  
Assessment  
Safe internet browsing

Audio visuals  
Spoken English  
Usable by Teachers  
Create Individualized Learning  
Electricity Independent  
Active On-Going Training Modules  
Blended Learning



Section 1  
**ABOUT THE PAPER**



# INTRODUCTION

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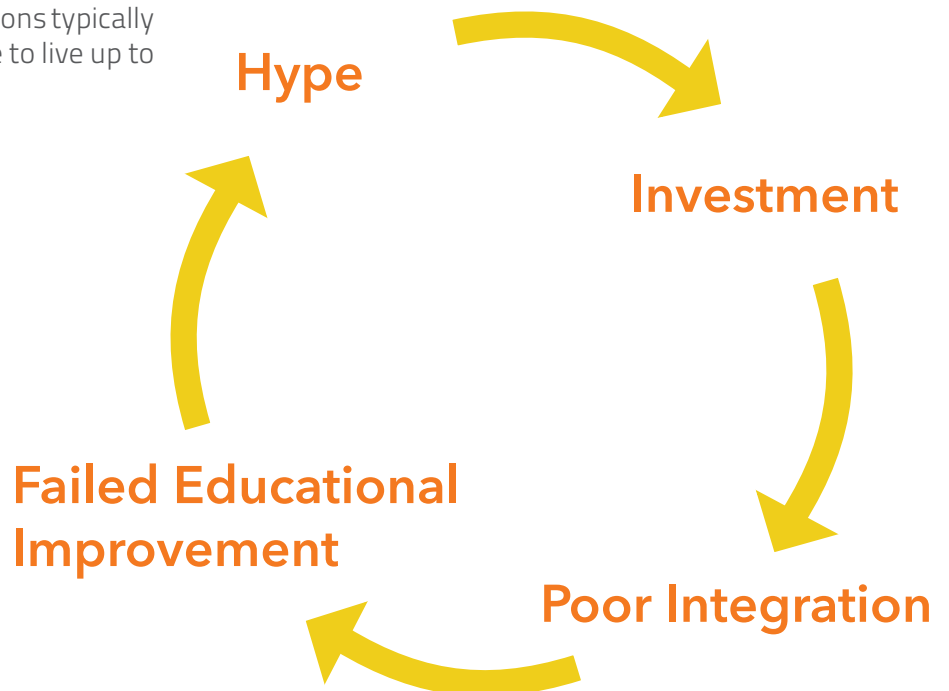
The challenges facing students in low-income communities in the developing world are daunting. Children are born to impoverished parents, whose limited education has curbed their earning potential. For this reason, children are taught at an early age that school is the only way out of their stifling circumstances. Many parents spend a substantial percentage of their income to help their children attain an education that will lead to better quality of life.

Unfortunately, enthusiasm for education is not enough to overcome the great barriers to progress erected by poverty. Students in the developing world are restricted to schools with poor infrastructure, inconsistent teaching quality, cramped classrooms with little individualized learning, and a poor emphasis on conceptual mastery. All of this seldom allows them to use education to rise up the social ladder.

In the face of these challenges, various education technology (ed-tech) innovations are presented as solutions. Ed-tech interventions include computer labs, smart classes, mobile phones, e-readers, and tablets. However, these proposed solutions typically enter an all too common cycle of failure to live up to their expectations.

Stakeholders initially express excitement and optimism around the potential of the new technology's impact on the future of education, creating "hype" for the ed-tech intervention. Resources then begin to flow in to make this technology available to students or integrated into the existing education systems. What follows is often a poor integration of a technology that is poorly designed for the school. At the end of the day, the technology fails to deliver on its promises to create educational improvements, until a new trending technology arrives on the market, renewing the cycle.

One example of this is One Laptop Per Child–Peru (OLPC), which went through this same cycle of "hype to failure." OLPC was a highly publicized project that aimed to empower the world's poorest children by giving each student a specially designed low-cost laptop. The laptop promised to be a tool that would "unlock the potential" of Peruvian children. After



much publicity, what followed was poor distribution, lack of training, and ultimately \$200 million in government spending on an intervention that yielded few, if any positive educational outcomes for students. There are many factors contributing to the disappointing results, but Parson's Professor of Innovation and Design Bruce Nussbaum offers a compelling reason. He asserts that the primary reason for OLPC's disappointing results was because it "broke the most important design rule from the very beginning of the project. Design from the bottom up, not top down." Rather than allowing a solution to emerge from the communities' interests and needs, OLPC assembled a team of top-notch designers to build what they thought the community needed.

**A poor understanding of an educational community lends itself to weak technology integration and ed-tech ineffectiveness in schools.**

This observation became readily apparent during the course of our work with Hyderabad's Affordable Private Schools (APS). In a place where power blackouts and technology illiteracy are common, we found that techno-classes and computers were often used minimally or not at all. Ed-tech solutions touted by the mainstream press as innovative in developing countries seemed entirely impractical in the settings that we worked in. As a consultant for Gray Matters Capital's educational tablets initiative, author Kim Campbell met many companies interested in entering the APS market, that were missing features that were crucial to effective school implementation. She realized that in many cases, a better understanding of the market could inform ed-tech designs that facilitated more successful adoption in schools. These observations and inquiries were formalized into a seven-month field research project in APS in Hyderabad, the findings of which are shared in this report.

**"Design strategy is about serving people. The real challenge is in trying to solve the human problem. It's about understanding their needs, their aspirations, and then meeting them in some way. So we are serving them."**

**-Chris Hosmer, Managing Director of Innovation at Continuum**



## RESEARCH QUESTIONS

The gaps in a various ed-tech solutions for APS clarified the importance of creating transparency into the beliefs, aspirations, and needs of the APS community. This paper acts as a bridge between APS stakeholders and the education, finance, and technology companies that are interested in making an impact and entry into India's low-income private school market. The driving question of our research is:

### **How can we better understand APS stakeholders' needs in order to facilitate more effective education technology solutions for that market?**

Understanding the aspirations and apprehensions of individuals inside APS is fundamental to improving the quality of technology integration in schools. Creating a stronger feedback loop between APS and the rest of the educational technology ecosystem that seeks to support it could be the first of many steps necessary to break the hype-to-failure cycle. This paper attempts to accomplish this through sharing insights that relate to the four primary stakeholders that make up the APS market: the school leader, the students, the parents, and the teachers.

**School Leader** - How might we better understand what motivates consumption of educational technology assets by school leaders?

**Student** - How might we better understand the level of exposure students have to technology? How might we better understand how technology fits students' educational aspirations? How might we understand the gaps in technology exposure that need to be filled by new solutions?

**Teachers** - How might we better understand the current pedagogy and implementation challenges that occur in the classroom around technology?

**Parents** - How might we better understand the motivations for purchasing new technologies for their children's education?



## Tablets

Though the majority of this paper deals with a broad set of technology forms in the APS sector, it also examines a specific case study of what is fast becoming the next ed-tech trend to sweep through India: tablets. Since author Kim Campbell was heavily involved in the initiation of tablet pilots in APS, she gleaned first-hand information on this particular innovation's potential role in the APS community.

This report provides an overview of the various players in India's educational tablet market, the APS community's response to the tablet, and the potential implementation and payment models that could make this device viable in low-income communities..

## Methodology

This study employs a blend of quantitative and qualitative methods for collecting what is presented in this report. Our qualitative methods relied on a user-centered research approach to collecting information. User research is defined as “the ethnographic approach to gather information about a person, relying heavily on user interviews and by studying people’s behavior in everyday contexts.” This forms the premise for the research team’s approach to the qualitative insights that were gathered. Our quantitative research came from two primary sources: original surveys that we designed and administered to 450 students in schools throughout Hyderabad and data collected through Gray Matters Capital’s school-wide assessments.

### Qualitative

The research team used methodologies such as in-depth and semi-structured interviews, participant observation, and surveys to collect the information that form the foundation for much of the report’s qualitative insights. In-depth interviews were conducted with 55 stakeholders across 18 APS in Hyderabad.

We also employed some of the unique approaches crafted by innovation consultancy IDEO to better understand users. IDEO’s Human Centered Design (HCD) methodologies are tools that facilitate effective connection to the populations being served by new products and services. In order to foster informative in-depth conversations with students about abstract ideas, we used IDEO’s aspiration cards. We presented students with a series of 30 cards with a variety of simple pictures on them. Some pictures represented careers, some were pictures of items, and others were more abstract representations of people and ideas. Students chose pictures that represented their greatest ambition and their greatest fears. They shared their interpretation of the image, why they chose it, and how technology related to the feelings they articulated.

In order to connect readers to the daily context of each stakeholder, we created fictional archetypes of school leaders, students, parents, and teachers in APS and how they view and interact with technology, and featured their story at the beginning of each stakeholder section. The archetypes are based on extensive exposure to the stakeholders in Hyderabad’s APS, but only serve as fictional representations of users. Following each stakeholder story, we discuss the factual statistics and insights that we collected through field research.

### Quantitative

The quantitative data on technology presence in Affordable Private Schools came from data sets that were provided to us by Gray Matters Capital (GMC), the foundation arm of social investment fund Gray Ghost Ventures, whose mission is to provide “an education and a job for 100 million women by 2036.” The foundation’s School Ratings arm conducts annual reviews of Hyderabad’s APS through regular assessments of the schools. The assessments are a thorough analysis of various elements of the school. The assessments evaluate everything ranging from the school’s financial sustainability to students’ academic performance levels. The GMC data we analyzed uses a sample size of 250 schools throughout Hyderabad.

The data-source for student access to technology was drawn from surveys that were designed and administered by this report’s researchers. A sample size of 450 students across 13 schools in Hyderabad was surveyed about their exposure to technology. All responses in both GMC’s and this report’s surveys are self-reported.

## **DATA LIMITATION**

Both qualitative and quantitative research was collected in the city of Hyderabad, which was chosen for its robust APS market and the research team's strong access points to the schools. While there were many advantages to conducting this research in Hyderabad, there were also some limitations in the data. Since the results from the surveys administered by the research team and from GMC are largely self-reported, several elements could affect the accuracy of the responses. Language barrier and pressure to fit in with peers or impress researchers are factors that were difficult to control for and could affect the quality of the results reported. To minimize these factors, we did utilize school and research staff who spoke the local language to facilitate some surveys. GMC assessments are also conducted by individuals who have a mastery of Telegu and Hindi.

There are likely to be variations of these insights in different regions throughout India. However, the constraints in APS across the nation are similar. As a result, some of the insights here could apply to some of the challenges in ed-tech implementation in APS throughout India.

## **WHY APS?**

While there is generally much positive press about affordable private schools, it's important to note that private school does not always equate to better quality education. Research has not conclusively proven that affordable private education improves learning outcomes and long-term success more than government schools in developing countries. Despite focusing our research on ed-tech in the affordable private school setting, we do not take a formal stance on the APS vs. government school debate. We chose to focus on APS because of our unique access and collective knowledge about these schools in Hyderabad and because they provided an opportunity to observe ed-tech interventions in a non-government marketplace.



Section 2  
**AFFORDABLE PRIVATE  
SCHOOLS**





# ABOUT APS

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## **What are Affordable Private Schools?**

Affordable private schools are a fast growing segment of private schools in the developing world. The APS sector creates an educational alternative to government schools for low-income families by charging low monthly fees for attendance. Low-income families in countries like India, Kenya, Nigeria, and Pakistan enroll their children in APS as an alternative to government-funded schools and private schools that are too expensive. Parents choose APS for a variety of reasons, including the perception that private schools provide higher quality education than government schools, and because APS are primarily English-medium schools.

## **APS in India**

The APS sector is particularly robust in India. There are an estimated 300,000 - 400,000 low-cost private schools in India serving almost 50% of urban students and 21% in rural areas. Estimates from the school ratings arm of Gray Matters Capital found that dense low-income communities have nearly 30 to 40 APS in a two-kilometer radius. Hyderabad, Andhra Pradesh has a very large APS market. A 2003-2005 study in the slums of peri-urban Hyderabad found that 65% of school children attend APS.

The following sections further describe APS in India with a focus on Hyderabad. It describes fees and finances, infrastructure, class size, teachers, and curriculum.

## Fees and Finances

APS in India are unaided by the government and by national law, must be registered as non-profits even though they are not typically supported philanthropically. Instead, APS are funded almost entirely by enrollment fees. School fee brackets provide a general idea of household segmentation of the APS market in Hyderabad, and are split broadly into three categories listed below. According to GMC, a typical APS earns revenue of US\$106 per student yearly, while spending US\$72 per student yearly.

One universal problem for APS is timely and consistent collection of fee payments. APS school leaders, usually rooted in the school's community, understand the APS parents' fluctuating incomes. They are expected to be lenient with school fees payments and usually don't reprimand parents too harshly for not paying the same amount monthly. This can cause a number of monthly cash flow and financial sustainability challenges for the school. In a study of APS in Hyderabad, 18% of APS enrollments were offered at free or discounted rates.

In addition to paying monthly fees, parents also have to pay for uniforms, books, school supplies, exams, food, and extracurricular activities as needed, increasing the overall enrollment costs.

Some schools charge as little as US\$5 per month fees; however, the upward bounds of what is generally considered an APS is US\$25 per month.

For the purposes of this report:

- Low-resourced schools have fees of US\$5.50 or less per month;
- Average income schools have fees between US\$7 and US\$13 per month;
- High-income schools charge more than US\$14 per month.



## Infrastructure

Many APSs in India lack well-maintained and proper infrastructure conducive to learning. While the majority of APS schools surveyed by GMC do have basic toilet facilities, blackboards, and benches, only 36% have a playground. Classrooms are often cramped and sparsely decorated. They lack substantial lighting or ventilation, and are sometimes held in open areas or rooftops. APS in Hyderabad experience regular power outages that can last from one to four hours daily.

## Class Size

APS enrollments range from 300 to over 1,000 students, with an average enrollment of 400 students per school. Enrollments usually decrease as grade levels increase, though gender ratios remain constant across grades. Girls make up on average 48% of APS enrollments. The average student-teacher ratio in APS is 27:1, lower than India's national average of 32:1.

## Teachers

Teachers in India's APSs are generally less trained and receive a lower salary compared to government schools. However, they have higher teacher attendance rates, averaging attendance of 89% compared to the estimated 69% attendance at government schools in five states across India. The average APS teacher salary in Hyderabad is US\$70 per month, while government teacher salaries range between US\$130 and US\$350 per month.

Teachers tend to be from the local community where the APS is located. Only 38% of APS teachers have formal teacher training qualifications, according to GMC. While some may have studied through 12th grade or college, others are young, single women working until marriage. They are not necessarily experts in their subjects, but rather filling an employment need for themselves and the school.

Teacher retention is an on-going problem at APS, and leaders fear that providing further training in English or teaching skills will lead the teachers to pursue better employment. APS teachers tend to struggle with non-rote methods of teaching. As GMC explains, "only a few teachers can enable conceptual understanding of students by using relevant contextual examples or using appropriate teaching aids such as charts, maps, and flash

cards. Teachers make limited efforts to engage students in problem solving and discussions to encourage peer-learning."

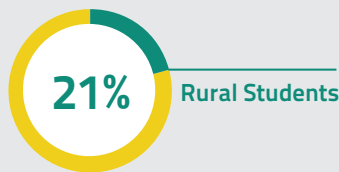
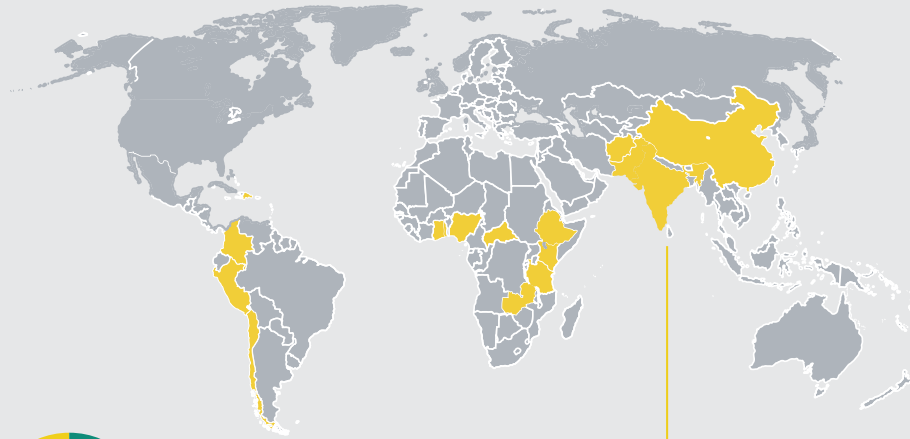
## Curriculum

A Hyderabad APS typically starts from pre-kindergarten (nursery) through 10th grade. For nursery through 5th grade, students are not bound to any state-wide or national curriculum. This changes in Indian schools across the nation from 6th to 10th grade, when schools adhere to one of four main boards: Central Board of Secondary Education (CBSE), International Baccalaureate (IB), Indian Certificate of Secondary Education (ICS), and State Board.

APSs in Hyderabad follow the Andhra Pradesh's State Board Syllabus, which culminates in an exam where students receive a Secondary School Certificate (SSC) once they pass. Passing the SSC exam enables students to continue their studies to Intermediate and eventually University. State Boards are currently undergoing a shift in curriculum called the Continuous and Comprehensive Evaluation (CCE). The CCE has a summative and formative assessment that aims to shift students away from rote memorization of facts. In Andhra Pradesh, 6th and 7th grade CCE has been implemented already, and 9th and 10th grade are expected to come on board in 2013-2014.

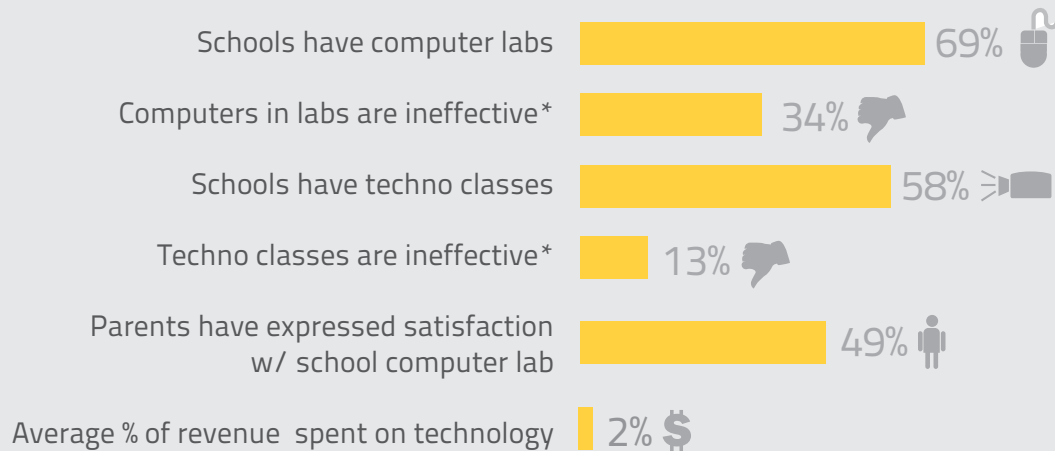
The average APS in Hyderabad teaches the following courses: English, Telugu, Hindi, Science (includes Biology, Physics, and Chemistry), Social Studies, and Math. APS with large Muslim populations may also have Islamic Studies, Prayer, and Urdu language classes.

# APS AND ED-TECH



Hyderabad, India APS courses include English, Telugu, Hindi, Science, Social Sciences, and Math. APS with large Muslim populations may also have Islamic Studies, Prayer, and Urdu language classes.

400 — Student average enrollment



Average spent on tech in 2011 US\$2048

\*Ineffective means that the device is either too poor of a condition to use - mostly due to unresolved hardware issues and viruses - or are not used properly by the school.

# AN OVERVIEW OF APS ED-TECH

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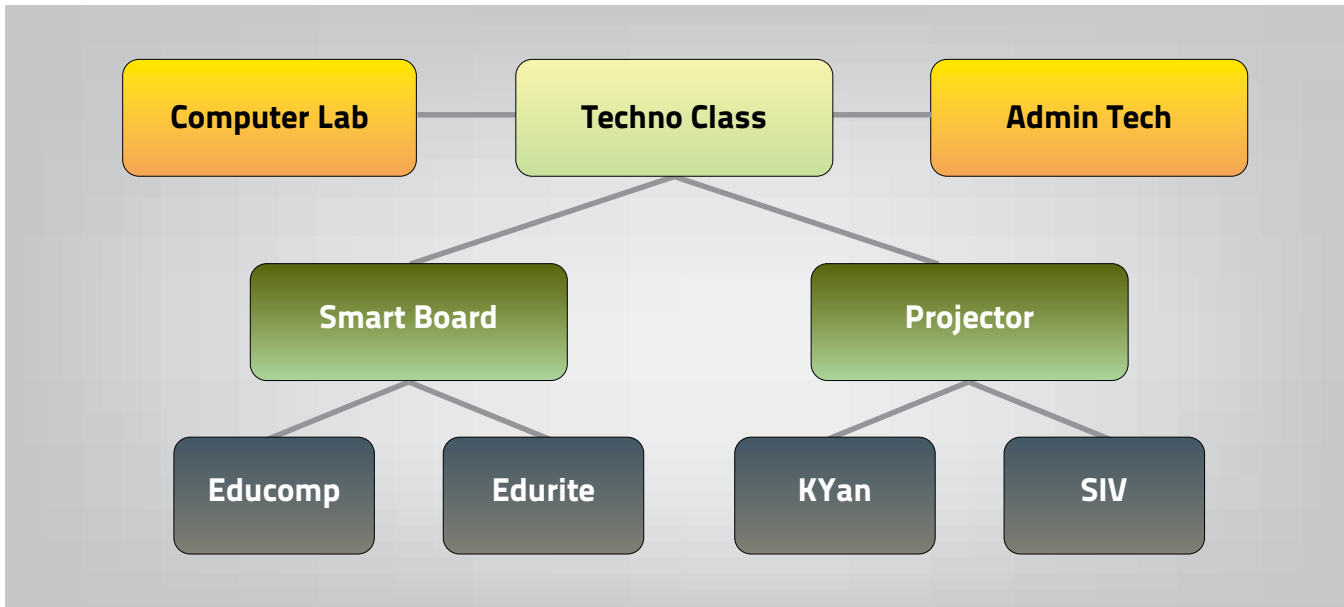
Through analysis of data from 250 APS in Hyderabad, several trends about technology in the APS market emerge. There is a widespread embrace of technology by APS. 69% of APS from the sample have computer labs and 58% have techno-classes. Another theme is the strong link between a school's fee brackets and the presence of technology. 87% of APS that charge more than US\$11 per month have techno-classes. However, only 37% of those who charge below US\$5.50 per month have techno-classes. Schools that charge more than US\$11 per month are 19% more likely to have a computer lab that charge less than US\$5.50. Until product prices decrease, schools with fees of about US\$8 or less are considered a weak market for smart class solutions. These schools often have smaller revenue streams and will likely have trouble keeping up with payments for smart class solutions.

## **Technology Ineffectiveness:**

Although most APS have technology, many them fail to use the technology at all. About one-third of all computers in APS are ineffective according to GMC, meaning that they are in too poor of a condition to use--mostly due to unresolved hardware issues and viruses--or are not used properly by the school. Some schools also face issues with electricity in their computer labs, both due to power outages and underlying infrastructure issues.

Parents tend to be aware of the lack of technology use. Only 49% of parents have expressed satisfaction with their school's computer lab.

# HOW TECHNOLOGY IS USED IN APS



## COMPUTER LAB

The average computer lab in an APS has 9 computers that comprise a keyboard, a mouse, and desktop PCs. They most commonly run on Windows 2008, XP, and Vista. The computers have few programs besides the default applications and Microsoft Office. It is even more rare for them have Internet access. It is common for school leaders to make the large initial investment to acquire used computers at low prices, but then fail to pay for their upkeep.

Computer class in APS is taught by a designated computer teacher, who typically teaches other subjects. It is usually held for students from 6th through 9th grade. The average computer class comprises of two sections in the week--a theoretical and a practical portion. Teachers either have children do redundant tasks with flat learning curves, or they rely on textbooks that have a weak emphasis on actual technology use and are mostly theoretical.

The theoretical portion of computer class is dictated by the syllabus and prescribed by whatever technology textbooks the school leader

has purchased. It often takes place in a separate classroom than the computer lab and mimics the teacher-centered pedagogy commonly employed in other subjects. For this theoretical portion, teachers discuss how computers work and teach how to complete specific tasks on computers.

The practical portion is where students go to the computer lab and use the machines. With an average of less than 10 devices in a room and class sizes that can range anywhere from 25 to 55 students in a class, smaller sections of each class meet on different days. Even with smaller portions of the class in the computer lab, it's common for two to three students to be on a computer at a time.

Students are frequently instructed to use default programs in Microsoft Office or standard Windows applications. A typical form of instruction in a practical class could include the teacher making a particular image with the paint feature and having students reproduce the image on their computers. Students may also be asked to type letters in repetition on the keyboard as typing practice.

## TECHNO-CLASSES

Techno-classes refer to an in-class technology solution whose content is displayed through a projection of audio-visuals onto a plain surface—typically a white board or a plain wall. There are two types of techno-classes: projectors and smart boards. Smart boards have interactive surfaces that respond to users' touch. They decentralize control of the content by enabling direct interaction for students and teachers. Projectors only display the image or video on the surface, but all controls are from a computer or the device itself.

Smart classes are taught by subject teachers who are not necessarily adept at computer use. The projector or smart class is often used in a classroom that teachers take students to one to three times per week. Some smart classes have Andhra Pradesh State Board curriculum outlined by chapter. The teacher must identify the chapter he wants to use, and then open the relevant video module. The teacher's level of interactivity varies based on the structure of the program. Some of the more sophisticated solutions build in prompts for the teacher to interact directly with the class or reinforce some of the material. Modules can also have interactive forms of assessment that the teachers must facilitate with the students by asking the questions that are on the board and then calling on a student to answer it. Some smart class content is solely unidirectional. It just involves students listening to an

animated description of a concept. These require the least level of interaction for the teachers. Below are descriptions of some popular brands of both types of techno-class in APS.

### PROJECTORS

#### Sunitha Infovision- Digiclass

Sunitha Infovision Ltd. (SIV) is an e-learning company that develops technology-learning solutions for students. The Hyderabad-based company, founded in 2002, entered the market with a product called DIGICLASS. SIV's DIGICLASS comes with a large collection of lecture-style video modules about 6th -10th grade level Math and Science. The content is projected onto a white board, or in many cases, a defunct smart class through the use of a set-top box and projector.

#### K-Yan

K-Yan is a projector solution made by the education and technology arm of the finance company Infrastructure Leasing & Financial Services (IL&FS). Pitched as a "community computer" that fosters group interaction, the K-Yan is a portable projector with built-in speakers, Wi-Fi access, and two USB ports which can be used to extract visual content from external sources. It comes with digital content in the major subjects of Math, Science, Social Studies, and English.



## SMART CLASSES

### Educomp Smart Class

The EduComp Smart Class is developed by India's largest education company, Educomp. It is one of the most popular smart class brands in APS. It comes with an exhaustive quantity of modules in all subjects that map to many state boards throughout the country. Their content comprises of videos and animations that explain each subject's concept. Educomp offers a stripped down version of their smart class to APS school leaders at a discounted monthly fee of \$94 per smart class per month.

### EduRite Smart Class

EduRite's DigitALLY Smart class solution is EduComp's biggest competitor in the market. As a Pearson product, DigitALLY also contains a wide variety of content options to its users that are aligned to major national and State boards. It has videos and animations for all major subjects for primary school students through 10th grade.

## MEXUS iKEN

Mexus iKEN is a comprehensive technology solution for schools with a series of hardware and software tools. It includes everything from school data management to a server with content that can be accessed with projectors, a CPU, or an interactive smart board. It caters to interactive learning in the form of games, quizzes, puzzles and slideshows. However, the syllabus is mapped to the CBSE curriculum, so there is a slight mismatch with the State Board syllabus more commonly found in APS.

## ADMINISTRATIVE

### Video Monitoring

Many APS have installed closed-circuit video monitoring in their classrooms. With video cameras in each classroom and televisions in the main office, school administration can easily monitor teacher performance, student obedience, and school security.

### Fingerprint Sign-In Points

Fingerprint sign-in technology is an administrative device that records teacher attendance. Teachers scan their fingerprints into a machine located in the main office in order to check in and out of work. This allows the school leader to have an accurate sense of which teachers are consistently punctual without having to spend an excessive amount of time monitoring teachers at the beginning of the day.

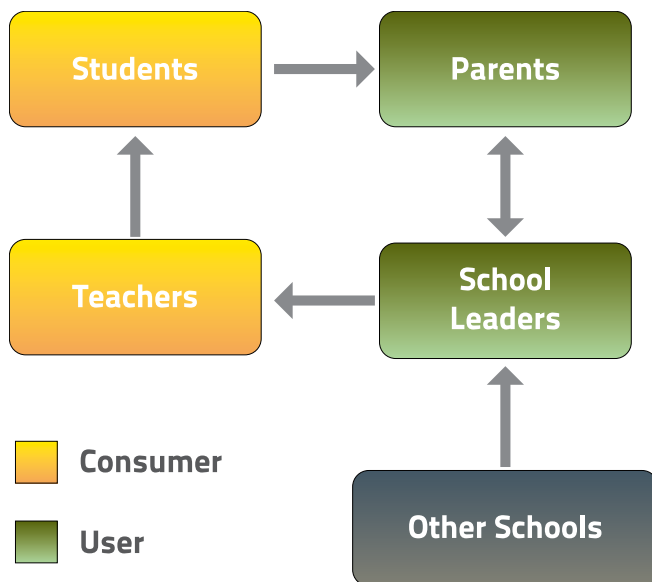
## SMS

Mass SMS text services are employed by some APS school leaders to communicate more effectively with parents. They are often used to send school notifications such as holidays, exam dates and fee-reminders to parents



# ED-TECH CONSUMPTION IN APS

The four primary members of the APS community are the school leader, the student, the parent, and the teacher. Each stakeholder plays a different role in how educational technology is consumed and used in APS, and they each influence each other in different ways to create the environment that ed-tech must exist in. The diagram and descriptions below describe these relationships.



## School Leader - Consumers

The school leader is typically the ultimate customer of technology in the APS space. She makes the final decision to invest in computer labs or techno-classes for the school. In making this decision, the school leader often acts in accordance with the opinions of their customers—the parents. She also takes a cue from the other schools in her area. In the highly competitive environment of the APS market, a school leader cannot afford to be behind in education technology. Such a mistake could cause a drop in enrollment and weaken a school's financial stability.

## Students - Users

APS students are often excited about technology. The majority has access to cell phones and is enthusiastic about the prospect of using new and different technology in the future. These students play a large role in influencing their parents to invest in technology.

## Parents - Consumers

APS parents are the primary consumers of education and have a large influence on school leaders' decisions. Many parents view technology as a necessary part of their child's education and insist that their children have access to technological resources in school. However, there are also parents that have reservations about technology and sometimes view it as potentially dangerous. To underscore the influence children have on technology consumption, parents often cited their child's education or happiness as the primary reason that they made a major investment in technology.

## Teachers - Facilitators

Teachers in APS are often untrained in using technology in the classroom. If they are not personally adept at computer use, they are prone to rely on books and often teach technology in the same way they teach other subjects—through having students memorize theoretical elements of the computer. Teachers have a minimal influence on schools when deciding which technology to purchase, but with products like the techno-class they are the primary users. As a result, they facilitate access with the students. Their relationship with technology is important to its successful adoption in schools.



## Section 3

# APS STAKEHOLDERS

# SCHOOL LEADER

Mr. Ahmer has been the school leader at Saraswati School for 15 years. He previously worked as a government school teacher and developed a positive reputation through the tuition classes he taught after school. He decided that he could contribute more to children if he was in charge of his own school, but this has not been an easy process. Constantly fighting to keep the school financially sustainable, Mr. Ahmer sometimes falls behind in paying the rent for his school building.

This is one of the major reasons that he has decided to invest in four new computers and a techno-class. He is afraid that without computers and a smart board his school will be left behind by the competition in his area. Some of the schools have considerably larger facilities and enrollment. He knows that his parents will opt for one of the many chain schools that advertise themselves as being "techno schools."

Additionally, Mr. Ahmer considers himself progressive and is aware of the importance that technology can play in education. Without a working knowledge of computers, his students will never get the jobs they aspire to. In this way, Mr. Ahmer considers it a responsibility to have computers in his school.

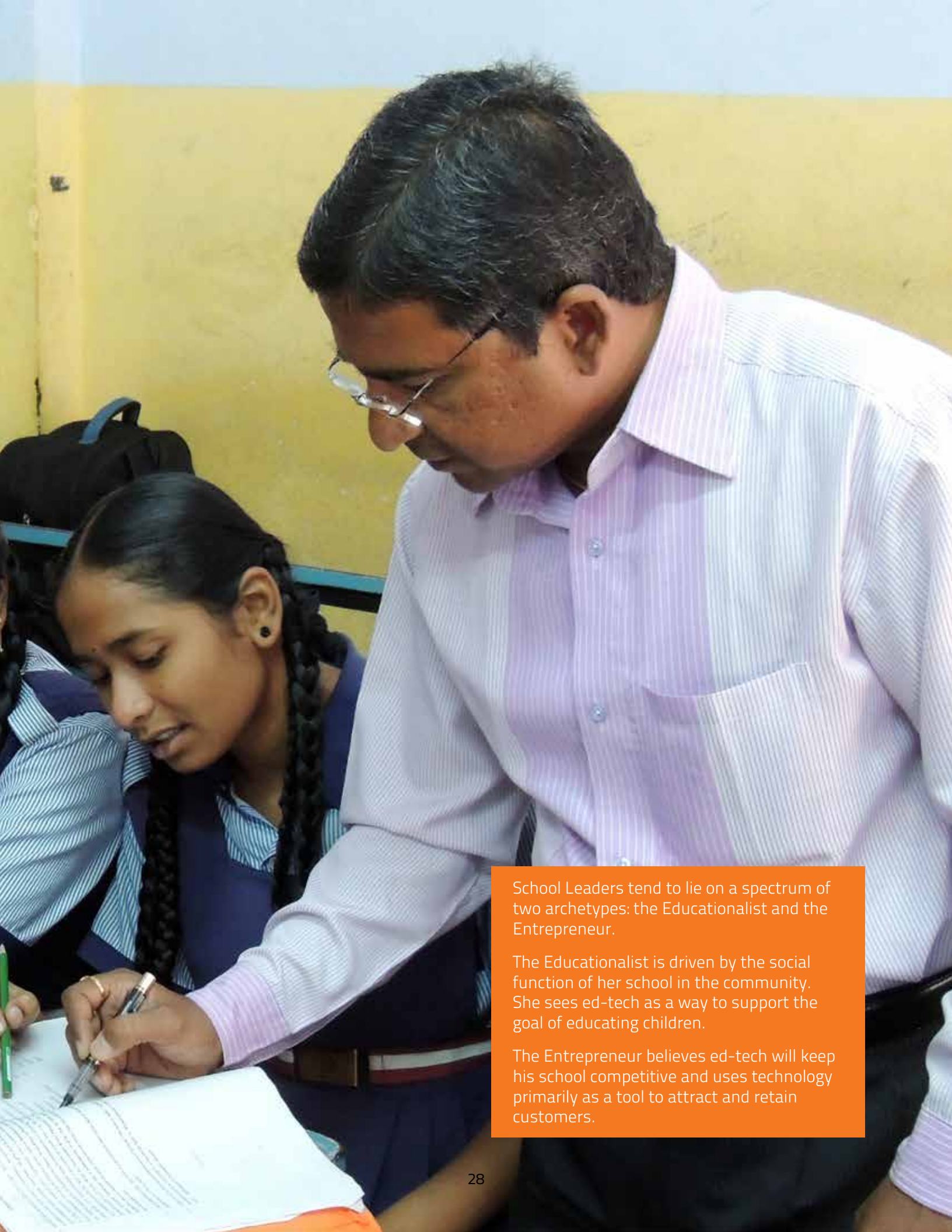
Although Mr. Ahmer sees the benefits of technology, he is wary of the drawbacks too. A school leader

in the area was recently subject to a scandal when some students used the Internet to access inappropriate content on the school's computers. The school's reputation and enrollment has been affected ever since. For this reason, Mr. Ahmer has decided not to invest in Internet at his school. The risks are simply too high.

Mr. Ahmer himself knows very little about using technology. He has recently installed software to manage the school's administrative tasks, but he still prefers paper ledgers and roll books. His staff are used to this system, so it is simpler to keep things this way. His teachers have only a very basic understanding of computers and he does not believe that training them will be worth the effort. Many of them are young and may leave after getting married, and others may use the training he gave them to find another position.

Despite all his doubts, Mr. Ahmer remains optimistic about the use of technology in his school. Only through technology can his students reach for the stars.





School Leaders tend to lie on a spectrum of two archetypes: the Educationalist and the Entrepreneur.

The Educationalist is driven by the social function of her school in the community. She sees ed-tech as a way to support the goal of educating children.

The Entrepreneur believes ed-tech will keep his school competitive and uses technology primarily as a tool to attract and retain customers.

# SCHOOL LEADER

## WHAT DOES TECHNOLOGY MEAN TO THE SCHOOL LEADER?

School leaders believe that technology is a way to prepare students for the 21st century global economy. They view technology positively, believing that it will help students learn better and aid their academic development. They don't want to fall behind the international movement surrounding technology, and want their students to be prepared to compete in a global economy.

School leaders also see technology as a way to distinguish their school from the competition of other schools in the community. Education technology is believed to be a way of attracting and satisfying parents—the school's customers. Many forms of ed-tech have been successful marketing tools for schools in the past, since many parents view technology as a proxy for the school's quality.

## HOW SCHOOL LEADERS THINK TECHNOLOGY CAN IMPROVE EDUCATION

### Improve spoken english

School leaders believe that ed-tech can play an important role in bringing more "spoken English" to their schools. Teachers and students at APS tend to have weak English skills because they don't hear or speak the language often. Ed-tech solutions with spoken English therefore fill an important need since they can help students get familiar with correct English regardless of their immediate environment

### Heavy bags

Given that even the youngest students must carry around heavy textbooks and workbooks, school leaders are especially interested in ed-tech solutions such as tablets that can condense textbook materials into one light device and lessen that burden. They believe this helps the student health-wise and potentially creates cost savings in textbook purchases.

### Connect students and families globally

A common trend among low-income Muslim families in India's APS community is that fathers work abroad for several years, often in the Middle East. School leaders view technology as a means for their students to connect with their fathers more regularly. Some school leaders have also expressed interest in using technology to connect their students with other students and faculty abroad to create cross-cultural learning opportunities.

### Help students learn

School leaders believe that interactive education technology with colorful animations helps students learn and retain information better. They argue that student learning improves through seeing visual representations of the content and hearing the subject

## HOW THEY BUY TECHNOLOGY

### ▪ Content

Content-alignment is a major factor in choosing technology. Given the emphasis on exams and state boards in APS, the leader has her teachers spend the majority of their time teaching for the tests. She believes that there is no time for content that is unaligned to the school's curriculum. The leader wants any ed-tech content aligned down to the chapter so that teachers can easily figure out how it fits into the class lesson.

School leaders want colorful animations and interactive options in their technology tools. They understand how technology engages different learning styles and can help different learners retain more through seeing, hearing, and interacting with digital content. They also know that their untrained teachers can sometimes find it difficult to teach in a non-rote style, which is why interactive technology interventions can fill an important gap.

### ▪ Price

One of the greatest challenges school leaders face managing APS is inconsistent cash flow from their customers. The volatile nature of parents' incomes coupled with the immense competition for enrollment means that they are always facing high budget constraints. This results in price being a very important element of consideration for school purchases. The amount of money a school leader is willing and able to pay for technology is highly dependent on the school's revenue, profits, and the parents' ability to pay. It is common for school leaders to pass on the cost of new technology to parents through tuition hikes or through subtle technology fee increases.

### ▪ Training

School leaders and teachers are mostly unfamiliar with technology, so they require extensive handholding. As a result, school leaders value ed-tech solutions with a strong training component. They like trainers who come to the school at scheduled times to work with the teaching staff, and regularly check-in over a period of time. They also want to be able to refer to one consistent individual if there are issues to troubleshoot. Not only have they come to expect this as common practice among other service providers, but they also experience weaker adoption without regular check-in and support. The most successful service providers in the APS space provide a hands-on approach to servicing the schools.

### ▪ Resource Requirements

Does access to the content require Internet? Does the solution require hardware installation? Is it mobile? These are all questions the school leader will need to consider. Not all schools will have the resources and infrastructure necessary to make the best use of all education solutions.

Some ed-tech solutions require dedicated staff to manage the tool during school hours. Short-staffed schools might have a difficult time meeting this requirement, so school leaders take staffing into consideration when purchasing ed-tech.



## STUDENTS

Lavanya and Akhil are siblings who both attend Saraswati School, an APS in their neighborhood. Lavanya is in 10th class, and Akhil is in 8th class, and their younger sibling is in kindergarten. In the mornings, Lavanya helps her mother get the youngest child ready for school. With all three children fully dressed in their uniforms, carrying book-bags that contain 15 different notebooks, they head to school at 8 am.

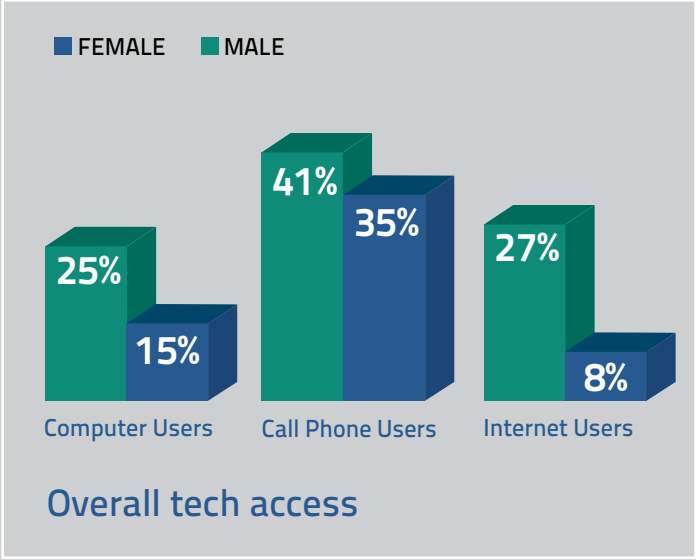
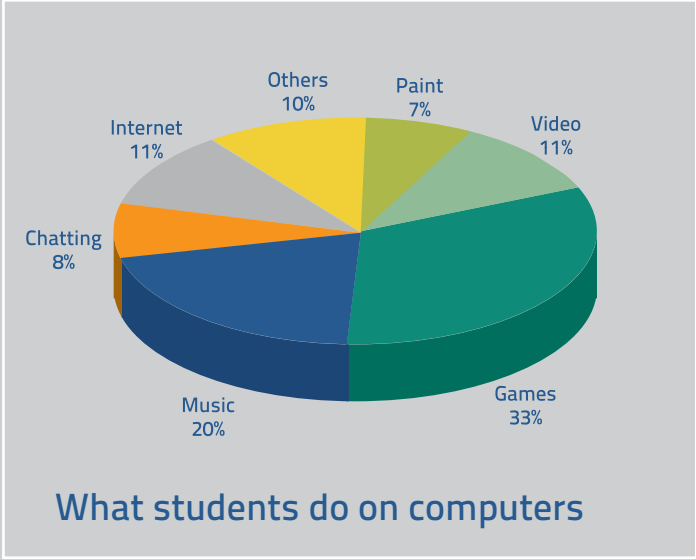
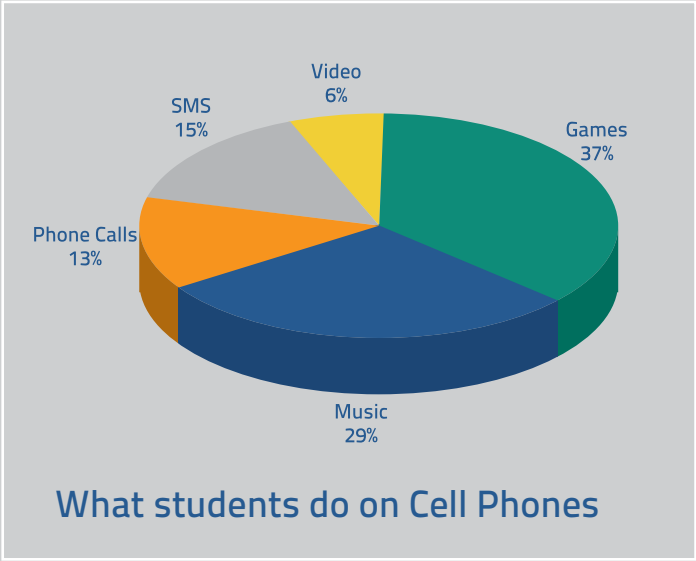
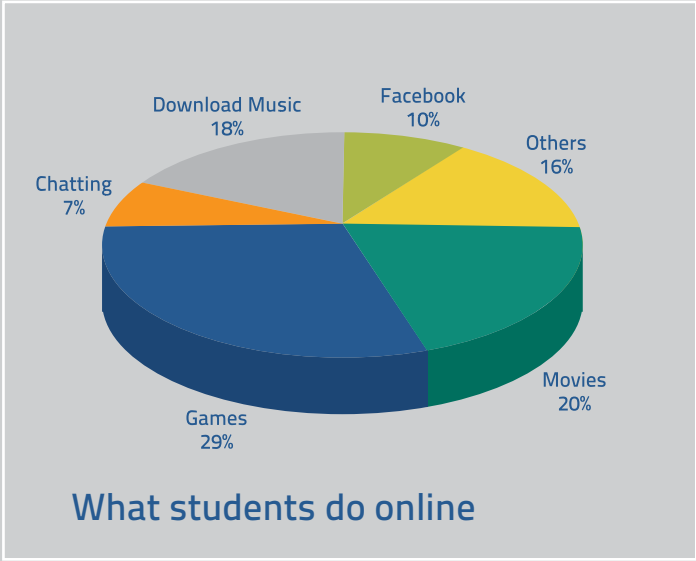
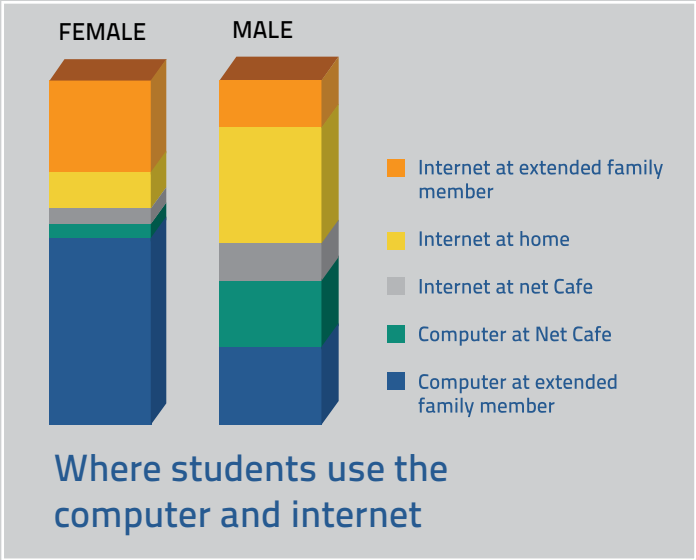
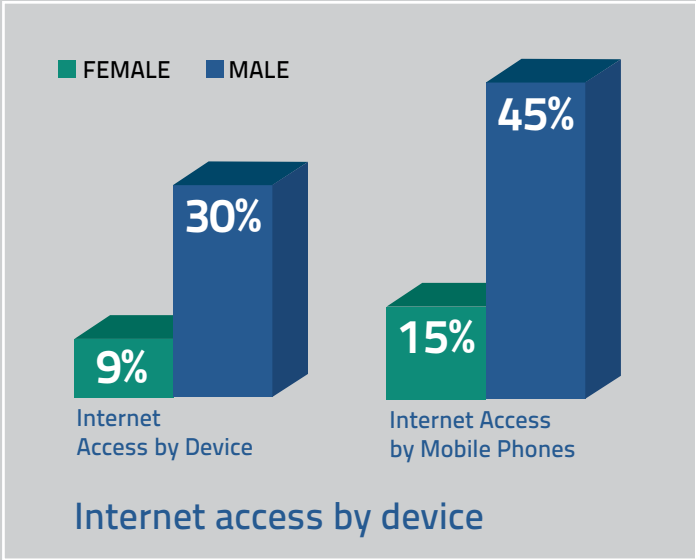
In Social Studies, Lavanya, who is wearing a badge for being first rank in class, is reading the chapter out loud. When she is done, her teacher Gayatri Ma'am verbally asks the class the first question in the corresponding worksheet. Lavanya quickly finds the exact phrase in the question and fills it in with the correct answer. When Lavanya is not being lectured in class, she is using her study periods to review material for the State Board Secondary School Certificate (SSC) exams at the end of the year to pass high school. Doing well is what will enable her to go to Intermediate and help fulfill her dream of becoming a doctor. She and her fellow 10th class students spend much of their time studying for the State Board exams.

Akhil also has a rigorous schedule at school. In a single day, he will study math, biology, chemistry, English, social studies, Hindi, Telegu, and Physics.

He is worried about the "halfly," or mid-term, exams that are looming before him next week. In Math class, he takes his seat on a bench with his two friends as the teacher circulates and checks for completed homework. When the lesson begins Akhil hurriedly copies down the problems and answers that the teacher is quickly dictating and writing on the board. After school, Akhil and Lavanya go to tuitions. This is where he gets the chance to review for his "halflies" and Lavanya resumes her study for the SSCs.

At 6:30 pm, when Lavanya and Akhil get home, Lavanya is called to help her mother cook. When she's done, she asks to borrow her mother's phone and plays a game to pass the time. Akhil's friend Rajesh has stopped by to invite Akhil to his home to play games on the computer. It's a computer that Rajesh's older brother bought for them. Lavanya has heard about the computer Akhil plays on, but has never used one herself. She is entertained enough by the games on her mother's phone, while Akhil finds them to be too boring. After a couple of hours at Rajesh's house, Akhil returns home and completes his homework. The family heads to bed on the floor of their one-bedroom home at 10:30 pm. The next morning, they are up early again for another long day at school.





## STUDENT ASPIRATIONS

Students in APS have aspirations of becoming middle-class professionals like doctors and engineers. They hope to have careers that afford them a level of status, security, and financial stability that, in most cases, are beyond their parents' educational and professional attainment. Students have an acute awareness of education's role in their upward mobility, and as a result, see school as the vehicle to the life they desire. Since success in school and access to higher education is so heavily determined by exam grades, students are constantly under pressure to perform well on tests. This means it's not uncommon for students to spend an additional two to three hours reviewing work after school during a proctored study session called "tuitions." They sacrifice free time in order to study because they see education as the primary safeguard against the physically challenging, poorly compensated work of day-wage laborers in construction or agriculture

We used a Human Center Design methodology developed by innovation consulting firm IDEO to encourage discussion about student ambitions and fears. Students were shown a set of drawings that represented a wide variety of symbols, people, and objects. They chose the cards that represented their aspirations, assigned meaning to it, and explained why they chose it.

### What they use, what they do

Through surveys with APS students, we explored student access to three major forms of technology: computers, cell phones, and Internet. Cell phones were most commonly used by the largest percentage of both male and female students; however, there is a deviation in access between the two genders with computers and Internet.

The most prevalent activity that students engage in across all income brackets with all three technologies is playing games. Games are the primary form of entertainment among students who use both cell phones and computers. The next most prevalent activity students engage in on these devices is listening to or downloading music. On the Internet, they enjoy watching movies. Technology is seen largely as a source of entertainment after school since students are not allowed to bring any personal devices to school.

### Technology and income brackets

Students in higher-income brackets experience a more equal distribution of access to all forms of technology. A higher percentage of students in lower-income brackets only have access to a cell phone, usually owned by a parent, older sibling, or extended family member. While playing games and music on computers is consistent across income brackets, students in higher-income brackets tend to use the computer in slightly more diverse ways than students in lower-income brackets. Those in the higher-income bracket are also more likely to engage in Internet tasks with mobile phones such as downloading music, than students in lower income-brackets. The higher the school's income bracket, the more likely a student will have access to a computer and Internet in their own homes, and through their extended family. This is unsurprisingly a result of the burden of expense involved in purchasing a computer or Internet.

## TECHNOLOGY AND GENDER

Overall, girls report less access to all three technologies than boys, with the largest gender difference existing with Internet access. More boys have Internet access than have computer access; however, it is the opposite for girls. This is largely a result of the physical limitations of girls in low-income communities. When students go home, girls are often not permitted to leave the house whereas boys are allowed to spend time with friends in a variety of public spaces. Girls also carry household responsibilities after school that their brothers may not. Internet cafes, friends' Internet-enabled phones, or friends' household computers are sources for Internet access that girls often cannot tap into.

Intel Corporation and Dalberg's report "Women and the Web," released in January 2013, explores Internet access for women in developing countries, with a focus on India. Their global study found that nearly 35 percent fewer women than men have Internet access.

Dalberg's study looked closely at Indian women, whom are less likely to have Internet access, at 8%, than the women in any of their other focus countries. Internet penetration for women and girls in Egypt was 32%, and 9% in Uganda. Internet use in India is not just low among women. India has a population of 1.1 billion but only 10.2% use the Internet, the majority of whom are in urban areas despite the fact that nearly 70% of Indians live in rural areas. Dalberg found that among non-Internet users, Indian women are the most likely, at 38%, to find lack of comfort and familiarity with technology as a reason to not use the Internet.

A major barrier to Internet access for women, and especially young girls, is that they believe the Internet is inappropriate for them. One in five women in India and Egypt believe this to be true, according to Dalberg's study.

In our own research, we found boys much more likely than girls to have used the Internet. Only 14% of 9th grade girls in Hyderabad's APS have access to the Internet. This is 40% less than the number of their 9th grade male counterparts who have access to the Internet.

This also impacts girls' computer access. The surveys show that girls primarily access computers through their extended family members or their own homes. Boys gain computer access from their homes, their family members, and external spaces like Internet cafes or friends' house. This means boys are less restricted by the technology access that their immediate families have because they can interact with computers in neutral external spaces.

Besides having fewer access points to technology outside of their homes, girls are often not given the same degree of encouragement to use technology in their homes. Many of the girls describe their brothers being permitted to use technology in their homes for longer durations of time or their brothers being prioritized in use of technology that they share.

## TECHNOPHILE VS. TECHNO-SKEPTICS

There were primarily two technology personas among APS students that emerged: the Technophiles and the Techno-Skeptics.

### TECHNOPHILES

Technophiles are students who are enthusiastic about technology. They often have a much wider exposure to technology than their peers, by having a laptop at home, owning their own cellular phones, or having consistent Internet access in their own or a relative's home. Technophiles can clearly express their preferences between different forms of technology and rarely articulate any negatives from using it. The similarities in their experience were as follows:

#### 1. Parents are strong technology advocates.

Not only do technophile students report parents having generally positive reactions to technology, but their parents also actively support technology use and invest in resources to enable this. Parents will invest in computers that they themselves don't use often or will pay for technology training at local Institutes for \$12-\$14 so students can learn technology skills that they don't obtain in school. This is especially relevant to female technophiles.

#### 2. Technophile students are more likely to use the Internet, but with provisions.

The Internet is one form of technology that is regarded cautiously due to the lack of control parents and school administrators feel they have over the expansive range of content available. While technophile students often have parents that are open-minded enough to give their children permission to use the Internet, they still encounter

**Pooja Phalke** is a bright and charismatic 14-year-old the research team interviewed at an APS in Hyderabad. She describes enjoying password protecting folders and making PowerPoint presentations on a computer at home. Her father encourages her to use the computer and often makes her brothers stop using the computer in their home so she has time to use it.

a bit of resistance. Students will face scolding for the duration of time that they use the Internet or for relying on the Internet for answers to school work.

#### 3. Technophiles feel responsible for teaching one another how to use technology.

Even though they have formal ways of learning how to use technology tools like taking classes at a local institute, technophiles value teaching their technology skills to others and value the role of the user as the educator. Many have learned from older siblings and pay it forward by teaching younger siblings and friends.

When the research team asked how he learned how to use technology, Prasanth, a 9th class student at an APS in Hyderabad, noted that his older brother taught him. When discussing his aspirations, he describes how one person in the community can teach everyone else about technology and help people become leaders.

#### 4. Technophiles see technology as an asset to their career aspirations.

Technophiles were able to clearly articulate how technology skills were useful to their personal goals. Some students had career aspirations that were directly related to mastering technology, like those who wanted to become computer engineers. Others could clearly describe how technology was useful in unrelated careers, like police officers who need to understand how to use technology to call in their partners, or doctors who utilize technology for complex surgeries and medical records. Even when students didn't make an explicit link to their jobs, they ascribed status, importance, and influence to using technology.

## TECHNO-SKEPTICS

Techno-skeptics are students who don't necessarily have a fear of technology; but are skeptical of its relevance and value to their lives. Techno-skeptics make up a significantly smaller percentage of students in APS. These students tend to be less exposed to technology, often not using any devices with much regularity outside of the cell phone. We found that they exhibited the following qualities:

### **1. Techno-skeptics' parents actively prohibit them from using the technology they do have access to.**

Techno-Skeptics are likely to have had extremely limited interaction with computers and many have never been on the Internet before. That said that even if their parents have cell phones in their home, they don't allow their children to use them. Techno-skeptics' parents will often not give them permission to use the Internet outside of their homes

### **2. Techno-skeptics regard technology much more cautiously than their technophile counterparts.**

Students who are techno-skeptics are able to more clearly see the potential negative consequences of each technology form. They can articulate drawbacks like environmental damage, or the dangers of being exposed to inappropriate material on the Internet. They are also more likely to describe the Internet as a dangerous space that can be manipulated incorrectly by the wrong people.

**Ramprasad Nayak** is 16 years-old student at a Hyderabad APS that the research team interviewed. He has never used the Internet, has only used a computer sparingly at school, and is not permitted to use a cell phone at home. He does not want to use the Internet though and describes technology as a force that makes people lazy by "making things too easy to get." He romanticizes a time before technology, saying "we can get some problems from modern. We cannot get problems from the old."

### **3. Techno-skeptics don't see explicit benefits technology could have to their ambitions.**

After sharing their career aspirations with the research team, many techno-skeptics could not see how technology was important to the accomplishment of their goals. They often expressed the belief that technology could neither help move them closer to the career ambitions they wanted nor keep them away from the labor driven life that they fear.

### **4. Techno-skeptics tended to choose images that represent traditional teaching methods of education when discussing their aspirations.**

Both technophiles and techno-skeptics expressed how important education was to accomplishing their goals; however, students in the techno-skeptic group consistently chose images that represented standard forms of education, such as a stack of books, or a teacher at the board. Their primary understanding of education is still bound by the standard "chalk and talk" method that they live daily.

## TEACHERS

**Madhavi Ma'am**, a 32 year-old computer teacher at Sai Baba School, leaves her house at 8 am to walk to work. She has worked at Sai Baba for six years, ever since her husband moved to that part of town for work. She learned about employment at the school from a friend who was also a teacher there. She never studied education and didn't have a teacher certification, but she finished Intermediate, which qualified her to teach 4th and 5th grade math. She started as math teacher, but after her third year at Sai Baba, the school got a new computer lab. The school leader asked Madhavi to take over the computer class since she had learned a little about computers from her younger brother. She now teaches computer and math classes at school.

When Madhavi gets to school, she picks up the large stack of Math exams from the Unit test that she has to mark, and enters 4th class for the first class of the day. She finds out that the social studies teacher is absent because of her cousin's wedding, so she must cover her 3rd grade class in addition to her regular schedule, which means she has no free periods for the day. With so many exams to grade, she writes four equations on the board for the students to copy and starts to mark exams. Occasionally, she gets up to discipline a student who is misbehaving but focuses mostly on the exams. The bell rings and she goes to 6th class to teach a computer lesson.

She opens up to a chapter in her technology textbook and sees that it is about the keyboard. She writes the different types of the keyboard on the board and watches as her students copy this down into their notebook. She recites the first term and waits for the students to recite. She moves on to the next term and the students follow. After a few rounds, she asks a question and the students all answer in unison. Once a week, she will let students play on the computers. Sometimes she finds it too difficult to manage the students who don't follow her instructions so she prefers to limit their computer time.

The bell rings and she continues to her next class, exams in hand, prepared to teach math for the remainder of the day. She rushes to finish marking her exams by the end of the day and goes home to take care of her young children.

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## THE CLASSROOM ENVIRONMENT

### Chalk and talk

Computer class in APS is taught by a designated computer teacher and When referencing the teaching methods in their schools, several school leaders described traditional pedagogy as “chalk and talk.” Hyderabad’s APS use a very teacher-centered approach to educating their students. The idea is that the teacher’s job as the expert is to dispense all her knowledge to her students. The student’s job is to record the information, and memorize as much as possible so that they can reproduce the responses later during an exam. The teacher often conveys main concepts by writing them on the chalkboard and reading the textbook aloud to students. Sometimes top ranked students in class will read textbook passages while the others take down notes or read along. However, the two primary tools for teaching are the use of the chalkboard and the teacher’s lecture. This is important to consider when examining the challenge of bringing new technology into the classroom. If the teacher is the primary user of technology, then the further away the solution is from this “chalk and talk” model of lecturing and rote memorization, the more challenging successful adoption will be.

### Exam culture

Like students, many teachers’ reputation and priorities are largely shaped by the exam. Teachers feel pressure to create positive testing outcomes for their students because student test performance determines their reputation in the eyes of both the school leader and parents. The frequency of testing that takes place isn’t just taxing for students; it also puts teachers through a time consuming testing cycle that takes them away from the job of actually teaching. For every exam students have, teachers must take time to put the exam questions together, administer the tests, mark each exam individually, tabulate the scores, record in her grade book, then redistribute the marked exams to students. With some form of assessment every two to three weeks, teachers are always managing some aspect of the exam process. This creates an opportunity for technology interventions that streamline or shorten any element of the exam cycle.



## HOW APS TEACHERS VIEW TECHNOLOGY

Schools with technology integration of a smart class have thrust teachers into the task of integrating the technology components into their lesson. Teachers have formed opinions about the smart class and see clear benefits and drawbacks for their use

### Benefits

**Teach more in less time:** Teachers report feeling that the smart board helped them cover more material in the same amount of time than when they taught using the “chalk and talk” method. Less time is spent on behavioral control and discipline because the video content keeps students more engaged, and the modules provide a very standardized way of covering clearly established portions of the material.

**Reinforce Math and Science concepts visually:** Science and math teachers were especially pleased with the smart class’s role in providing accurate audio-visual aids to their lessons. Geometry, trigonometry, biology, and chemistry lend themselves well to visual representation of content. If they were teaching students about the heart, before, the teacher may draw the image on the board or reference an image in the textbook if there was one. With the smart board, students can see these images more clearly and understand movement or interaction between different parts of the heart better.

**Easy to use:** Teachers voice an appreciation for smart class interventions that are simple and don’t require a lot of training to use. They like systems that clearly establish what they should do, and make it easy for them to choose the appropriate content for each lesson.

**Asset for younger students:** While teachers often see computers as a device that only older students are responsible enough to interact with, smart class content can be geared towards younger students in 1st through 5th grade. Teachers note an impressive level of engagement with their primary school students and believe that the colors, songs, and images are instrumental to their development at that age.

**Helps with assessments:** Ed-tech solutions such as tablets assist teachers by automating student assessment in a faster, more routine way that requires less effort from the teacher than hand grading each exam. This gives teachers more time to plan lessons or help students that require extra attention.

### Drawbacks

**Increased planning:** For solutions that don’t have lessons that are very tightly aligned to the textbook or the curriculum, teachers must spend time to plan which media piece they are going to use. This is especially difficult since many teachers do not characteristically make lesson plans early in the week. The requirement to plan how to incorporate technology is a new responsibility that they must take on.

**Low exposure level:** Most schools do not have the means to buy enough smart boards to be used in every classroom. Most have one, at most two smart boards that are used for as many as nine grades of students in the school. This results in students using the smart class for very limited times throughout the week. Students may get exposure to the smart board once or twice a week. This is also compromised sometimes by daily power outages.

# PARENTS

Krishna and Deepa are a working-class married couple living in the Katedan neighborhood of Hyderabad. Both of them are originally from a village 50 kilometers outside of Hyderabad, but moved to the city when they were young because their families thought they could find better work in the city. They have two children—Lavanya and Akhil. Krishna works as a watchman at an apartment complex that they live in. To supplement the family income, Deepa is a domestic worker for some of the tenants.

In the morning, Krishna returns from a night shift that went from 8pm to 6am. Though he is tired, he likes to see his children in the morning before they go to school. Deepa is busy preparing breakfast and packing lunches for Lavanya and Akhil.

After he wakes up in the afternoon, Krishna calls the school leader on his cell phone. He has scheduled an appointment to speak with Sir about Lavanya and Akhil's exam. After talking with Sir, he calls Deepa to make sure she is on her way to the meeting. Deepa, who knows why Krishna is calling, ends the call without answering, which allows them to save a few extra rupees.

At the meeting, Krishna and Deepa are happy to learn that Lavanya has scored well on her last exams at the school and is expected to score at the top of the class when she takes the all-important 10th exam later in the year. However, they are upset to learn that Akhil has scored only in the middle of his class and will need to spend extra time in tuitions if he wants to improve.

While Krishna and Deepa are at school, they also express doubts that their children are not learning enough English and do not have access to a computer lab. Deepa relates how Akhil is seldom able to read English signs in the street and how Lavanya has told her that her friends at other schools have access to computer labs twice a week. Both Deepa and Krishna know that the school leader has managed the school for over 15 years and deserves his good reputation in the community, but they want to make sure that their children are receiving a modern education. They explain that have heard

that another local school has just bought several new computers and a techno-class and they are upset that their children's school has not done the same. The school leader assures them that he has just made an investment in four new computers and an English-language smart class and that soon there will be a computer class for the children every day.

Krishna and Deepa return home and Krishna begins his guard shift. Exhausted by the long day, Deepa serves the children dinner and lets them play with her cell phone if they have completed all of their homework. After a couple of hours of watching television, she gets the children ready for bed and goes to sleep.

## PARENT ASPIRATIONS

APS parents want their children to grow up to be white-collar professionals. They envision their children holding esteemed roles as doctors or engineers. This aspiration is common for APS parents because they believe that such a position will allow their children to climb the social ladder and attain financially secure futures.

Parents are well aware of how difficult it is to rise through socio-economic ranks. This is why they greatly stress the importance of education to their children and are willing to invest whatever resources they have into education. Parents of APS students spend an average of 13% of their total expenditure on education, 4% higher than what the average non-APS family spends. They look to school to provide children with skills that will make them ultimately more employable. This is why elements like technology and English have become so important in schools—parents see technology as a tool that will help students accomplish more than they have. Parents often view English language and technology skills as vital even when they are English and technology-illiterate themselves.

When they are at home, they pressure their children to study, so that they can receive the best possible scores on exams.



## USE OF TECHNOLOGY

Through interviews with parents in APS, several themes emerged about their relationship with technology. Most households that can afford to have televisions purchase them. In addition, even very low-income families usually have cell phones. Cell phones, with all of the convenience that they provide, are seen as virtually indispensable. They allow for families of even very low-income backgrounds to communicate with family members and to better coordinate with one another.

Most APS parents have limited interaction with computers. Few parents even own computers and many do not know how they function.

## VIEWS ON TECHNOLOGY

APS parents are generally accepting of technological innovations. The importance of cell phones and televisions in APS parents' lives has made the acceptance of other technologies, such as computers and tablets, much more prevalent. Technology is seen as something that can improve lives, rather than a threat to traditional values.

Most parents also view technology as an important part of education. Not only is technology a tool that will help improve the effectiveness of their children's learning experience, it is also something that they believe that their children must understand to be successful in the future. If their children are not familiar with technology, they believe they will be left behind. 53% of APS parents consider whether a school has computer subjects as a top parameter for assessing whether or not they should send their children to that school. It's seen as a direct contributor to the school's brand and reputation and more importantly, as a skill that will make their children more employable.

Despite an overall enthusiasm for technology, many parents are also hesitant about some aspects of technology for their children. They are very afraid of their children finding inappropriate content on the Internet. They also worry that by using only

computers or tablets, their children may lose the skills necessary to effectively complete exams that are administered on paper. In addition, they worry about some of the health consequences of technology, such as the impacts on vision of staring at a screen for extended periods of time.

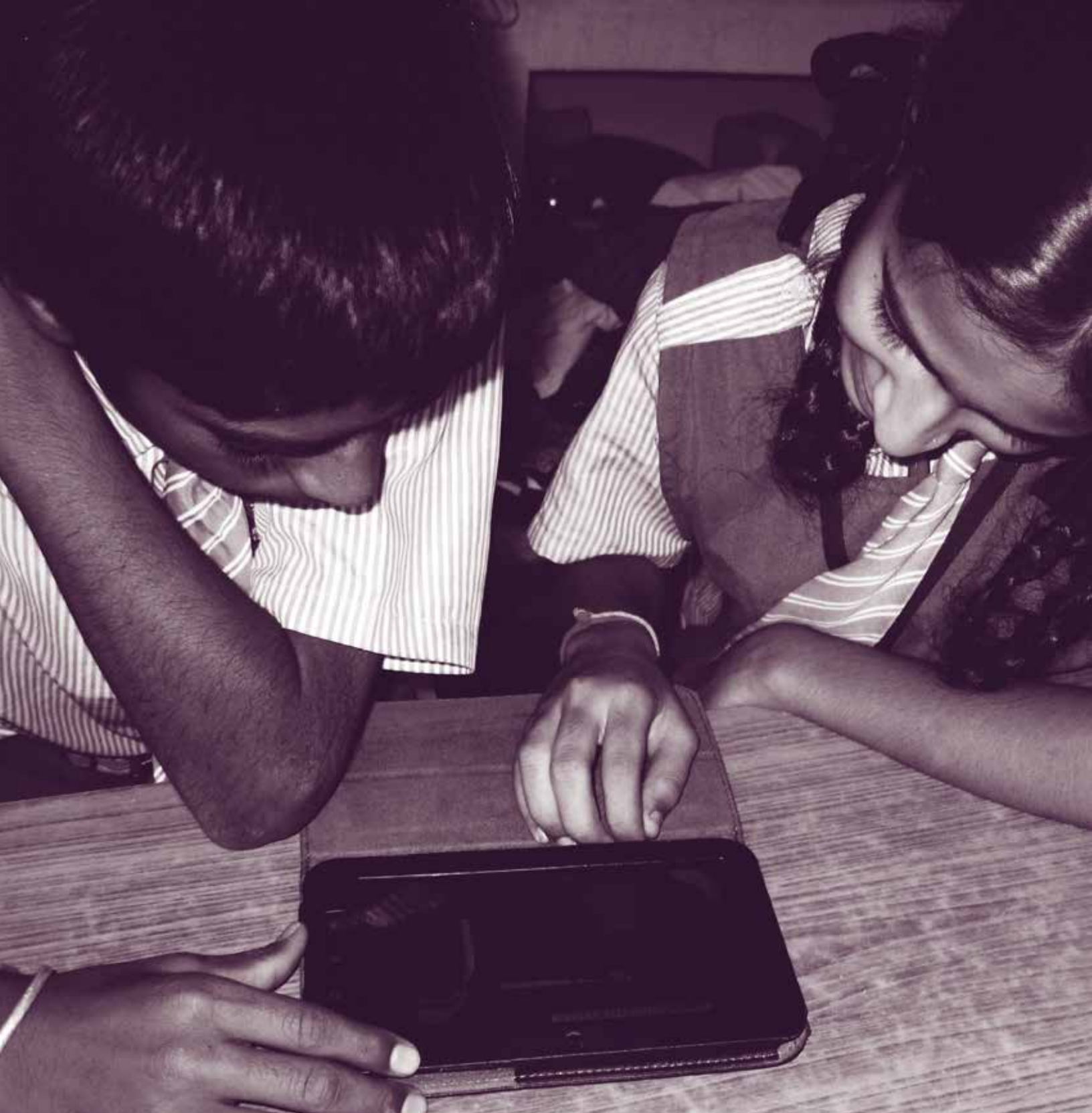
## CONSUMPTION INFLUENCES

Even though parents view technology positively, they often have a limited understanding of new technologies. When this is the case, their children and school leaders have a large influence on how their opinions are formed.

The school leader is seen as an authority on children's education. Parents—who view the school leader as a trusted leader and educator—will believe his or her claims that technology will help their children learn.

APS parents often don't have the resources or time to accurately gauge the quality of education their children are receiving in their school, so they rely on their children for feedback on teacher quality and general school environment. Similarly, parents trust their children as credible sources of information about technology's value proposition in school. They trust that children understand the value of technology better than they do and will consider and purchase technologies that the children advocate for.

Lastly, APS parents are influenced by what other parents and children are doing around technology. Parents live in tight knit communities in very close proximity to one another that tend to be in the same neighborhood as their school. They share core resources with one another and develop strong systems of social capital between one another. Many parents' perception of a school's quality is heavily determined by their social network's opinion and recommendation. This makes peer pressure a very tangible factor that influences the forms of educational technology that parents demand in school and are willing to purchase for their children.



Section 4  
**TABLETS**



# WHY TABLETS?

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Tablets have multiple advantages to existing technology for educational use in developing countries, as well as several problems, as described below.

## Benefits

1. Tablets are portable and light. Students can carry. Tablets are portable, light, and have the potential to condense various materials into one portable device. Students can carry them easily in their backpack, in place of carrying heavy textbooks, and easily transport them between home and in the classroom.

2. Tablets are independent of electricity once charged, which means that tablets are less affected by power outages that are frequent in the developing world.

3. Tablets provide one-to-one interaction. Students can spend more time with their individual device than they can sharing a computer with multiple students, or a smart board with the whole classroom. This is especially useful for students who require more time to understand a concept, as they can review and even pause and rewind videos and lessons.

4. Tablets make the assessment cycle more efficient. Educational tablets typically include applications for completing homework and tests, and reviewing results and grades. This is beneficial for teachers, whom typically track grades by hand. With a tablet, teachers can automatically receive detailed, individual updates, and analysis of student learning levels. Parents can also more easily check their child's performance on the tablet.

5. With 3G capabilities, tablets can improve Internet access, particularly for girls. Tablets can provide access to the Internet for individuals that previously had no Internet access due to lack of smart phones or computers at home. This is especially pertinent to girls since the device's portability gives them the capacity to use it at home since they aren't allowed to leave the house after school.

## Challenges

1. Most affordable tablets provide Wi-Fi access, but due to high monthly costs and no previous need for the Internet, most low-income schools and homes do not have any Wi-Fi access. Thus, a major functionality and benefit of the tablet goes unused by the school and students.

2. Despite the affordable costs of tablets, the price remains challenging for many low-income families.

3. There is inconsistent quality control in the low cost tablet market. Many of the affordable tablets still suffer from low battery-life and slowness.

4. Tablets, without appropriate context and content, do not necessarily encourage more critical thinking. Instead, they just provide another form of rote learning, as students can review lessons as needed with the pause and fast-forward features until content is memorized.

5. Tablets can require extensive planning to integrate well into the classroom. Like computers, tablets are devices. Integration is largely dependent on the content since the software can help guide how the tablets are used, however the school leader, teacher, and administration will have to decide how to best utilize this tool to maximize its impact in schools.

6. Tablets' durability particularly in APS environments, is still in question. While it's advised that cases are provided with the tablets for extra protection, there are still a number of situations that can result in breakage or hardware damage. Besides the threat of accidents like water damage or dropping the device, there is still a question of how long an average tablet will last due to the normal wear and tear that comes with regular use.

# INDIA AND TABLETS

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Out of India's 1.2 billion population, there are 900 million cell phone subscriptions, yet 95% of Indians have no computing device." At the moment, there are an estimated 150 million Internet users in India. Tablets are increasingly popular in this market and expected to increase the number of Internet and computing device users substantially. Tablet sales in India were expected to grow 40% from 2011 with an estimated 1.6 million units by the end of 2012.

There are at least 90 vendors in the Indian tablet market. The top five producers are Micromax (18.4% of market share), Samsung (13.3%), Apple (12.3%),

HCL, and Karbonn, according to a 2012 Cyber Media Research (CMR) report. The Micromax affordable tablet price range begins at just over US\$100, while Apple and Samsung tablets cost at least US\$500. According to CMR, most vendors sell tablets in the US\$90 to US\$180 price range.

The momentum towards tablet prevalence in Indian education is palpable and moving rapidly. India received international attention in 2011 and 2012 for the seven-inch, highly functional and affordable Aakash tablet, which at US\$35 is the cheapest tablet in the world. The Aakash was marketed specifically for use in Indian schools, with support from the Indian government and excitement from the international community and mainstream media.

The first Aakash—developed by the company Datawind Ltd—received high hopes but bigger disappointment. It was criticized for weak functionality, such as short battery life, poor screen responsiveness, and applications that didn't work. With the development of Aakash II and its re-entry to the market in late 2012, 100,000 units are expected to find their way into college students' hands at the Indian government-subsidized price of US\$20. If this implementation of tablets is successful, the Indian government hopes to distribute tablets to each of India's 220 million college students. The commercial version of the Aakash II tablet, Ubiplate, currently sells in the market for US\$70.





# Tablet Ecosystem

There are primarily three kinds of players that make up the tablet ecosystem building the products and services related to India's educational tablets.

## Hardware Manufacturers

Hardware manufacturers are solely responsible for building the device itself. Since Android is an open-source platform, hardware manufacturers and developers can build Android-compatible devices that use their own cost-effective material but provide access to Google's expansive applications store. This has created a robust market of devices with a wide variation in quality, sold at increasingly accessible prices to middle and low-income communities throughout the world. A hardware manufacturer sells devices with a standard Android interface, basic pre-installed apps and access to the thousands of apps that are available on Google's app store.

Manufacturers of tablet solutions are either locally manufactured in India, or they are imported from East Asian countries, most notably, China. There are advantages and disadvantages to both. Tablets from local manufacturers like Karbonn, Micromax, and HCL tend to be more expensive than imported tablets, which drives up the cost of the solution. However, they often come with the advantage of local servicing options. Imported tablets, often manufactured in China, typically offer better quality for cheaper prices, with the option to procure bulk orders. However, users are at the whim of local electronic repair shops if the tablet stops working. These imported tablets often come with no warranty and no servicing options.

## Educational Content Companies

Companies that specialize in developing educational content, either through textbooks, CDs, or smart boards, are finding ways to develop a tablet-friendly solution that hosts their content exclusively. Pearson Education is one such company. The advantage of educational content companies is that they have developed content for years and as a result have built-up brand loyalty in the market. They have also already invested the time and resources to develop quality content. The drawback is that companies

often only use their content exclusively, so the entire solution is only as good as the range and quality of that one company's content. This doesn't necessarily maximize student's access to the best digital resources out there.

## Aggregators

Some companies don't specialize in content development or hardware manufacturing. Rather, they focus on building a solution through the aggregation of content and hardware resources that are developed by other companies. Such companies include Pengala and Khan Academy. Aggregators have three main sources for their content:

1. They can host content through licensed deals with educational content companies. Educational content companies that don't want to absorb the expense of expanding into a tablet product may see aggregators as a way of widening their distribution and expanding their content's reach.
2. Aggregators can also get content through open educational resources (OERs). Open educational resources are learning materials that are freely available for use, remixing, and redistribution. Since OERs are free and available to the public, aggregators focus on building a platform that organizes them and makes them easily accessible to their target market on a platform that the tablet can access.
3. Aggregators can also utilize user-generated content that all users on their platform can access with their device. All these content sources are bundled into a customized solution that best fits their target market's needs. The advantage is a diversity of content in one solution that the user can access. The disadvantage is there could be inconsistency in the access and availability of content in a solution. The content is as good as the quality of the partners they are able to attract. If they're too dependent on one content provider, they could find themselves without a strong offering if the terms of the agreement change.

# TABLET IMPLEMENTATION

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While there are a plethora of tablet solutions being assembled by different players of the tablet ecosystem, the question still remains how a device that is still a luxury item makes its way into the schools and homes of poor communities in India. There are several ways that tablets are being made financially accessible to low-income communities in APS and beyond.

## PAYMENT

There are currently five conventional models of payment for technology in schools:

**Government Distribution Model** - The government pays for 100% of the tablet and distributes them to schools or students.

The Government Distribution Model was executed in Thailand when newly elected Prime Minister, Yingluck Shinwatra purchased 400,000 tablets from the Chinese firm Shenzen Scope Scientific Development and distributed them to first grade students in June 2012.

**Government Subsidy Model** - The government significantly subsidizes a portion of the tablet cost and parents or schools pay the remaining portion. The school or parent has 100% ownership

This is the Aakash model in India. The government is subsidizing the cost of tablets in India and selling it to parents and schools at the lower cost to use as they see fit.

**School Asset/Tab Lab Model** - The school leader pays the tablet producer the market price for a bulk of tablets. He owns 100% of the tablets and keeps the devices at the school as a technology asset that students can use when they are in school. He may recover his costs by increasing fees or through anticipated increases in enrollment.

**Parent Ownership Model** - Schools buy tablets from tablet producers. Parents pay for 100% of the tablet through installments, and students have 100% ownership. Students can use it at school and bring the device home.

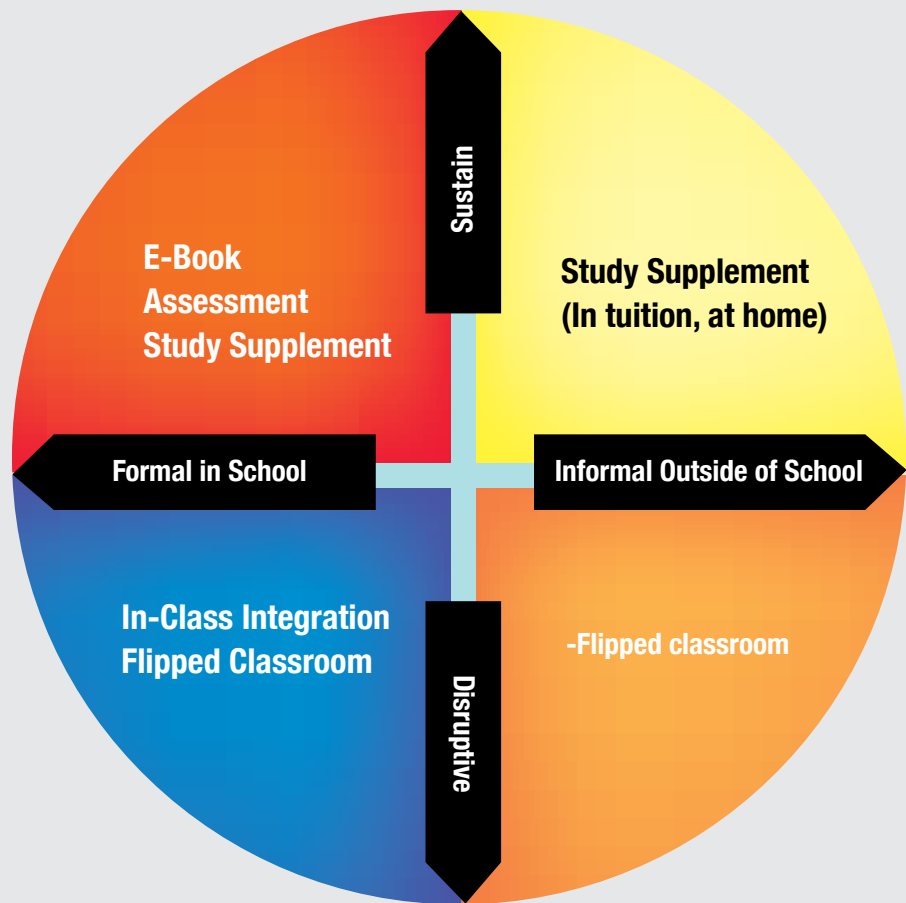
**School Subsidy Model** - School leaders buy tablets from tablet producers. They subsidize the cost of tablets for students who can't afford it. Students can use the tablet at home if parents pay in full. Students can only use it in school if the school has subsidized their tablet.

The school subsidy model was implemented at a Hyderabad APS called Ushodaya. The school leader purchased the tablets, then gave parents the option to pay for the tablets in installments. Students whose families could not afford the tablet were permitted to use them in class, but could not take them home.

## TABLET IMPLEMENTATION

One of the most important elements crucial to the success of education technology is its implementation. A product can be flawless in every way, but without understanding how it is going to be used by students and teachers, its impact is minimal. In many ways, a product's innovation is not a result of a new feature, but about the value people get from how it's used. This section explores the various ways tablets could be used in the APS environment.

The framework below is based on innovation expert Charles Leadbeater's model of innovation for education. It describes the two planes in which education innovations occur. An intervention can either sustain the existing educational system or disrupt it. The second plane describes how these innovations can either occur in formal institutions such as schools, or take place informally in communities and homes. Below is a map of where some tablet use cases lie in this framework.



**E-Book** - Providing e-book formats of student textbooks on the tablet was a fairly common implementation model mentioned by teachers and school leaders in APS. This is one of the least disruptive ways tablets can be used in schools but it provides the advantage of reducing students' book bag burden. It can also enrich reading with embedded dictionaries that define new words.

The Kenyan ed-tech company Kytabu uses the E-Book model, which also provides ways to make textbooks more affordable to students. Kytabu makes textbooks in Kenya 60% more affordable by leasing small increments of the textbook as needed through tablets for very small amounts of money at a time.

**Customized Assessment** - Schools are using tablets solely as a device to accelerate the assessment process in the school. By enabling teachers and administrative staff to administer tests on the tablet, the process of tabulating, recording, and disseminating scores is completely automated. Teachers no longer have to accomplish these things manually. Instead they can focus more of their time on class preparation or actual teaching.

**Study Supplement** - If a tablet has curriculum-aligned content, especially with built in assessments for the students' purposes, it can be used as a very effective study supplement. The students would independently review their lessons and reinforce the material that they learned through whatever modules were available on the tablet. This student-led studying could take place at school in the form of a tuition class. Or students may conduct studies with friends in their neighborhood.

**In-Class** - Integration: This use case deals with tablets being integrated into a teacher's classroom lesson plan. It involves directing the students' activities on the tablets so that elements of the tablet's content can supplement her lecture. This is one of the most difficult use cases for the tablet because it requires a level of comfort with the tablet from the teacher, an understanding of its offerings, and a level of planning for how it can work with her own teaching style. Furthermore, there can be wide variance in how disruptive this is in the classroom. It depends largely on how the teacher opts to use it.

**Flipped Classroom Model** - The flipped classroom model inverts the classic classroom model of homework being done at home and lectures being taught in school. With video content in the tablet, students now have a new tool that enables them to absorb lectures from qualified teachers at home, then reinforce the material with the help of their local teacher in class. This is especially useful in APS since there is such a wide variation of quality and expertise in the lectures teachers deliver in school. There is also the potential added benefit of other family members in the household being exposed to the lessons since most students voice they are comfortable with sharing their tablet at home. This model directly challenges the long held assumption that learning should take place in school. It also creates a shift from teacher-centered direction to student-centered learning.

## TABLETS IN APS

In 2012, Gray Matters Capital initiated the first pilot of tablets in affordable private schools in Hyderabad, India. After in-depth research into various educational tablet providers, GMC selected the Edutor tablet to implement in two APS in Hyderabad. In both schools, the school leader purchased the tablets with a loan and then had the parents purchase the tablet from the school in installments. During the implementation phase, we interviewed stakeholders at the two APS to gain a

better understanding of their views on tablets in education. Researchers also interviewed students about their engagement with the tablet, ease of use, and interest. At the time of the interviews, the tablet was still very new to the stakeholders.

APS stakeholders each have a different perspective on the value proposition, benefits, and drawbacks of tablets, based on the interviews.

	Student	Teacher	School Leader	Parent
Stakeholders' Expectations	It provides a source of entertainment and a way to learn through videos and narration, in addition to text.	It keeps students interested and lessens the amount of teacher preparation for exams.	It will meet parents' expectations to innovate technologically at the school, and improve the school's reputation.	It will improve their child's grades and they will learn more as a result of using tablets.
What's driving consumption or use	Students want to have access to technology and not feel left out from their peers. They also want to play games and improve their studies.	Teachers want it to facilitate faster assessment and provide students an opportunity to review lessons more frequently.  They think students will learn better than through books, since audio and video appeals to different learning styles.	School leaders want the tablet to differentiate their school from others, making it appear progressive in parents' eyes.  It will also help students perform better in exams thereby improving his reputation.	Parents don't want their child to feel left out from technology or look less invested in their children's education than their peers.  They also believe the school leader's argument that it is good for the students and it will help their child's education.
What they like the most about the tablet	Students can explore subjects of their choosing in the encyclopedia, can see visuals of subjects in biology, and play games or puzzles with the accompanying applications.  They can review as needed until they learn the content.  Since they aren't allowed to carry mobile devices to school, they like that the tablet is a technology device they're allowed to bring to school.	Compared to a smart board, children get more individual exposure.  Children don't have to carry heavy bag with texts.	The school leader benefits reputation-wise for having the device in his school without bearing the cost for the technology. Unlike other ed-tech solutions, which the school has to buy and maintain, in many cases parents buy the tablet and are ultimately responsible for it.	The tablet only has educational content, so there is no fear of straying to things that are inappropriate or that distract from learning.  Tablets can teach the student at home. Fear that if the child practices on the tablet too much, they will forget how to do exams.  Relying solely on the tablet will also affect the student's writing skills.
Drawbacks	Games are not interesting or challenging enough.  Battery life on some of the devices is not long enough for regular use.	If only some students have tablets, it will create disruption between students.	The tablet requires maintenance. They have fears of breakage and servicing or warranties in place if that occurs.  Uniform physical appearance of tablets makes mix-up or theft easier.	Fear that they purchased the tablet and it will not improve learning levels or will not be used by teachers or students.



## Four common trends emerge from these perspectives about the use of educational tablets in APS.

**1. It will improve learning.** All the stakeholders believe that tablets will improve student learning, through the interactive and customizable platform, even though they have no proof of improved learning outcomes yet. This belief is solely based on what they hear about tablets from their school leader and the tablet service provider. The lack of proof is why some parents are hesitant that it will actually make a difference, but purchased the tablet regardless.

**2. Tablets keep students current with global technology trends.** Every stakeholder is concerned with keeping their school and students up to date with the latest technology trends such as mobile phones and tablets. They don't want student to be left behind due to lack of access to technology, and they all believe that technology plays an important role in daily life.

**3. Peer pressure.** In the case of school implementation where the parents buy the tablets from the school, and students whose parents don't purchase a tablet can only use it at school, there is a sense of peer pressure. Students don't want to feel left out if their peers have a tablet, and parents don't want their child to feel left out either. Schools also feel the pressure that if another school has tablets, they should purchase them also.

**4. Audio-visuals and games are a big draw.** All the stakeholders are attracted to how audio-visuals can impact learning levels and keep students engaged inside and outside the classroom. Students are especially attracted to the games and encyclopedia as well, since it's the closest thing to the Internet that students have access to.



## Insights about Tablets from Conversations with Parents and Students

A. Srinivas is the father of a 9th class tablet-owning student and an auto-driver and shop owner. He said: "We need to change according to changing trends and generations, and the same goes for technology. It is also easy to communicate with technology." He bought a tablet so that his daughter can learn quickly, because "growth is possible through technology and knowledge is available through technology"

9th class student B. Kajal said that she likes the tablet because of the Biology lessons, the puzzles, and the ringtones. Her favorite subject is Biology and with the tablet she can understand it easily and see how the human system functions.

S. Pushpa is an auto-driver and the father of a 9th class tablet-owning student. He said that the tablet looks promising for his child's education. "I believe it will open their minds, but this will work only if the school gives access to Internet as soon as possible."

Ashvini is a housewife and mother of a 9th class tablet-owning student. She bought the tablet because she believes her child will study more with it and because all the other students were buying it. She is able to afford the tablet because she pays in installments.

Shaik Mohd, a 9th class student, said that his favorite feature on the tablet is the Encyclopedia because of the pictures of animals and places. But he doesn't like how he can't play "good games" because the tablet is locked.

M. Nandini in 9th class said "I like the tablet, it's so useful because it's easy to understand lessons. But I have no time to use it because I have to work at home. My father is a dairy farmer and I sell milk, so I have no time to use the tablet. But I use on Saturdays and on holiday; if I have time, I will use it."



Section 5  
**FINDINGS**





# SUMMARY OF FINDINGS

Each stakeholder brings a unique set of challenges, ambitions, and attitudes towards technology and education. However, there were some ideas about ed-tech that were echoed consistently among all stakeholders. Insights from stakeholders and additional research elucidated several opportunities for ed-tech companies working with low-income schools. These insights form a foundation for the most common barriers to use, gaps, and opportunities for educational technology in APS.

## Barriers To Use

There are many factors that contribute to a failure to use technology in meaningful ways in schools. The challenges of integration are shaped by teacher use and decisions made by school leaders. Below are some of the major implementation challenges that APS face when integrating technology.

### 1. Knowledge Gaps

A common reason that technology is not effectively implemented is because the school's good intentions are not matched by knowledge of technology's potential. Many school leaders and teachers are unaware of how to use technology to its full capacity. This is observed most frequently with investments in computer labs.

School leaders often spend large amounts of money on computers, without developing clear learning goals for the students or even having a full awareness of what students can learn on a computer. This often results in the computers being used to a very limited extent. Rather than teaching highly marketable computer literacy skills like coding, basic web design, mastery of Microsoft office, or presentation skills, students spend their time in the computer lab playing with the WordArt and Paint applications. Likewise, without Internet access at most APS, school leaders and teachers are also largely unaware of the free educational resources they could download for use in the classroom.

## 2. Resource Limitation

Another barrier to successful technology implementation is the high cost associated with acquiring, maintaining, and maximizing the use of ed-tech tools.

Even smart classes catered towards the APS market can be a cost burden to the schools. The monthly installment payments for the smart classes can be too high for many APS struggling with financial sustainability. If school leaders stop paying, the content is not renewed. This results in inactive smart classes installed in schools but with no access to the content.

Another example of how limited resources affects implementation is that schools may be able to afford computers, but can not afford to make the necessary repairs or upgrades to keep them running after installation. Schools may have a computer lab but may be unable to afford Internet for the school.

Cost constraints also prevent school leaders from being able to hire and retain qualified computer teachers who have a mastery of technology and know how to creatively teach computers to the students. Instead, schools are left with unskilled teachers who often act as enforcers or avoid using the technology entirely.

## 3. Cultural Barriers

In some cases, ed-tech's ineffectiveness can be explained by an unwillingness to fully implement the technology by school leaders or teachers. Some school leaders view investment in technology primarily as a marketing tool, instead of as an educational one. This can result in a reluctance to let the children use the machines regularly. They fear that students will damage the technology and only allow use irregularly during monitored times; but they will proudly show visitors and potential customers that their school has technology. Furthermore, some school leaders are unwilling to invest in teacher technology training because they fear that trained teachers will use their new skills to try to find a higher paying position elsewhere.

Teachers' lack of will is largely influenced by APS's teaching culture, which is very teacher-centric. The teacher-centric pedagogy that places teachers as the sole authority in the classroom works against creative use of new technologies tremendously. Not only has the teacher likely not deviated from teacher-centered learning in all the time she has been learning and teaching, but she also fears making a mistake in front of her students. Teachers in APS are also largely untrained and unfamiliar with how to use technology, and are therefore scared to try to learn how to incorporate the tool into their classroom and teach it to their students. This makes learning and using devices that are completely different than what they are accustomed to using very difficult.

## 4. Logistical Restrictions

Some schools have trouble finding a physical room to dedicate entirely to new technology interventions like computer labs or smart classes. For smaller schools, space is a premium, and the attempt to accommodate growing classrooms of children is challenging enough.

Schools can also find it difficult to schedule time to hold computer classes since core academic subjects have a much higher priority. All of these classes, compounded with tuitions and extracurricular activities, leave very little time for a computer class.

# Gaps and Opportunities of Ed-Tech in Aps

An understanding of the collective gaps most frequently communicated among different stakeholders clarifies opportunities for technology to be relevant and successful in the APS environment. Below are the most common gaps and opportunities that shape the quality of technology product offerings in the market. The opportunities either call for innovations in content development, hardware development, service elements of ed-tech in APS, or its socio-cultural integration in individuals' lives.

## CULTURAL INTEGRATION

### Technology and 21st Century Skills

**Gap:** Today's workers and leaders require a number of skills influenced by technology and the Internet, from coding to Internet social media etiquette. The lack of Internet penetration in low-income communities means that the 21st century technology skills expected of future generations are largely unfamiliar to low-income youth and teachers.

**Opportunity:** Technology class pedagogy should include broader lessons on the contextual relevance of technology to students' preparedness for the 21st century. This would be a useful way to disrupt the perceptions techno-skeptics largely hold through their parents' own limited interaction with technology. This would also be useful for teachers and parents to understand how ed-tech can relate to a child's future professional ambitions.

### Global Aspirations

**Gap:** Almost all students, teachers, parents and school leaders in the APS referenced technology as something that would benefit children beyond the confines of their neighborhood or even their country. Many shared a deeper ambition for technology to keep their children relevant and successful in a global economy. There is an implicit value placed on technology's ability to transcend classroom walls and connect students to the world outside of their immediate environment.

**Opportunity:** It is prudent for any service provider to market their product with reference to a connection to global standards or the ability to cultivate international skills.

### Gender Equality in Technology

**Gap:** Girls in low-income communities in India have less access to technology than their male counterparts. This creates inequality in learning opportunities and skill-building.

**Opportunity:** Interventions should be made to equalize access to Internet and computers for girls. This could be especially pertinent to technology integration in school since cultural gender norms often prevent girls from using neutral spaces like computer labs or even other people's houses to access the technology.

### Mimic Students' Natural Technology Consumption

**Gap:** Students with access to technology prefer to listen to music, play games, and watch movies. These uses of technology are the most entertaining, so when they come across standard educational games, they are considered boring.

**Opportunity:** Students' interest in music, movies, and games should be utilized when designing educational technology software. Students will likely retain interest if the product mimics the way they opt to consume technology.

## CONTENT

### Curriculum Alignment

**Gap:** School leaders have struggled to find ed-tech solutions that have curriculum aligned specifically to the State Board curriculum they are mandated to teach.

**Opportunity:** The content should be as closely aligned as possible to the school's curriculum and State Board. Since the majority of APS are English-medium, the content, except of that related to language instruction, should be in English. Ed-tech solutions should also be prepared to align to the new standards being established with the CCE.



## Assessment

**Gap:** Test performance ties closely with school leaders' reputations and capacity to attract new students to their school. In addition, assessments are the most time consuming task that regularly takes teachers away from the act of teaching.

**Opportunity:** Ed-tech solutions should seek solutions that make assessments more efficient and should illustrate how your tech solution can help students perform better on their 10th standard exams.

## Safe Internet Browsing

**Gap:** Currently, there are no child-safe Internet filters that APS parents and school leaders trust to monitor students' Internet use. School leaders, teachers, and parents are well aware that children could access inappropriate information and are susceptible to threats through the Internet. This is one of the primary justifications for not giving students access to the Internet. School leaders are especially sensitive to the negative impact the Internet could have on the school's reputation if students are exposed to inappropriate content in the classroom. While they are not opposed to the Internet, they are not willing to risk the consequences without proper mechanisms for monitoring students.

**Opportunity:** Computer, tablet, and mobile systems that allow for student access to the Internet should have safeguards to ensure responsible use and close monitoring of each child's Internet usage.

## Audio-Visuals

**Gap:** The prevalent pedagogical approach to teaching in APS is very rigid and relies solely on students understanding and retention of information from a lecture or through text. There are very few tools at a teachers disposal that can be used to teach students who are audio-visual learners or just to explain concepts that are better served by accurate images and diagrams

**Opportunity:** Technology that explains concepts using audio and visuals gives teachers another way of conveying concepts. It helps teachers reach students with different learning styles and can help make theoretical concepts more concrete. Spoken English

## Spoken English

**Gap:** Even though spoken English is a highly valued skill in the APS market, the quality of spoken English education is fairly low. Children usually memorize English phrases instead of learning to comprehend the language. Additionally, students are usually unable to understand native English speakers' accents.

**Opportunity:** There is a need for technology that boosts English comprehension and spoken English proficiency. It can be a particularly useful tool for delivering accurate, grammatically correct English that the children can mimic.

## HARDWARE

### Usable by Teachers

**Gap:** Teachers in APS are largely untrained in education or technology and are most comfortable with the teacher-centric model of classroom management. Lower class teachers are often the least skilled. Grading and the APS assessment culture take significant teacher time away from focusing on lesson plans and student attention.

**Opportunity:** Design content for the lower classes as these teachers could use the most support and it's an important developmental age. Build solutions that don't require immense planning on the teachers' part. Smaller, less sophisticated APS often don't have formal methods of lesson planning in place. Adding more work for the teacher will make adoption more difficult.

### Create Individualized Learning

**Gap:** One issue school leaders identified with computer labs is that they do a poor job of providing individual student engagement. A class of 40 students will usually have to split time with less than ten computers, which means students actually spend very little time using the devices. Schools face similar challenges with smart classes. Most schools do not have the means to buy enough smart boards to be used in every classroom. Most have one, at most two, smart boards that are used for as many as nine grades of students in the school. This results in students using the smart board for very limited times throughout the week.

**Opportunity:** Consider solutions that are handheld mobile computing devices that each student can own, and use individually. Smart Class producers may also consider offering remote clickers that enable interaction with a Smart Class and allow for more individual student interaction and monitoring.

### Electricity Independent

**Gap:** APS in Hyderabad face daily power outages that interrupt use of all technology, including classroom lights, computers, and smart classes, making use of ed-tech tools that require power difficult to schedule and coordinate. It forces school staff to constantly readjust how they use technology from week to week and creates constant breaks in the attempt to implement new technology.

**Opportunity:** Ed-tech solutions should be rechargeable, solar, or battery powered, and should not be dependent on electricity to work.

## SERVICE

### Active On-Going Training Modules

**Gap:** Technology implementation often goes awry because the school administration suffers a lack of adequate external support. This comes in the form of both hardware support and software training. With techno-classes, service providers often integrate some form of hardware support for malfunctioning machines and training for teachers. However, they typically hold teacher trainings once, soon after the device is installed. Given the high turnover of teachers in schools, this creates the common problem of some teachers having a formal introduction to a new technology and others who join the school after the training not having any experience or having to learn informally from peers.

The challenges with computer labs are even more severe since computer labs don't offer support as part of the purchase contract. School leaders often buy computers used or receive them as donations, so there is no service provider to fix hardware issues or train teachers. Furthermore, there is no training for used computers. Schools are left to the whims of a teacher's existing computer knowledge or dependent on a textbook.

**Opportunity:** Customizable and regular hands-on training modules are important. Service providers should have a service component and should train teachers several times a year. There may also be an opportunity to create training modules that encourage teachers to teach one another the technology. Student-to-student peer teaching on technology should be encouraged. It can empower students to become leaders, not just in their school, but also in their communities.

### Blended-Learning

**Gap:** Although parents, school leaders, and teachers have generally positive attitudes towards technology in schools, they still hold a great deal of respect for traditional methods of teaching. This creates some tension or initial fear that new ed-tech tools like tablets will completely replace standard teaching. This creates a fear of the unwanted effect of technology dismantling teachers, and obliterating important skills in children that are acquired through traditional education.

**Opportunity:** Teachers must be trained for how to incorporate technology into their classroom, with the explanation that technology does not replace but rather supplements the teacher. Build in optional opportunities for teachers to be interactive with students when building smart board solutions. It can give some teachers the feeling that they are still central to the class while working with the technology.

# FUTURE OF ED-TECH IN APS

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In our exploration of ed-tech in APS, we found that APS tend to follow the trends of higher-end schools in India. When higher-end private schools began incorporating smart classes, APS followed suit several years later. This may be for several reasons. APS try to emulate the higher-end private schools to show parents another form of differentiation from government schools. Additionally, service providers tend to initially build their product for higher-end private schools, and as their business becomes profitable, they create or sell a similar product at a lower cost to the low-cost private schools.

Whether implemented by higher-end schools or unique to the affordable private school space, we've observed a number of emerging trends of ed-tech in affordable private schools.

**1. Expansion of Internet in school.** Internet is becoming more integral to daily life in India, through expansion of Internet access by the government and through mobile phones. Schools will also begin to provide Internet. We are already seeing the beginning of this trend in several APS in Hyderabad. This also becomes pertinent as more ed-tech products begin to rely on Internet access, essentially requiring the school to purchase Internet access in order to use the product.

**2. Tablets will become more prevalent in schools.** With the popularity of the Aakash II initiative in government schools in India, and the increasing access to smart mobile devices capable of learning applications, many argue that more people in the developing world will access the Internet through mobiles and tablets rather than through computers. Some APS have already been on the forefront of tablet and mobile application implementations at their schools, and as these products become more common and marketable to low-income community, we expect this trend to continue.

**3. More learning will occur through mobile phones.** Past ed-tech interventions have provided mobile phones to students for use. The trend now is to build applications that can work on both low-end and smart phones for students to use in the

classroom and at home. These apps can be downloaded for little or no cost. This content can be incorporated into the schools' curriculum or can include supplemental learning games.

**4. Expansion of techno-classes.** Techno-classes have already successfully penetrated APS in Hyderabad. It has almost become a basic expectation that an APS will have a smart classes, though as explained in this report, they may not use it frequently or effectively. Smart class providers are also lowering their costs, and more are entering the market to provide better competition. We expect that in the future, the vast majority of APS will have some form of smart class, though actual implementation and regular use of the class will likely remain problems.

**5. Ed-tech companies will increasingly become aggregators.** Given the vast educational resources on the Internet, many companies are moving away from providing their own content, as they are not content experts. Instead, they are building technologies that aggregate content and provide it in a learning platform to schools and students. We expect this trend to continue, as companies provide services to schools of aggregating content and creating a curriculum from a number of open resources, taking the lesson planning and aggregation burden off of teachers.

**6. Distance learning tools.** School leaders have expressed interest in having students interact with lecturers and students abroad, to enhance exposure to cultures and learning abroad. While we haven't seen this implemented in any schools, it's a desire commonly expressed that existing technologies and companies can adapt to meet.



## User-Designed Ed-Tech Companies

There are a few education technology companies working in the developing world that have truly been designed around user needs and have the potential for real impact on learning outcomes. We looked for ed-tech companies in South Asia and Africa that emphasize user-centered, customizable education technology solutions for low-income communities. Below are several companies that we believe are working in the right direction.

### Zaya

**Why they are great:** They have a focus on blended learning and found a way around the issue of Internet access through their Micro-Cloud solution.

Zaya, formerly known as Teach a Class, is a non-profit founded in 2012 that provides supplemental education to children ages 6 to 13 in India through ed-tech learning labs. Each Zaya Learning Lab incorporates their blended learning approach and bypasses lack of Internet infrastructure through their Education Micro-Clouds, a proprietary hardware and software solution that powers their labs. Each Micro-Cloud has a 10-hour power supply, mobile, plug-n-play and is pre-loaded with a variety of educational resources, teacher-training curriculum, and an adaptive learning platform.

### Edutor

**Why they are great:** Edutor has created a user-friendly tablet that is capable of aligning to the school's curriculum.

Edutor Technologies was started in 2009 in India, with a focus on fostering personalized learning by bringing emerging technologies to the classroom. The StudentTab from Edutor is a Tablet PC, which is customizable for a school's curriculum. The tablet has a built in assessments feature, and the content is a blend of animations, e-books, and videos aggregated from several content partners. They piloted their tablet at a reduced cost in two APS in Hyderabad in 2012.

### M-Prep

**Why they are great:** They are a teacher-designed education solution that works on low-end phones students already own.

MPrep is an SMS, mobile, and web-based study solution founded in Kenya in 2011. It was designed by a teacher that spent significant time working in rural Kenya. The MPrep platform, which started as an SMS assessment-based system that quizzes students on topics from class, is now becoming a multi-media learning platform accessible to a large number of students on any widely used ICT device. MPrep uses data to give schools and parents information about student strengths and weaknesses.





### Worldreader

**Why they are great:** They are bringing books to students in Africa by working with locals to make sure their e-books and e-readers are user-friendly.

Worldreader is a US and European non-profit founded in 2010 aiming to bring digital books to children in the developing world through e-readers. They've delivered 428,000 e-books to 3000 children in sub-Saharan Africa as of January 2013. In addition, they have more than half a million people reading books and educational material on their mobile phone through their device Worldreader Mobile. Worldreader provides technical and teacher training support to project managers and local teachers working with the e-books and students, and train locals to repair their e-readers.

### EduComp

**Why they are great:** While they are not geared only towards the low-income market, they have successfully penetrated the APS market in Hyderabad, making smart classes practically a prerequisite for top APS.

Educomp Solutions Limited is the largest education company in India. It was founded in 1994 and reaches over 32,000 schools and about 21 million students and teachers in the world. Their smart class is popular throughout schools, including APS. It is a teacher-led, educational content-based solution that can map school curriculum, and includes multimedia and student interaction options such as clickers. Schools install smart class infrastructure in classrooms and then link up to an Educomp server for the content. Educomp also has trainers that visit the school regularly and train the teachers.

### InOpen

**Why they are great:** They are teaching 21st century computer skills to India's students.

InOpen is an Indian company founded in 2009 that focuses on computer training and 21st century skills. Currently, InOpen focuses on higher-end private schools and government schools, and currently reaches more than 300,000 students. One of their programs, Computer Masti, can customize content for every school and work in multiple languages. They also work on IT literacy solutions.

# Conclusion

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Education is the cornerstone of development for millions of people throughout the world. An increasing number of families are choosing private alternatives to public school to secure the progress education can afford their children. For too long, education has failed to deliver on the promise of progress for children in poor countries throughout the world. Technology has the potential to innovate in a way that can reinvent the future of education for children in the developing world, but doing so requires an understanding of the communities who are using the technology.

The Indian APS sector is a solid breeding ground for innovation. The competitive market dynamics of the schools provide an incentive for school leaders to stay ahead of the curve and try new products and services that will set them apart from public schools and other APS in the area. While tablets are an innovation that is making its way into the APS sector, there are an abundance of market opportunities for technology companies to fill important gaps in the education sector and beyond.

Whether the intervention is tablet or computer-based, or focuses on teacher training, it must take into account the roles, influences, and values of all the players of the school ecosystem. Building solutions that adequately accommodate each stakeholder's needs is crucial to success of any education technology product that enters the market.

The future of educational technology in APS and in Indian education at large seems bright. Increasing numbers of entrepreneurs, foundations, and businesses are coming together to make educational technology a reality in low-income communities throughout the world. Attracting new ideas is not the challenge; stopping the technology from entering the hype to failure cycle is.

Our hope is that the information provided in this report will act as a foundation for better designed technology in places that could reap the most benefit from well-designed product interventions.

# Authors

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