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Data – Its Use and Relevance in Schools

Asma Zafar, United Arab Emirates

Data - the word has a wider enormity to what it actually means. In simple terms, the word data refers to extended information regarding anything and everything. This includes practically everything around us including living objects, non-living things, static and non-static items, space and beyond. The purpose of this article is to discuss data in an educational environment from a practical point of view. Using the processes embedded in a focal school in the UAE, the article examines the different sources of information used, how it is collected in a consolidated form so it is both available and reliable at the same time and what relevant information we derive from it so it is meaningful for both staff, students and parents.

Introduction

As poignant and succinct it may seem, it is almost an absolution that if the available information can be measured, we can have various ways to use and manage the wider relevant objects better suited to our needs.

Further to its basic definition, data comes in a variety of shapes and forms and can also be both qualitative and quantitative. By qualitative data we define it as descriptive material that is harder to analyse by analysts. This data is mostly used for individual studies and perhaps to find out ways how people feel and think for various studies. Quantitative data, on the other hand, is all information that can be measured and written as numbers. While to the mathematicians amongst us, data may only be numbers (quantitative) but to others it may be a very rudimentary form of extended information (qualitative).

In today's world, the term “Big Data” has also cropped up (Chen, Chiang & Storey, 2012). “Big Data” is the humongous amount of data that is being accumulated around us and is becoming hard to manage even for company giants like IBM. This is because of an information overload with respect to all plausible things around us. This may result in lack of resources and shortage of data analysts to manage and analyse this volume of information.

Whichever shape or form the data is, it is meaningful to the users only if it has the integrity. This refers to accuracy and consistency of data over a period of time and between updates. This can be ensured by three key factors; Reliability, Availability and Relevance (Teeling, 2012).

The Reliability of data can be attributed to the fact that the available information is generally accurate and error free for use in its context (Morgan, 2004). Availability will imply that data is accessible and continues to be available to all who may benefit from it and in all

circumstances ranging from normal to crisis situation (Mullins, 2013). As for relevance, the data needs to be relevant to the purpose it is required for. It should be able to solve a problem or help find a solution for the issue (Suer, 2016).

Given these brief definitions, when referring to schools specifically, the data relates to many varied aspects including students, staff, parents, resources (both moveable and immovable), transport, and buildings. In order to have the data sorted in a usable way for teachers and administrators, there are six main stages namely collection, preparation, input, processing, output and interpretation and storage. These six stages are implemented via four key steps before the data is analysed (Harris, 2013). They are:

- *Identification of storable information:* When information is the focal point, the first step is to identify the objects we want to procure and store data for.
- *Definition of processes for storage and backup:* After identification, the necessary processes need to be in place for storing this information.
- *Retrieval*: The third step is to retrieve that data when needed
- *Backup and recovery:* This often-neglected step is important in case of a disaster and there is a need to recover data

For as long as record keeping dates back, storage of data and relevant information has been a key process in all organisations whether big or small and has a long history of evolution (Khan Academy, 2017). Even when data was not stored electronically, bookkeeping and ledger records were used for keeping pertinent information intact in physical files, registers and folders.

In recent times, (and given the explosion in technology and internet accessibility) this process has become more advanced where companies have huge data servers connecting all computers within the organisation via a network thereby storing a majority of the data on the server. Similarly, there are backup servers usually kept off site (ie cloud technology) to recover the data in case of an emergency/hazardous or disastrous situation.

The need for keeping vital data intact and available has always been of paramount importance but has become more urgent due to the plethora of information we are receiving all the time from a wide range of sources. In today's data-driven society, the tasks for data analysts has become arduous in many ways because they have to determine the meaningfulness of data within that big chunk comprising of miscellaneous information and often containing irrelevant pieces of information.

Processing and Storage of Data

"In God we trust, all others must bring data."
W. Edwards Deming

"If we have data, let's look at data. If all we have are opinions, let's go with mine."
Jim Barksdale

Brief History

Amusing as these quotes may seem, they are more meaningful than a vividly worded paragraph on data. Both of these quotes signify the importance of apt data and how helpful it can be in drawing fact based conclusions.

There is no doubt that data is vital to any organisation and the focal school exampled herein is no exception. The process of storing data electronically at the focal school began in 2008 where all the library and other resources were electronically catalogued to have a categorical inventory which could inform about future resourcing requirement. Since then this process has only become more refined and robust because we have also moved forward in our understanding of the importance and usage of data. The early days of our administration began with vital student information being recorded in Excel sheets. The majority of this information was still kept on physical files. Gradually attendance data for the entire school was transferred as a soft record for better analysis and management. At the same time assessment data sheets were designed and made available to staff for relevant input for English, Math, Science, Music and ICT.

Current Process

As the school enrolment increased and with the move to our current facility, the need for redefining this process arose. It was evident that recording all the relevant information on Excel sheets was not enough to meet the increasing needs of all staff members. The data needed to be decluttered, aligned to suit everyone's needs from teaching staff to administration to accounts. Initially, this data was stored on Google drive which is our main source for collaborative tasks to date. The school decided to invest in a Management Information Systems (MIS) for this purpose. Since March 2016, the school transferred the majority of our school student data to the MIS for our school. This process has helped crease out many irregularities and discrepancies in terms of data availability to stakeholders.

Processing of Available Information

The information available via our MIS system entails itself to be useful for:

1. Admissions
2. Attendance
3. Student information for the whole school
4. Timetables

In addition to the above, and since the beginning of the 2015/2016 academic year, the school started to use Google Drive as a major form of a collaborative work environment. Despite using the MIS for our majority student driven data and day-today management, the drive is used for recording and collection of assessments data and end of term reports to parents. The reason for using the cloud or the drive for this purpose is that all assessment and reports related documents need input from a number of staff members and drive provides a very quick, reliable way of achieving this task where no overheads are involved in terms of hardware and new up to date software requirements.

In the following section, the data analyses process will be explained which includes:

a. Assessments Analysis
b. Other Data Analysis
a. Assessments Analysis

As stated assessment data is required to be analysed by data teams and the relevant analysis needs to be passed on to the relevant teaching staff in order to align their teaching to the learning needs of the students. In the focal school, to support the school strategic plan, different categories of assessment data is collected and stored in the drive. Being a collaborative tool, relevant staff can access and support the analysis process.

Below is a brief description of various types of assessment data stored and recorded for analysis used at our school.

Kindergarten (KG) Baseline Assessment Data
Our KG baseline data is recorded for both English and Arabic by teachers on predefined templates in cloud storage thrice in an academic year. This data is analysed to check on student progress in term 2 and term 3 as compared to the previous term. The analysis is then shared with the teachers to see if the progress is consistent. The analysis also confirms if the Individual Education Plans defined for students with special education needs are effective or need alteration to secure improved teaching and learning levels.

KG Reading Data
Reading assessments information is also recorded by teachers for all three terms for both Kindergarten 1 (KG1) and Kindergarten 2 (KG2). Admission assessment data indicates that students joining our school for the first time in KG1, start from a very basic level but as the year progresses, the attainment levels rise more so in KG2 then in KG1.

Elementary School (ES) Reading Data
Grade 1 to Grade 5 have a robust system of diagnostic tests in place for reading whose information is again recorded on the drive on predefined assessment recording templates. The data is recorded on cloud storage for the various tests that students take three times a year. The process of analysing starts as soon as the data is available for the first series of assessments. The data analysts look into the all relevant information to deduce best possible judgments for student course of action. The results of this analyses are then shared with teachers. Reading groups are created and staff allocated to the English lessons so informed learning can take place for all students.

ES Writing Data
Writing tasks are set for students four times a year; one when student begins the school year and then once in each term. Like reading data, writing results are also recorded onto our cloud storage on the drive. Once the results are available for at least two assessed writing tasks, this data is analysed and students are subjected to increasingly challenging writing exercises suited to their needs.

ES Math Data
Grade 1 to Grade 5 students take multiple pre and post unit tests during the whole year ranging from two or more in each term. Once the results are gathered for a unit for pre and post tests without even a detailed analysis, the subject teacher is able to identify the areas where different students are struggling or have excelled. This helps the teacher guide his/her teaching to stay focused on areas which need more attention than others. This data is further analysed by the

data team to find progress rates and average scores for the unit tests identifying which units have been most excelled to those which need more attention in terms of teaching methodology.

Reports Subject Data

Another important type of data that has recently become a part of our analyses and recording is our report card data. During the data analysis process this year, considered reflections were made to find out in detail how to actually measure student progress and attainment. Report card data is only one of the most important pieces of information that we actually share with parents since most diagnostic data analyses are targeted at guiding teaching and learning only. For parents and other critiques, report card data is most relevant as it clearly shows student progress/regress. Therefore, it was decided to have this data tracked and analysed from term to term in order to meet the following two objectives.

- To measure progress between the terms (for various subjects and to observe if it is a progressive trend)
- To measure the rate of progress between the terms and from the first term to the last term (to find if an acceptable to good level of progress has been made between the terms and during the whole year)

It is also one of our main sources of identification and progress and tracking of our Middle School (Grade 6 - Grade 8) student body. The subject areas covered within this data type are English, Math, Science, Social Studies, Art, Music, PE, Arabic, Islamic Studies, UAE Social Studies, Design Technology and US Social Studies.

Arabic, Islamic Studies and UAE Social Studies Data

With a student body of 90% native Arabic speaking, it is imperative for the school that Arabic and related studies data is carefully recorded and analysed in a timely fashion to identify any instructional gaps and put a purposeful teaching plan in place without wasting a lot of term time. The students from Grade 1 onwards take diagnostic reading, spelling and writing assessments three times a year as per UAE Ministry of Education requirement for Arabic. In addition to this, two additional assessments for Islamic Studies and UAE Social Studies are undertaken each term as mandated by the Ministry of Education for these subjects. Once data is available for two terms, it is analysed. The analysis determines progress made by students between the terms, their average scores and if there is an improvement in these and then finding out how many students have exceeded, met or are below their grade level expectations.

MAP Data

MAP (Measure of Academic Progress) by NWEA tests are standardised adaptive tests that are widely used in North America and schools in an international context like our school. Students can take MAP for reading, math, language and science from K - 8. MAP scores are based on Rasch UnIT (RIT) scores. These scores are same regardless of the age and grade of the student. RIT scale is used as an achievement scale which is accurate, is at regular intervals and shows growth over time (NWEA, (2017)). Students have been taking these tests since 2010, thrice a year. After the tests are taken, the results are available through a variety of quantitative reports based on means, standard deviations and percentile values.

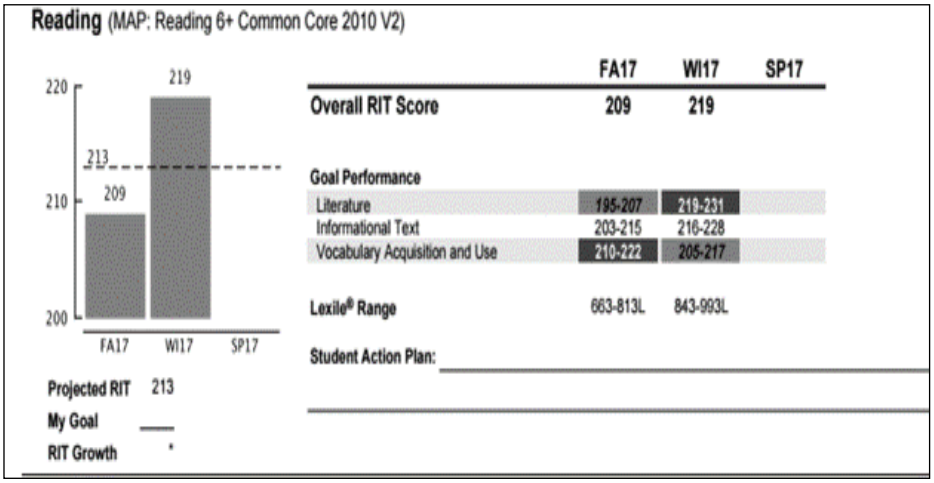

Figure 1: MAP Reading Data

There are many other reports which pinpoint to student growth quadrant and identify their targets for both long and short term. Since 2014 these reports are further analysed to measure if students have achieved their set target for the year. Figure 1 is just an example of an individual student goal setting report based on MAP data for reading (NWEA, 2017)).

Grade Tracking Sheets

A relatively new type of data collection for our school, piloted in October 2016, is the recording of information about each and every student as per the Virginia State Standards of Learning covered in each of the subjects over the three terms of the academic year. As part of the school's continuous assessment expectation, there are three further breakdowns within a single standard where the teacher records the date, evidence of assessing that standard and the grade the student may have achieved. Although this needs to be filled in quite meticulously, it pinpoints to gaps in teaching if a particular standard taught in class does not render the necessary results for the students.

Below are the various methods that have been employed in the focal school to analyse different data types from assessments, attendance to surveys and forms.

Methods Employed for Analyses of Various Data Types

There are many ways to analyse quantitative data including averages or means, growth percentiles, standard deviations and range. In the focal school we employ a mix of these methods whichever may best fit the information available. This difference incurs from the innate nature of information that is pertinent to these categories. Some require summing up of strands in one term, others may require mean values and for some types of information we divide it into sub categories and then counts and averages are computed and ranges compared.

For KG data, different aspects within the baseline assessment strand are summed up for one class and then the difference between the terms are computed to identify progress. If the range of data is highly varied, it helps us find the difference in teaching and learning at a single class level. After this, these sums are averaged on each KG level and results re-plotted as bar graphs

for having a visual understanding. KG reading data, on the other hand, is measured by observing the progress made at various levels and measuring the difference between the terms and then plotting it via a pie chart to see the progress.

ES reading diagnostic data is mostly analysed by enumerating various aspects and then quantifying them at individual class and grade level. This analysis is very helpful in identifying our reading intervention groups with a modified learning plan.

ES writing data is analysed by averaging various strands between different assessments, then fixing an arbitrary but logical and attainable target for each grade level and observing the progress for between the terms and the entire year.

For ES math data the analysis is done by observing the progress in the first instance between various pre and post unit tests and then averaging that progress score. These average progress scores give a very distinct picture of various units and their grasp by students.

As mentioned earlier the reports subject data is very helpful in gauging student progress between the terms with regards to direct reporting to parents. This data is recorded for each subject according to the predefined grading key and compared between terms and the rate of improvement. It is very helpful to find out which subject teaching has had most/least progress and how to improve on that.

Arabic, Islamic Studies and UAE SS data are analysed by separately extracting the number of students who have exceeded, met or are below the grade level expectation or have scored 80% or above in various term exams. Their scores as a grade are also averaged for each term to observe any progress in that. Arabic diagnostic tests are analysed by mean scores between the terms and between the first and the third term in order to find the rate of progress. Diagnostic assessment scores for reading, writing and spelling are very effective in identifying the problem areas for various aspects of the language.

As for MAP data, once MAP assessments are taken, the teachers and administrators are able to generate many different types of reports which are very helpful in doing the analysis further. The most useful report amongst these is Assessments Summary and Growth (ASG) Report, which gives meaningful information about the number of students who have met/exceeded their growth target, have progressed, have stayed the same or have declined in performance. Since RIT score is directly related to targets pertinent to that score, it is quite useful for a subject teacher to identify those areas, set individual targets and then adapt and plan their lessons to suit those students' needs.

Grade tracking sheets, once filled for various standards for a subject, provide the final grade based on those standards through an averaging computation for all the grades. This also helps the teacher in calculating an overall grade for a subject for reporting to parents, although the overall grade for a subject depends on many other aspects as well including class participation, homework and projects.

Trend Data Analyses

Starting from the beginning of the academic year, we have started to put together trends for last three years in all subject areas including KG data, MAP data and Arabic, Islamic Studies and UAE SS data. It needs to be noted that our student body has significantly changed from 2014 - 2015 to now with the number increasing from 227 in 2014 to 841 in 2016. Due to this, some of these trends cannot be categorised as like with like comparison but do give us an idea of why in some cases the trend is not an upward slope or vice versa.

Other Data Analyses

Apart from assessment, progress and attainment data for students, below are two other types of data that we regularly analyse and share with staff, students and parents

1. Attendance Data
2. Surveys and Forms Data

1) *Attendance Data*

Since attendance is directly linked with student progress, the school places a huge emphasis on improving student attendance. This is why, attendance data as collected and stored on our MIS, is analysed daily for absence reporting to parents via an SMS and on monthly, termly and yearly basis. Based on this data, we have in place strategies to promote good levels of attendance and punctuality, by rewarding students and classes on exceptional or perfect attendance and by highlighting students and classes attaining our benchmark attendance of 96% or above in our weekly newsletters and SMS to parents. Analysis of grade based data and attendance data reveal the correlation of poor attendance leading to lower grades.

2) *Surveys and Forms*

Staff, parents and students are regularly surveyed for their feedback and responses on various aspects of the school environment. The results of these surveys and forms give an insight about our strategies and how well we are doing on those grounds. These results are also shared with relevant stakeholders once available and as appropriate. Even before the availability of self-analyzing forms, the surveys' data has been analysed in stakeholders' performance data documents for our school for 2014 – 2015. Currently, this process is easier to manage and share with stakeholders due to readily available analyses of these surveys.

Presentation of Data Analyses

Most of our quantitative data analysis is presented via tables, bar graphs and pie charts. Below are examples for how we present these in the data documents for our school. Table 1 and Figure 2 show improvement in KG2 reading levels between term 3 and term 1 for 2016 - 2017 (Al Yasat Private School, 2017).

Levels	No. of Students	%
0	37	23%
1	42	26%
2	36	22%
3	23	14%
4	14	9%
5	5	3%
6	5	3%
7	2	1%
1 – 7 Levels	127	78%

Table 1: KG2 Reading Data Term 3

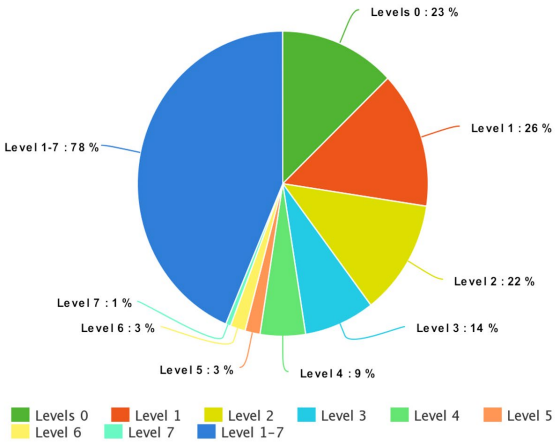

Figure 2: KG2 Reading Data Term Three

Table 2 and Figure 3 are examples of the type of data share about the progress made by our intervention group students at a Grade 4 level, similar progress information is available for all grades from 1 - 5 in our reading analysis for 2015 - 2016 and 2016 - 2017 (Al Yasat Private School, 2017).

These types of graphs and figures are provided for a range of data including trends data for Arabic and related studies. These are provided across grades as well as over time. Additionally, trends data for attendance or progress in English are easily demonstrated by such devices.

As the analyses process becomes more streamlined, there is a need to consider other aspects of data while formalizing the results. In this next section, these target areas are discussed, focusing on what our school believes should be considered while discussing and analysing student data.

Class	Number of Students	% Progressed	% Could join mainstream class
Cardinals	6	83%	17%
Condors	6	100%	0
Emus	5	100%	60%
Peacocks	5	100%	20%
Total	22	96%	24%

Table 2: Intervention Group Progression Data

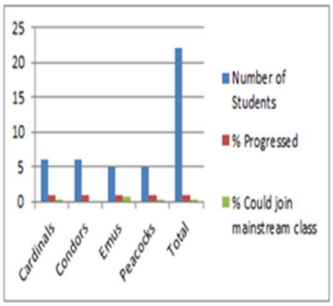

Figure 3: Intervention Group Progression Data

Target Areas for Inclusion in Various Future Analyses

1. *Based on Genders*

So far, all types of assessment data are analysed at grade or class level. However, we do need an analysis based on genders to find out any significant differences between girls and boys. The need for this type of analysis will be important to find any discernible difference between the attainment and progress of girls and boys.

2. *Based on Ethnicity*

The analyses based on ethnicity will also give us a clear idea to identify any difference between various ethnicities. We do have analyses available for non-native Arabic Speakers which provide us with relatively different progress aspects compared to our majority student body.

3. *Based on Similar Student Cohorts*

For trends data to be more meaningful for us, our target needs to include the like with like comparisons for students who have been with the school for at least three years. This will require us to identify them across the years for separate analyses for their growth and progress. This process will be streamlined in our coming academic year where most assessment data will be recorded in our MIS system and will help ease out the process of analysis for the team.

4. *PD (Professional Development) for Teaching Staff for Data*

As the school grows and amount to data increases, it is imperative that data-driven PDs are held for all teaching staff for them to provide their very valuable input in the important process of data analyses. Since teachers are the most important building blocks in identifying areas for improvement driven by data, it will be extremely beneficial to include these in school's annual CPD plan based on the classroom observation of teacher performance.

5. *Creating Data Teams*

Since the focal school is still relatively new to this process for collecting and meaningfully using data in its perspective, further to meeting the above target, there is an urgent need of forming data teams who work collaboratively in analysing various components of data. Currently, data is analysed by only a few members of staff which are then shared with Heads of Sections and Heads of Departments who trickle down the information to their respective teams. A suggestion is to combine subject leaders, head of section and heads of department and form teams who are actively involved in the process of analysis and are then able to provide meaningful instructional feedback to their teams in order to alter the teaching methodologies.

Conclusion

"It is a capital mistake to theorize before one has data. Insensibly one begins to twist facts to suit theories, instead of theories to suit facts."
Sherlock Holmes (Arthur Conan Doyle)

The above quote sums up the importance that can be given to meaningful data and how it is relevant in drawing conclusions, theorise and then passing it on to people who can benefit the most from it. From our school's perspective, different type of collected and stored data is for different categories of people who may need it and eventually benefit from it. Our data gets channelised to various sources including educational governing bodies (in our case ADEC and Ministry of Education), human resources department, finance department, administrative staff, school leaders, middle leaders, teaching staff, parents and students. Basically, it includes all the stakeholders in our community who have access to data that is most relevant to them. This further implies that all types of data have to be given prime importance in terms of proper storage, recording and backups so its availability is guaranteed when needed by various types of people/departments mentioned.

Moving forward with our school planning, we are striving to have more robust data. One of our major targets is to ensure that all relevant data is shared with people in a timely fashion so informed decision making can be made for the progress and betterment of all involved. Sharing of data in a timely fashion is as important as analysing it. The effectiveness of information is lost if it is not passed on in time to those can benefit from it.

Based on our "in place" processes and practices, our target as a school is to keep on strengthening refined strategies on procurement and analyses of a variety of data by building cohesive teams. These teams will need to work in collaboration for devising methodologies to guide the instruction that takes place in a classroom and to ensure that meaningful and achievable targets are set to match our long-term plan for school development.

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