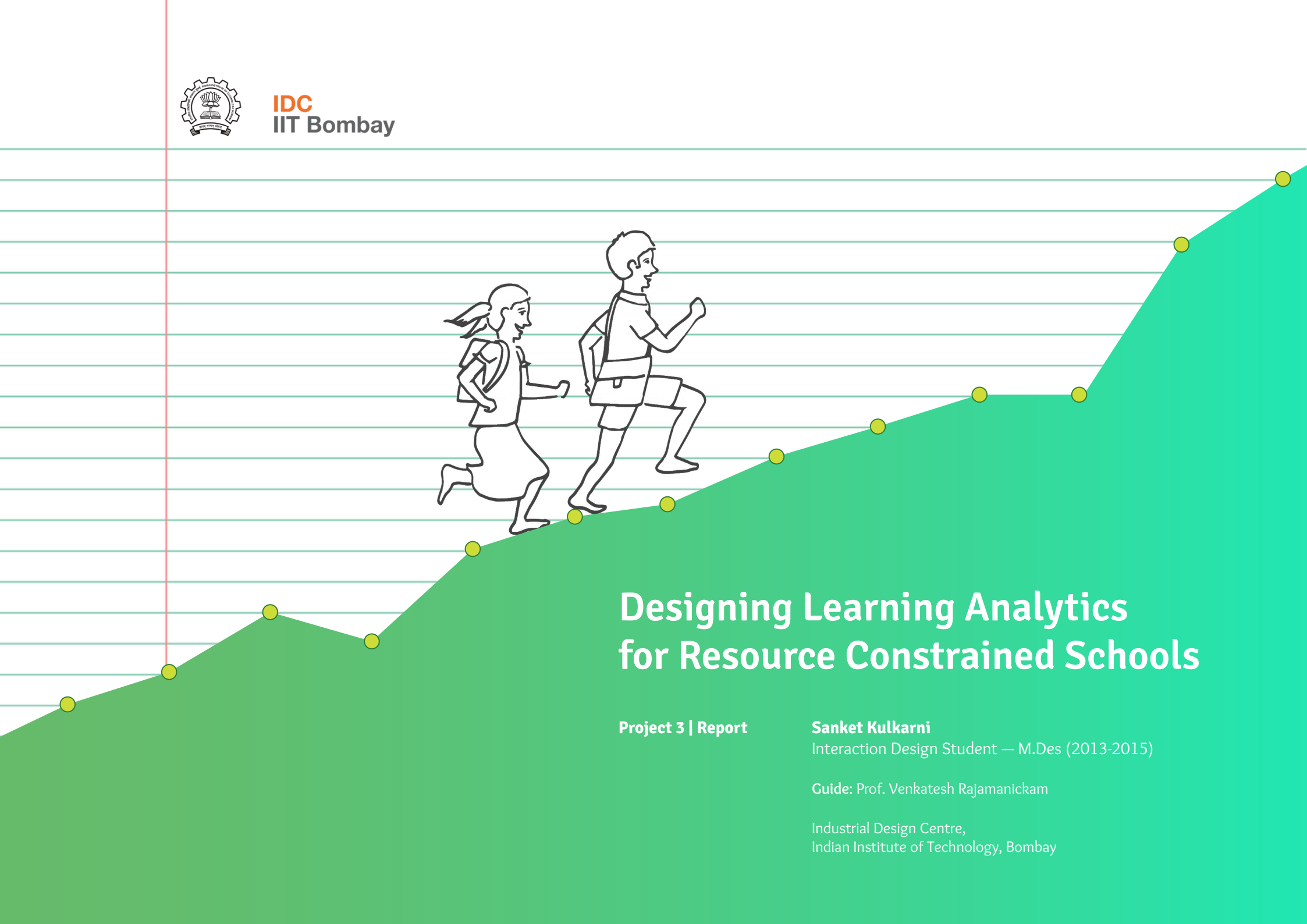

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Designing Learning Analytics for Resource Constrained Schools

Project 3 | Report

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Declaration

I declare that this written document represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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June 10, 2015

Approval Sheet

The project titled '**Designing Learning Analytics for Resource Constrained Schools**' by Sanket Kulkarni, is approved for partial fulfilment of the requirement for the degree of 'Master of Design' in Interaction Design.

Guide 

Chairperson 

Internal Examiner 

External Examiner 

Date 9/07/2015

Acknowledgments

I would like to thank Prof. Venkatesh Rajamanickam for his guidance and support throughout the tenure of the project.

Thanks to Prof. Anirudha Joshi, Prof. Girish Dalvi and Prof. Ravi Poovaiah for their valuable inputs during the course of the project.

Thanks to Bhushan Nalage sir and other teachers from Krantivir Vasudev Balawant Phadke Prathamik Vidyalaya, Pune for helping me in the primary research of this project.

Thanks to Samidha Shinde madam from Identity Foundation, Pune for sharing the reading ability data.

Thanks to all class-mates for criticising and motivating me regularly.

Most importantly, I would like to thank my parents, my motivation, for supporting me without any expectations.

Sanket

Abstract

Learning Analytics (LA) focuses on thorough analysis of learner and tutor data to provide meaningful insights. The applications of LA has shown significant improvements in online learning environments. For utilizing intensive data analysis methods of LA, the availability of data in digital form is necessary. Hence, computing devices and internet become an inherent prerequisite for learning analytics.

Many elementary schools in India do not have enough resources to support basic learning environment. More than 50% schools do not have enough teachers for teaching to all students (Aser 2014). Only 19.6% of schools have computer available for students (Aser 2014). Due to unavailability of computing resources and manpower, state-of-the-art applications of LA have failed to penetrate in such context. It then becomes a challenge to design a solution that can work in deprived schools for the benefit of students and teachers.

To deal with this problem, we propose an open data analytics platform which can be used by schools, researchers and NGOs for conducting surveys, sharing data and analysing it. The platform provides multiple ways of offline and online data collection which can tolerate unavailability of specific computing device and internet. Additionally, platform allows school stakeholders like headmaster to co-relate data of multiple surveys and draw collective insights.

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Introduction

Learning Analytics

Learning Analytics (LA) specializes in analysing educational data for the benefit of learner and tutor. LA has evolved from various fields like Academic Analytics (AA) and Educational Data Mining (EDM). The research in this area has shown promising results in the last decade, thereby making it more popular (Fig. 1). Use of LA in online learning environments like MOOC and internal university portals is now widespread (Harmelen and David Workman, 2012).

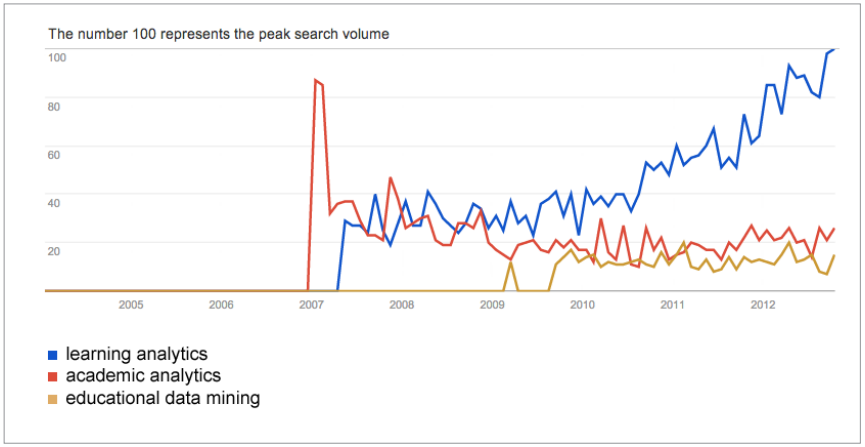


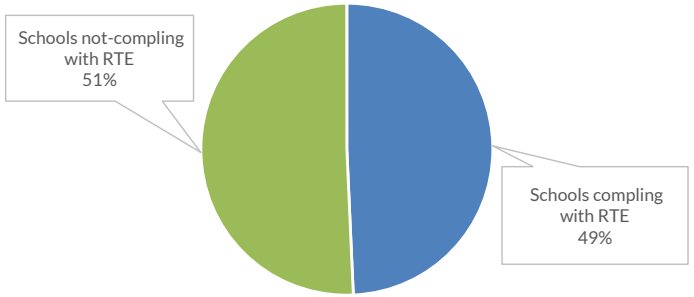
Figure 1: Relative levels of interest for the terms learning analytics, academic analytics, and educational data mining as revealed by Google trends (Harmelen and David Workman, 2012)

Resource Constrained Schools

Resource constrained schools are those schools who are lacking teaching and learning resources like teachers, libraries, computers and other supportive teaching-learning material.

In India, 65% children (age 6 -14) are enrolled in government schools (ASER 2014). Due to poor pupil-teacher ratio (Fig. 2), teachers are not able to give personal attention to students and cannot keep track of student's progress efficiently. Students from these schools fail to exhibit even basic reading and arithmetic abilities because of poor learning environment. Due to lack of funding and delay in the implementation of government schemes, most of these schools do not have necessary resources for student's learning.

Figure 2: Pupil - Teacher ration in Indian Schools (ASER 2014)



Introduction

Problem Area

The contemporary state-of-the-art LA applications like Course Signals, GISMO and SNAPP (reviewed in next section) rely on availability of data in digital format. However, most of the data in resource constrained schools is recorded on physical mediums like papers. Moreover, these schools are deprived of computing devices and digitally literate manpower (ASER 2014, Fig. 3). Consequently, the applications of LA have not successfully penetrated in such resource- constrained learning environments. There is a need to overcome the challenges and come up with different ways in which learning analytics can be applied in such schools.

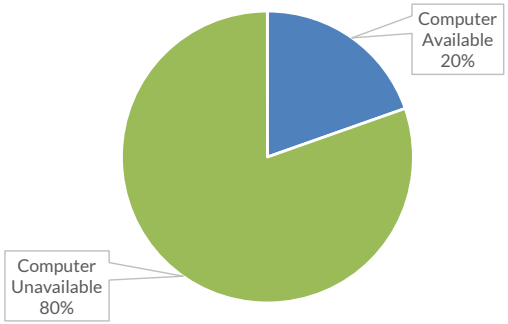


Figure 3: Availability of Computers in Schools (ASER 2014)

The initial objective of project was to explore opportunities that learning analytics can have in the context of resource constrained schools in India. Considering the tenure of the project, we focused our study only on elementary government schools. The findings from primary and secondary research helped us in realising the need gap in current data collection practices. Finally, the revised primary aim of the project is to design new data collection methods that can tolerate unavailability of digital devices and digitally literate man-power. The secondary aim is to design a generic workflow for implementing learning analytics in elementary schools.

Before proceeding further, first it is necessary to understand about learning analytics in detail. In the next section, we present findings from our literature survey about the same.

Understanding Learning Analytics

Introduction to Learning Analytics

Technology Enhanced Learning (TEL) is a well-established and deeply researched area. It means the use of ICT tools and techniques for improving learning environments. Learning Analytics, a lately emerged field, is subset of TEL. Learning Analytics is defined as follows:

> *"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".*
>
> - 1st International Conference on Learning Analytics and Knowledge 2011

Learning Analytics helps stakeholders of educational institute to critically analyse and evaluate success of learning environment. Learning Analytics derives its methods from diverse range of fields to provide meaningful actionable insights which can not be directly seen by human eyes. The predictive feedback provided by LA tools helps in recognizing risks sooner and gives more time to intervene.

Introduction to Learning Analytics

The need of learning analytics as a separate field has evolved from various fields like educational data mining, academic analytics, action research, recommender systems and personalized learning environments (PLEs) (Chatti et al 2012). Hence, researchers and organizations working in these domains have defined Learning Analytics with different perspectives. Some of the most influential definitions are mentioned below:

"Learning Analytics is the use of data and models to predict student progress and performance, and the ability to act on that information".

- Educause

"Learning Analytics refers to the interpretation of a wide range of data produced by and gathered on behalf of students in order to assess academic progress, predict future performance, and spot potential issues".

- Johnson et al. (2011)

Figure 4: Influences of Learning Analytics, (Chatti et al 2012)

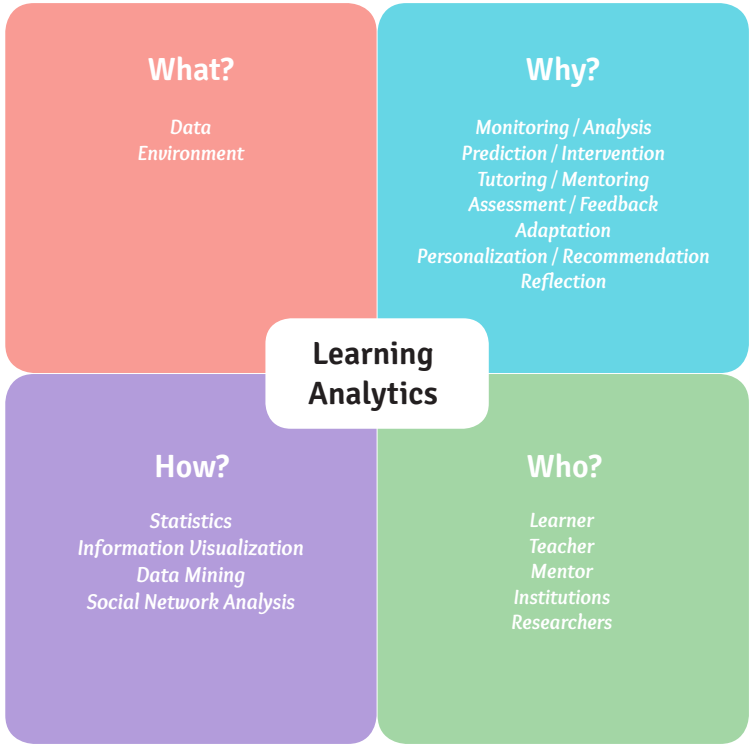
Reference Model of LA

Chatti et al (2012) showcase a reference model for learning analytics which summarises different factors which should be considered while designing a learning analytics system. They have categorised the factors based on fundamental questions like “what is being measured?”, “for whom?”, “why is it being measured?” and “how it is being measured?”.

Data and Environment (What?)

As LA is dependent on the quantitative data gathered about learning activities, it is important to understand from which source data is coming and how it is collected. The channels of data collection of source can be formal and informal. In LA, we gather data from multiple data sources so as to give complete picture of learner’s discrete activities. It is most likely that collected data from different channels is heterogeneous and is not directly compatible with each other for analysis. Hence, LA requires data cleaning and processing mechanisms which convert data into homogenous format.

Figure 5: Reference Model of LA (Chatti et al, 2012)



Stakeholders (Who?)

Generally LA system has stakeholders like learner, tutor, administrator, fund raisers, institution, etc. Different stakeholder have different expectations from the LA system. E.g. a learner might be interested in checking improvements in her class performance. On the other hand, a fund raiser might be interested in predicting how many students are about to drop out from the institution. Hence, while designing LA system, designer must consider who is going to benefit from the system.

Objectives (Why?)

In the reference model for LA, Chatti et al(2012) classifies objectives of LA into seven categories.

Monitoring and analysis

It involves tracking and evaluate learner's progress and activities to take informed decisions.

Prediction and intervention

Applications of LA under this objective include predicting future outcomes of learner based on his/her current and past activities. It allows to identify learners under risk and allow teacher to intervene and take proactive measures.

Tutoring and Mentoring

In tutoring, LA allows tutor to enhance teaching process in the context of specific course. On the other hand, use of LA in mentoring is focused on helping learner to improve overall life-long learning process.

Assessment and feedback

The objective of LA is used to provide actionable feedback to learner and tutor too improve learning process.

Adaptation

The goal of LA is to suggest learner/ tutor about next teaching and learning activities adaptively.

Personalization and recommendation

The goal of LA is to let learners personalize learning process depending upon their capacity and current learning state. The recommendation system at this stage suggests learner different ways in which she can reach he learning goals.

Reflection

Insights provided by LA can allow tutors and learners to scrutinize their own teaching or learning experiences so as to improve in the future.

Techniques (How?)

LA derives its methods and techniques of analysing data from different fields like statistics, information visualization, social network analysis, data mining, etc. The purpose or objective of LA decides which method to use.

Statistics

Statistical methods are generally used to understand basic interactions of learner with the learning environment e.g. average or mean or standard deviation of learner's performance, frequency and distribution of learner's activities over the period of time.

Information Visualization

Information Visualization methods are used to make the analysed data more understandable, usable and actionable for the stakeholders.

Social Network Analysis (SNA)

SNA methods are used to visualize important connections and linkages between different objects. The linkages can be derived from different metrics. SNA helps in unearthing hidden connection among objects and thereby identifying central or important objects as well as connections.

Data Mining

It is generally used for predicting unknown learner metrics or indicators. Data mining offers methods like classification, clustering and association rule prediction.

- **Classification**: used to predict class of unknown object metric by analysing class names of others
- **Clustering**: used to group objects using the similarities and dissimilarities they have.
- **Association rule prediction**: used to find interesting associations and co-relations between different metrics of different objects.

State-of-the-art Applications of LA

Signals

Signals is a learning analytics project developed by Purdue University. As its name suggests, Signals is inspired by the metaphor of traffic signal. It predicts students who may not perform well in the course by using factors like course performance till now, time on task and past performance. Professor/ teacher needs to initiate the analysis. The students under risk receive messages from their professors for tips and encouragement through Signals. Signals user interface is provided through mobile application and website.

Figure 6: Signal Mobile and Web Platform, Source: purdue.edu

SNAPP

SNAPP means Social Networking Adapting Pedagogical Practice. As its name suggests SNAPP analyses conversations and discussion threads in order to determine involvement of different members of group. Different aspects of social networking analysis can help in unearthing hidden problems like learner isolation, biases in facilitator's engagement with learners and non-interacting groups.

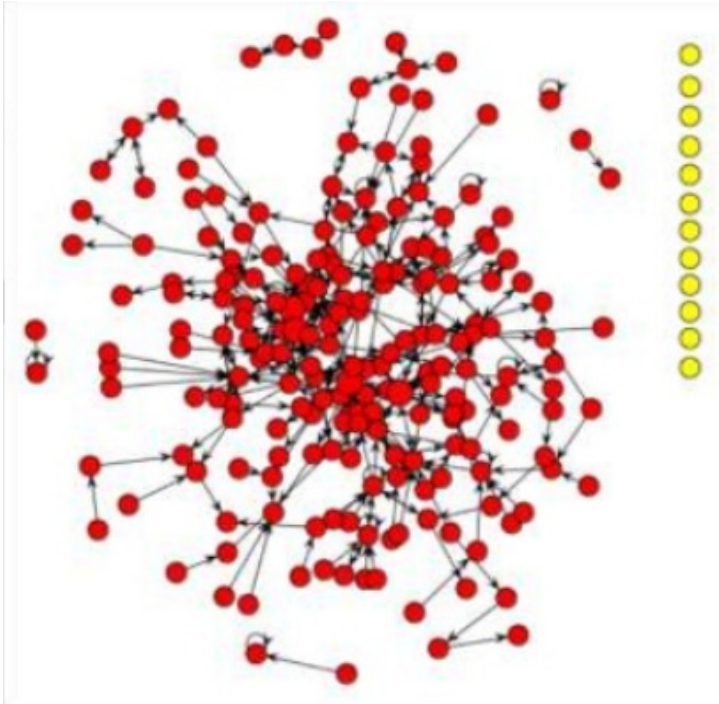


Figure 7: Learner Isolation, Source: snappvis.org

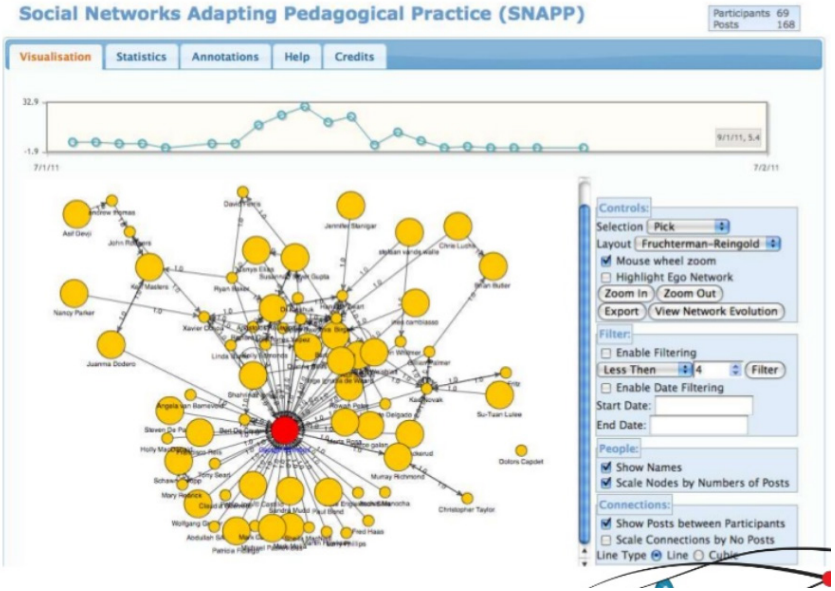


Figure 8: SNAPP User Interface, Source: snappvis.org

To illustrate, by looking at two different discussion threads, it is impossible for a human to imagine the involved interaction. However, when interactions are mapped onto a directed graph, the visualization clearly shows individual interactions. Hence, it becomes possible to point out students who are isolated and have less or no interaction with other members.

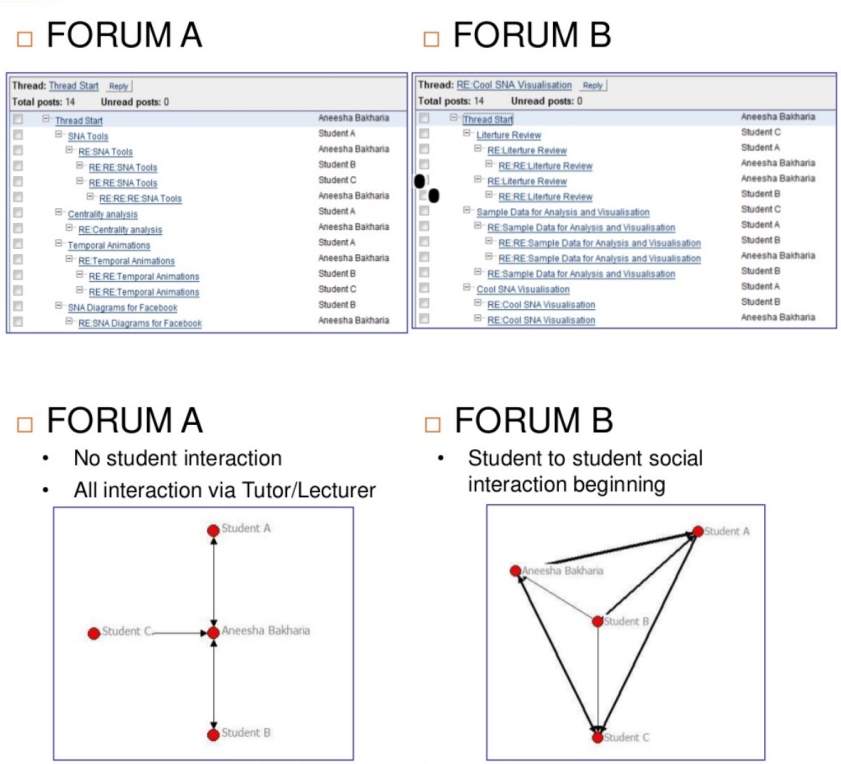


Figure 9 & 10: Analysis of discussion forum using SNAPP, Source: snappvis.org

Directed graph can also reveal the biases in the facilitator's engagement with students. This can give actionable insights to facilitator in order maintain equal interaction with all students.

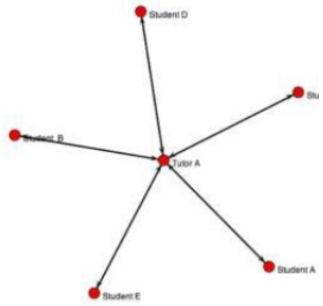


Figure 11: Biases in the Facilitator's engagement with learners, Source: snappvis.org

Additionally, social network graphs can expose non interacting group of students. This gives meaningful insights to facilitator for improving interaction and collaboration among students.

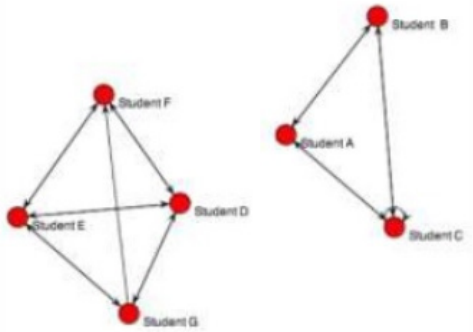


Figure 12: Non interacting groups, Source: snappvis.org

GISMO

GISMO is an add-on visualization library for Moodle, a Course Management System (CMS). GISMO visualizes the logged data like student's visits to CMS, student's use of resources and submission of assignments in order to reveal meaningful insights to facilitator. GISMO provides insights at three levels that are course, student and resourced in static as well as longitudinal way.

Figure 13: Use of Resources by Students, Source: gismo.sourceforge.net

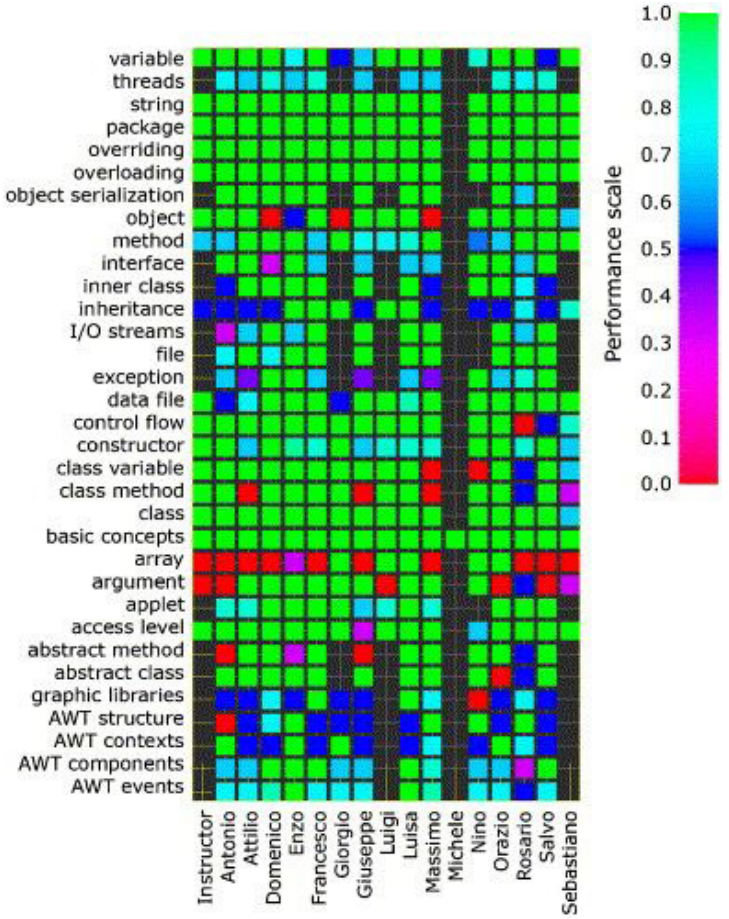


Figure 14: Conceptual understanding of student of Computer Science course, Source: gismo.sourceforge.net

Learnings

Most of the current LA tools like Signals, SNAPP and GISMO are built on top of already existing digital system. Signals extends present university portal. SNAPP utilizes existing email clients and online discussion forums. GISMO is built on top of online learning management system, Moodle.

Data is readily available in digital format for these tools. Additionally, all of these tools assume availability of digital devices and internet connectivity. Just to give example, Signals uses course performance and past performance data. This data is captured using online tests which happen on university portals. Indirectly, Signals requires students and universities to have computers, mobile phones and internet to access system. Similarly, SNAPP and GISMO are also directly dependent on availability of computing and digital resources. Subsequently, these applications also assume the user of LA system to have the experience of using computers. In other words they expect user to be digitally literate.

To sum up, availability of computing devices, internet connectivity and digitally literate manpower become critical resources to implement Learning Analytics system.

In terms of learning analytics, by word "resource constrained" we mean that unavailability of digitally literate man-power, computer resources and internet connectivity.

Concerns with LA

Change in the role Teacher

Due to LA, the role of tutor will change to a mere data collector. It must be noted that machine intelligence can never take role of teacher. Hence, human intervention is always needed

Permanent Record

Data collected about learner will be stored permanently and hence, it will get attached to his profile for life-time. Hence, failures of learner will also be permanently attached to his profile. Even if learner wants to improve and change his image in the society, the permanent record will not allow the same.

Privacy and Data Breach

There lies many ethical concerns with who will use the learner's public and private data. There are chances that learner's data will be used for marketing purpose without his/her consent.

Dependency on Materialistic Performance Indicators

One's success in the learning will be evaluated by short-term materialistic parameters. Deep learning skills like learning to learn will not have any value in education system.

User Study Summary

Method of Conduct

The user study was conducted in two phases. The initial phase of user studies was focused-

- To understand the problems faced by teachers and students in resource constrained schools
- To understand what kind of data exists in schools and how it is captured and utilised

Total number of interviewed users: 5

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

Interviews were conducted using contextual inquiry method.

The second phase of user studies involved shadowing sessions in classroom for 4 days to manually collect data related to learners and teachers. Focus of the study was

- To study the school, classroom environment to look for potential opportunities where learning analytics solution can intervene.
- To observe teacher-learner interactions for capturing data related to classroom talk.
- To check the validity of proposed metrics and to collect the data for the same.

School Visited for Studying

School Address	Gov./Private	Type	Medium of Teaching
Municipality School, Kannamwar Nagar I, Vikhroli West, Mumbai, Maharashtra	Government	Primary	Marathi
Savitribai Phule Vidyalaya, Bhavani Peth, Pune	Private	Primary	English
Krantivir Balawant Phadke Vidyalay, Fatima Nagar, Pune *(selected for second phase)*	Government	Primary	Marathi

School Profile

Krantivir Balawant Phadke Vidyalaya, Pune

It is a municipality school, established in 1957. It is a primary school and hosts classes from 1st standard till 7th standard (1 class each).

Total Number of Students: 251
Number of Teachers: 6 Teachers
School does not have headmaster appointed. School does not have any teacher for Drawing. A government provided drawing teacher visits school once a week.

Needs 8 Teachers + 1 Headmaster
No Reading Room
No Computer

About Students

Most of the students from these school come from low income background. Parents of these such students are doing blue collar jobs like housemaid, municipality worker, painter, etc. Most of the students reside in the Ramtekadi slum area which is situated 1.7 km away from the school. Most of the students travel to school by public transport like city bus service or shared auto-rickshaws.

Data Collection Practices

School related Findings

- Most of the data, collected at school level, is recorded in physical format in registers or notebooks.
- Type of recorded data based on its frequecy of repetition

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

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

Quarterly
- Unit Test Marks

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

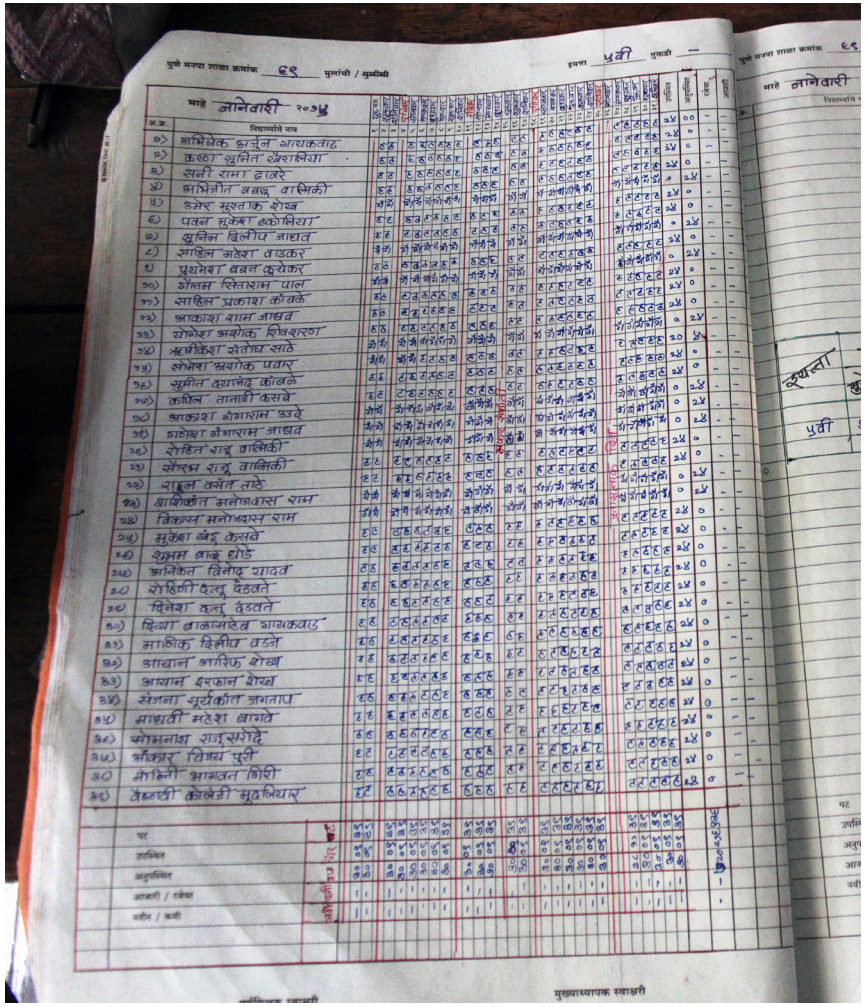


Figure 15: Daily Attendance Sheet

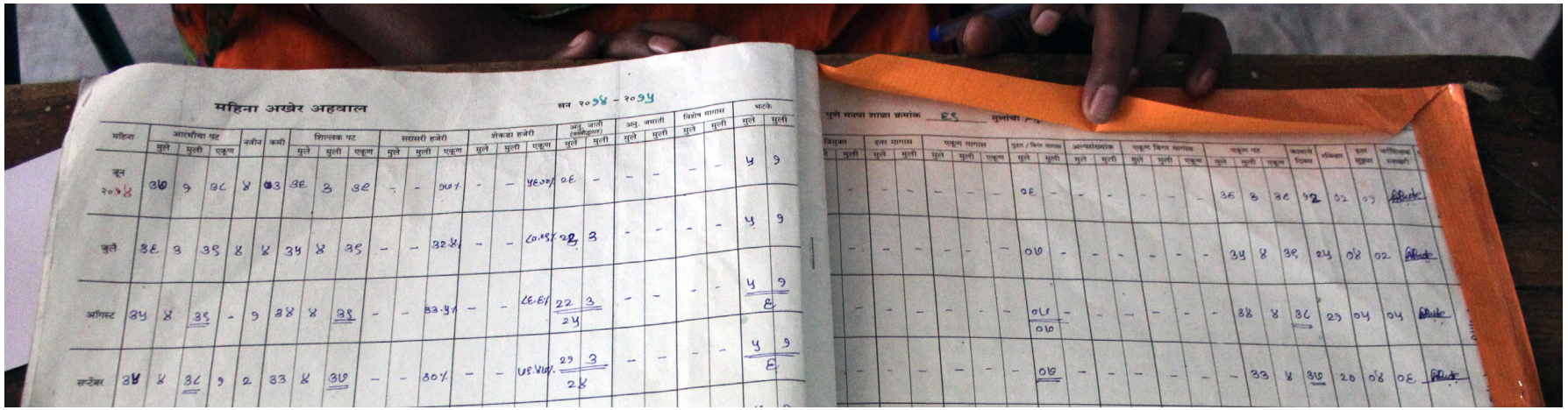
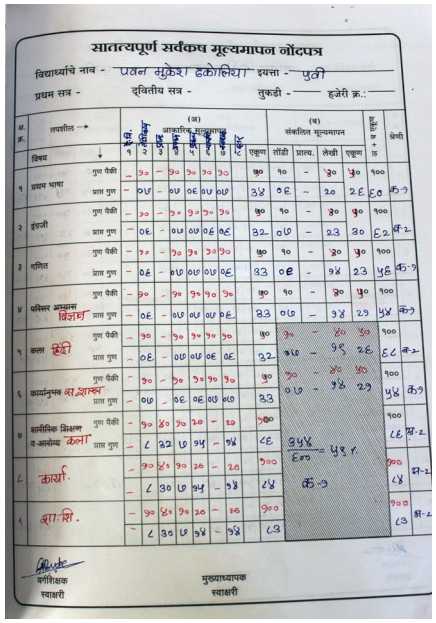


Figure 16: Monthly Report maintained at the back of Attendance booklet



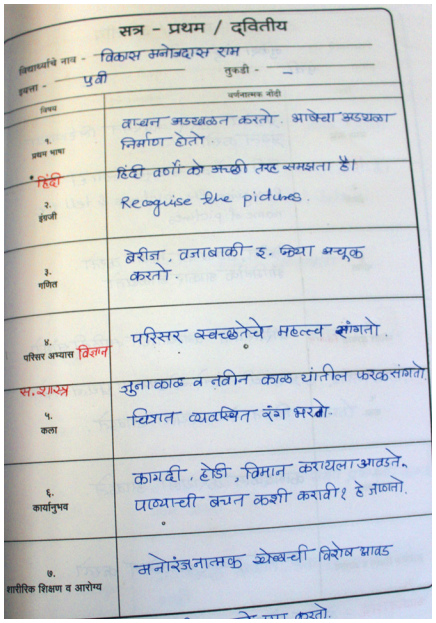


Figure 17 & 18: Student's semester marks and remarks maintained in Student Progress Booklet

Figure 19: Semesterly grade-wise summary

NGO related Findings

- Unlike schools, NGOs have their volunteers to collect data. In the Identity Foundation NGO visited during field study, it was observed that the data is digitised by volunteers by manual data entry in softwares like Excel sheet. These volunteers are trained to use computer and MS office.
- The volunteers only help in data entry. The collected data is analysed by a senior officer.
- The method of analysis includes visualising data in simple charts like bar charts or pie charts.
- Type of recorded data based on its frequecy of repetition

  Daily
  - Book Issued
  - Attendance

  Monthly
  - Date of Scheduled Visits
  - Attendance of that Day
  - Number of Visits happened in month
  - Extra visits
  - Number of Books issued to Students
  - Number of students who issued books

  Quarterly
  - Student Wise - Reading Ability Test Score

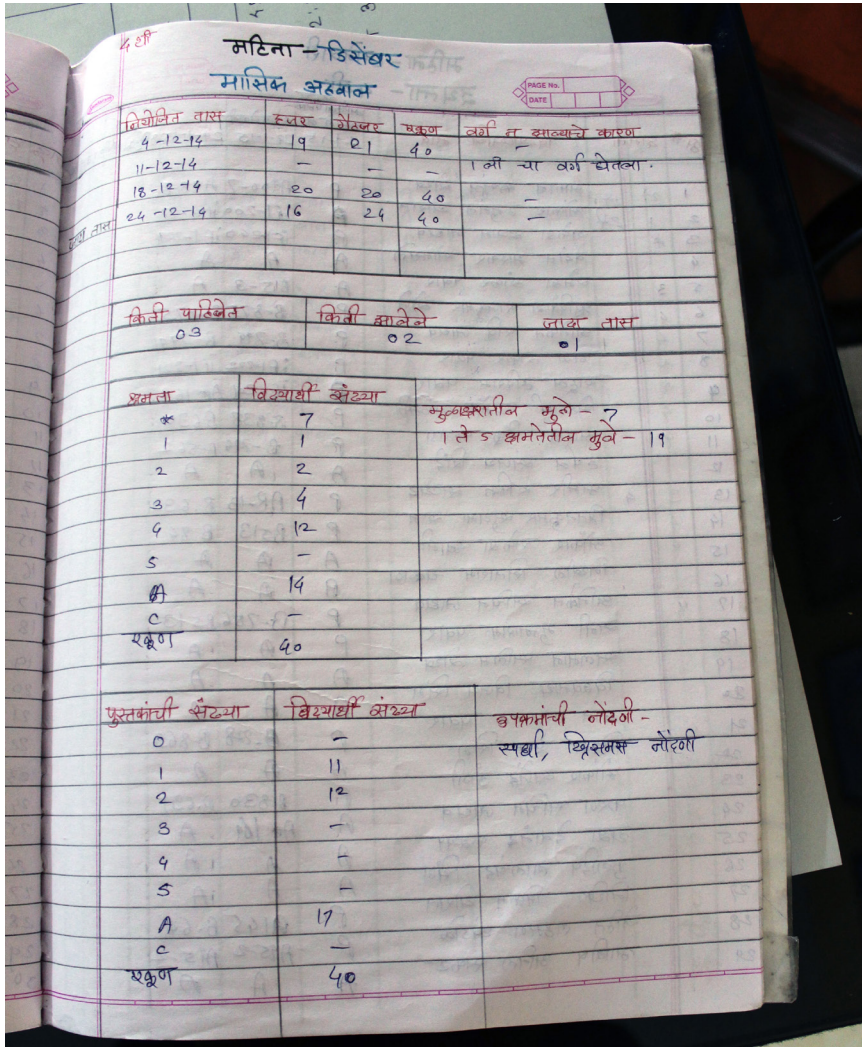
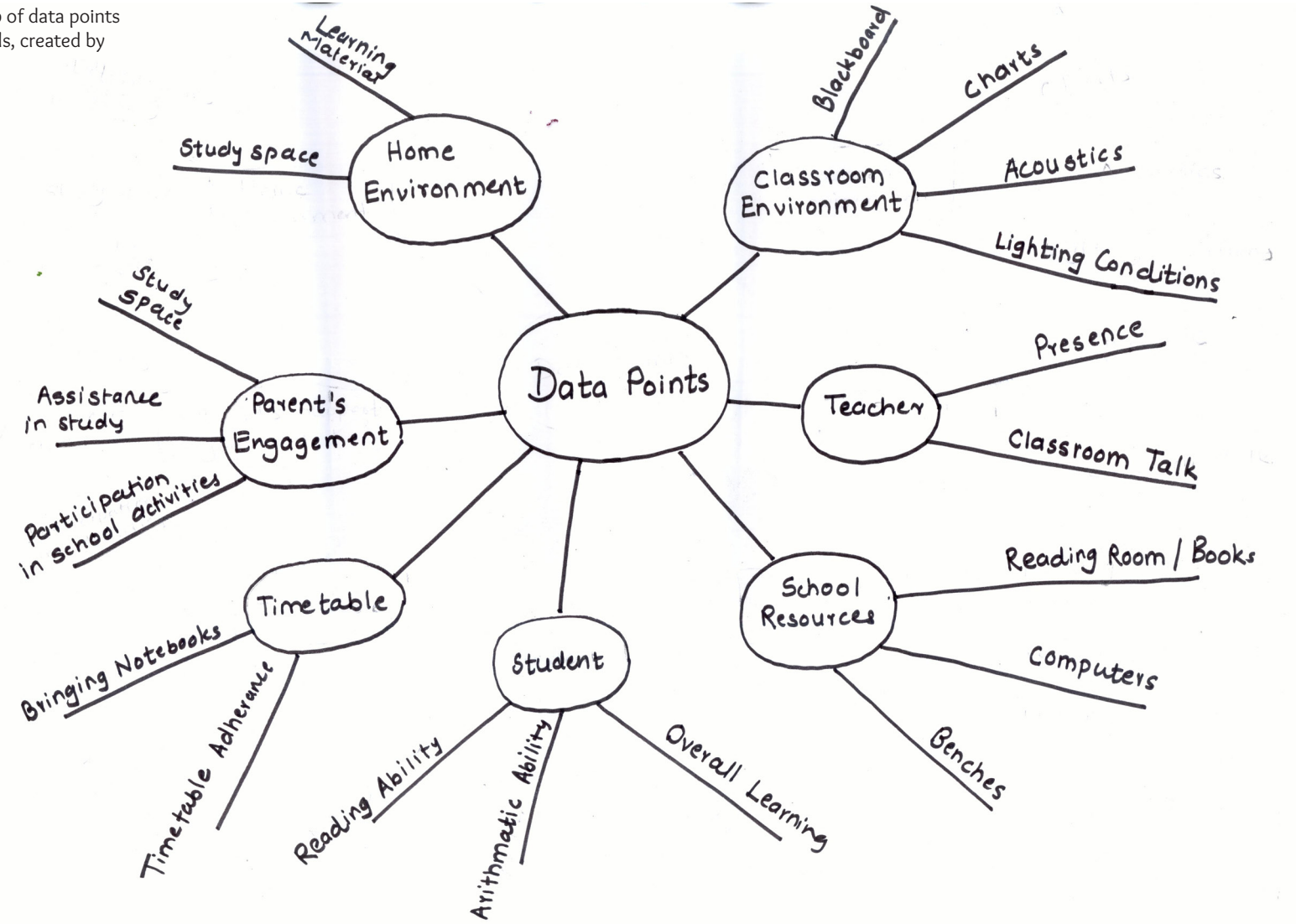


Figure 20: Monthly Report of issued books and Reading Test score for 4th grade

Figure 21: Mind-map of data points in elementary schools, created by brain-storming



Opportunities for Learning Analytics

Data Access and Control

Many educational organizations and NGOs, work collaboratively with deprived schools to solve their problems and meet their needs. While helping, they collect data of students. For their own analysis and improvement, they convert physical data into digital format. In most cases, this digitised data is not shared back with school. As a result, school teachers are not able to analyse data further and gain insights about their students.

Findings

Krantivir Vasudev Balwant Phadke Vidyalaya, which participated in user studies, does not have a library. To solve this problem it is collaboratively working with a NGO, named Identity foundation, to provide books to students. Identity Foundation provides extra-curricular books to students based on their reading ability. They conduct a reading ability test once every three months and based on this score the difficulty level of book to be given is decided. However, the data collected is utilized by Identity Foundation for understanding their own contribution. Neither this data is not proactively shared with school teachers by NGO, nor school desire to use it for further analysis and gaining insights about their students.

Many schools are associated with multiple NGOs. The Savitribai Phule Vidyalaya, Pune was associated with TeachForIndia as well as Aakansha foundation. Even though, these NGOs collect data of same students, all data is not related and available through a common tool to draw collective insights.

To sum up, there is need to share collected data back to school and benefit them by its analysis. There is need to collect data on a single platform where it can be co-related and collective insights can be drawn.

It was also observed in primary research that school authorities are very careful while sharing the data about their school with any entity. Their main concern is that the study or shared data should not be used to draw any conclusive insights about school. The insights drawn from study or data should not be published without their consent. In other words, they want control on the use of their. Additionally, they also demanded to maintain the privacy of identities of involved students and teachers.

Data Access and Control

Design Idea

There can be a common platform for schools, researchers and NGOs to share data and analysis. The prime objective of this platform would be to allow school authority to be able access data in digital format and analyse it. The secondary objective of this platform would be to store data in relational format so that collective insights can be drawn. To illustrate, if two NGOs collect data of same student, the data of both studies will be accessible from student's profile. Similar is the case with schools and teachers data.

After allowing organizations and schools to share data with each other, the question of authority and control of data arises. Additionally, the privacy of identity of students and school's sensitive information should be taken care of.

The proposed platform will allow school authority to have control over their data. The school authority can share this data with other entities if they wish to do so. If someone wants to access data, he/she needs to request data access to school authority through platform portal.

Additionally, while sharing data, the platform will inherently maintain secrecy about identities of students and teacher by not sharing data fields like name or roll number.

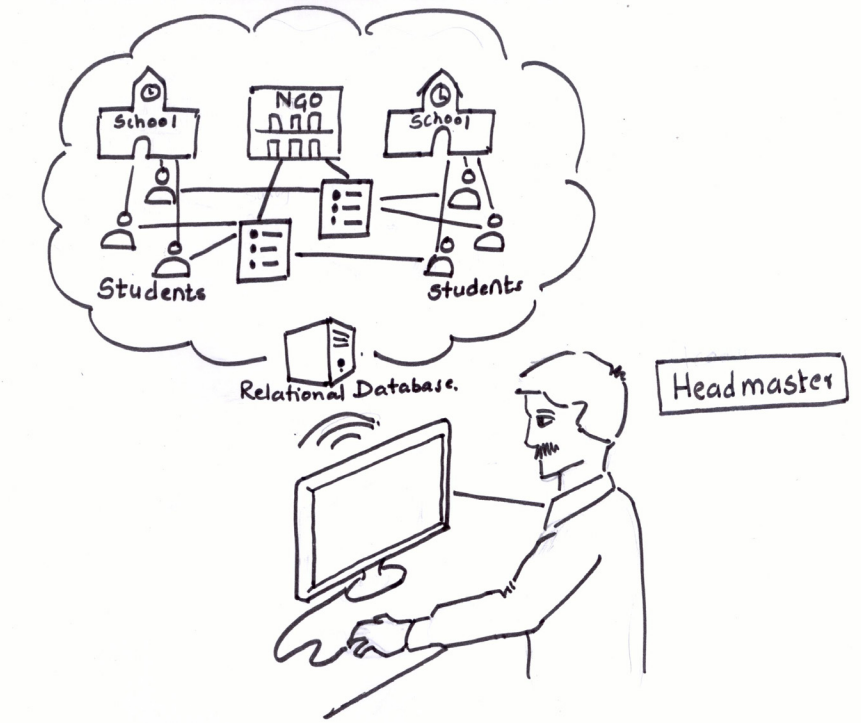


Figure 22: Common Platform for Data Acess & Control

Critique

The design idea lacks the clarity about for what purpose data will be used by school authority.

Additionally, there is need to identify context specific services offered to school by proposed platform. These services can be analysis methods specifically designed for schools.

Parent's Engagement in Student's Education

The initial findings from user studies and pilot data collection suggested that many students are suffering from poor parent's engagement in studies. However, due to lack of availability data and involvement of multiple unknown factors, it is difficult to find out how much student is affected and in what aspect he needs help.

Supplementary Findings

- Teachers complained that parents of many students do not attend parent-teacher meetings at school or they do not even visit students about child's progress.
- Majority of students received assistance from their elder sister or brother instead of parents. One of the prominent reason behind less participation of parents in studies was that they were not well educated (mostly educated till 4th standard).
- Many students do not get a calm and focusable home environment for study. These students lived in one room houses and had to study in the room having Television set.

What researchers think about measuring Parent's Engagement?

Many research studies claim that the availability of stimulating objects, books and play materials within the home are critical indicators for the overall quality of the home environment and a good indicators of parental interest and involvement in child's development. Selim Iltus from UNESCO has reviewed metrics proposed by many such studies (Selim Iltus, 2007). In his analysis, he has categorised indicators into two types that is related to home environment and parent's behaviour. Following are the critical indicators suggested by him:

Indicators related to Home Environment

- Availability of reading materials and children's books in the home
- Availability of drawing and art supplies
- Availability of toys

Indicators related to Parent's behaviour

- Parents engaging in joint reading with their child
- Frequency of the parents engaging in play activities
- Control put by parents on their children

Indicators like availability of reading material are directly related to education. However, other indicators like availability of drawing, art supplies and toys are important for developing child's problem solving

Parent's Engagement in Student's Education

Data Collection Experiment

To explore this problem area, we decided to collect detailed data from students and teachers. We used the indicators we found from brainstorming session, user studies and our literature survey. The objective of experiment was to be able to find students suffering from different aspects of parent's engagement. Depending upon aspect of the involved risk, student can be provided with selective help or intervention by their teachers.

We conducted a school-wide survey in selected school and collected data about parent's engagement from 125 students. The data collection involved a personal interview of student. Some of fields like parent's attendance were collected from teachers. The data was collected using OMR questionnaires prepared using FormReturn software. The reason behind using OMR sheets as data collection method was to decrease human data entry efforts. Additionally, the process helped us in understanding the complete workflow of OMR data collection and challenges involved in using OMR as a method of data collection in resource constrained environments.

Critique

As the most of the data was collected by interviewing students (age: 6 to 14), the validity of data cannot be guaranteed.

Even though study was successful in pointing out students who were having less parental engagement in studies, there was no statistical co-relation found with output indicators of student (grades, reading ability and attendance). In other words, except the findings from secondary research, statistically we were unable to prove that less parental engagement has bad impact on student's output.

Classroom Talk

In elementary education, class talk is necessary for child's language developement (Dufresne, 1996). However, it was observed that due to undeliberate biases in teaching style and lack of students' active participation in class activities, classroom interaction suffers from poor class talk.

Findings

- It was observed in the user study that some students do not pay attention in the class while teacher is teaching.
- Teachers preferred some students to ask questions to. Such teachers subconsciously neglect other students. Additionally, some teachers did not gave chance to students to interact or ask questions while teaching.

What is Classroom talk and why it is necessary?

According to Robert J. Dufresne et al, classroom talk in elementary schools is necessary for the language development of student. In an ideal scenario, both teachers and all students actively participate in teaching-learning process by having a healthy both-sided dialogue. Poor class interaction may affect child's overall interest towards education and can have severe impact on language development. (Dufresne, 1996)

Hence, there is need to have a neutral way by which teachers should be able to know actual amount of interaction individual student and they had. This can be achieved by collecting data at individual student and teacher level and provide insights about teaching style and participation.

Classroom Talk

Data Collection Experiment

As a part of user study, a classroom of 5th standard was chosen for observation for 3 days. During these shadowing sessions, researches did not disturb class environment except the disturbance caused by their mere presence in classroom. The participation of students while teaching was noted and teachers teaching style was observed. To analyse class interaction in depth, the lectures were recorded. The following visualization shows the mapping of class interaction for a Maths lecture on time scale. Additionally, as researcher did not know identities of students (name or roll number), a spatial map of classroom was used to show the student who were not interacting.

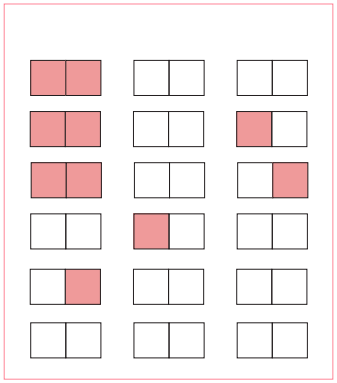


Figure 24: Students who did not participate (Sitting Arrangement wise)

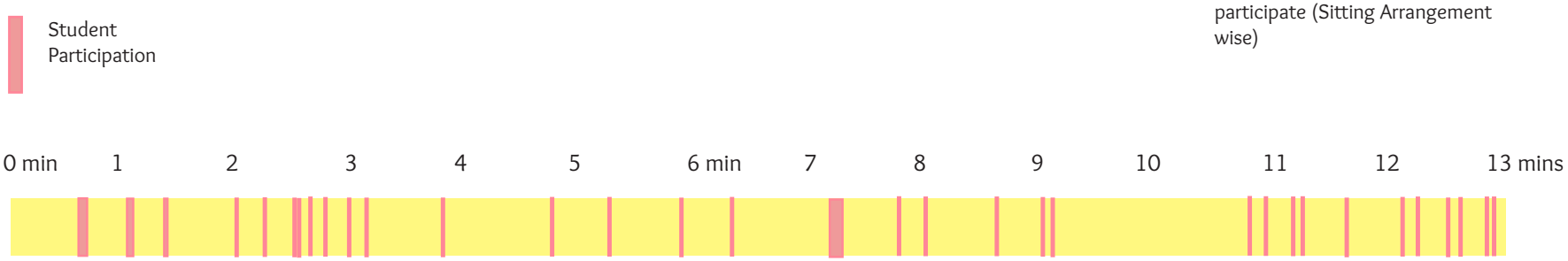


Figure 23: Visualization of Maths Lecture

Critique

In feedback sessions, teachers stated that they were not comfortable with the idea of constantly monitoring their teaching. Additionally, for class talk, it is necessary proposed system to identify student by some means, so that personalized insights can be provided. With the currently available technology, it seems impossible to provide a low cost solution which can separate students' voices from classroom noise and identify students by their voice.

Reading Ability

Many students from 1st grade to 5th grade lack reading skills. Due to poor reading and writing ability such students are not able to understand the curriculum of their current grade. One of the main reason behind their poor reading ability is that they start schooling late as compared to others. The imbalance between the reading and writing proficiency of students, teacher has to spend extra time in attention to their progress.

Design Idea

By analysing the reading test score, the students with low and similar reading ability can be grouped together. These groups can have students from different grades. Each group can be given special training periodically based on their reading ability.

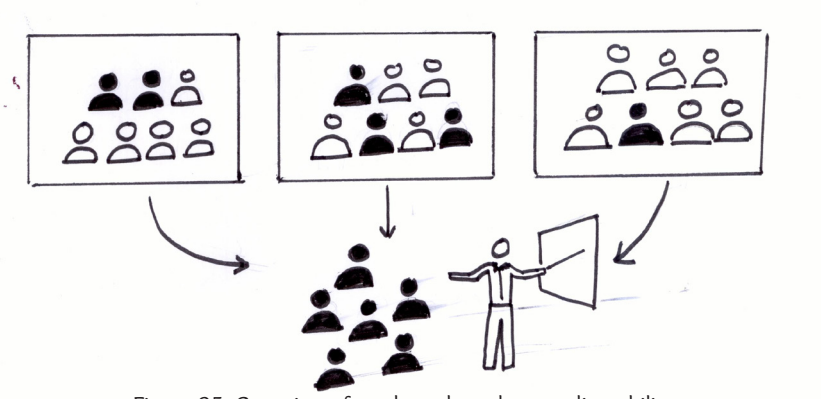


Figure 25: Grouping of students based on reading ability

Table 1: 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

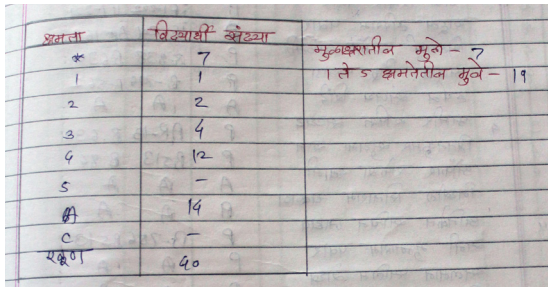


Figure 26: Reading Abilities of 3rd grade

Critique

The idea brings out important inherent need of forming groups of students with special needs. This strategy can be applied in other problem areas also.

Due to shortage of time and unavailability of actual data from Identity Foundation, we were not able to explore analysis of data in this area.

Expressing School Needs

There exists many educational and corporate organizations who are willing to help schools by providing monetary assistance or their services. While deciding which school to help, these organizations require need-analysis from schools.

CSR for PMC Schools

It is an initiative by “Shyaam chi Foundation” and Pune Municipal Corporation to bridge the gap between organizations who are willing to help schools and schools.

Under this initiative a website is hosted, where corporations, NGOs and media can view school profiles and come to know their needs. After deciding the school to help, they can approach the CSR cell of Pune Municipality and make an agreement of the project.

Drawbacks

Currently website displays all types of needs for every school. Additionally, even though the website claims that need analysis exists for each need of each school, it fails to portray the same.

Website provides no means of comparison between school and their needs. As a result, helper entity is not able to take decision before approaching the school.

To sum up, in order to decide which school to help, helper organizations need quantifiable means of comparing school’s current state and its needs.

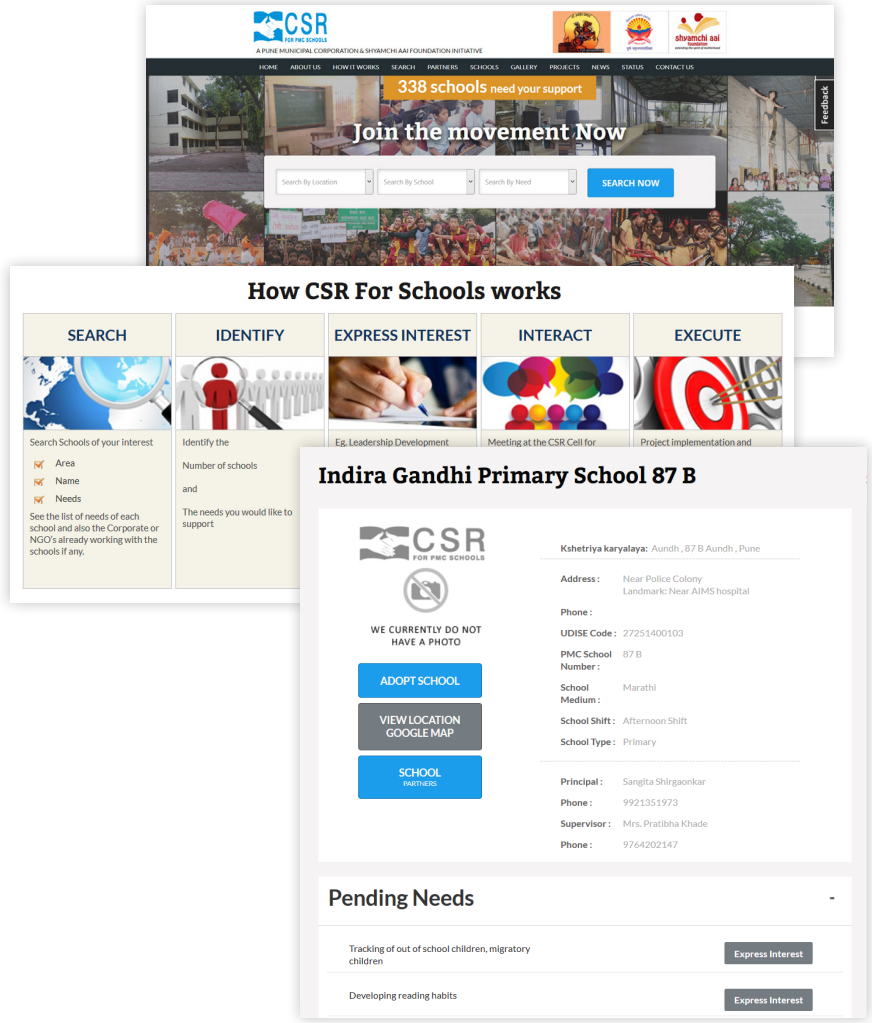


Figure 26: CSR for PMC Schools, Source: csrforpmcschools.org

Teacher's Availability

Teachers are not able to utilize their available classroom time. It was found that including tenure of both semesters, a school gets 220 days in a year. Out of 220 these days, typically only about 145 days are utilized. As a result of this, they don't get enough time to cover all topics in details and complete syllabus.

Following are the reasons

- **Training:** Every teacher has to attend training enforced by government ranging from 10 - 12 days in a year to 40-50 days a year. These training include MSCIT training, English training, elections training, learning new method, and training for implementing new government scheme.
- **Substitute Teachers:** Whenever, one teacher is on leave due to training or personal leave, learning of two classrooms gets hampered as another teacher has to keep an eye on the class. In order to control two or multiple classes at a time, teacher gives only writing assignments to students of both classes.
- **School events:** During school events and inter school competitions, students have to spend time preparation.
- **Holidays:** Typically, a school gets more than 60 official holidays in a year.

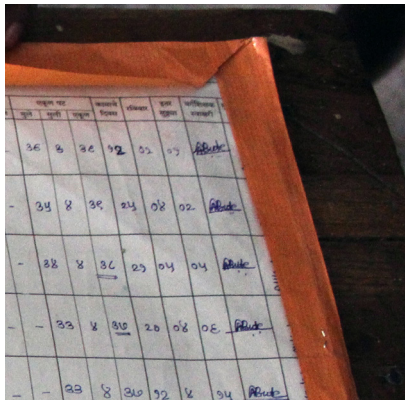


Figure: 27: Teacher's Yearly Attendance Report

It shows that from July to December 2015, school got 67 holidays

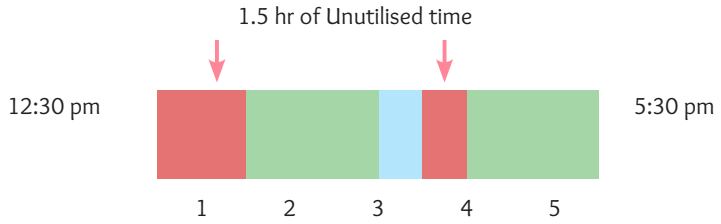


Figure 28: School Timing

Teacher's Availability

Design Idea

We can design a syllabus tracking booklet for teachers to monitor current state of completed syllabus and to intervene if teacher will not be able to complete syllabus on time. It can achieve the same by comparing the amount of expected time to be spent for certain topic with actual remaining time for that topic.

Data Points to be collected:
- Subject and Topic wise expected teaching time
- Actual time spent by teacher in classroom
- Actual topics covered by teacher till date

User Roles
- Teachers – Teachers will fill the syllabus booklet regularly. The substitute teacher can refer to this booklet to check the completed syllabus.
- Headmaster – Headmaster can inspect syllabus booklet periodically to monitor whole school and will know risk associated with completing syllabus in advance.

Critique

The idea is highly dependent on teacher's proactiveness to fill the syllabus tracking book. Additionally, there are chances that teacher's might fill dummy data at 11th hour for facing inspection.

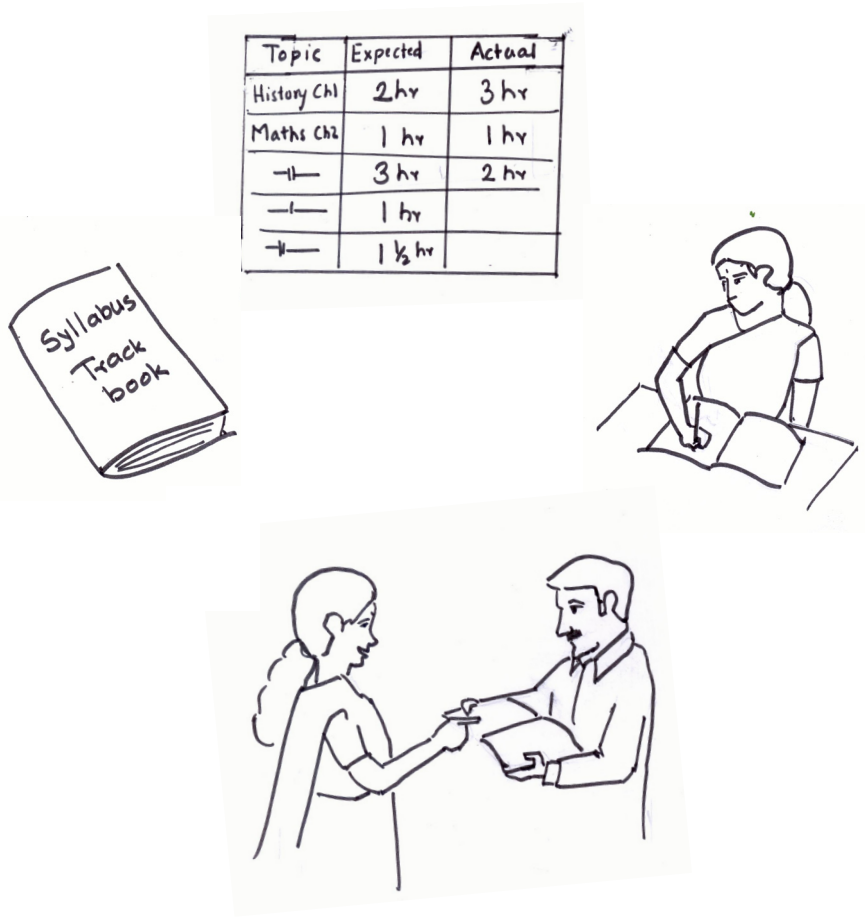


Figure 29: Usage of Syllabus Tracking Book

Need Gaps

In previous section, we discussed many opportunities for learning analytics. Some of these opportunities point to very specific problems like parent's engagement, class talk and reading abilities of students. Other opportunities like giving back the data collected by NGOs back to school present the issues about general data collection practices. Following are the identified needs:

Needs related to Data Collection Practices:

- To design digital data collection methods which can tolerate the unavailability of specific computing devise, internet connectivity and useful manpower
- To share digitised data, collected by NGOs or educational organizations, and its analysis back to schools
- To provide access and control to school authority over the data collected in their school
- To be able to co-relate data from multiple surveys/ data sources and draw collective insights
- To minimize the time and efforts of teachers required for manual data entry

For problems related to parent's engagement, teacher's availability or classroom talk, the problem exists because the key indicators or metrics have not been identified. For problems where data already exists like reading ability of students, main challenge is to identify ways of analysing data to bring interesting meaningful insights. Hence, higher-level needs are:

- To identify key indicators
- To design sustainable methodology of collecting valid data
- To find of ways analysing the problem and communicating the analysis to school authorities

Design Goals

As discussed in previous section, the needs gaps that we found through secondary and primary research are related to general data collection practices and specific problem areas.

However, we need to make a choice before designing a solution that whether to design a solution which addresses specific problem area or to design a generic solution which deals with data collection practices.

In my opinion, in the context of resource constrained school, it is more important to solve the problem related to data collection practices. I believe that designing new ways of data collection can enable utilization of majority of existing data. In this way, the solution will have much more impact.

Hence, following are my primary and secondary goals of this project

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

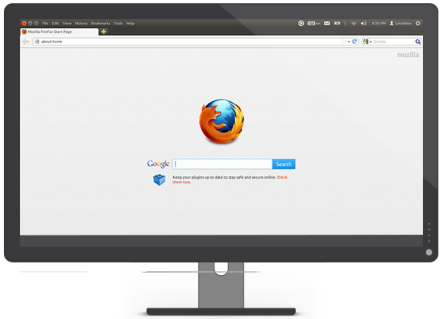
To design a learning analytics system which gives ability to school authority to

- 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

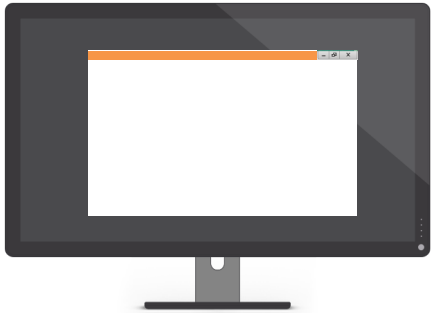
Initial Concept

Open Data Analytics Platform

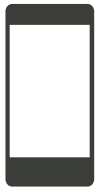
The initial concept proposed a common data analytics platform for sharing data among NGOs, schools and other researchers.
The platform is accessible through multiple channels including mobile application, desktop application and website. The platform is accompanied by multiple data collection methods which can be strategically used by user to collect data depending upon availability, quality and quantity of computing devices and internet connectivity.



Website



Desktop Application



Mobile Application

Figure 30: Channels supported by platform

Key Features

Multiple Data Collection Methods

Proposed platform allows user to collect data using following ways:

Printed bubble sheets

- Scan bubble sheet using regular scanner
- Take photograph of bubble sheet using mobile camera. Image processing and data extraction of photograph of printed bubble sheet will happen on central server. The photograph can be uploaded on server using online Mobile Application/ Desktop Application / Website.

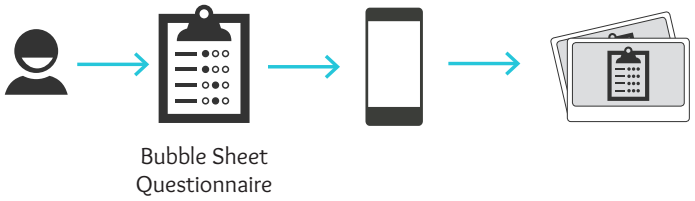


Figure 31: Data Collection using Printed Bubble Sheet

Offline Mobile/ Desktop Application

Survey can be configured on mobile using configuration file. After collecting data, data can be exported into CSV format. This csv file can be uploaded to central server using other online mobile application/ desktop application/ website

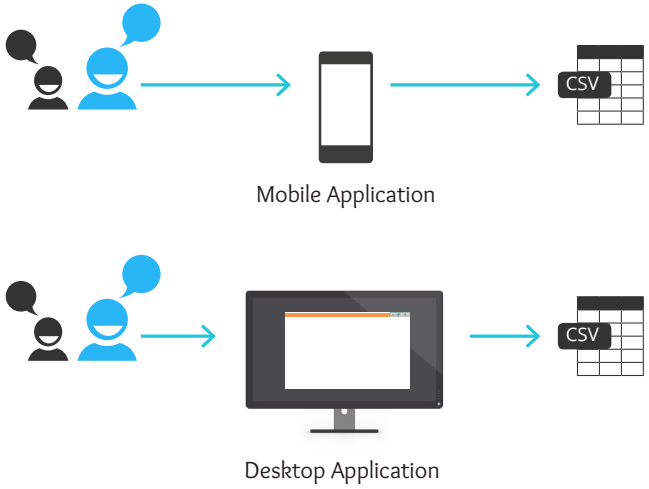


Figure 32: Data Collection using Offline Application

Key Features

Online Mobile/ Desktop Application

Collected data will be directly uploaded on central server. As mentioned earlier, Online mobile / desktop application can help in uploading photographs of printed bubble sheets or exported CSV data.

Website

It is accessible from anywhere. Like online mobile/ desktop application, website can be used to upload collected data directly uploaded on central server. It can help in uploading photographs of printed bubble sheets or exported CSV data.

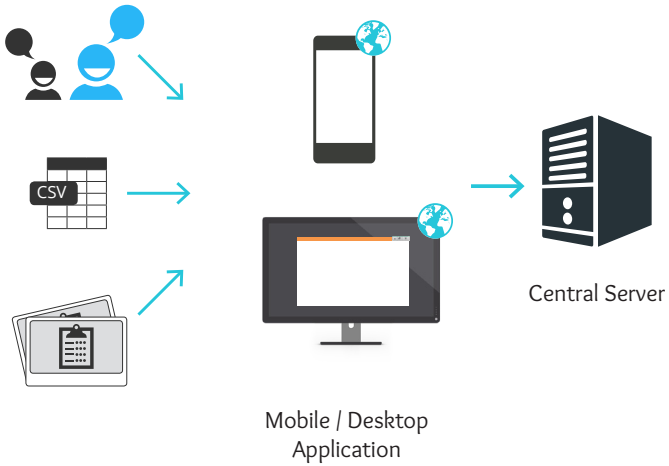


Figure 33: Data Collection using Online Application

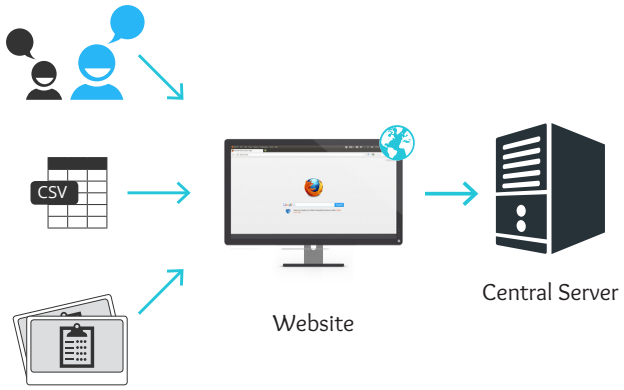


Figure 34: Data Collection using Website

Key Features

Visualizations Specifically Designed for Schools

School Level Visualization

In school level visualization, each fragment represents one student. Hence, it is directly possible to point out a student and access his/ her profile. School level Visualization also provides comparative analysis of classes, so that user will be able to compare and select grade to see detailed data.

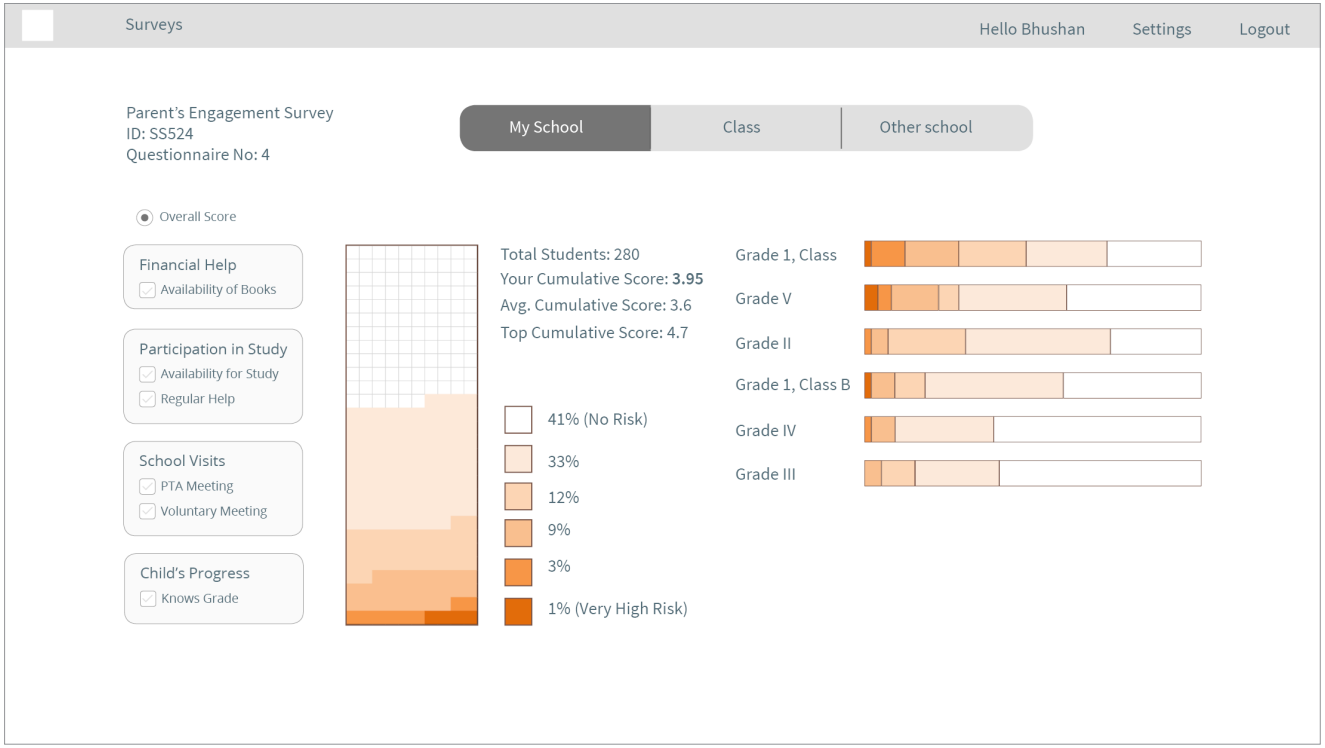


Figure 35: UI for School level Visualization

Key Features

Visualizations Specifically Designed for Schools

Class Level Visualization

Class level visualization overlays marks of students (outcome indicator) on the top. Hence, it becomes easy to compare mark of student along with his other data. Class level visualization also shows list of students ordered by high to low risk.

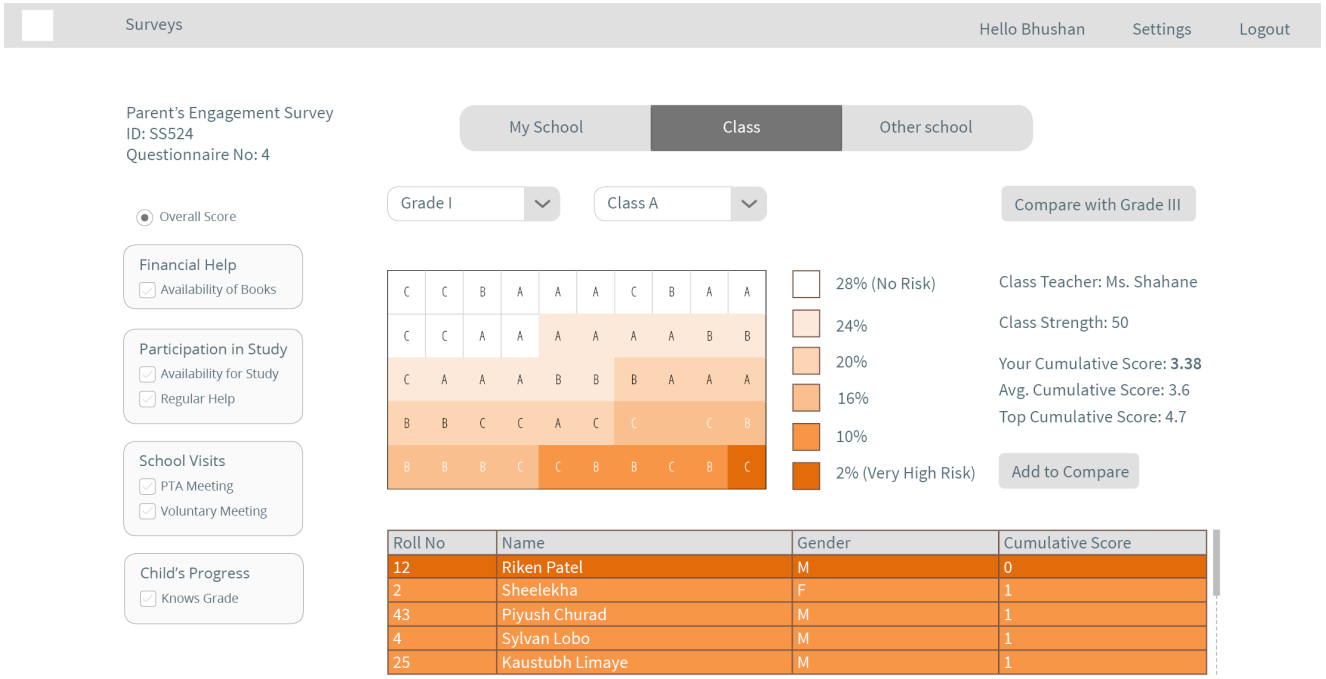


Figure 36: UI for Class level Visualization

Key Features

Visualizations Specifically Designed for Schools

Student Level Visualization

Student level visualization shows all the data available from multiple surveys for that student.

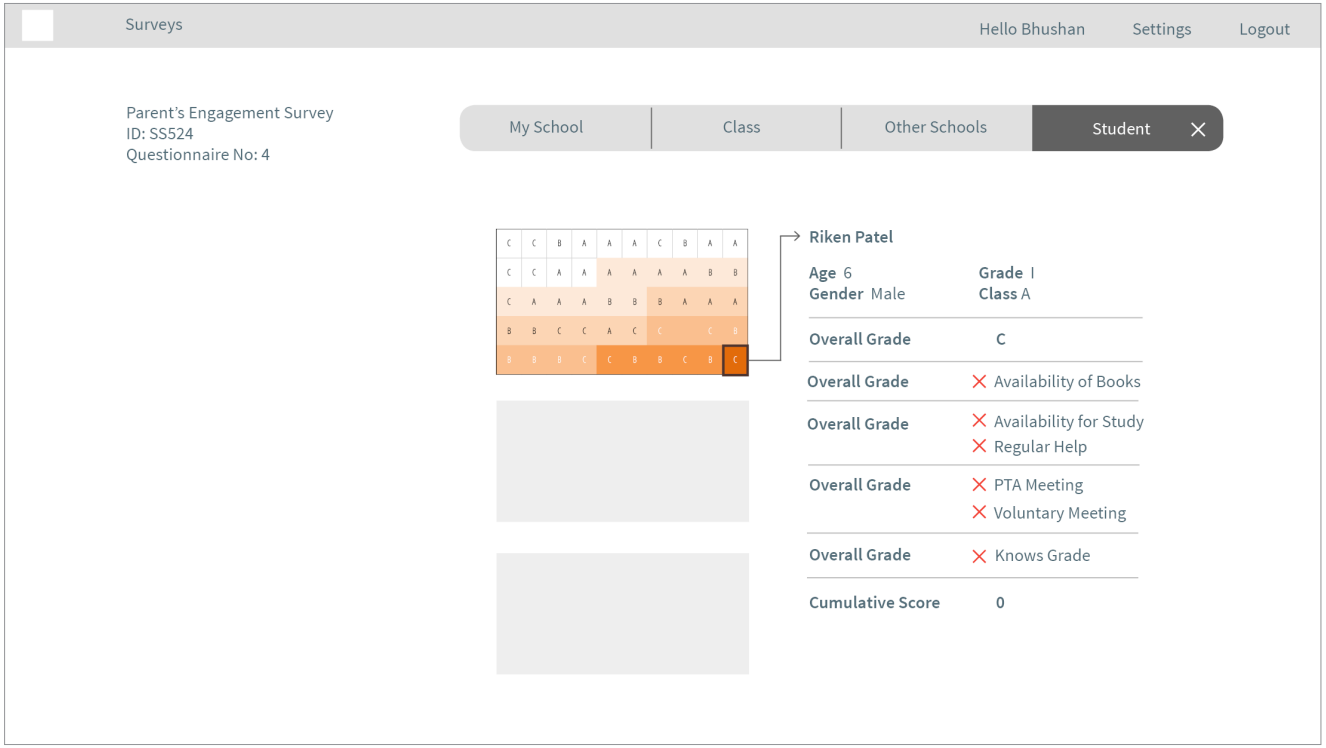


Figure 37: UI for Student level Visualization

Key Features

Compare with other schools

If similar survey has been conducted in other schools, their data can be compared with data of user's school in order to get competitive insights. User will not be able to access identity information of students from other school.

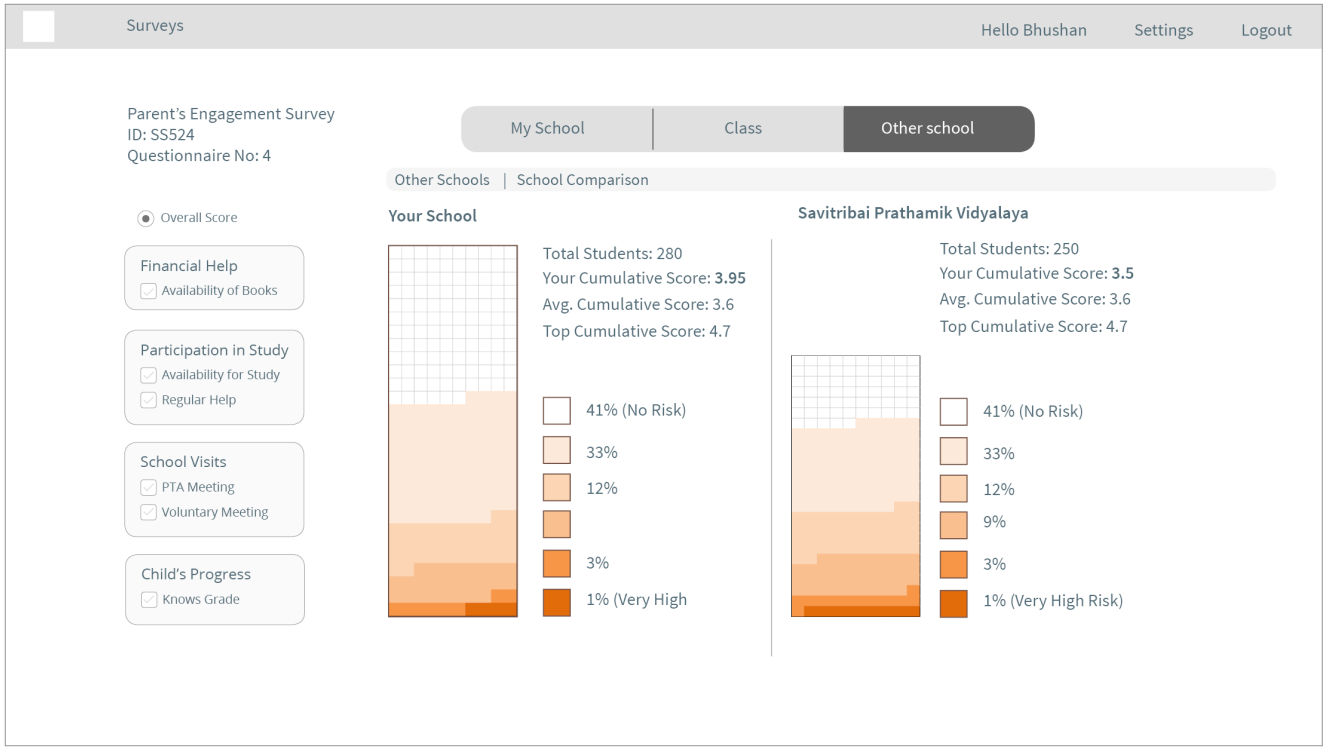


Figure 38: UI for Comparison of schools

User Feedback

- The teachers liked the organization of analysis: School level, Class level and Student level.
- After identifying students at risk, teachers expected that tool will suggest next step of action.
- Teachers also expected tool to tell them which problem should be solved first.
- Even though, users seemed OK with the use of English language. However, user's responses were based on short interaction with concept. Users might face language problems while having long interaction.

Review of Survey Developement Products

As discussed in earlier section, the initial concept included the provision of offline and online data collection using printed bubble sheets, mobile application, desktop application and website. However, for designing a comprehensive learning analytics system, it is necessary to consider all possible workflows.

There exist many online data collection applications like SurveyMonkey and Google Forms in the market. In this section, we present our study of these applications. We aim to identify common workflows, design practices and build state-of-the-art feature repository.

SurveyMonkey

SurveyMonkey is a web tool for designing and conducting surveys for individual and enterprise users. In SurveyMonkey, questionnaire can be designed on using pre-identified question types. These surveys are distributed to audience using different channels like link, email, etc. The collected data can be analysed in various ways. The data is automatically visualized in graphs based on question type. User can select desirable visualization from provided options.

Distinguishing Features

SurveyMonkey allows user to compare results of different questions with each other. User can create filters from using question responses and analyse data.

SurveyMonkey provides common survey template like Employee satisfaction and Netpromoter survey. SurveyMonkey calculates top and average score for such common surveys. It shares such scores with its users. In this way, SurveyMonkey allows its users to leverage from the other's data without revealing identities.

Drawbacks

The results of multiple surveys cannot be collectively analysed, as identities of participants is not maintained across different surveys.

Data can be collected only using online devices.

Figure 39: SurveyMonkey is available on web and mobile platform, Source: thenextweb.com

Google Forms

Google Forms is a Google Drive sub-product which allows user to design questionnaires and collect data. Unlike other Survey products, instead of opening new account, one access this functionality using one's gmail account. Additionally, collected data is automatically stored in a google drive sheet. The data is updated real time and ready to download.

Distinguishing Features

Google forms avoid the complexity of supporting advanced question types. It offers basic question types, using which advanced question types can be created. This makes interface of drive simple and easy to use.

Google Forms provides facility of authenticating user using gmail account before giving surveys.

Drawbacks

Like SurveyMonkey, Google Forms also lacks the ability to collect data in offline environments. It is not possible to keep track of participant across multiple surveys. Therefore, longitudinal surveys are not supported. User manually has to join data together in order analyse data collectively.

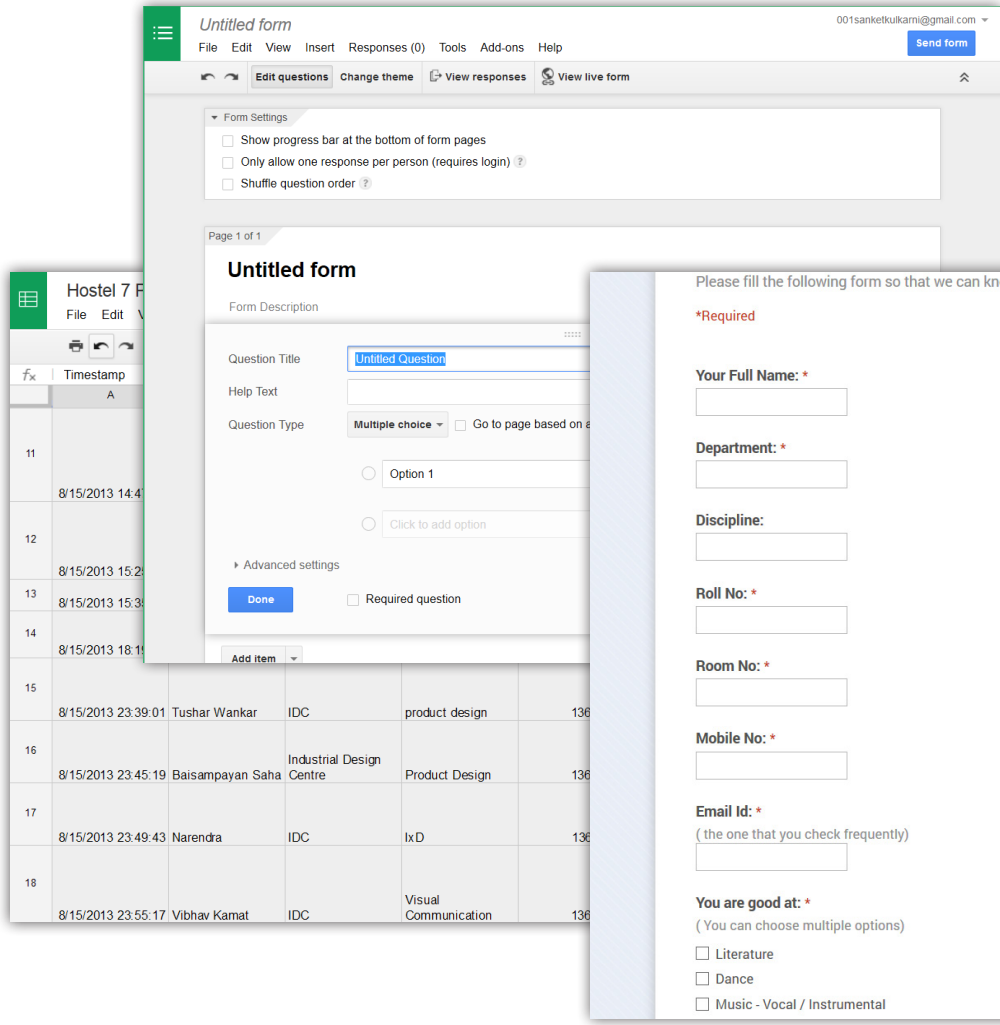


Figure 40: Google form's User Interface, Source: google.com

Google Analytics

Google Analytics is a tool which website makers can embed in their website to analyse various aspects of website. Google Analytics help in introspecting user visits through various dimensions like time, individual pages, uniqueness, country, language and entry-exit flows.

Distinguishing Features

Google Analytics keeps visualization simple by using only two variable at a time. Users can select any two metrics against each other to analyse results in multiple ways. For example, user can select visits and time, visits and country, visits and language, country and referrals.

Google Analytics allows users to set goals in terms of metrics. After reaching goal, google notifies user through email.

Google Analytics allows user to create custom reports.

Instead of always showing data in graphs, Google Analytics shows data in tabular format whenever necessary or as per need.

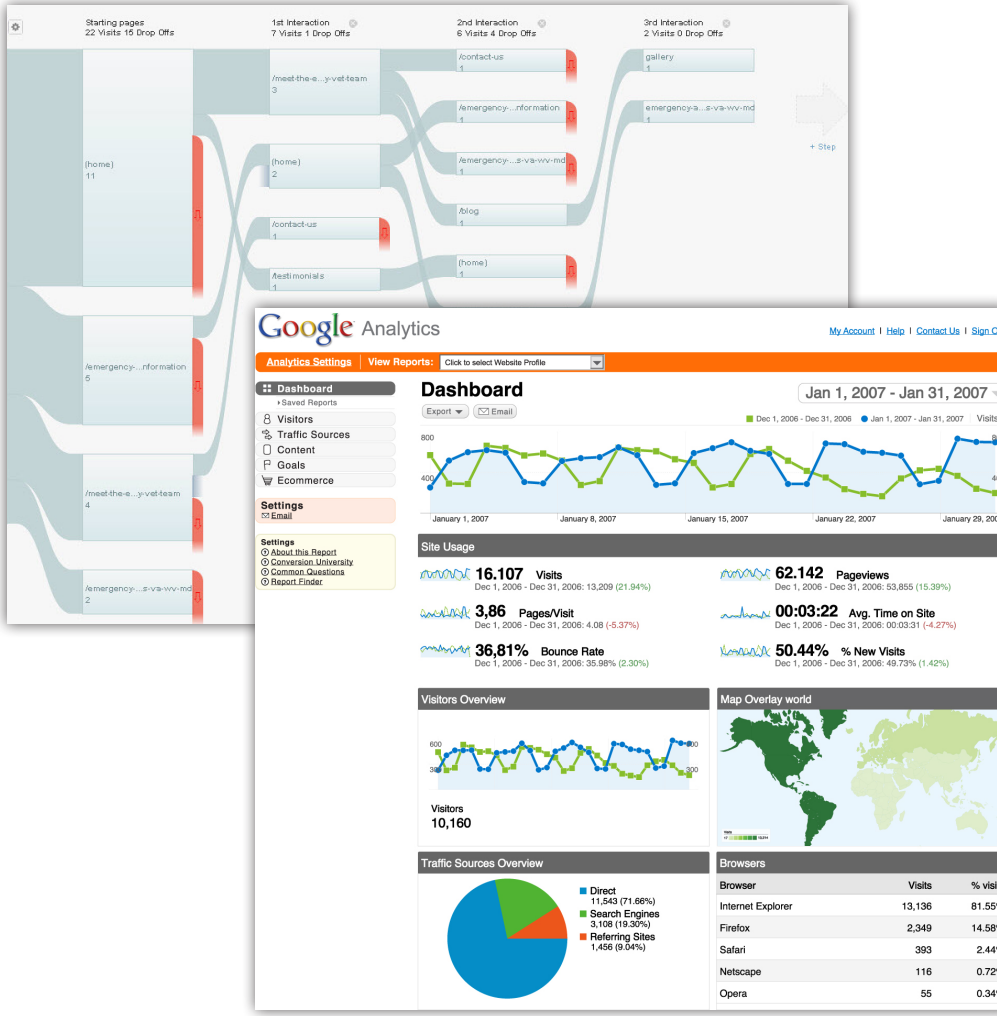


Figure 41: Google Analytics User Interface, Source: businessbee.com

U-DISE

U-DISE is an Indian government initiative for nation-wide collection of school data and analysis. U-DISE means Unified District Information System for Education.

U-DISE has categorized nation-wide schools into clusters, blocks, districts and states. U-DISE distributes a software, publicly available, to regional offices at cluster, block, district and state level. Every office is provided with trained data entry operators. A Data Capture Form (DCF), a paper-based form, of fixed format is distributed to all schools. School headmasters are asked to fill this form and submit to regional offices. Data entry operators fill this data onto software and upload it to server. The regional officer is responsible for checking validity of school data, while data entry operators are responsible for error free and consistent data entry.

After collecting data, it is analysed to create report for each cluster, block, district and state. Additionally, every school is provided with a report card. All of these reports and raw data is publicly available to download

Figure 42: Data Collection Form, Source: dise.in

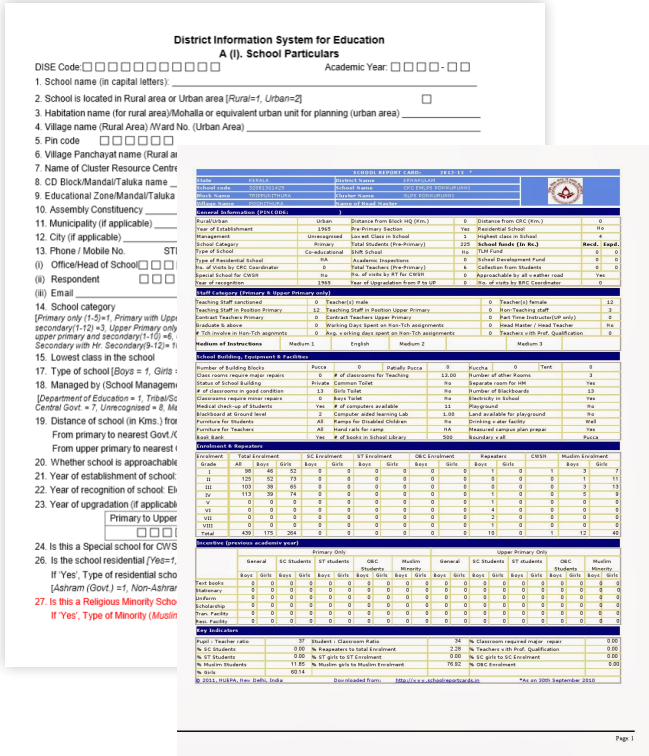


Figure 43: School Report Card, Source: dise.in

Distinguishing Features

- Trained data entry operator ensures error free correction.
- Due to paper-based data collection form, School teachers are not required to be digital literate to collect and submit the data.
- The Cluster/ Block regional officers are authorised to check validity / correctness of data.

Drawbacks

- Data collection form has fixed parameters. If it is 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.

Learnings

After reviewing online survey applications, we found that following are the features which we can be useful in our problem context. However, we need to redesign these features considering the context of resource constrained schools:

- The data of other organizations can be indirectly shared with user by calculating top, mean and average score.
- The data can be filtered by type of responses given by respondents
- Ability to create customized reports
- Already created questionnaire templates can be used to create new questionnaire.

Data Collection using OMR Technology

OMR (Optical Mark Recognition) is a method of capturing hand-marked data into digital format. Due to its easy implementation, accuracy in capturing data and low cost, it has become highly popular. It is vastly used in conducting closed question examinations.

For exploring the workflows related to data collection using printed bubble sheet, I decided to conduct a data collection using OMR technology. We chose an already explored problem area of "Parent's Engagement in Child's Study" for data collection. For choosing the OMR software to conduct study, we reviewed currently available OMR softwares available in the market. We found that FormReturn is software which supports majority of the process of data collection. Therefore, we chose FormReturn software for data collection.

In this section, we wish to discuss our analysis of OMR softwares and our learnings from data collection process. Finally, we propose a comprehensive workflow for incorporating in the final concept. The workflow explains responsibility of each user role throughout the different stages of the process.

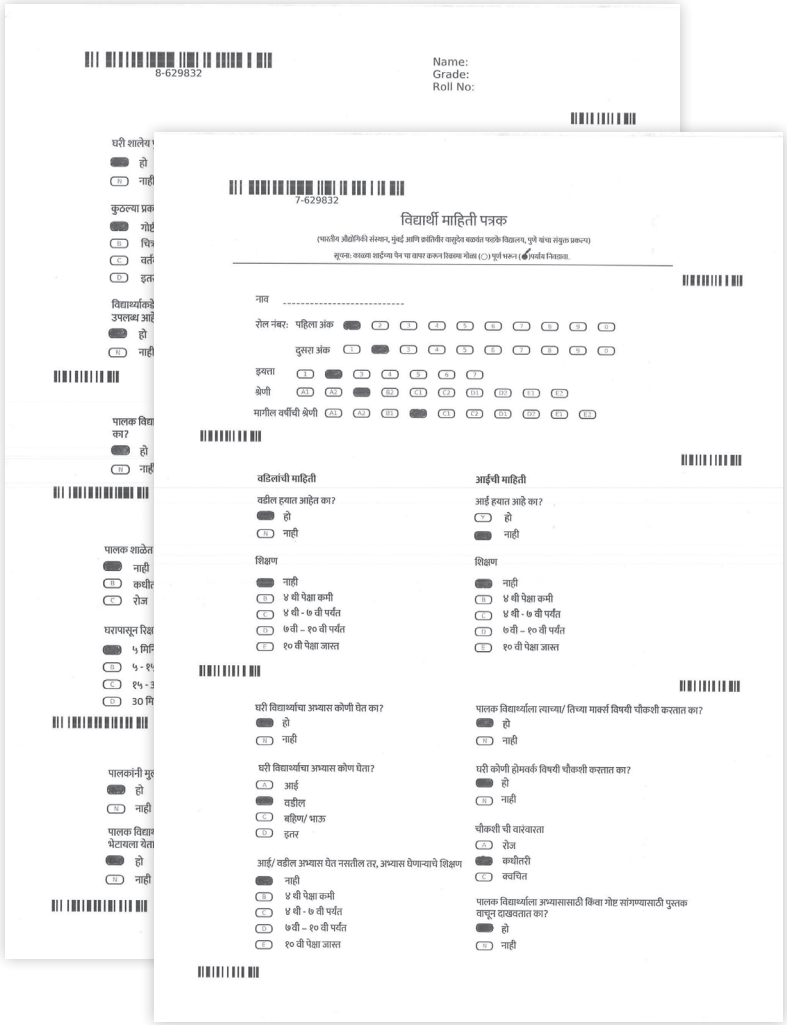


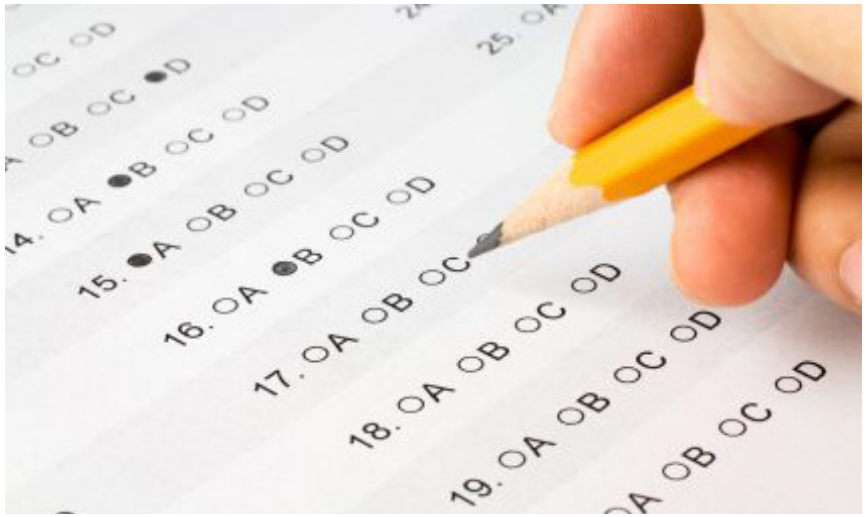
Figure 43: OMR Sheet designed using FormReturn Software

State-of-the-art OMR Softwares

Socrates

Socrates is an online practice test provider for competitive exams like SAT. Students have to open a paid account to give tests. Socrates hosts lot of practice tests for different exams. Students have option of giving test online and offline. For giving test offline, Socrates gives facility to generate bubble sheets. Students can download bubble sheets, give test and upload scanned bubble sheet online to get score.
Socrates provide diagnosis reports to students. In report, Socrates considers multiple dimensions like sections, question types, topic and difficulty level.

Figure 44: Students can submit answers offline using bubble sheets, Source: socrato.com



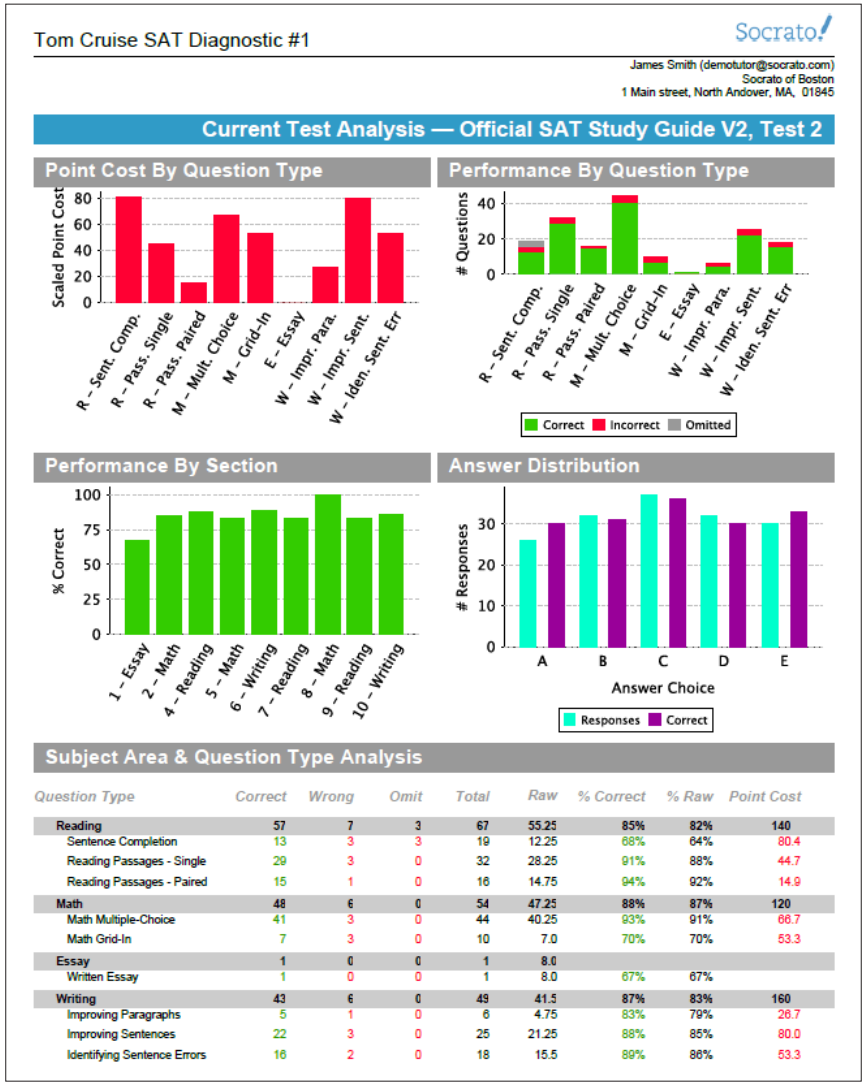


Figure 45: Diagnosis report for SAT exam, Source: socrato.com

FormReturn

FormReturn is paid OMR scanning application with a one month of trial period. The same software was used to create questionnaire and collect data in this project. FormReturn supports complete flow right from creating questionnaire to data collection. The distinguishing feature of FormReturn allows user to set scoring parameters for questions. Hence, while exporting data after processing responses, it directly gives you question wise score of participant.

The error correction workflow in form return is very tedious, as it asks user to go to each form separately in order correct errors. Ii is possible to make it simple by offering all error correction in a single view.

Figure 46: Creating Questionnaire, Source: formreturn.com

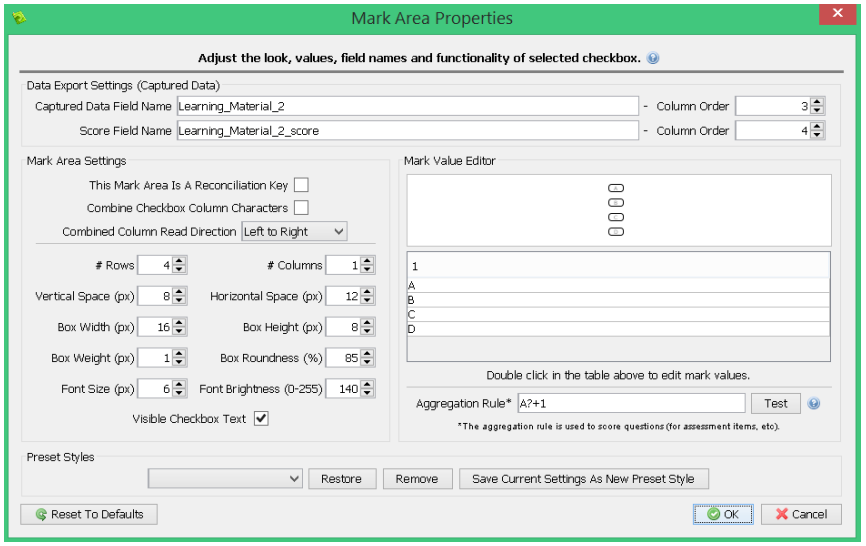


Figure 47: Pilot Testing, Source: formreturn.com

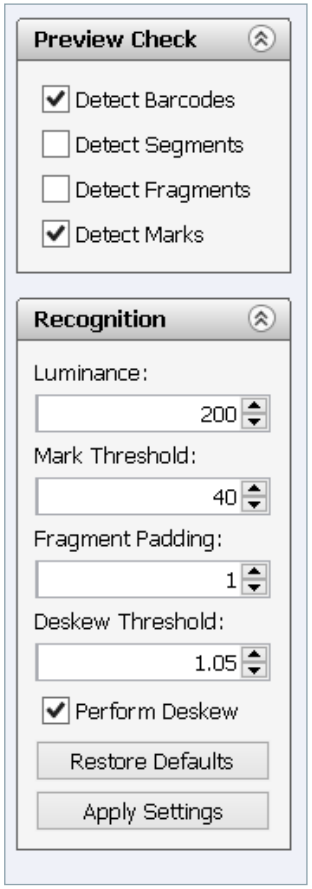


Figure 48: Error Correction, Source: formreturn.com

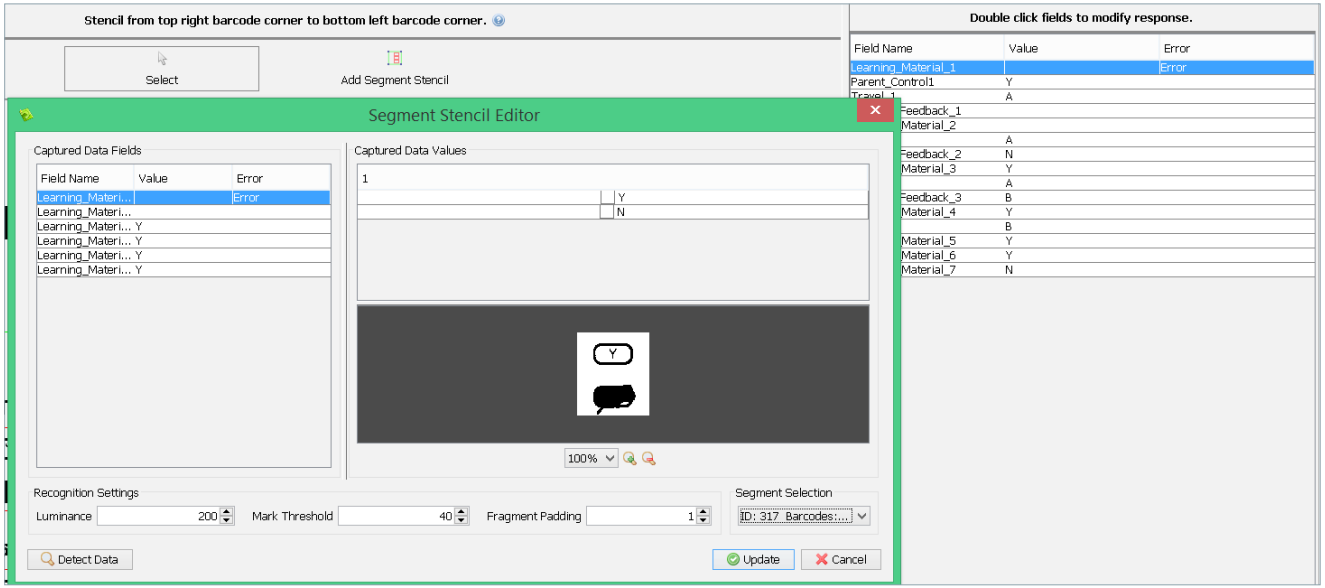
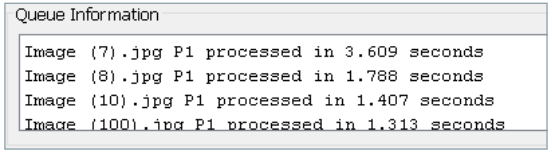


Figure 49: Submitting Scanned Questionnaires , Source: formreturn.com



FormScanner

FormScanner is open source tool for scanning and processing OMR responses. FormScanner offers a fast process for scanning examination answer sheets, which contain large grid of bubbles. However, for survey type of questionnaires, the same process becomes very tedious. Additionally, FormScanner does not provide means to create questionnaire. It expects its users to create OMR questionnaires in excel sheet or PowerPoint.

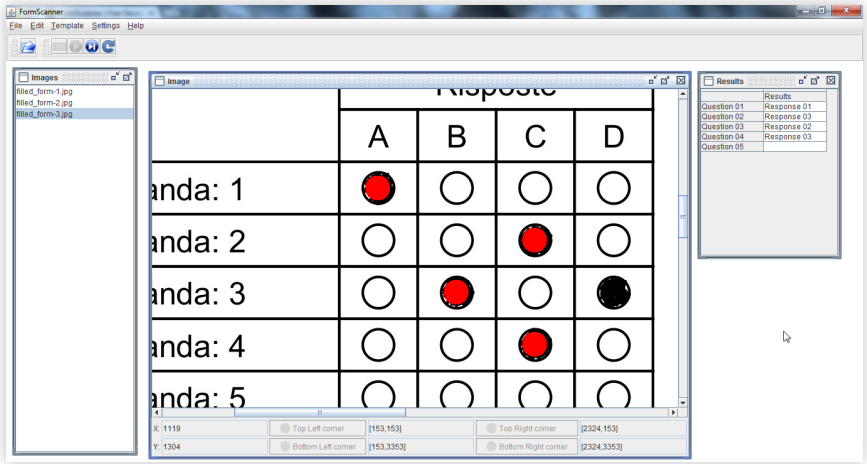


Figure 50: UI of FormScanner, Source: sourceforge.net/projects/formscanner

SDAPS

SPASD (Scripts for Data Acquisition with Paper-based Surveys) is an open source tool for data collection using OMR. It uses Latex and LibreOffice to create OMR questionnaires. One of the greatest drawback of SDAPS is it offers a command line user interface. Only for error correction, SPASD provides a graphical user interface in which user can mark unrecognized answers.

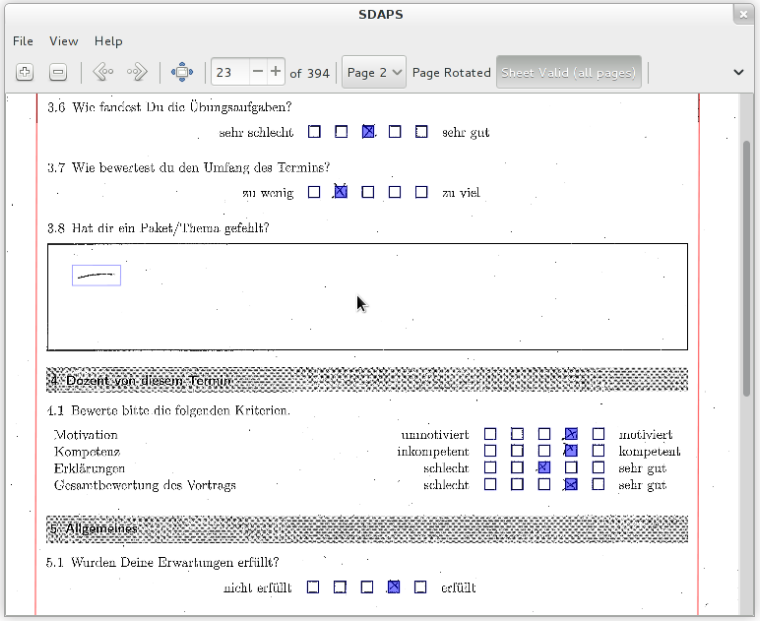


Figure 51: UI of SDAPS, Source: sdaps.org

Learnings from data collection

Many scenarios, which were not considered in initial concept, became clear after actually collecting data using OMR sheets

- OMR sheet needs to be designed. OMR format is not suitable for capturing textual/ descriptive data. OMR sheets are best suited for ordinal data.
- After creating, OMR sheet is tested by uploading sample images
- Many times OMR sheets are not scanned properly and user needs to manually correct errors. Generally, following type of errors are faced
    - Barcode not detected
    - Answer not detected
    - Section bar code not detected
- Bubble sheet is downloadable through online application

Proposed Workflow

We propose following workflow after considering our findings from actual data collection and review of online survey development products and OMR softwares.

	Create	Test	Conduct	Submit	Export
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
School Administrator			• Check Data Collection Status	• Check Data Collection Status	
Data Collector			• Check Data Collection Status • Collect Data	• Upload Pictures of Paper based Questionnaires • Check Data Collection Status (School / Grade wise)	
Visitor	• Register/ Create Login				• Export Data to suitable format

Proposed Workflow

	Analyse	Upload	View	Download

Survey Administrator	• Analyse Data
	• Create Visualization / Report
	• Form custom groups
		• Upload Visualization / Report
		  • Static
		  • PDF
		  • DOC
		  • JPEG
		  • Interactive
		  • Online
		  • Standalone Application
			• Views Levels
			  • School Level
			  • Class Level
			  • Student level
			• Compare
			  • Schools
			  • Classes
				• Download
				• Print
				• Receive via Email

School Administrator	• Analyse Data
	• Create Visualization / Report
	• Form custom groups
			• Views Levels
			  • School Level
			  • Class Level
			  • Student level
			• Compare
			  • Schools
			  • Classes
				• Download
				• Print
				• Receive via Email

Data Collector			• Views Levels
			  • School Level
			  • Class Level
			  • Student level
			• Compare
			  • Schools
			  • Classes
				• Download
				• Print
				• Receive via Email

Visitor	• Analyse Data
	• Create Visualization / Report
		• Upload Visualization / Report	• Views Levels
			  • School Level
			• Compare
			  • Schools
				• Download
				• Print
				• Receive via Email

Need Gaps

Even though OMR techniques is under practice for more than two decades, there does not exist any common standard for creating OMR documents. To illustrate, different OMR softwares use different shape to represent options. FormReturn uses rounded rectangle while FormScanner uses square or circular shapes. As a result, OMR questionnaires created using different softwares are not compatible with each other. Hence, user have to stick to a single OMR software throughout the whole process of data collection.

As both are intended for data collection, the online survey softwares and OMR softwares have many workflows in common. However, online survey platforms have evolved in terms of usability. They exhibit highly sophisticated and easy to use user interface. On the contrary, the OMR softwares still offer fairly complex user interface and workflows.

In the context of this project, teachers and researchers need a tool to create OMR questionnaire for their own purpose. For teachers, who are already loaded with lot of academic work, we cannot expect them to spend lot of time in learning the software. Additionally, we cannot guarantee that all teachers will have enough computer literacy in order to carry out complex workflows. Therefore, workflows specific to OMR functionality need to be redesigned for simplicity and usability.

Scanning Technology on Smartphones

One of the hurdle in implementing OMR technology in resource constrained schools is the availability of scanner. However, nowadays the computing power of smartphones have increased. Smartphones are equipped with more powerful cameras. It is now possible to run heavy duty image-processing algorithms on smartphones. There are many applications like Google Drive and CamScanner who offer scanning of pages using phone camera. Hence, in resource constrained schools, we can use smartphones to scan OMR sheets.

Figure 52: Google Drive Scannin Functionality, Source: lifehacker.com

Final Concept

Open School Learning Analytics

Introducing OSLA

OSLA is a survey development and learning analytics platform. OSLA means **Open School Learning Analytics**. As its name suggests it is a common platform for schools teachers, researchers and NGOs to openly share data and its analysis with each other. OSLA helps in capturing micro-level data of schools. Unlike other platforms, OSLA relates all collected data to students and their schools. This allows researchers to co-relate data the way they want and draw collective insights.

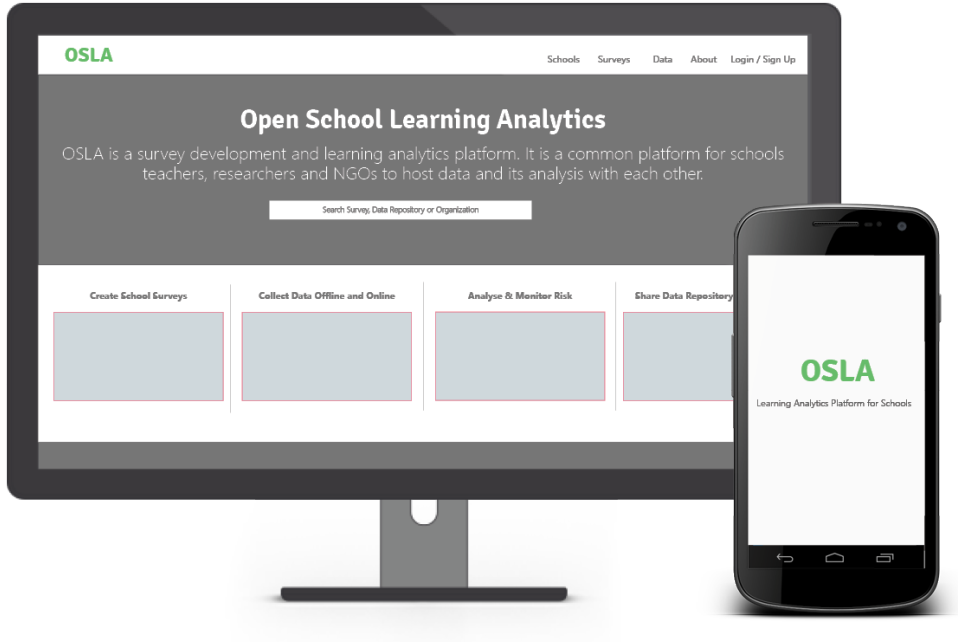


Figure 52: OSLA Platform

Key Features

Search, Analyse & Download School Data

As OSLA is a common platform for schools, NGOs, educational organizations and researchers, one can search about existing surveys, data repositories, schools and organizations on OSLA. As OSLA hosts open data, there is no need for a visitor to be registered to search and get basic analysis of surveys and organizations. Moreover, any registered user can download openly hosted data of any school or survey. While openly sharing data, OSLA maintains secrecy about identities of any involved individuals like teachers or students.

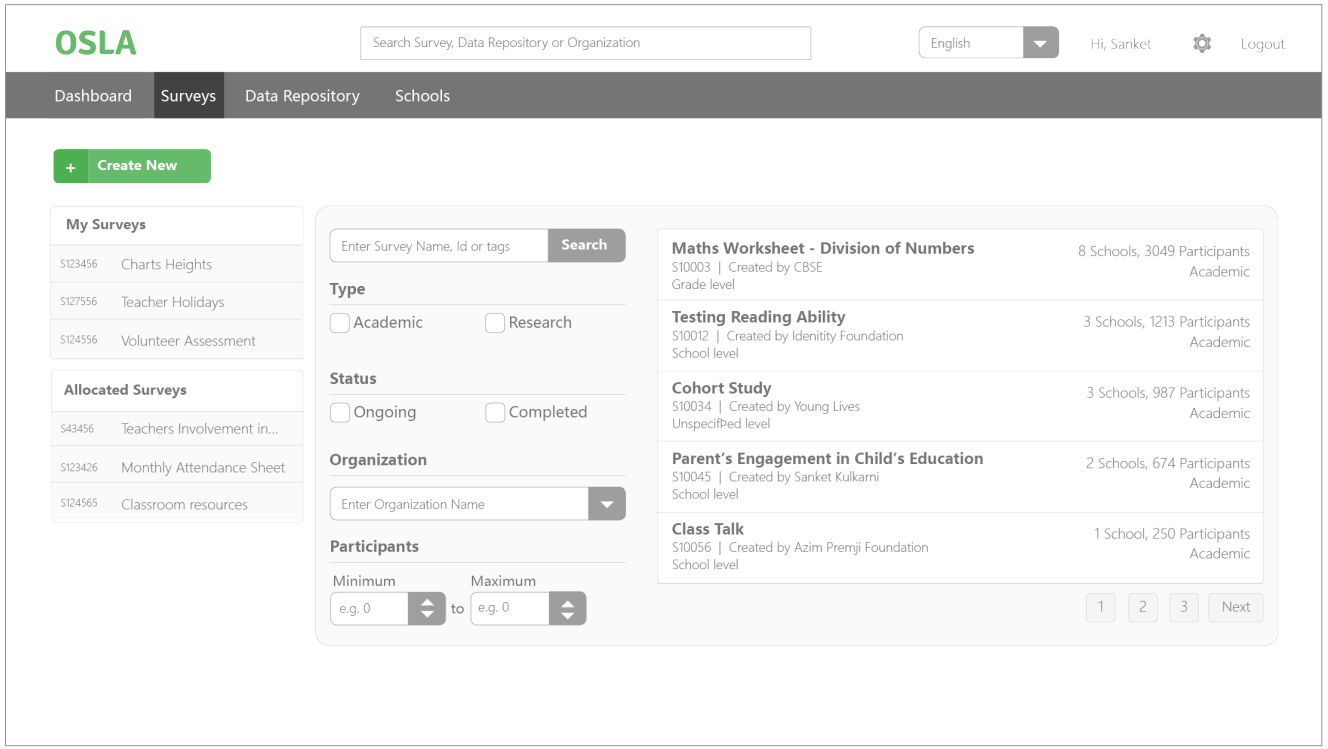


FIgure 53: User Interface for Survey Search

The search tool provides visitor different types of filters to get desired results fast. Additionally, survey metrics like 'number of participant' and 'used by' help user to decide popularity and authenticity of survey.

Key Features

Create Surveys to Collect Almost Any Data

OSLA provides users state-of-art facility to create questionnaires. For creating questionnaires faster, users can use existing questionnaires to build on top of it. Users can also utilize section templates like student basic information and teacher information provided by OSLA platform. As OSLA is designed to collect any type of ordinal data, one can create survey to capture any type of existing ordinal data like attendance of students, exam grades and subject-wise marks.

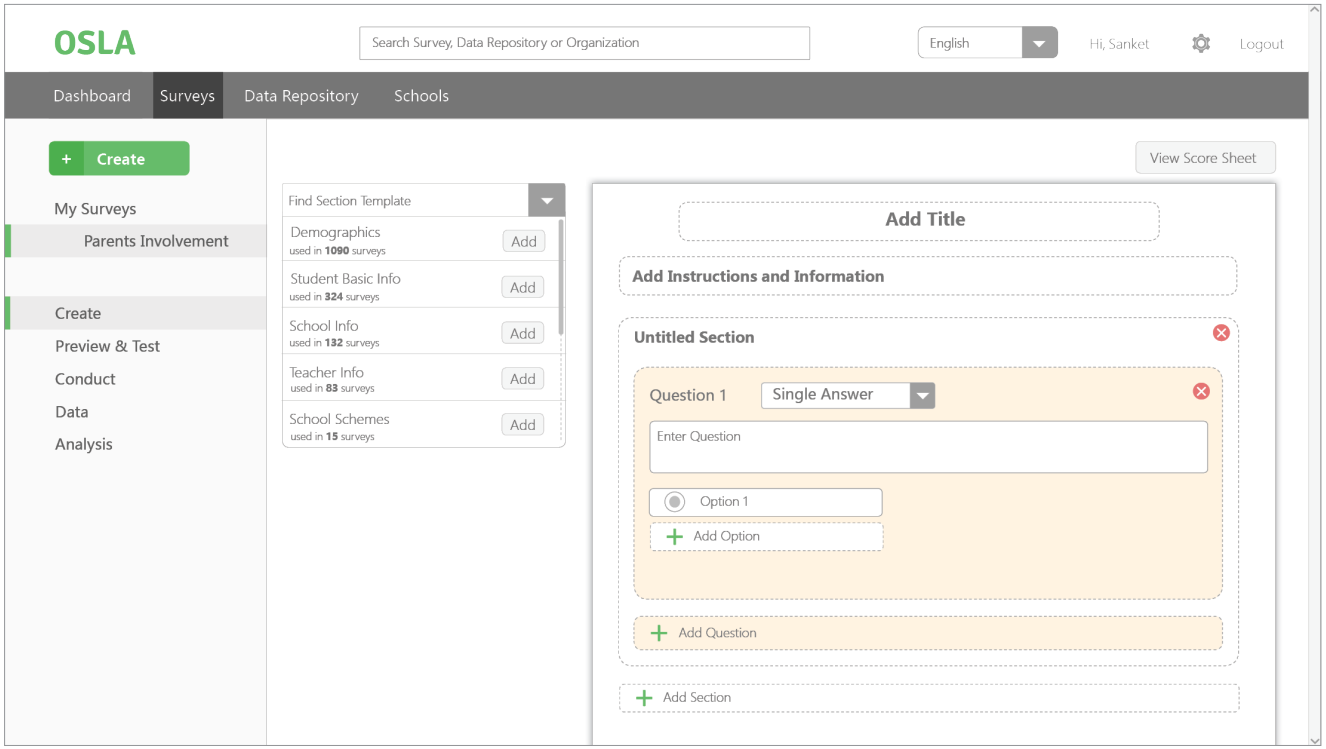


Figure 54: User Interface for Survey Search

In addition to the feature of creating survey, OSLA allows users to add scoring to question. User can assign scoring and associated risk factor to each type of response. This scoring sheet is automatically taken into account while creating visualizations in analysis phase.

OSLA enforces to use identifier for school, teachers and student while creating survey so that collected data can be related back after uploading.

Key Features

Collect Data Offline or Online

Using OSLA platform, survey can be conducted on multiple channels with or without internet connectivity. OSLA allows survey to be conducted using

- OMR sheets
- Mobile Application
- Desktop Application
- Website

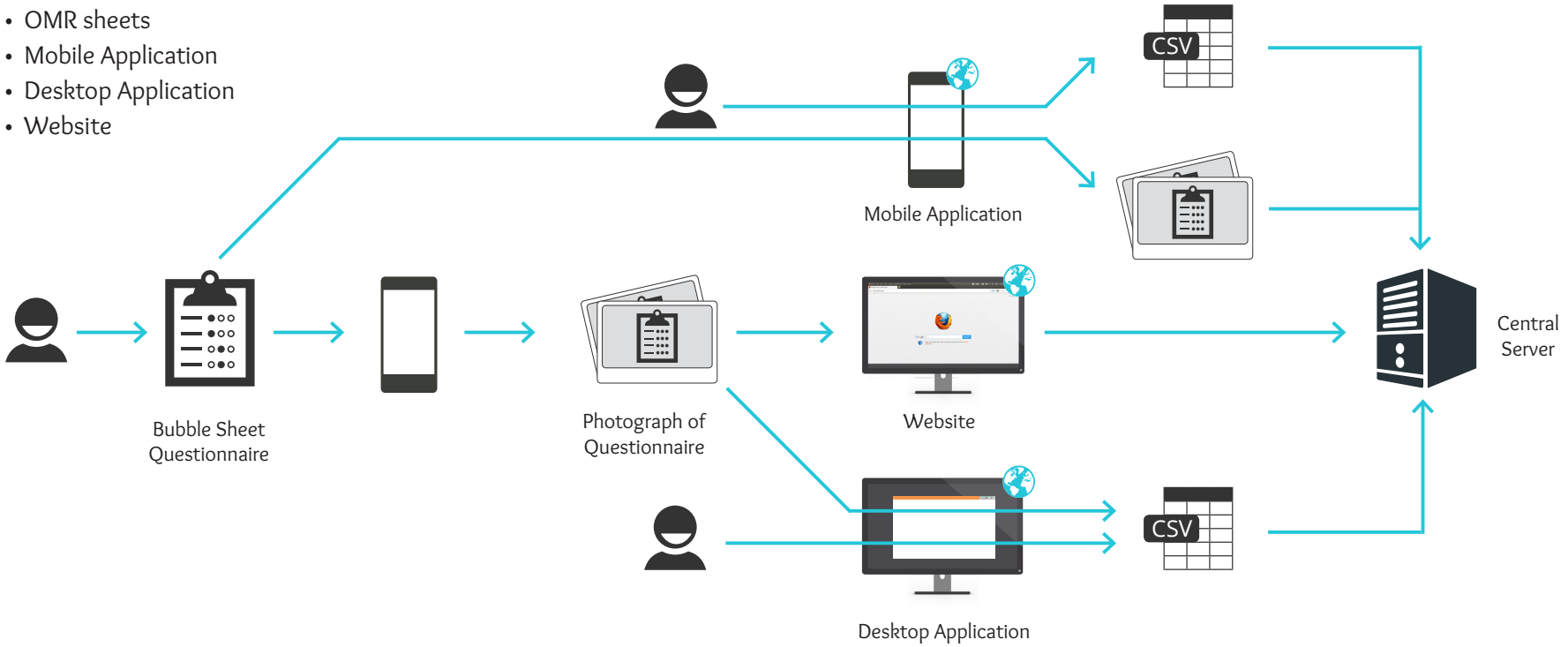


Figure 55: Data Collection Methods- System Design Diagram

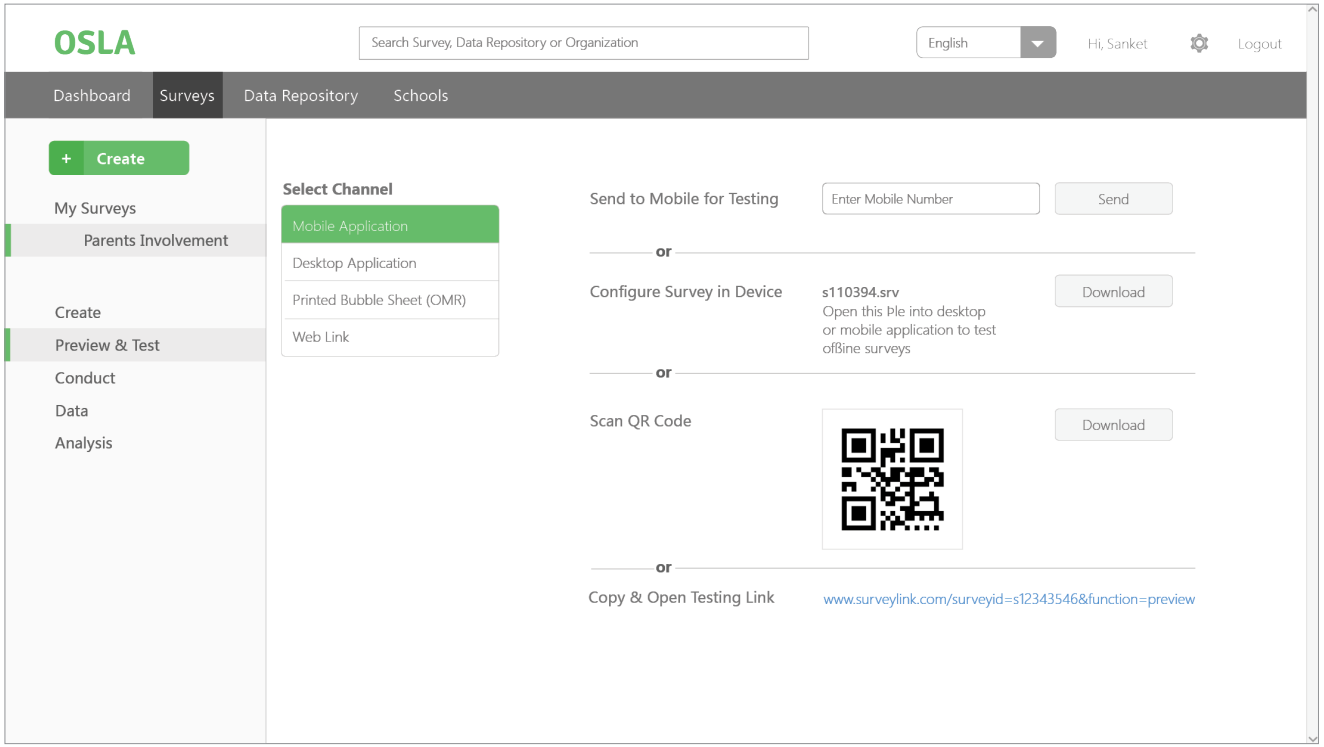


Figure 56: UI for selecting the channel to conduct the survey

OSLA creates a ".srv" configuration file for a survey. This file can be configured in standalone mobile or desktop application. This enables application to be able to conduct survey without internet connectivity. Additionally, it also allows OSLA application to process OMR sheet responses. Whenever, application gets connected to internet, it automatically uploads data to central server. Otherwise, data can be exported and can be submitted to central server through any other OSLA application having internet connectivity or website.

OSLA combines sophisticated patterns of online survey development applications with the workflows of OMR softwares. The result is a simplified workflows of OMR questionnaire creation, conducting survey and error correction. In this way, OSLA has less learning curve than traditional OMR softwares.

The OMR sheet is automatically generated by OSLA based on questionnaire. The user is provided with multiple auto generated layouts of OMR sheets. He can directly download PDF file, take printout and start collecting data. He can optimise any layout further by choosing layout of options of each question and section.

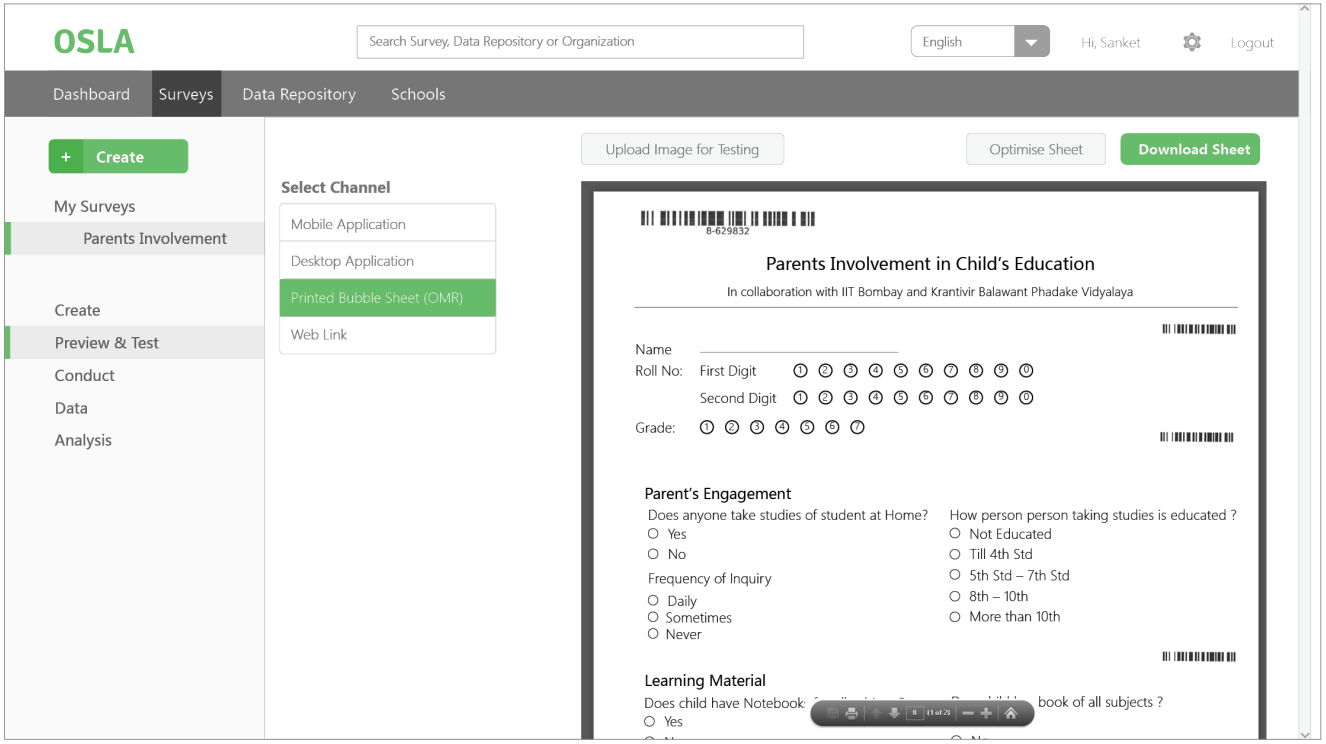
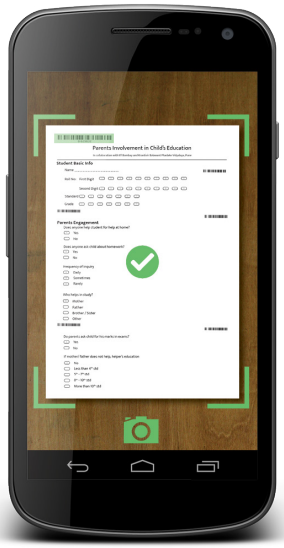


Figure 57: Auto-generated OMR sheet by OSLA



After collecting data using OMR sheets, user can take photograph using his/her smartphone and process these images using OSLA mobile or desktop application.

Key Features

Analyse data with enhaced filtering and sorting options

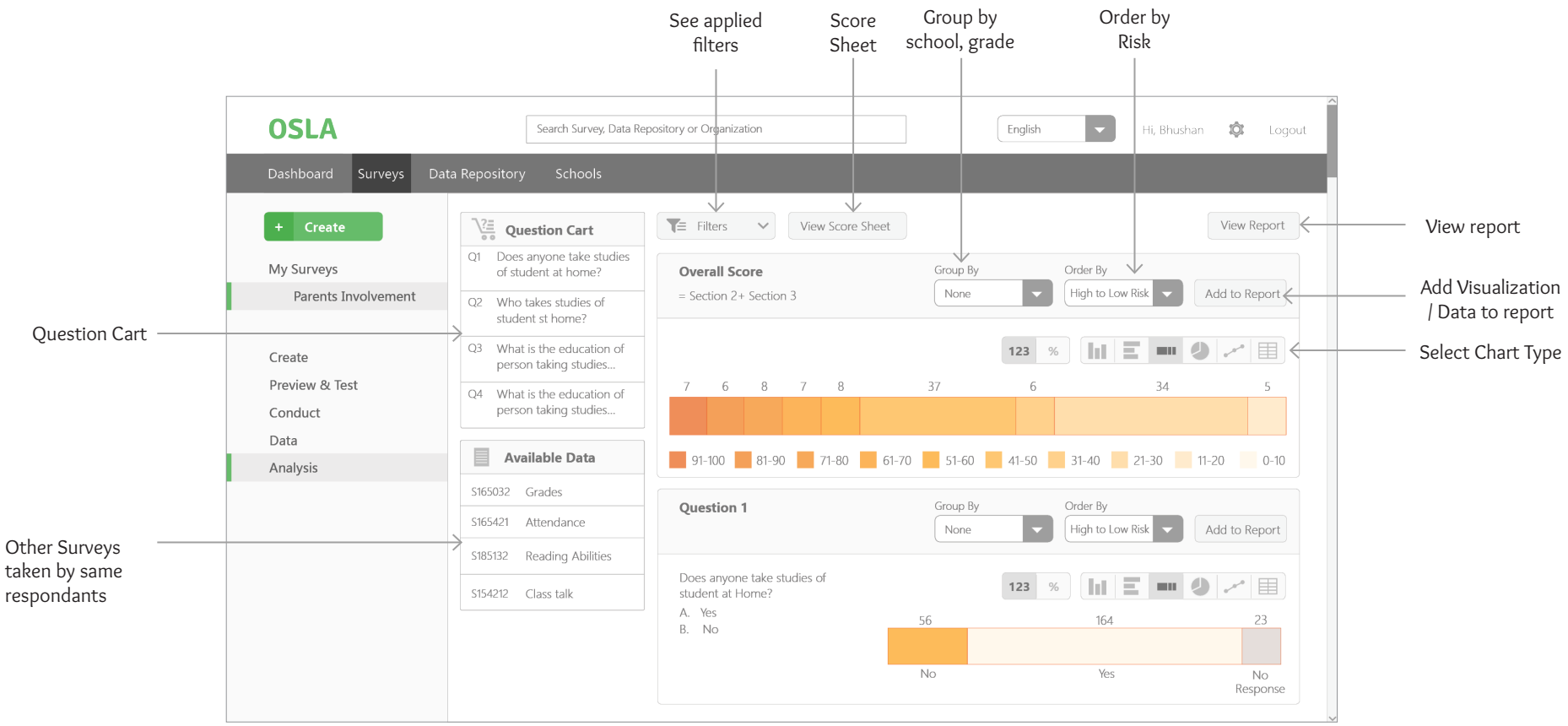
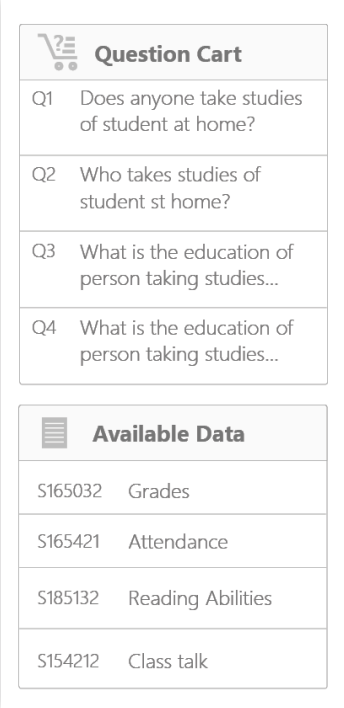


Figure 58: UI for Analysis of Survey Data

Utilize multiple survey data using Question Cart

As specified earlier, OSLA co-relates all collected data by students, school and organization profile. To achieve the same, OSLA provides facility of question cart. Like the connotation of shopping cart, question cart can have questions imported from multiple surveys. While analysing survey data, OSLA suggests available data from previously conducted questionnaires for the same participants. User can select questions from suggested surveys and import them into question cart. In this way, user can analyse and visualize data from multiple surveys at same place.



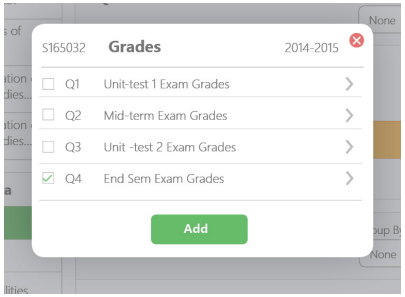


Figure 59: ions from other surveys to Question Cart

Use Advanced Filtering for Creating Custom Groups

OSLA provides advanced filtering options while analysing data. The participants can be filtered by selecting type of responses given by them. The filtered responses or participants can be saved as custom groups. Later on these groups can be used to conduct more surveys. School authority can publish these custom groups to express actual need to the willing to help organizations.

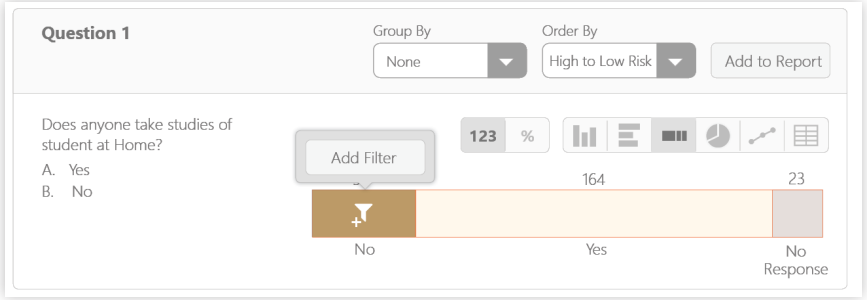


Figure 60: Filters responses by choosing the answer

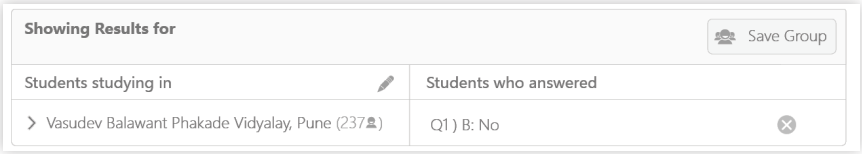


Figure 61: Panel showing applied filters

Sort and Filter Responses by using Involved Risk

While specifying scoring, each option, sectional score or overall score can be marked as High Risk or Some Risk or No Risk. This enables OSLA to understand involved risk for that answer. This tagging of options based on involved risk brings consistency in the visualizations. For example, darker orange colour in any visualization means more involved risk for that response. This colour coding is followed in all visualizations. Hence, while looking at any visualization user can understand involved risk for any group of responses. Additionally, responses can be sorted from High Risk to No Risk or vice versa.

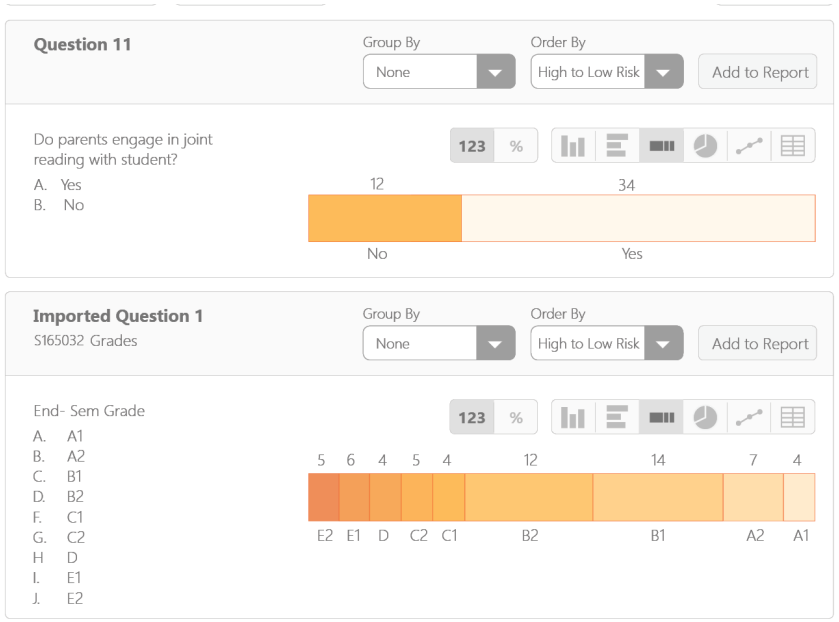


Figure 62: Consistency in colour schemes across all visualizations

Customize and Export Reports

User can select multiple range of chart types to represent data as per his need. Later he/ she can add visualization or tabular representation of response data to report at any point of time i.e. he can add question and its analysis to report even after filtering or after modifying question cart.

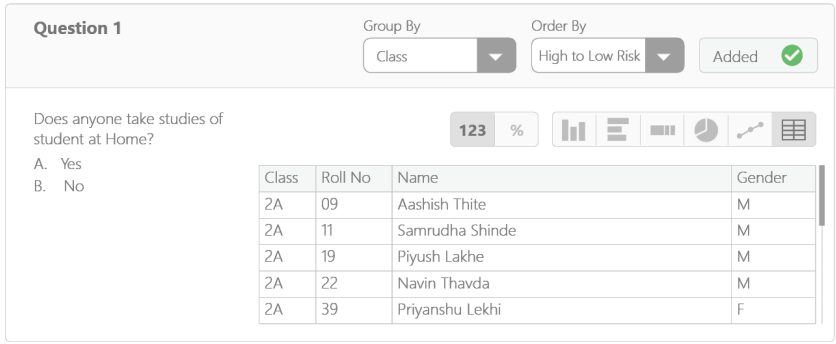


Figure 63: Data added to report

User Roles

Organization Administrator

Organization Administrator is member of organization who is granted authority to maintain account and profile of organization on OSLA platform. Organization can be school or NGO. For school, school administrator can be a senior teacher or headmaster. Organization Administrator is appointed by mutual consent of other members. Organization Administrator is expected to be moderately comfortable with using computer or website, so that he/ she can maintain account of organization on AnyHow platform.

Tasks

(in the order of high to low priority)

- To view results and analyse data
- To track survey collection
- To approve data collection
- To print report
- To create school profile
- To add teacher and student accounts

Survey Administrator

Survey Administrator has authority to manage activities in survey lifecycle. Survey Administrator can add different data collectors to survey and can track progress of survey data collection. There can be multiple survey administrators. Multiple survey administrators are required while managing same survey in different schools.

Tasks

(in the order of high to low priority)

- To create survey
- To keep track of survey responses
- To analyse survey responses
- To add data collectors
- To correct errors
- To print report

Data Collector

Data Collector is person who is allocated a survey to collect data. The data collector can choose any channel to collect data as his/ her comfort. Generally, data collector can be teachers from schools or volunteers from NGO.

Tasks

(in the order of high to low priority)

- To collect data directly using mobile phone
- To correct errors

Visitor

Visitor is person visiting OSLA website. Visitor can search surveys, data repositories and organization profiles without creating account. However, in order to download data or upload analysis reports, he has to register with OSLA platform.

Tasks

(in the order of high to low priority)

- To search survey, data repository
- To view school profile
- To download data

Scenario 1

Create OMR Questionnaire

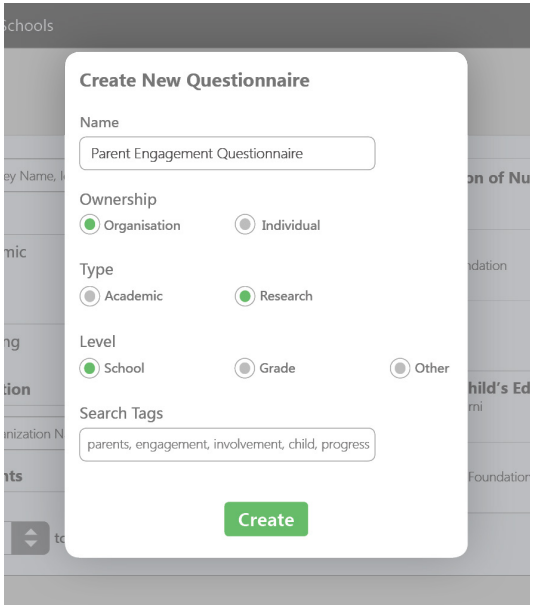
Background

Sanket is doing research in the area of parent's involvement in child's education. He wants to conduct a survey for the same. He has already talked with Bhushan sir from Vasudev Balawant Phadake Vidyalaya, Pune for the same. Bhushan Sir told him that teachers of school will help him in conducting data.

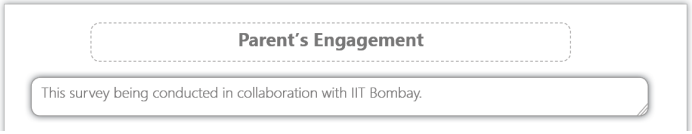
The school has only one computer which is used for accounting. Many teachers are not comfortable with using computers. Many teachers don't have smartphones. Teachers do not have more time to spend for this activity. Additionally, Sanket wants data in digital format for analysis. He does not want to spend time in manually data entry. Bhushan Sir insists Sanket to conduct survey using OSLA platform because finally he will also be able to analyse data collected suing this survey and get benefit from it.

.

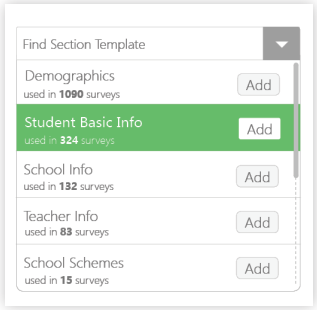
1 Sanket logs into OSLA platform. He chooses to create new survey.

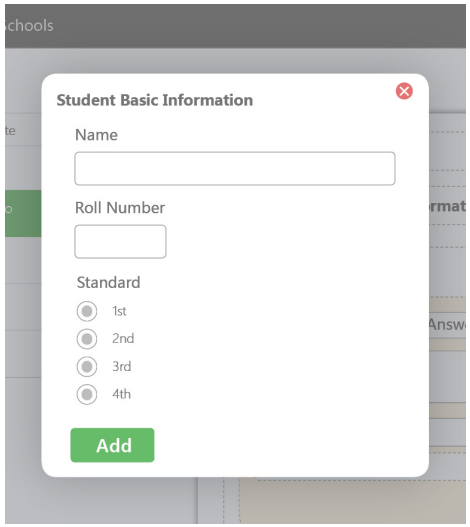


2 He enters title and instructions.

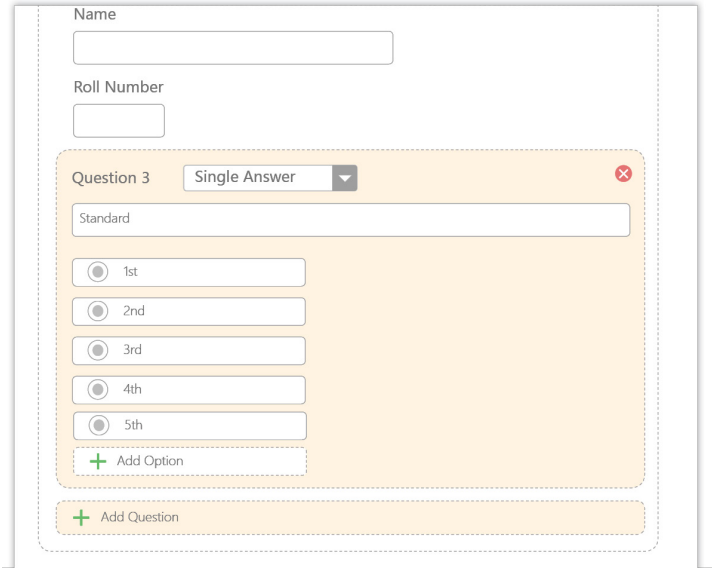


3 He looks at section templates and chooses “Student Basic Information” Template to add to questionnaire.

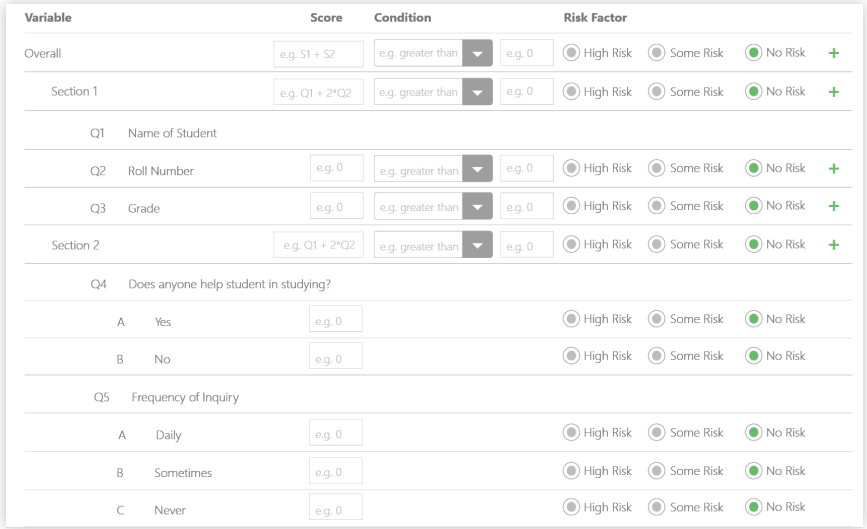




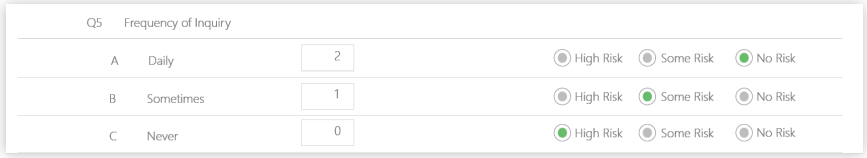
4 He is conducting survey for students till 7th std, but question from template has options till 4th std. He add remaining options to question.



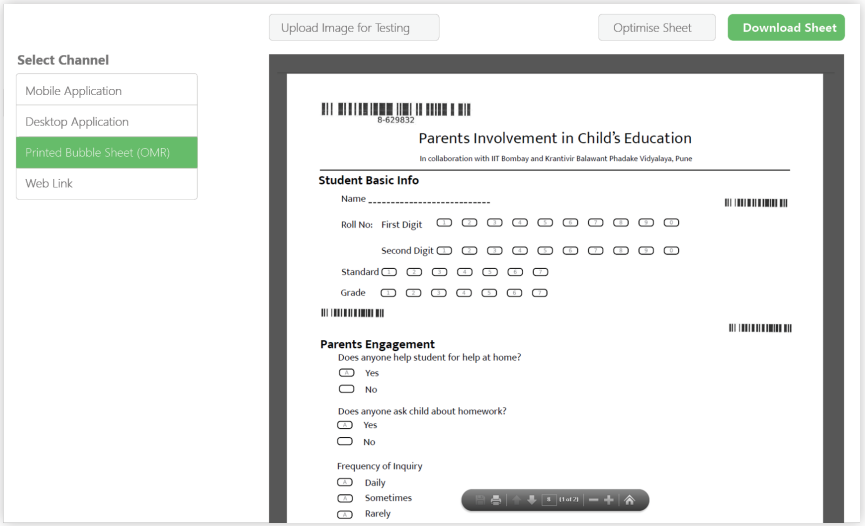
5 He selects to add scoring to questions. In scoring sheet, he is presented with a table of questions.



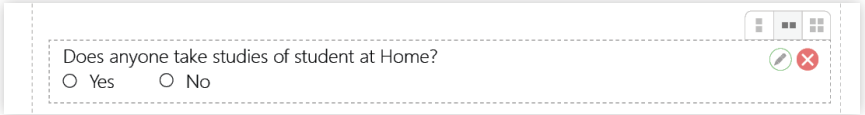
For question, he adds different scores to options. He also selects whether option has high risk, some risk or no risk.



6 After completing the questionnaire, he chooses to create OMR questionnaire out of it. Default OMR questionnaire takes 1 ½ pages. He chooses to optimise it.



7 He edits the orientation of options of some questions. After satisfied with layout, he saves OMR sheet and downloads it.



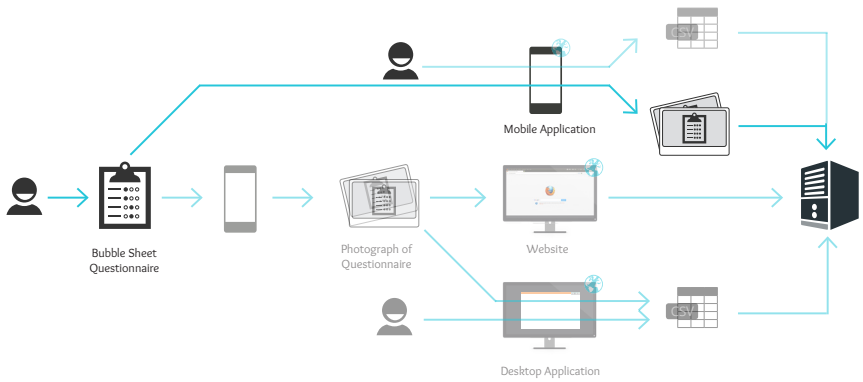
Scenario 2

Conduct Survey

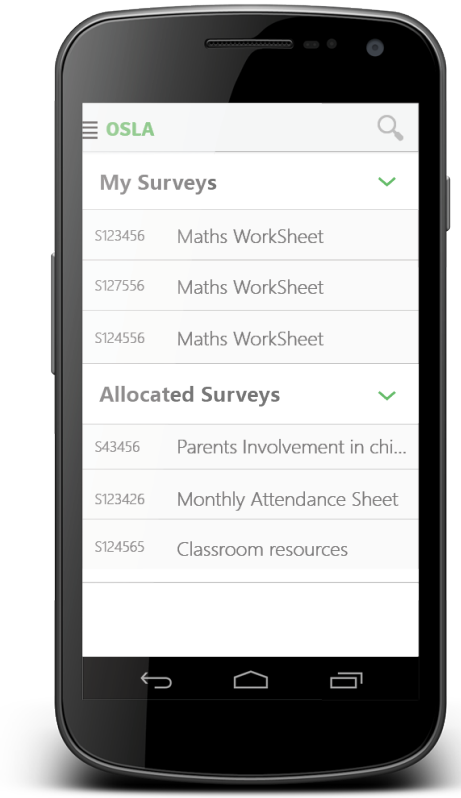
Background

Shruti and Vasundhara are teachers in Vasudev Balawant Fadake VIdyalay, Pune. Bhushan sir, headmaster of school, has allocated “Parent’s Involvement” survey to Shruti as well as Vasundhara. However, Shruti does not have smartphone to conduct survey. Hence, she needs to conduct using OMR sheets. She gets printed OMR sheets from Sanket, which already has name, roll numbers, class, grade and school code already printed on it.

She conducts survey in her class. After conducting survey, she takes OMR sheets to Vasundhara. Vasundhara has a smartphone. She already has OSLA application installed on her mobile phone. Vasundhara helps Shruti to upload data on server.



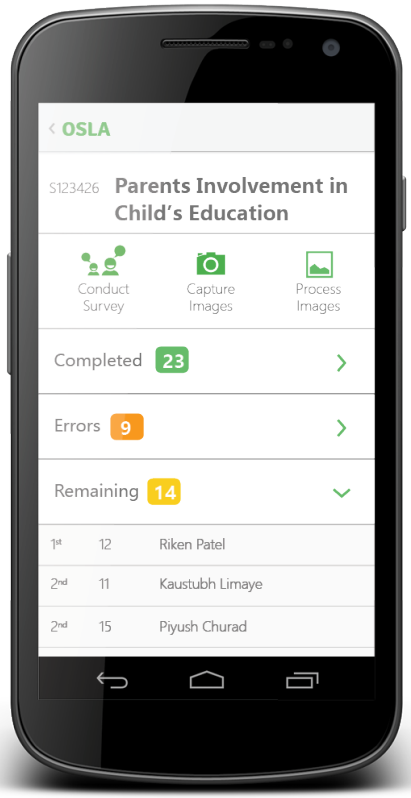
1. Vasundhara opens the OSLA application. As same survey is also allocated to her, she finds “Parent’s Involvement” survey in dashboard. She selects that survey.

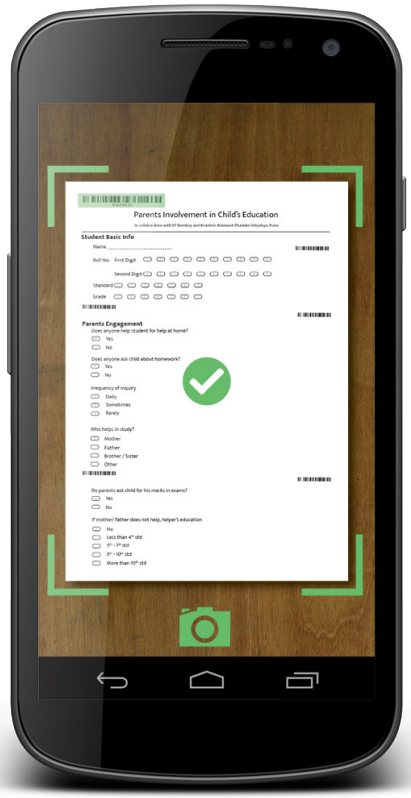


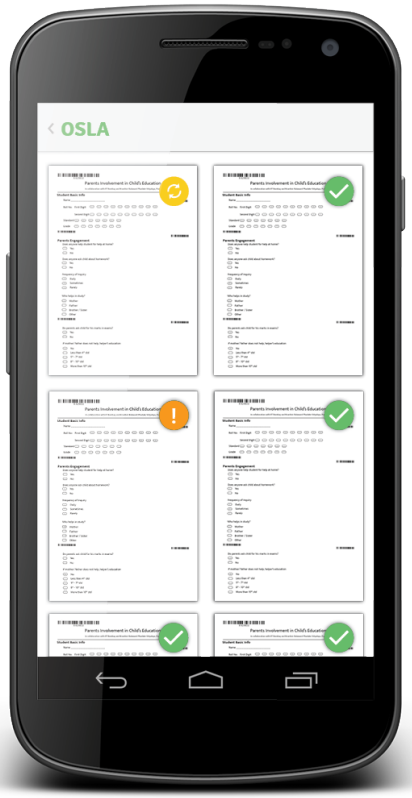
2 In survey profile, Vasundhara is able to see list of responses which are complete, have errors and remaining. She selects to capture images for survey.

3 She takes the picture of OMR sheet using camera. The camera view inside application guides her for correct alignment of sheet.

4 Application starts uploading photos to server.



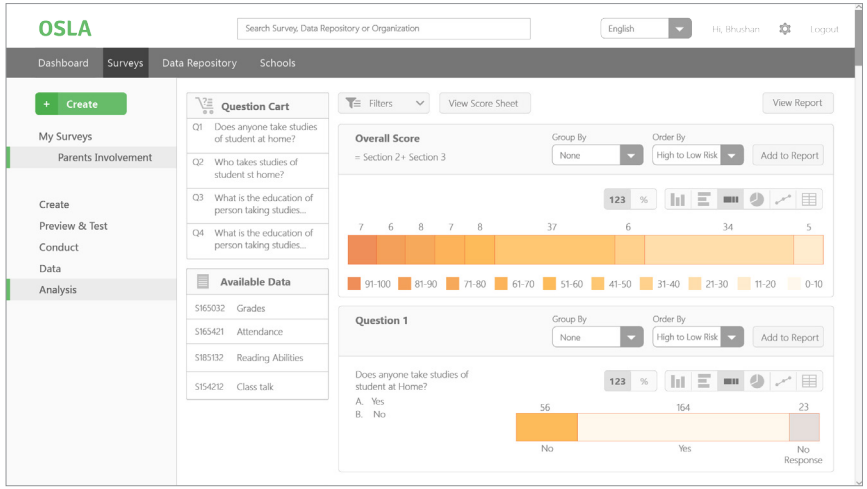




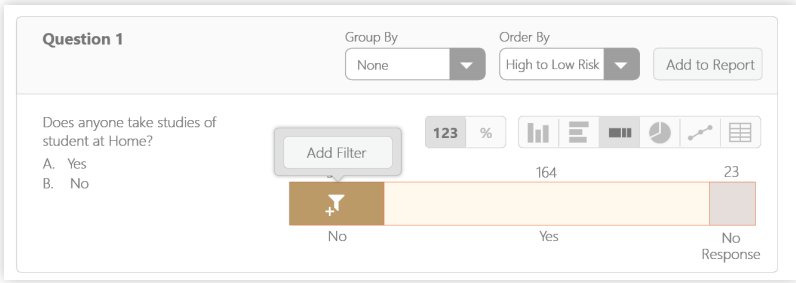
Scenario 3

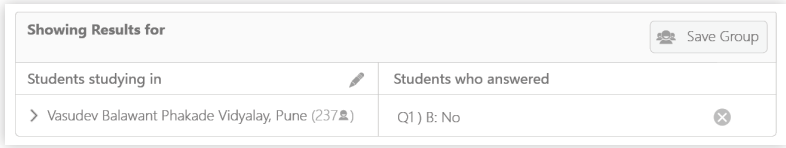
Analyse Survey Data

1. Bhushan, headmaster of school, logs into application using website on Desktop. He selects Parents Involvement Survey. Website directly shows him preliminary analysis.

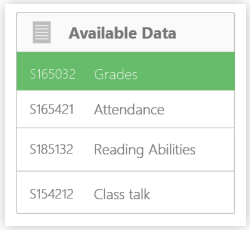


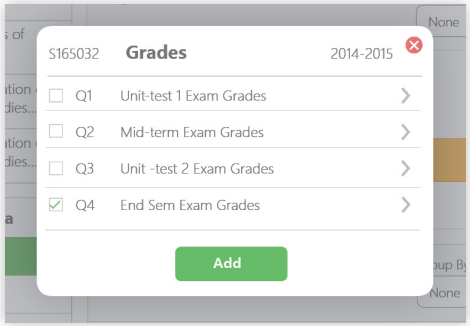
2. He goes through question wise responses. He selects group of students who don't get help from home. He sees other data available for these students.

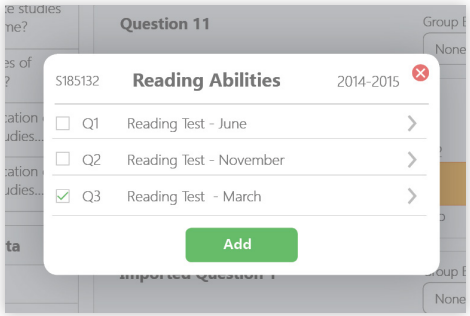




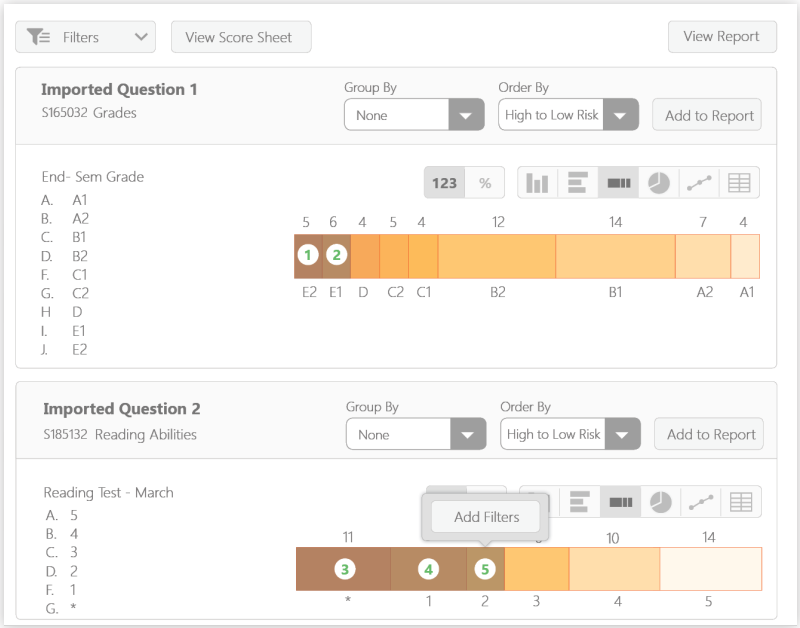
3 He selects reading level survey, selects parameter. Parameter gets added to cart. Then he selects grades survey, selects parameters. Parameter gets added to cart. The selected parameters get added in the view.

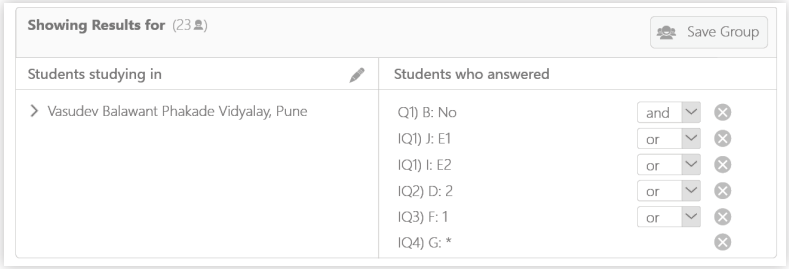




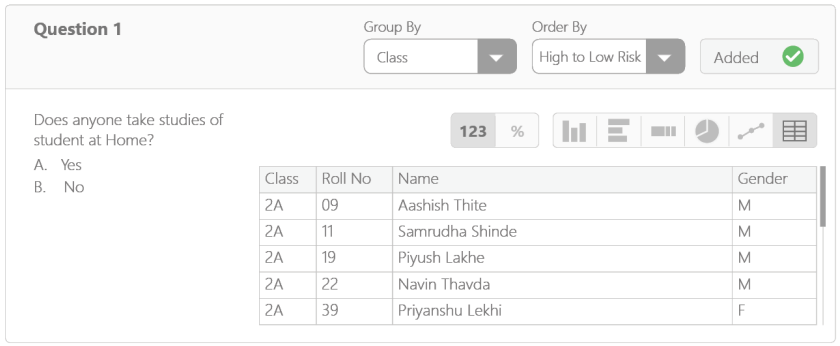


4 Then he filters students who do not have good grades and students who have low reading level.





5 He then adds their names to report. He can now download and take printout of report.



Class	Roll No	Name	Gender
2A	09	Aashish Thite	M
2A	11	Samrudha Shinde	M
2A	19	Piyush Lakhe	M
2A	22	Navin Thavda	M
2A	39	Priyanshu Lekhi	F

Evaluation

The purpose of user evaluation for this project was to understand conceptual, usability and feasibility issues faced by user while new functionalities provided by OSLA platform.

Objectives

- To evaluate usability of proposed data collection methods
- To evaluate improved workflows of OSLA platform by comparing its usability with state-of-art OMR software.
- To evaluate user's ability to analyse data using OSLA platform
- To examine perceived usefulness of OSLA platform

Evaluation was be conducted in two parts.

1. **Heuristic Evaluation:** It consisted of 2 heuristic evaluation sessions with 4 Interaction Designers (3 M.Des, 1 Ph.D). It helped in getting expert's feedback on usability of product. Each session lasted around 1 hour and 30 minutes.

2. **User Testing:** It included testing of prototype in actual context.

Protocol for User Testing

Before starting evaluation, participants were given a small training session. In this training session, the purpose of OSLA platform and its key features were explained. The training session lasted around 15-20 minutes.

After training, participant were asked to perform task as per his/ her role. For example, if a participant was recruited for data collector role, he/ she was be asked to perform prime tasks of data collection role. In the task, participants was given a specific goal to achieve. Participants were provided a smartphone or laptop depending upon type of task. During the evaluation test, participants were observed to collect data about evaluation criteria.

For OMR workflow related tasks, user were asked to perform task after giving demo of same task on FormReturn OMR software.

After performing task, participants were asked about their feedback and overall experience using contextual inquiry.

Evaluation

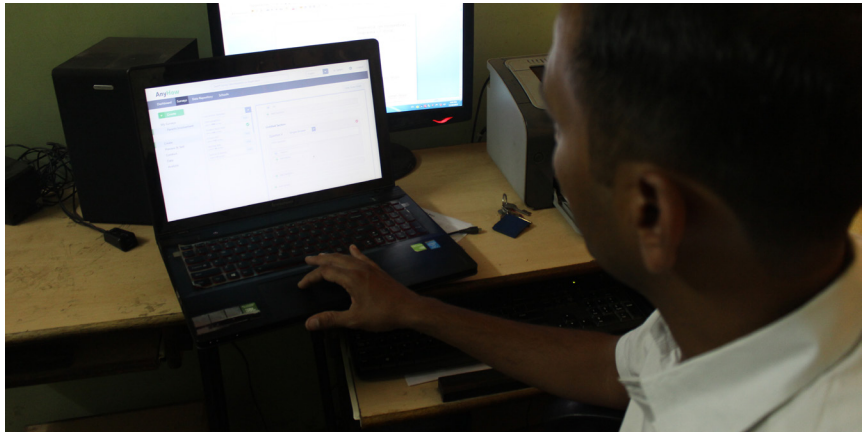
Tasks for Evaluation

Mobile Application

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

Website

- To search survey and download Data set
- To download / Optimise OMR Sheet
- To utilize multiple surveys using question Cart
- To form custom group using filtering options



Recruited Users

The prototype was tested with 4 users (1 Male, 3 Female) thoroughly. Out of these 4 users, one user was a senior teacher who was acting headmaster of the school. Others included 1 teacher and 2 DIET (District Institute of Education and Training) committee members.

Evaluation

Positive Feedback

- Users found proposed data collection process very easy.
- Users found OSLA very easy as compared to the demonstrated OMR software because, OSLA required less effort for creating a questionnaire and OSLA has relatively simple user interface.
- Users liked the fact that data for students can be co-related. Hence, it is possible to track longitudinal growth of students.
- Users suggested that even health and sport related data can be added. This can be considered as positive feedback as users were suggesting new ways of using OSLA platform.
- The facility of report creation was found to be useful by users as they need to spend lot of time to analyse data and create reports periodically.

Feedback for OMR related tasks

Based on number of attempts user required to complete the task, the following list represents tasks in order of easy to difficult.

1. **To capture OMR Responses by taking Photographs** (easiest)
2. **To conduct Survey on Mobile**
   Observation: Some users thought that using OMR sheets for capturing responses is mandatory. The reason behind this could be the overall emphasis on OMR related tasks in the evaluation.
3. **To correct error**
   Observation: Users needed guidance while correcting errors for first time. All of them were successful in second attempt. From user's feedback, it became clear that users were not able to understand how software is capturing images.

Common Concerns

- Currently, it is still unclear how OSLA will authenticate identity of survey participants.
- Interaction Designers and users found user interface for data analysis too much cluttered and complex to understand.
- **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.
- There is need to make labels more actionable. E.g. "Search Survey Templates" to "Add Questions using Templates.

Conclusion

In this project, for availing learning analytics in resource constrained schools of India, we propose a system which is designed to tolerate unavailability of resources and to provide multiple ways of accessing, collecting and analysing data. The results of evaluation show user's positive feedback towards UI flow of data collection methods in resource constrained schools.

However, implementing OMR library for mobile devices is still a challenge which needs to be solved. Even though users did not complain about using English s language for interface, there is need to research issues related to its use in detail. Moreover, currently only mobile application part of proposed eco-system is implemented. The website and desktop application needs to be implemented.

Learnings

The project brought me an opportunity of understanding Learning Analytics Domain in depth. Additionally, this was my first project in the school environment. It helped me in getting a thorough understanding of school dynamics and resource constrained environments. I was also exposed to basic information visualization techniques like relational and hierarchical data visualization.

References

Ferguson, Rebecca (2012). Learning analytics: drivers, developments and challenges. International Journal of Technology Enhanced Learning, 4(5/6) pp. 304–317.

M.A. Chatti, A.L. Dyckhoff, U. Schroeder, and H. Thüs , A Reference Model for Learning Analytics , International Journal of Technology Enhanced Learning (IJTEL).

Will Analytics transform Education? - Learning Frontiers (http://www.learningfrontiers.eu)

Siemens, G. (2010) What Are Learning Analytics? Available online at: http://www.elearnspace.org/blog/2010/08/25/what-are-learning-analytics/ (accessed on 24 September 2010).

Johnson, L., Smith, R., Willis, H., Levine, A. and Haywood, K. (2011) The Horizon Report: 2011 Edition, The New Media Consortium, Austin, Texas.

ASER 2014 - Annual Status of Education Report, January 2015

Mark van Harmelen and David Workman, JISC CETIS Analytics Series: Vol.1 No. 3. Analytics for Learning and Teaching, 2012

Selim Iltus , "Significance of home environments as proxy indicators for early childhood care and education", UNESCO Education for All Global Monitoring Report 2007.

Robert J. Dufresne, William J. Gerace, William J. Leonard, Jose P. Mestre, and Laura Wenk , "Classtalk: A Classroom Communication System for Active Learning", Journal of Computing in Higher Education Spring 1996, Vol. 7(2), 3-47

Signals: http://www.purdue.edu/newsroom/students/2009/090827ArnoldSignals.html

SNAPP: http://www.snappvis.org/

GISMO: gismo.sourceforge.net

CSR PMC Schools: http://csrforpmcschools.org/

SurveyMonkey: http://thenextweb.com/asia/2014/05/26/surveymonkey-ceo-says-asia-could-be-its-biggest-market-but-an-android-app-is-critical/

Google Forms: https://www.google.co.in/forms/about/

Google Analytics: http://www.businessbee.com/resources/marketing/search-engine-marketing/set-up-google-analytics-for-your-website-in-5-easy-steps/

U-DISE: http://www.dise.in/udise.html

Socrato: socrato.com

FormReturn: https://www.formreturn.com/videos/quick_start_guide

FormScanner: http://sourceforge.net/projects/formscanner/

SDAPS: http://sdaps.org/Documentation/GUI

Google Drive: http://lifehacker.com/five-best-mobile-document-scanning-apps-1691417781