



Designing **Learning Analytics** for **Resource Constrained Schools**

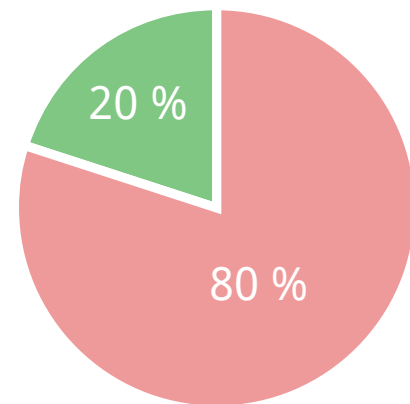
P3 | Defence

Sanket Kulkarni
IxD | 136330001

Guide: Prof. Venkatesh R

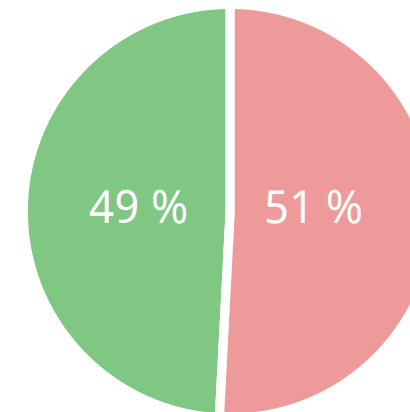
Resource Constrained Schools

Availability of Computers in Schools
(ASER 2014)



- Computer Unavailable
- Computer Available

Pupil - Teacher ratio in Indian Schools
(ASER 2014)



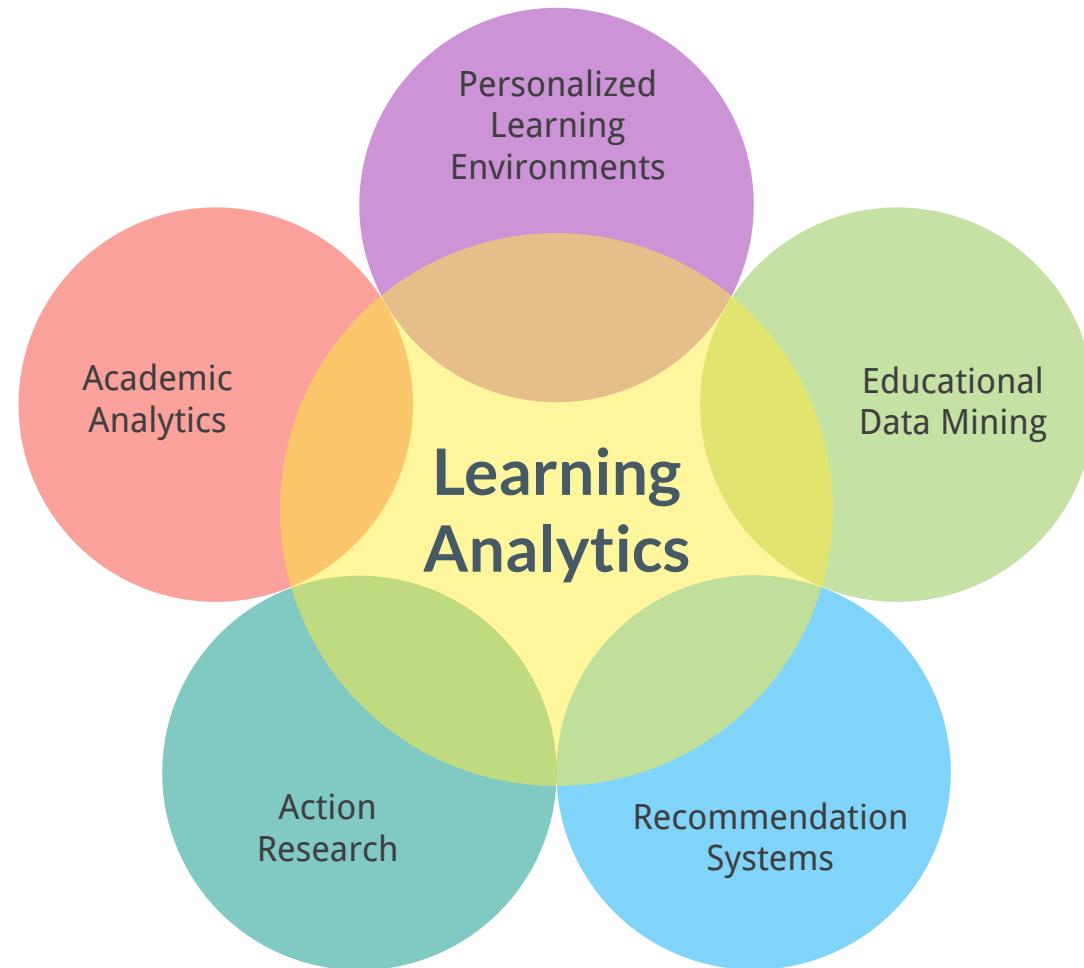
- Schools not complying with RTE
- Schools complying with RTE

Learning Analytics is the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs

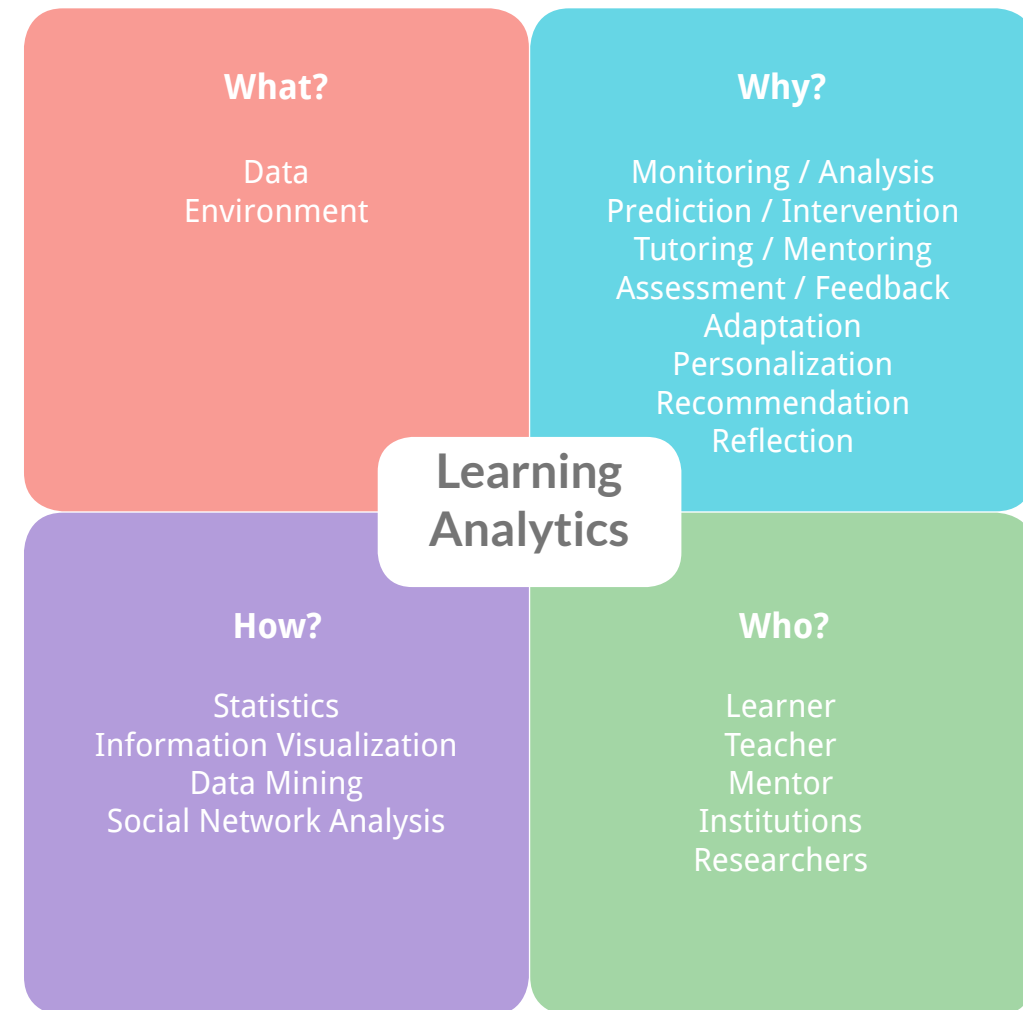
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Influences from Other Fields



Reference Model of Learning Analytics



State-of-the-art Applications

Learnings

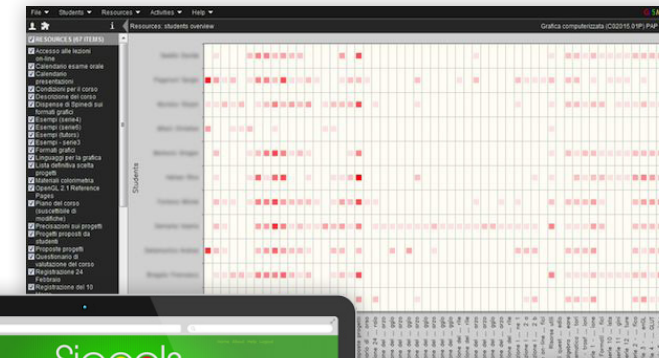
Built on top of already existing digital system

Data is readily available in digital format

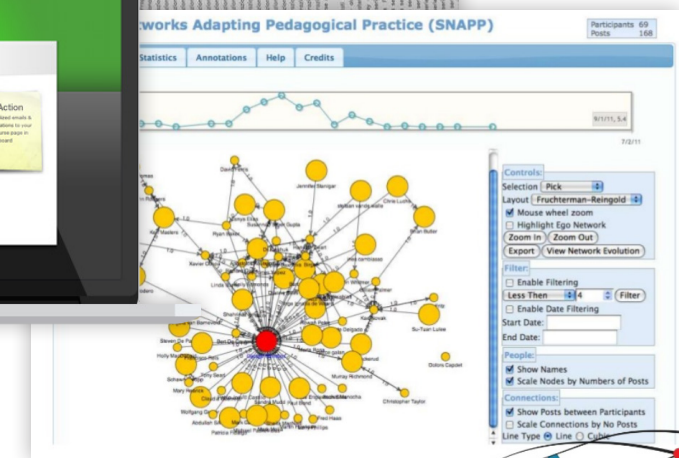
Resources in terms of Learning Analytics

- Availability of Computing Devices
- Availability of Internet Connectivity
- Digital Literate Manpower

GISMO



Signals



SNAPP

User Study

Summary

Objective of Study

- To understand **what kind of data** exists in schools and **how it is captured**
- To explore potential **opportunities** for learning analytics

Phase 1: Interviews

- **4 Teachers** - 3 from Marathi medium School and 1 from English medium school
- **1 M.Ed Student** from Azim Premji University.

Phase 2: Observation

- **Shadowing** sessions in classroom for **4 days**

Participating School

Krantivir Balawant Phadke Vidyalay, Pune

Established in 1957

1st standard till 7th standard (1 class each)

Total Number of Students: 251

Number of Teachers: 6 Teachers

Needs 8 Teachers and 1 Headmaster

No Reading Room

No Computer





Krantivir Vasudev
Balwant Phadke
Prathmik Vidyalaya

Ram-Tekadi

Vishal Mega Mart

Honeywell

Canal Rd

Bhairoba Nala

Witthalrao Shivarkar High
School & Junior College

Rd to Hadapsar MIDC

Ramtekdi Rd

Pune Solapur Rd

Pune-Solapur Hwy

Bhairoba Nala

Data Collection Practices

Daily

- Attendance of Individual Student
- Total number of present and absent students

Daily Attendance Sheet

Monthly

- Number of students enrolled
- Number of students left school
- Average Attendance – Male and Female
- Number of Holidays and Weekends
- Cast-wise Enrolment of Students

Monthly Report maintained at the back of Attendance Sheet

Data Collection Practices

Quarterly

- Unit Test Marks

Semesterly

- Grade Summary of Whole Class
- Subject Wise – Remarks
- Subject Wise – Marks Split up

[illegible]

सत्र - प्रथम / द्वितीय	
विद्यार्थ्यांचे नाव - विकास मनोजदास राम	सुकाठी -
इसता - प्रती	वर्गनामक नोंदी
विषय	तुम्हाने अडथळत करतो. आजच्या अडथळा निर्माण होतो.
१. प्रथम भाषा	हिंदी वर्णां को अच्छी तरह समझता है।
* हिंदी	Recognise the pictures.
२. इंग्रजी	
३. गणित	बेरीज, तजाबाकी इ. क्रिया मध्यक करतो.
४. परितर अभ्यास	परिसर स्वच्छतेचे महत्त्व सांगतो.
सा.शास्त्र	सुनाकाळ व नवीन काळ यांतील फरक सांगतो.
५. कला	चित्रात व्यवस्थित रंग भरतो.
६. कार्यानुभव	कागदी, होडी, मिमान करायला आवाडे. पाण्याची बचत कशी करावी? हे जाणतो.
७. शारीरिक शिक्षण व आरोग्य	सनोरांजनात्मक खेळांची विरोध भाव

Student's semester marks and remarks maintained in Student Progress Booklet

Data Collection Practices

Daily

- Book Issued
- Attendance

Monthly

- Number of Visits happened in month
- Number of Books issued to Students
- Number of students who issued books

Quarterly

- Student Wise - Reading Ability Test Score

महिना - डिसेंबर
मासिक अहवाल

दिनांक	पुस्तक	बोर्डर	मकूल	नवीन वाचक/बोर्डर
4-12-14	19	21	40	1 नवीन वाचक
11-12-14	-	-	-	-
18-12-14	20	20	40	-
24-12-14	16	24	40	-

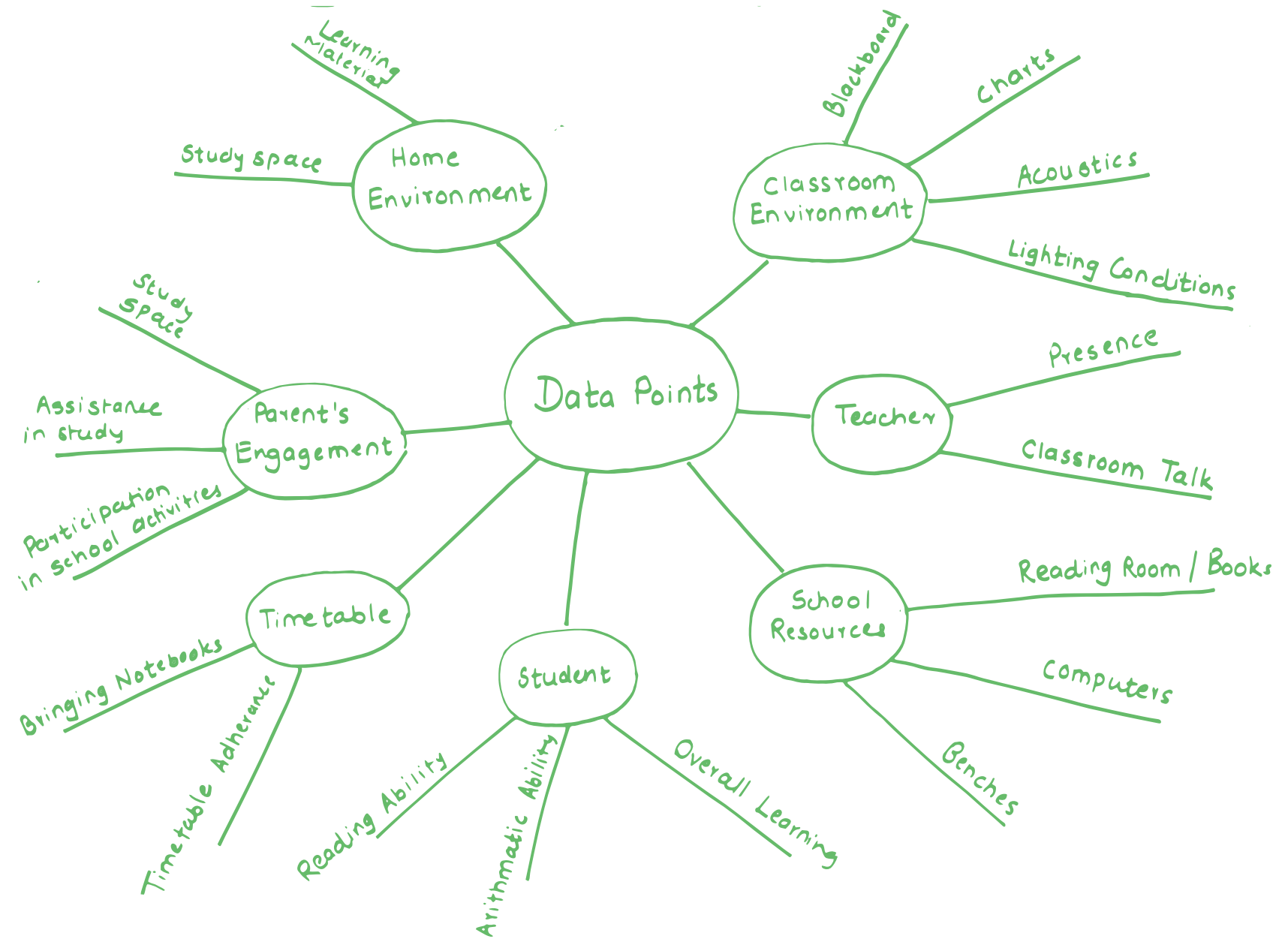
किती वाचक	किती वाचक	नवीन वाचक
03	02	01

अवकाश	विद्यार्थी संख्या	मुल्यमापन मुल्य
1	7	1 से 5 क्रमोत्तम कुल - 19
2	1	
3	2	
4	4	
5	12	
6	-	
7	14	
8	-	
9	-	
10	40	

पुस्तकची संख्या	विद्यार्थी संख्या	व्यक्तिगत नोट्स
0	-	स्वामी, विश्वनाथ नोट्स
1	11	
2	12	
3	-	
4	-	
5	-	
6	17	
7	-	
8	-	
9	40	

Monthly Report of issued books and Reading Test score for 4th grade

Mindmap of Data Point



Data Collection Practices

Findings

- Most of the data is in **physical format**
- Unlike schools, NGOs have their **volunteers to collect data**
- The data is digitised by volunteers by **manual data entry** in softwares like Excel sheet
- The volunteers only help in data entry. The collected data is **analysed by a senior officer**
- For analysis, data is visualized in **basic chart types** like bar charts or pie charts

Distinguishing Features

- Trained data entry operators
- Paper-based data collection form
- The Cluster/ Block regional officers are authorised to check validity / correctness of data

Drawbacks

- Data collection form has fixed parameters. If changed, then software database schema needs to be updated.
- U-DISE captures only school level macro data
- Separate Data Entry operator needs to be hired

[illegible]

Data Collection Form, Source: dise.in

Opportunities for Learning Analytics

Data Access & Control

Problem Area

- Collected data is not shared back to School
- No way for school authorities to collectively analyse data from multiple surveys
- Need of controlling use of data. Teachers do not want data to be used to draw undesired conclusions about school

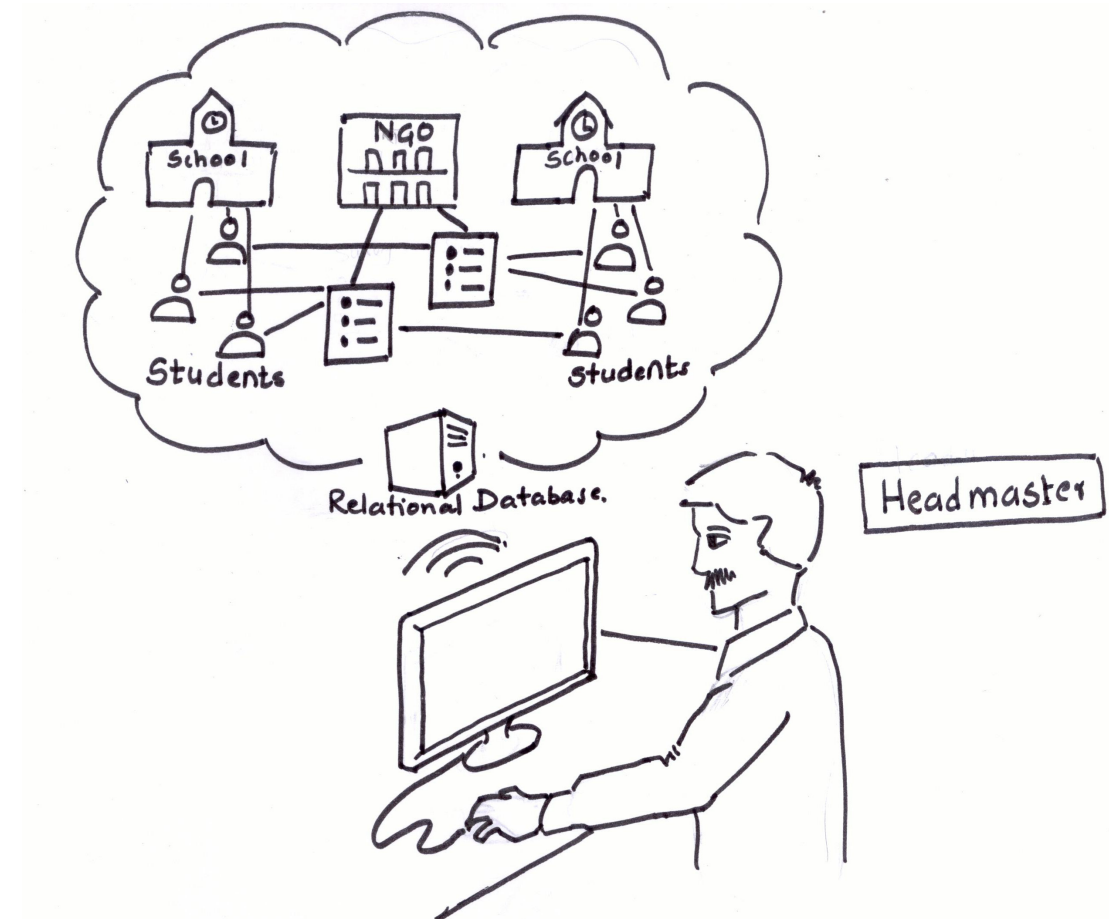
Data Access & Control

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Design Idea

- A common platform for schools, researchers and NGOs to share data and analysis
- Ability to access data in digital format and analyse it

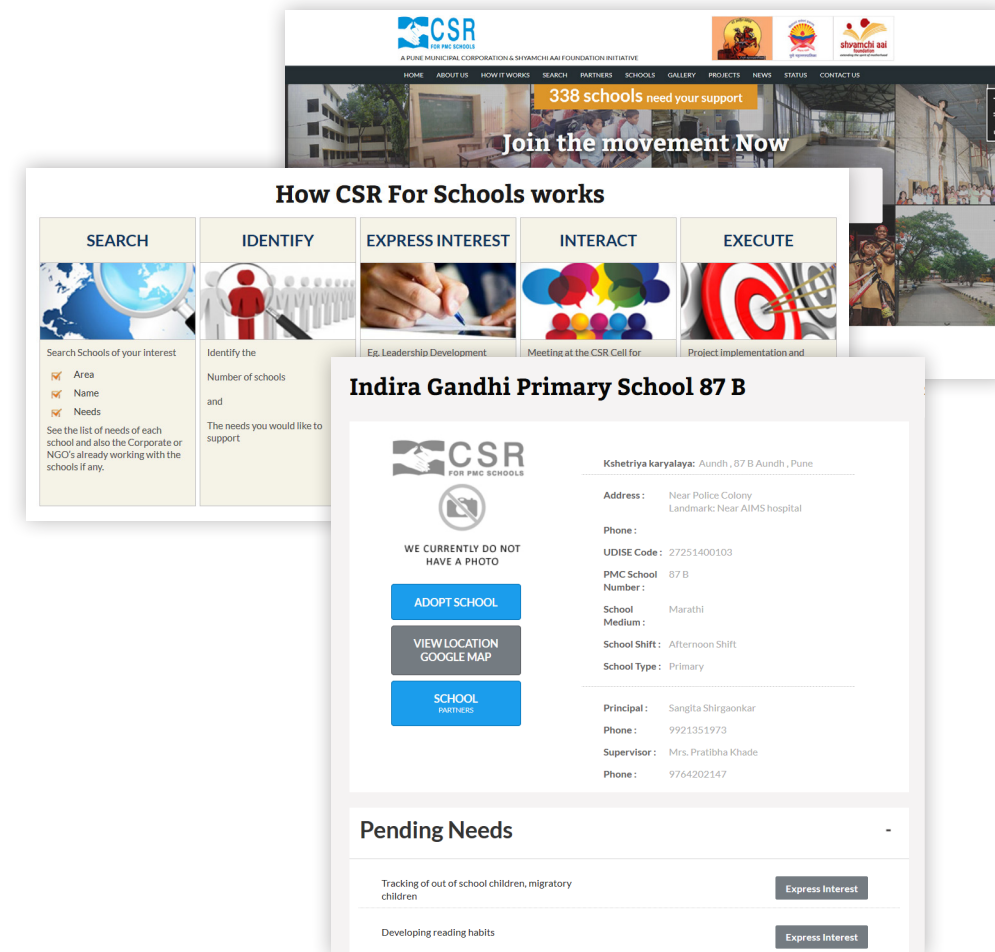


Common Platform for Data Access & Control

Expressing School Needs

Problem Area

- Helping organizations require Need-Analysis from schools before taking decision to help
- Current Solutions do not provide quantifiable means of comparing school's current state and its needs

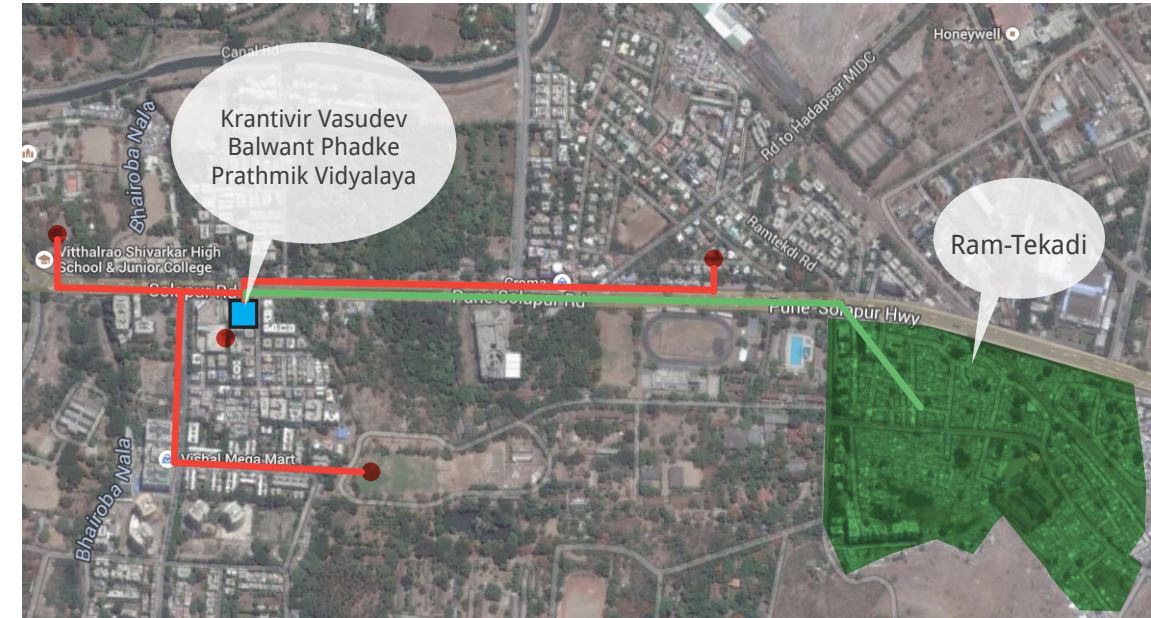


CSR for PMC Schools, Source: csrforpmcschools.org

Parent's Engagement in Student's Education

Problem Area

- Teachers claimed that students are suffering from poor parent's engagement in studies
- Lack of availability data, it is difficult to find out how much student is affected and in what aspect he needs help



Parent's Engagement in Student's Education

Problem Area

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Data Collection Experiment

- 130 Students, from Grade I- VII
- Data Points
 - Parent's Background
 - Engagement in Studies
 - Availability of Learning Material
 - Parent's Control
 - Participation in School Activities

The image shows two overlapping OMR sheets for a survey titled "विद्यार्थी माहिती पत्रक" (Student Information Sheet). The sheets contain various questions with radio button options for "हो" (Yes) and "नाही" (No). The questions are organized into sections, including personal information, school details, and parental involvement. The sheets are designed with a clean, professional layout, featuring a header with a barcode and a footer with a barcode.

OMR Sheet designed using FormReturn Software

Class Talk

Problem Area

- Class talk is necessary for child's language development (Dufresne, 1996)
- Poor class talk due to
 - Undeliberate biases in teaching style
 - Lack of students' active participation

Class Talk

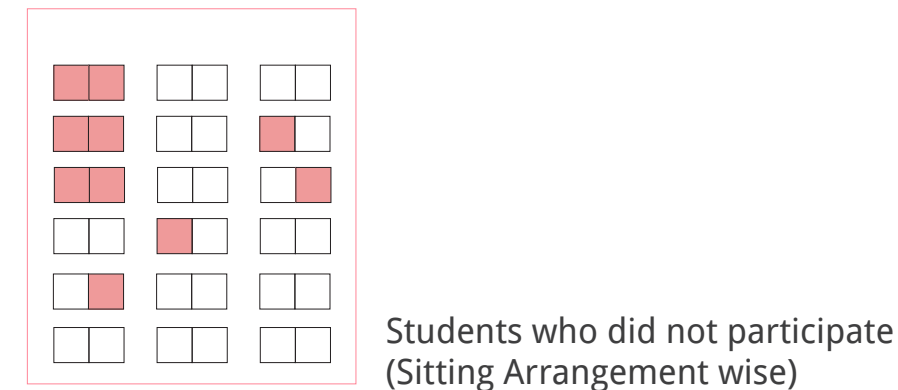
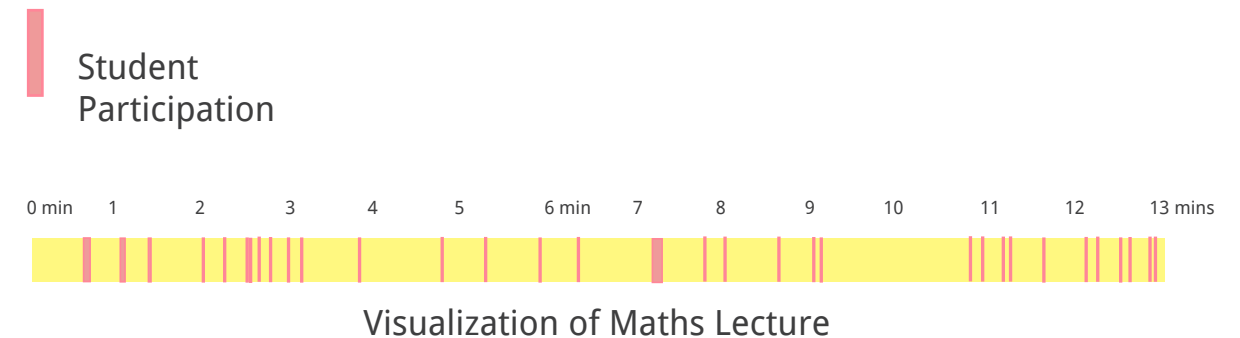
Problem Area

- Class talk is necessary for child's language development (Dufresne, 1996)
- Poor class talk due to
 - Undeliberate biases in teaching style
 - Lack of students' active participation

Data Collection Experiment

Drawbacks

- Teachers were not comfortable due to presence of data collector
- Difficult for a human being to collect data without error



Reading Ability

Problem Area

- Many students from 1st grade to 5th grade lack reading skills
- Such students are not able to understand the curriculum of their current grade
- Teacher has to spend extra time in attention to their progress

Grade-wise summary of reading test score

Grade	Reading Level 0	Reading Level 1	Reading Level 2	Reading Level 3	Reading Level 4	Reading Level 5
1st	14	1	5	1	1	-
2nd	16	-	6	-	1	-
3rd	9	-	6	7	2	1
4th	7	1	2	4	-	12

अवस्था	विद्यार्थी संख्या	मुख्यशालीन मुल्य
*	7	मुख्यशालीन मुल्य - 7
1	1	1 से 5 क्षमतालेनी कुल - 19
2	2	
3	4	
4	12	
5	-	
6	14	
7	-	
8	-	
9	-	
10	40	

Reading Abilities of 3rd grade

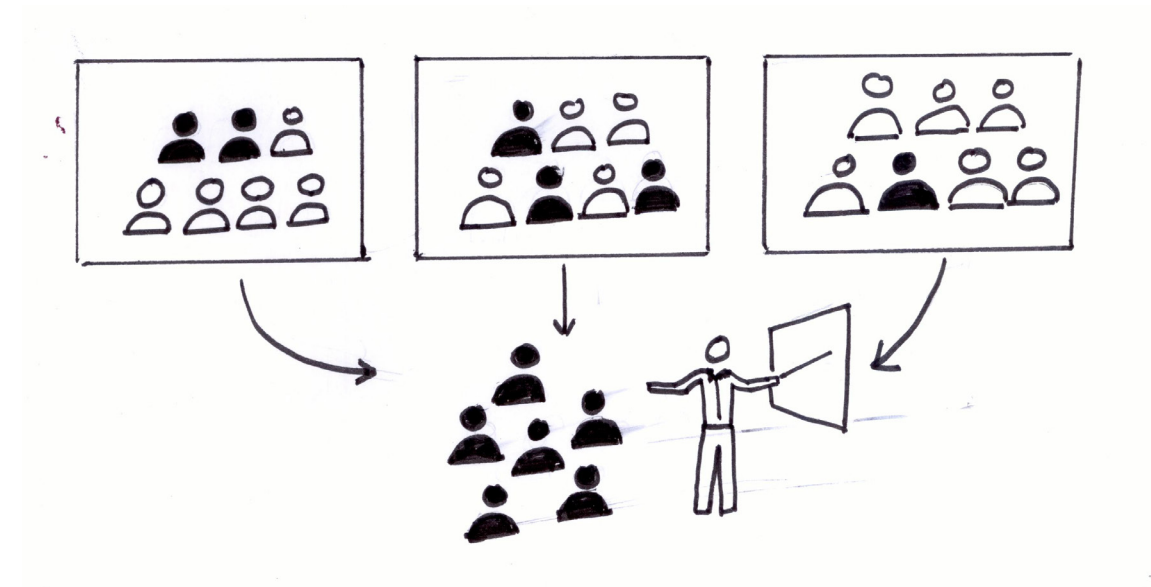
Reading Ability

Problem Area

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- Such students are not able to understand the curriculum of their current grade
- Teacher has to spend extra time in attention to their progress

Design Idea

- Students with low and similar reading ability can be grouped
- Specialised training to each group based on reading ability



Grouping of students based on reading ability

Design Brief

Primary Goals

To design ways of collecting data which can

- Tolerate unavailability of resources critical to learning analytics
- Minimize time and efforts of manual data entry

Secondary Goals

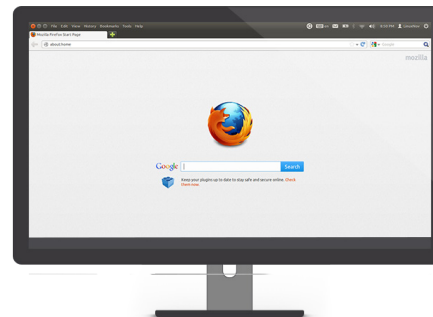
To design a learning analytics system which gives ability to school authority to

- Access and control over the all data related to their school
- Co-relate and analyse data from multiple surveys
- Express school needs to society in quantifiable way

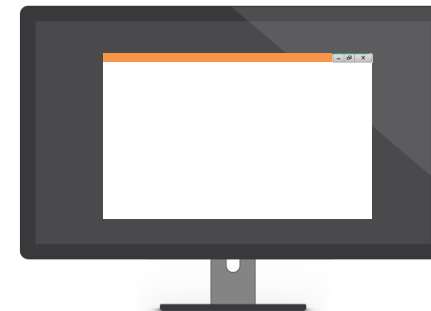
Initial Concept

Open Data Analytics Platform

- A common platform for schools, researchers and NGOs to share data and analysis
- Supports multiple methods of data collections through multiple channels
- School, Class and Student views for analysis
- Ability to compare data of multiple schools



Website



Desktop Application

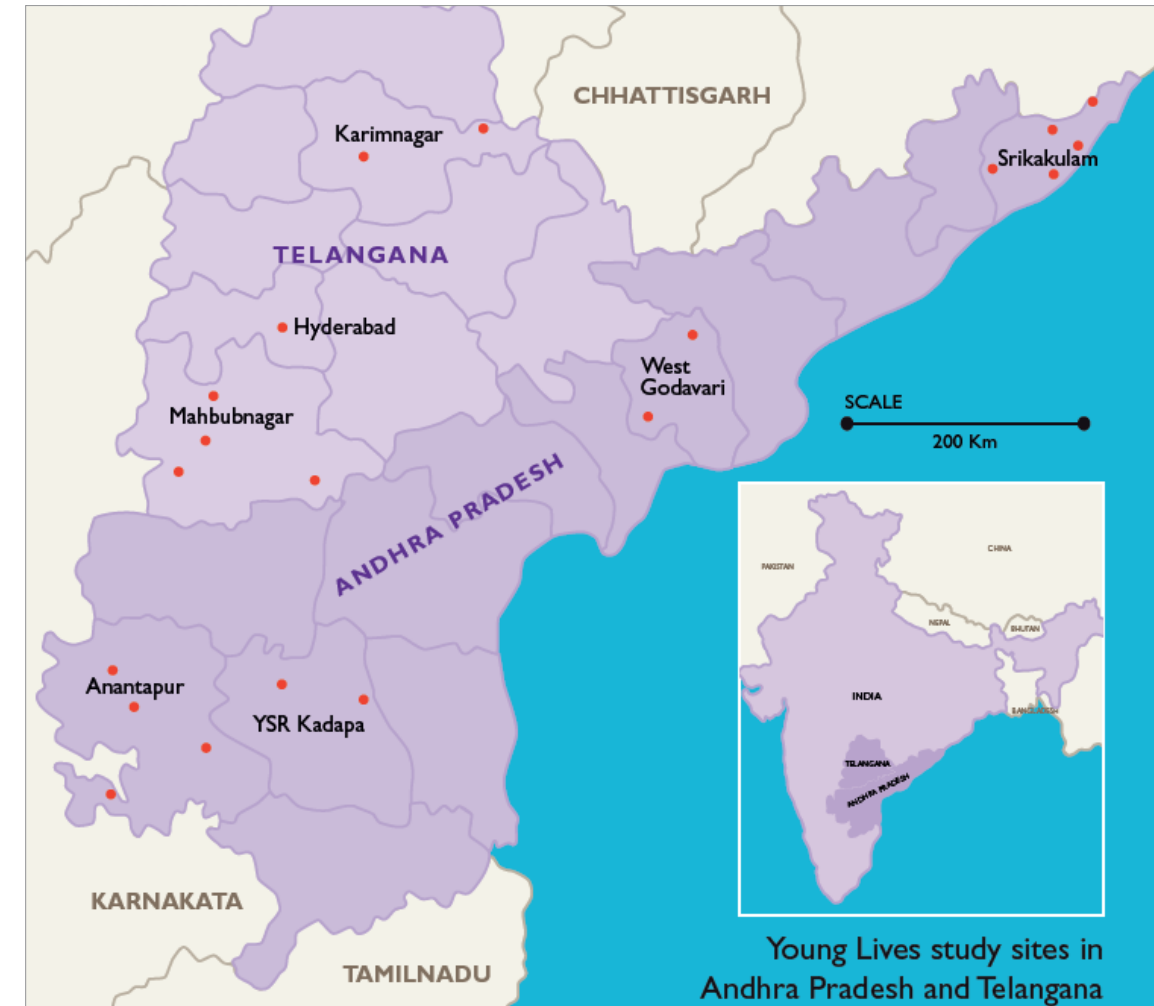
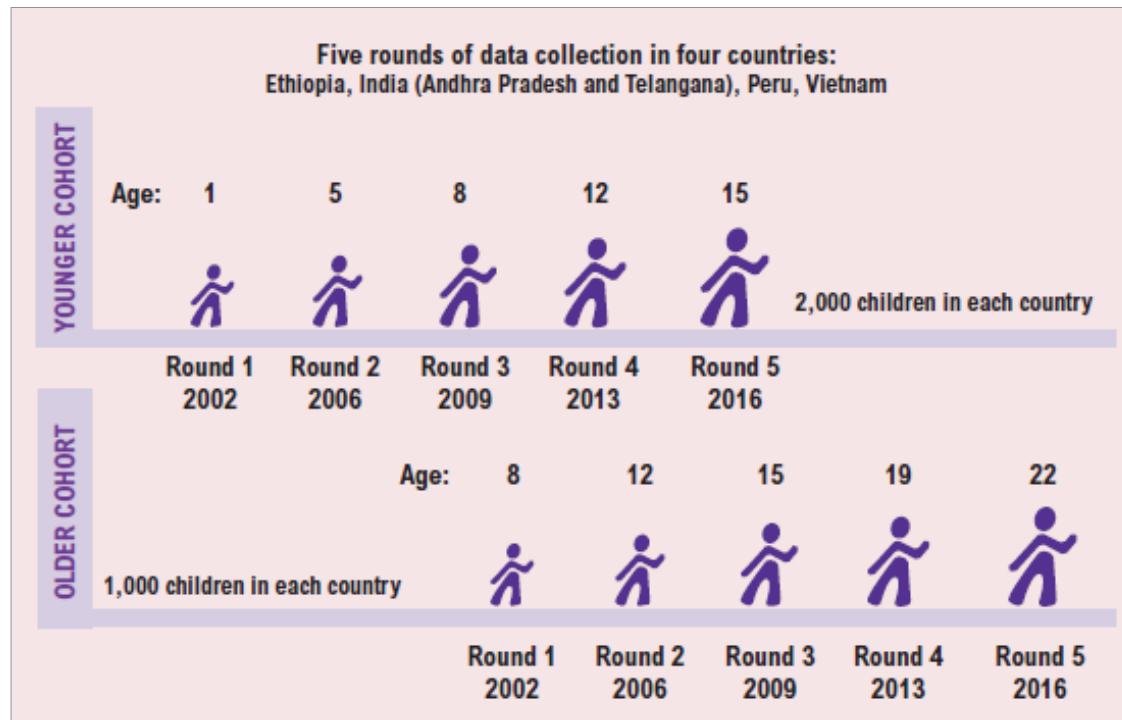


Mobile Application

Data Source

Young Lives Survey

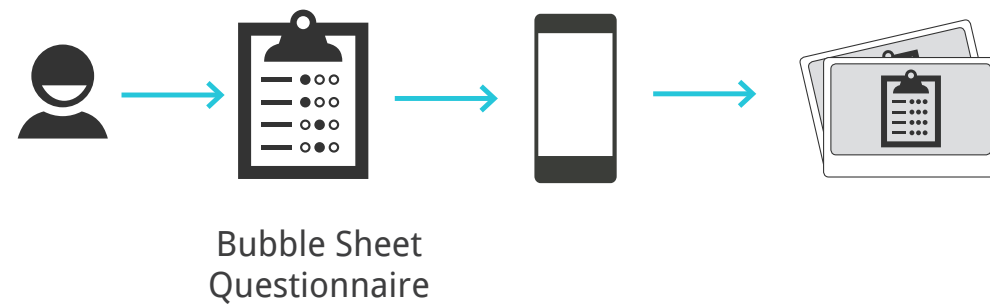
Longitudinal cohort study to explore the causes and consequences of poverty in childhood



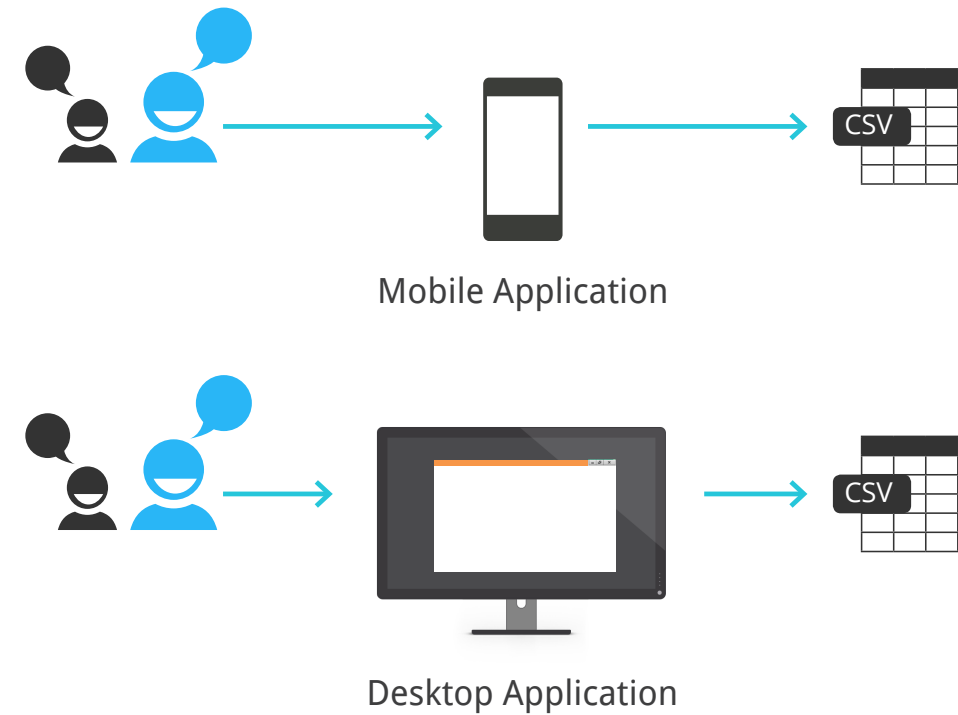
Key Features

Multiple Data Collection Methods

Printed Bubble Sheet



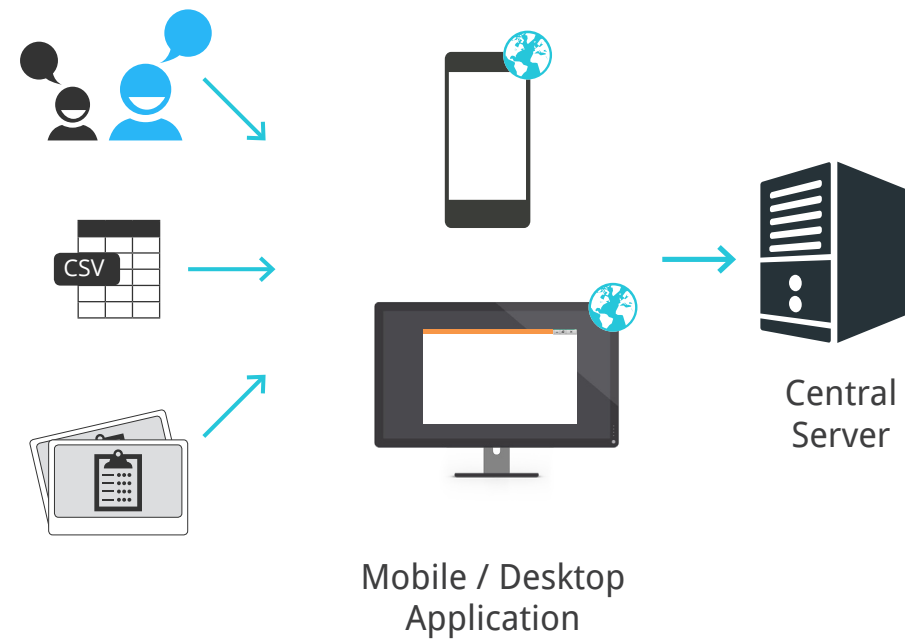
Offline Application



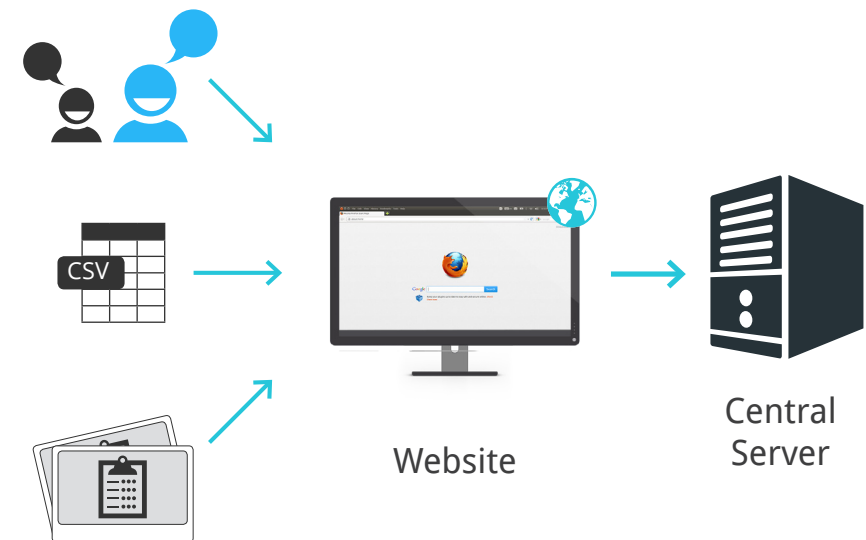
Key Features

Multiple Data Collection Methods

Online Application



Website





Parent's Engagement Survey
ID: SS524
Questionnaire No: 4

My School

Class

Other school

☒ Overall Score

Financial Help

☒ Availability of Books

Participation in Study

☒ Availability for Study

☒ Regular Help

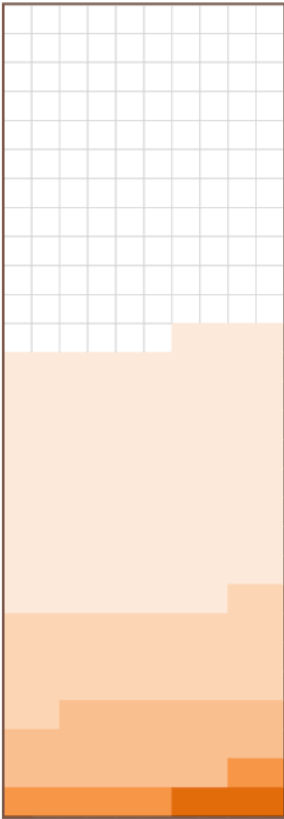
School Visits

☒ PTA Meeting

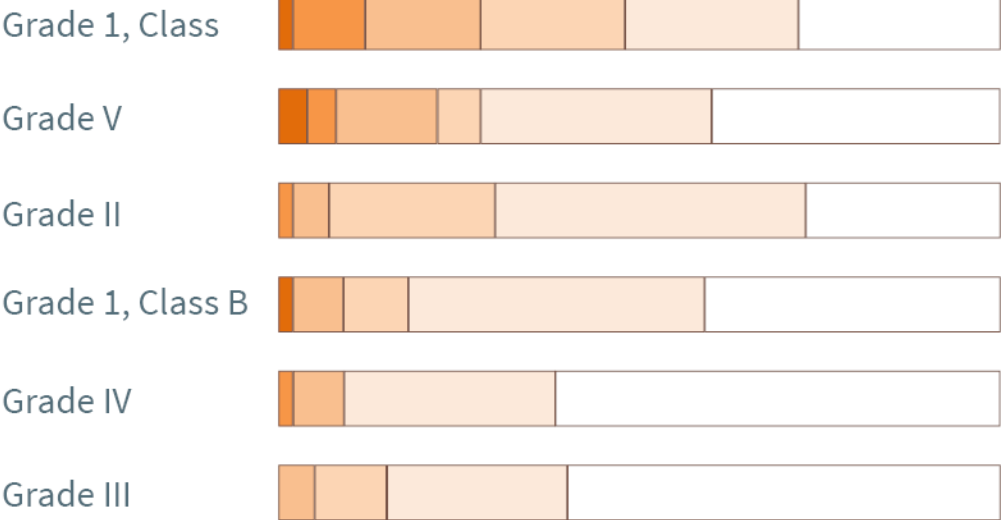
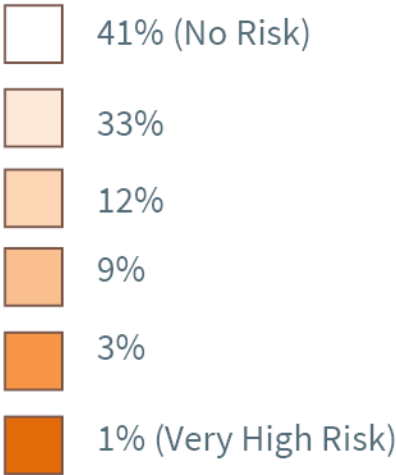
☒ Voluntary Meeting

Child's Progress

☒ Knows Grade



Total Students: 280
Your Cumulative Score: **3.95**
Avg. Cumulative Score: 3.6
Top Cumulative Score: 4.7





Parent's Engagement Survey
ID: SS524
Questionnaire No: 4

My School

Class

Other school

Grade I



Class A



Compare with Grade III

☒ Overall Score

Financial Help

☒ Availability of Books

Participation in Study

☒ Availability for Study

☒ Regular Help

School Visits

☒ PTA Meeting

☒ Voluntary Meeting

Child's Progress

☒ Knows Grade

C	C	B	A	A	A	C	B	A	A
C	C	A	A	A	A	A	A	B	B
C	A	A	A	B	B	B	A	A	A
B	B	C	C	A	C	C		C	B
B	B	B	C	C	B	B	C	B	C

	28% (No Risk)
	24%
	20%
	16%
	10%
	2% (Very High Risk)

Class Teacher: Ms. Shahane

Class Strength: 50

Your Cumulative Score: **3.38**

Avg. Cumulative Score: 3.6

Top Cumulative Score: 4.7

Add to Compare

Roll No	Name	Gender	Cumulative Score
12	Riken Patel	M	0
2	Sheelekha	F	1
43	Piyush Churad	M	1
4	Sylvan Lobo	M	1
25	Kaustubh Limaye	M	1



Parent's Engagement Survey
ID: SS524
Questionnaire No: 4

My School

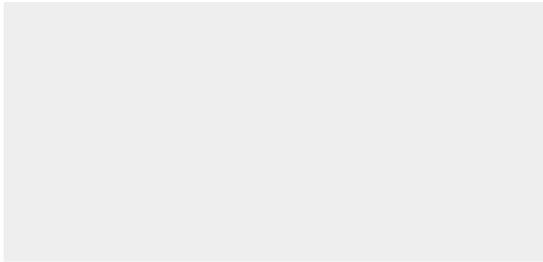
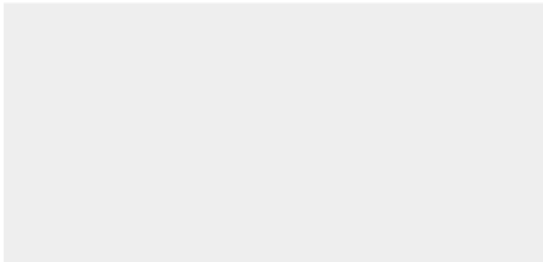
Class

Other Schools

Student

×

C	C	B	A	A	A	C	B	A	A
C	C	A	A	A	A	A	A	B	B
C	A	A	A	B	B	B	A	A	A
B	B	C	C	A	C	C	C	C	B
B	B	B	C	C	B	B	C	B	C



Riken Patel

Age 6

Gender Male

Grade I

Class A

Overall Grade

C

Overall Grade

✗ Availability of Books

Overall Grade

✗ Availability for Study

✗ Regular Help

Overall Grade

✗ PTA Meeting

✗ Voluntary Meeting

Overall Grade

✗ Knows Grade

Cumulative Score

0



Parent's Engagement Survey
ID: SS524
Questionnaire No: 4

My School

Class

Other school

Other Schools | School Comparison

● Overall Score

Financial Help

☒ Availability of Books

Participation in Study

☒ Availability for Study

☒ Regular Help

School Visits

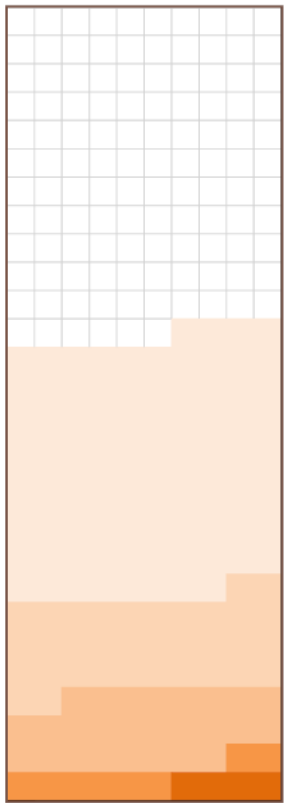
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☒ Voluntary Meeting

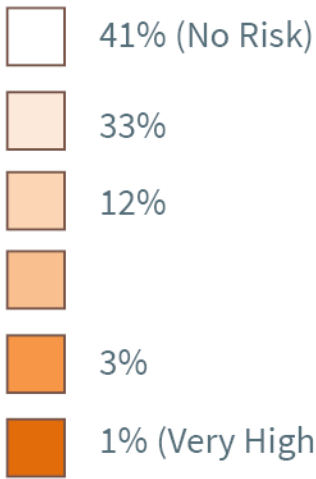
Child's Progress

☒ Knows Grade

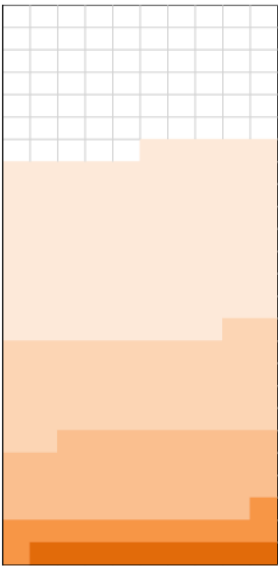
Your School



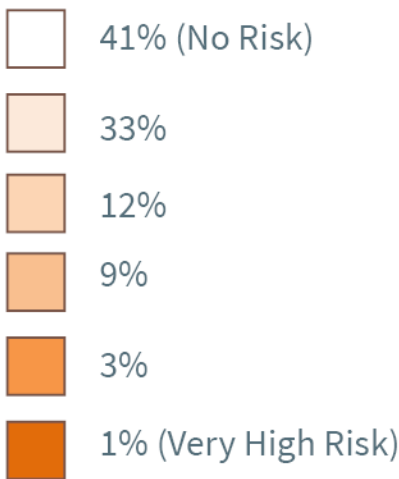
Total Students: 280
Your Cumulative Score: **3.95**
Avg. Cumulative Score: 3.6
Top Cumulative Score: 4.7



Savitribai Prathamik Vidyalaya



Total Students: 250
Your Cumulative Score: **3.5**
Avg. Cumulative Score: 3.6
Top Cumulative Score: 4.7



Survey Developement Applications



SurveyMonkey

Please fill the following form so that we can know about your skills and interests.

***Required**

Your Full Name: *

Department: *

Discipline:

Roll No: *

Room No: *

Mobile No: *

Email Id: *

(the one that you check frequently)

You are good at: *

(You can choose multiple options)

☐ Literature

☐ Dance

☐ Music - Vocal / Instrumental

Google Forms



Google Analytics

Survey Development Applications

Findings

- Data can be collected only using online devices
- Results of multiple surveys can-not be collectively analysed

Feature Repository

- Create filters from using question responses
- Leverage from the other's data without revealing identities
- Already created questionnaire templates can be used to create new questionnaire
- Ability to create customized reports

Data Collection using OMR

Advantages

- Human as well as machine readable
- Data collector is not required to be digitally literate
- Decreases Human efforts/ errors of manual data entry

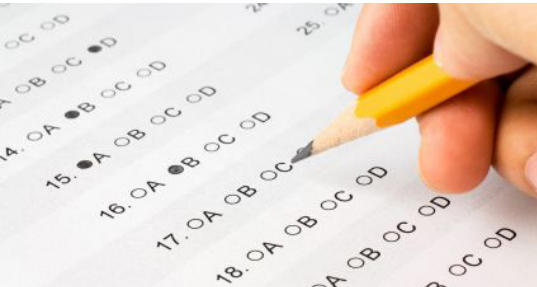
Disadvantages

- Not suitable for capturing textual/ descriptive data

The image shows two overlapping OMR sheets. The top sheet is titled 'विद्यार्थी माहिती पत्रक' (Student Information Form) and contains fields for Name, Grade, Roll No., and various demographic and academic data points. The bottom sheet is a continuation of the form, containing more detailed questions about the student's background and academic performance. Both sheets feature multiple-choice questions with bubbles for marking answers.

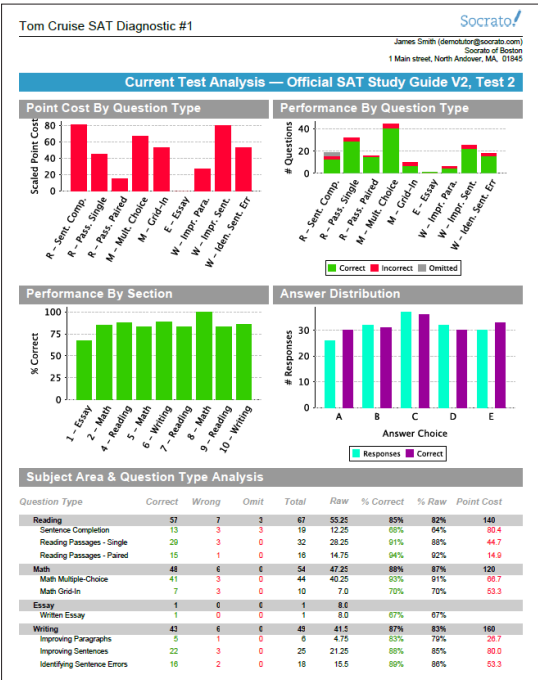
Review of OMR Softwares

Socrates



Drawbacks

User can not create bubble sheets for their own purpose



FormReturn

Stencil from top right barcode corner to bottom left barcode corner.

Select Add Segment Stencil

Segment Stencil Editor

Captured Data Fields

Field Name	Value	Error
Learning_Material_1		Error
Learning_Material_2		
Learning_Material_3		
Learning_Material_4		
Learning_Material_5		
Learning_Material_6		
Learning_Material_7		

Captured Data Values

Value
1
Y
N

Recognition Settings

Luminance 200 Mark Threshold 40 Fragment Padding 1

Segment Selection

ID: 317 Barcodes:...

Update Cancel

Double click fields to modify response.

Field Name	Value	Error
Learning_Material_1	Y	Error
Parent_Control1	Y	
Travel_1	A	
Feedback_1		
Material_2		
Feedback_2	N	
Material_3	Y	
Feedback_3	B	
Material_4	Y	
Feedback_4		
Material_5	Y	
Material_6	Y	
Material_7	N	

Drawbacks

- Tedious Error correction workflow
- Users are required to write conditional formulas for scoring

Review of OMR Softwares

FormScanner

The screenshot shows the FormScanner application window. On the left is a file explorer showing 'filled_form-1.jpg', 'filled_form-2.jpg', and 'filled_form-3.jpg'. The main area displays a questionnaire form with a grid of bubbles. The grid has 5 rows labeled 'anda: 1' through 'anda: 5' and 4 columns labeled 'A', 'B', 'C', and 'D'. The bubbles are filled with red or black ink. A 'Results' window on the right shows a table of responses.

Question	Response
Question 01	Response 01
Question 02	Response 03
Question 03	Response 02
Question 04	Response 03
Question 05	

Drawbacks

- User is asked to create questionnaire in powerpoint/ excel

SDAPS

The screenshot shows the SDAPS application window. The top bar includes 'File', 'View', and 'Help' menus, along with a page indicator '23 of 394' and 'Page 2'. The main area displays a questionnaire form with multiple choice questions. The questions are numbered 3.6, 3.7, 4, and 4.1. The responses are marked with blue ink.

3.6 Wie fandest Du die Übungsaufgaben?
sehr schlecht ☐ ☐ ☒ ☐ ☐ sehr gut

3.7 Wie bewertest du den Umfang des Termins?
zu wenig ☐ ☒ ☐ ☐ ☐ zu viel

4. Dozent von diesem Termin

4.1 Bewerte bitte die folgenden Kriterien.

Kriterium	unmotiviert	motiviert
Motivation	☐	☒
Kompetenz	☐	☒
Erklärungen	☐	☒
Gesamtbewertung des Vortrags	☐	☒

Drawbacks

- Command Line interface for creating surveys
- User should have prior knowledge about Latex

Review of OMR Softwares

Missed Workflows

- Creation of OMR sheets
- Preview and Testing
- Error Correction. Generally, following type of errors are faced
 - Barcode not detect
 - Answer not detected
 - Section bar code not detected

Proposed Workflow

	Create	Test	Conduct	Submit	Export	Analyse	Upload	View	Download
 Survey Administrator	• Create Survey • Questionnaire Design • Selecting Channels • Creating School & User Profiles • Define Sample Sizes	• Pilot Data Collection	• Check Data Collection Status • Collect Data	• Upload Pictures of Paper based Questionnaires • Check Data Collection Status (School / Grade wise) • Error Count • Correct error manually	• Export Data to suitable format	• Analyse Data • Create Visualization / Report • Form custom groups	• Upload Visualization / Report • Static • PDF • DOC • JPEG • Interactive • Online • Standalone Application	• Filter Responses • Compare • Schools • Classes	• Download • Print • Receive via Email
 School Administrator			• Check Data Collection Status	• Check Data Collection Status		• Analyse Data • Create Visualization / Report • Form custom groups		• Filter Responses • Compare • Schools • Classes	• Download • Print • Receive via Email
 Data Collector			• Check Data Collection Status • Collect Data	• Upload Pictures of Paper based Questionnaires • Check Data Collection Status (School / Grade wise)				• Filter Responses • Compare • Schools • Classes	• Download • Print • Receive via Email
 Visitor	• Register/ Create Login				• Export Data to suitable format	• Analyse Data • Create Visualization / Report	• Upload Visualization / Report	• Filter Responses • Compare • Schools	• Download • Print • Receive via Email

Final Concept



Open School Learning Analytics



Evaluation

2 Heuristic Evaluation Sessions

- 4 Interaction Designers (3 M.Des, 1 Ph.D Student)
- Each session lasted around 1hr 30 min

User Testing

- 4 Users (1 Male, 3 Female)
- 1 Headmaster, 1 Teacher, 2 DIET members

Tasks for Evaluation

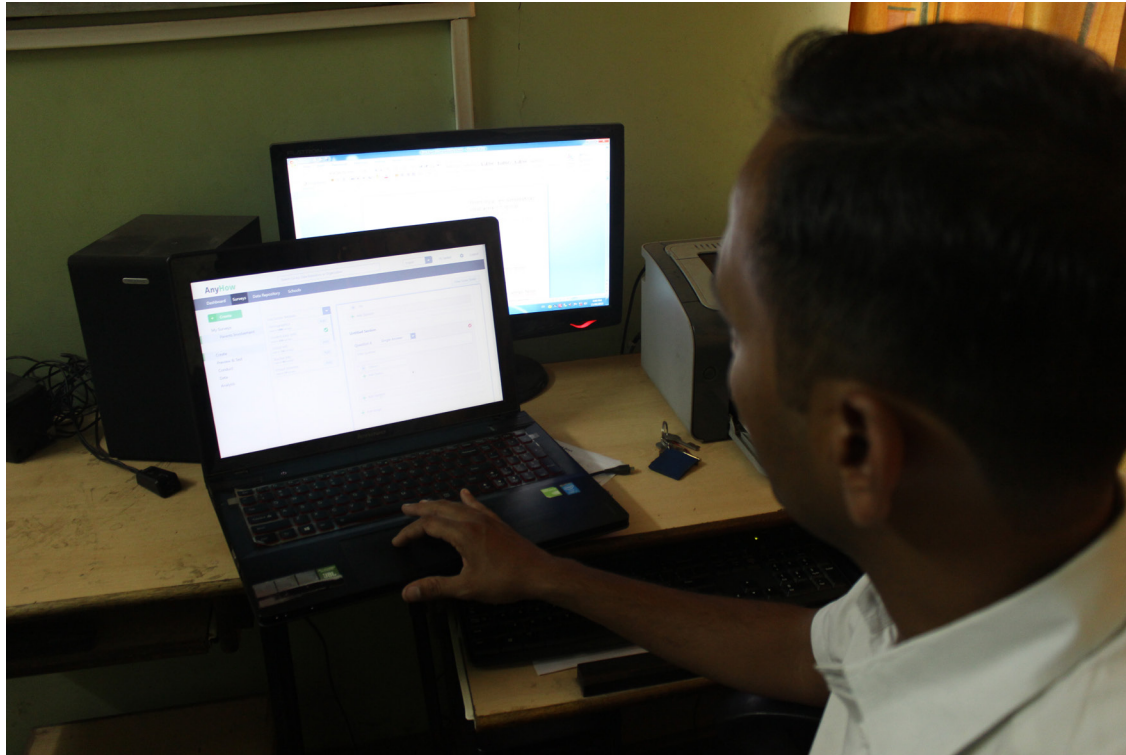
Mobile Application

- To capture OMR Responses
- To correct errors found in the response
- To conduct Survey

Website

- To create OMR Questionnaire
- To download / Optimise OMR Sheet
- To utilize multiple surveys using question Cart
- To form custom group using filtering options

Evaluation



Evaluation

Positive Feedback

Found very easy for data collection

As compared OMR softwares found OSLA easy due to

- less efforts of creating questionnaire from scratch and layouting
- relatively simple user-interface

Liked the fact that as data is related to students,
longitudinal growth of students can be tracked

Users suggested that even **health and sports related data** can be collected

Easy for report creation

Evaluation

Feedback for OMR related tasks

Easy to Difficult

(based on number of attempts)

- 1. To capturing OMR Responses by taking Photographs** (easiest)
- 2. To conduct Survey on Mobile**
 - Some users thought that they have to use OMR sheets for capturing responses
- 3. To correct error**
 - Needed guidance while doing task for first time. All of them were successful in second attempt.
 - Users were not clear that how software is capturing images of error.

Evaluation Results

Common Concerns

- **How to authenticate** identity of survey participants
- UI for Analysis is too much cluttered
- Privacy Concerns : Parents/ Students should get **option to access, inspect and delete data** about them.
- User should be able to get **help** anytime. It can be provided using embedded tutorials, tooltips, FAQs.
- **Make labels more actionable.** E.g. "Search Survey Templates" to "Add Questions using Templates."

Directions for Future Work

- To research issues related to **use of “English” language** for interface
- To implement website

Learnings

- Detailed understanding of Learning Analytics Domain
- First project related to school environment
- Understanding of Resource Constrained Environment as context
- Exposure to basics of Information Visualization Techniques

Thank You !!!