IMPROVING SYSTEMS FOR REMEDIAL SCHOOLS IN SOUTH AFRICA: A CLOSER LOOK INTO EDUEXCELLENCE

by

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Executive Summary

A Student Management Information System (SMIS) can enhance organizational operations by consolidating and organizing all aspects of a school in one hub to enable efficient allocation of resources which will lead to more effective management decisions and lead to continuous organizational improvement. This project report addresses an in-depth study and analysis regarding an industrial engineering approach to developing an improved solution for a remedial school in South Africa.

The aim of this report is to explore and investigate the challenges and best practices associated with managing and improving efficiency and quality of the systems within the remedial education industry. The study investigates the need, benefit and challenges of an SMIS, current trends in industry, metrics and standard operating procedures. In addition, several industrial engineering mechanisms will be explored in order to select the best techniques and tools required to achieve an improved design. Thereafter the problem or the as-is state is analysed using the appropriate techniques to obtain the requirements of the organization, which enables the foundation of the logical design.

The logical design includes drawing up a complete set of requirements comprising of both functional and non-functional requirements. These requirements are then modelled using several data modelling techniques. The design also includes the development of metrics according to the Balanced Scorecard Framework that will be used as performance indicators in the form of dashboards in the SMIS.

Various alternatives were evaluated to allow for a comprehensive set of possible solutions. A feasibility analysis and various criteria concluded the infeasibility of developing the system due to cost and time constraints and thus a custom modified COTS (Commercial Off-The-Shelf) software package was the undisputed alternative. Even though a COTS software is not enterprise specific, this was selected with the intention of adding extra modules to meet all requirements. Three COTS software were evaluated against each other using several methods and criteria. Trial versions of the alternatives were tested with the required users and then surveyed to attain user input and opinions

A thorough evaluation on the various alternatives using both technical and financial criteria allowed for the selection of the best candidate, which was then verified and validated against the system specification. Finally, a brief implementation checklist and schedule was drawn up in order to assist the implementation process to be a smooth transition from the old system to the new system. The report concludes with a summary of the findings.

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1. Introduction

1.1 Background

Each individual needs to accomplish specific milestones at a certain age throughout his/her life. Children with special needs have unmet milestones, and if continued without intervention, they will lead lives “a step behind”. Remedial schools focus on this intervention process in order for children to re-enter mainstream education. Thus, creating, developing and sustaining these institutions are critical to our society. Practitioners involved in interventions sacrifice themselves in time and effort to create a normal life for others. However with improving the existing processes within these institutions, we can achieve a far higher success rate in contributing to the betterment of society.

Established in 2007, EduExcellence is an exclusive private therapeutic remedial school with approximately 150 students situated in Lynnwood Glen, Pretoria. This unique school concept provides much needed therapeutic remedial education for children struggling to learn, concentrate and function in large school setups (so-called ADD(Attention Deficit Disorder), hyperactive children)(Van der Westhuizen, 2011).

Unlike any typical school, remedial schools have added dimensions due to the therapeutic related activities. The owner and founder of EduExcellence, Dr Beulah van der Westhuizen has completed in depth research in the field of educational psychology as she designed and implemented various teaching methods and ideologies into the school. These include , Integrated Learning Therapy(ILT), TheraEd, Ecosystemic Approach, Auditory Integration Training(AIT), Balance Board Work and The Structure of Intellect(Van der Westhuizen, 2011). With these added factors and limited hours per day, practitioners find it challenging to accomplish all the requirements set out by the Department of Basic Education along with therapy requirements in a seven hour school day. Nevertheless, these practitioners exert themselves to assist these children wherever possible.

By developing and implementing an optimised solution to improve and manage the systems at a remedial school, practitioners can help these children accomplish their goals much easier and thus increase the success rate of children being able to cope in mainstream schools. Through an effective solution, the quality of education within the remedial education industry can be elevated.

1.2 Project Aim

The aim of this project is to provide a solution to improve and manage the systems at a remedial school, increasing the efficiency and quality of education within the remedial education industry.

1.3 Project Approach

The project focused on the operations within a remedial school in South Africa viz., EduExcellence.

1.3.1 Project Scope

The project commences with an in-depth literature review to attain information on the best practices related to student information systems or school management systems and in particular Information systems for special needs or remedial education institutions. In addition, research was done on metrics and measurements of an organization. Research on how to document standard operating procedures is also included. The literature study provides insight on the needs and benefits of information systems and how it can assist an organisation in improving its efficiency and management and solve problems such as a staff/learner scheduling problem. It also entails an investigation of constructing an object system versus purchasing commercially off the shelf (COTS) software or custom-tailored software and the options available on the South African market. Thereafter a brief look at the challenges to the organization in implementing a new system is discussed. to complete the literature review, evaluation mechanisms are considered for selecting the best system using a range of criteria and a look at how implementation of a new system is carried out.

Dietz (2006) states that one can only derive requirements for an object system (OS) (e.g. Information System), if you understand the construction of the using system (e.g. the enterprise), thus we first need to map out all the key As-Is business operations or processes. This is done using business process modelling, which utilizes the BPMN (Business Process Modelling Notation) process modelling standard.

A cause-and-effect diagram (fish-bone diagram, Ishikawa diagram) is constructed to outline the factors that lower productivity at the school. A SWOT analysis evaluates the internal and external aspects of the school as a whole. Sampling of documentation and forms along with surveys carried out assessed staff perceptions, and assured stated problem areas. In addition, the PIECES framework provided an analysis of the systems currently utilized at EduExcellence. A cost analysis recognized the relevant costs incurred through the current system.

Thereafter, a thorough requirements analysis was performed. This determined all of the organization requirements and what specific needs are required from the users. These functional and non-functional requirements are established through research and site visits, observation of the working environment, questionnaires and interviews. Correspondence with the owner was conducted via emails and online communication (Skype). A Joint Requirements Planning (JRP) session was also completed. After all the requirements were identified, the logical design of the object system was commenced. This was done by modeling the requirements using a Use Case Diagram, an Entity Relationship Diagram and a Context Data flow Diagram.

With the requirements clearly defined, developing Metrics, Scorecards and Dashboards for measuring staff, student and organizational performance can easily established. These user defined metrics can be used in the system to assess performance and create reports for the management and the owner to manage the organization more effectively. With this being completed, a standardized template of the standard operating procedures can be formulated, which is integrated into the system thus creating and editing procedures will be an effortless task.

Various alternatives were evaluated to allow for a comprehensive set of possible solutions. A feasibility analysis and various criteria concluded the infeasibility of developing the system due to

cost and time constraints and thus a custom modified COTS (Commercial Off-The-Shelf) software package was the undisputed alternative.

Thereafter, alternatives were considered for the supporting solution. This included evaluating the selected tailor-made solutions that best suit the requirements drawn out. This can be tested for any further modifications and system capabilities through a trial version, whereby appropriate changes were made. Subsequently an evaluation using the matrix techniques to select the most appropriate system from a set of three alternatives. This selected alternative was then verified and validated using a simple requirements mapping table using both technical and financial criteria and through focus groups & surveys. This verified any misalignment between what was needed to what was selected. With this step done, and all technicalities and finer details all integrated into the system, the final step was to draw up an implementation checklist and schedule in order to assist the implementation process to be a smooth transition from the old system to the new system. Finally, the findings and recommendations are presented to management and the report concludes with a summary of the findings.

1.3.2 Deliverables

The deliverables of this project are all the positive products and outputs identified from the study that make up the Optimized Solution:

- Detailed customer specifications including Functional & Non-Functional Requirements
- Logical Designs representing the functional specifications
- Scorecard & Dashboard Development
- Standard Operating Procedures Module within the SMIS (SOP Template)
- SMIS (School Management Information System)
- A full evaluation & verification of the selected SMIS
- An Implementation Schedule & Checklist

1.3.3 Graphical Representation (Scope)

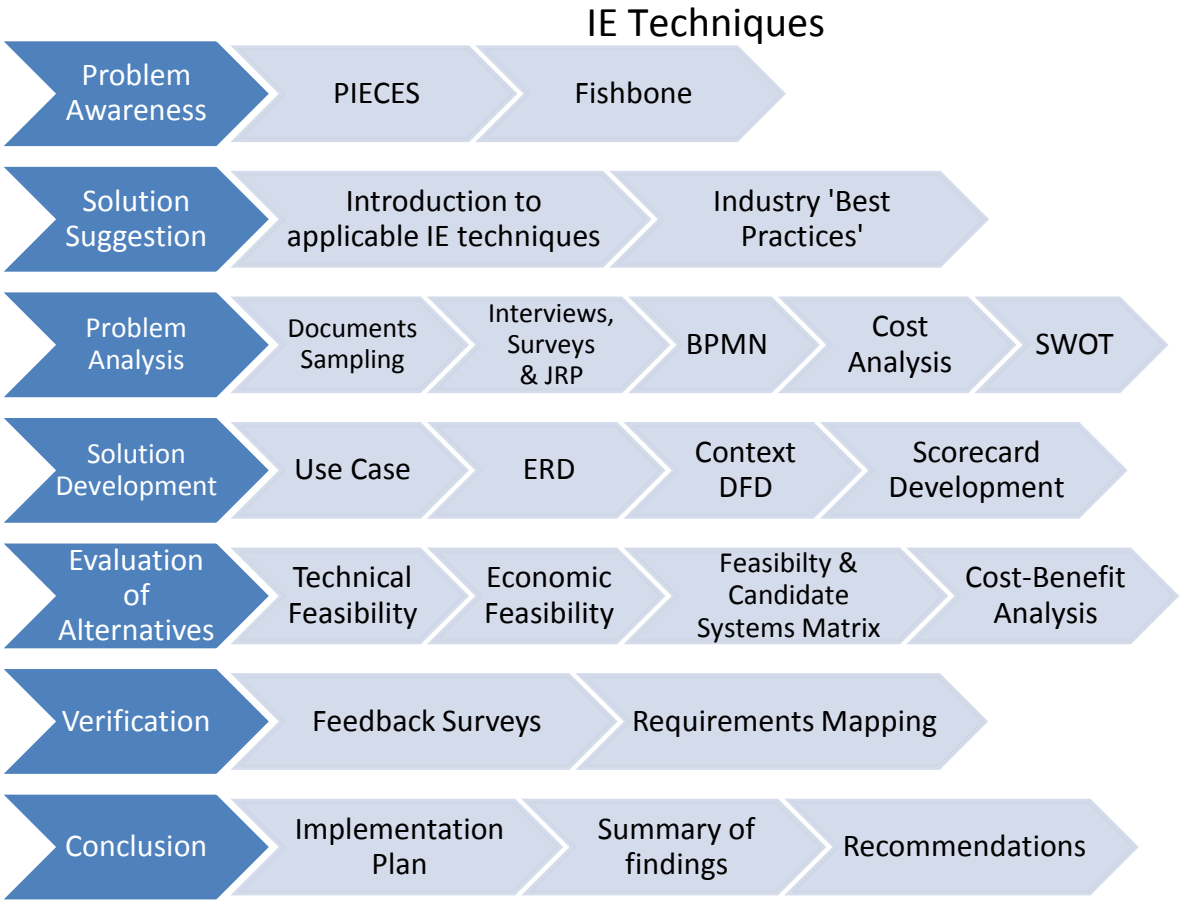


Figure 1 - Graphical Representation of Scope

2. Literature Review – Current Methods, Tools & Techniques

2.1 School Management Information Systems (SMIS)

2.1.1 Definition

Information systems which are used by education institutions to manage student data are often referred to using various terms such as the following: Student Information Management Systems (SIMS) , Student Management Information Systems (SMIS), Student Data Warehouse (SDW), Student Academic Information Systems (SAIS), Student Records System (SRS), Student Management System (SMS), Student Data Systems (SDS), Campus Management System (CMS) or School Management System (SMS) or Student Information Systems (SIS).(Ngoma, 2009)

To maintain clarity in this report, any reference to a school or student related information system will be referred to as a School Management Information System (SMIS). The reason for this is that the focus of this project is not restricted to simply student data, but rather a school in its entirety encompassing numerous stakeholders.

Figure 1 below illustrates the concept of an Information System which can enhance organizational operations by containing all aspects of a school in one nucleus to enable efficient allocation of

resources which will lead to more effective management decisions, and lead to continuous organizational improvement.

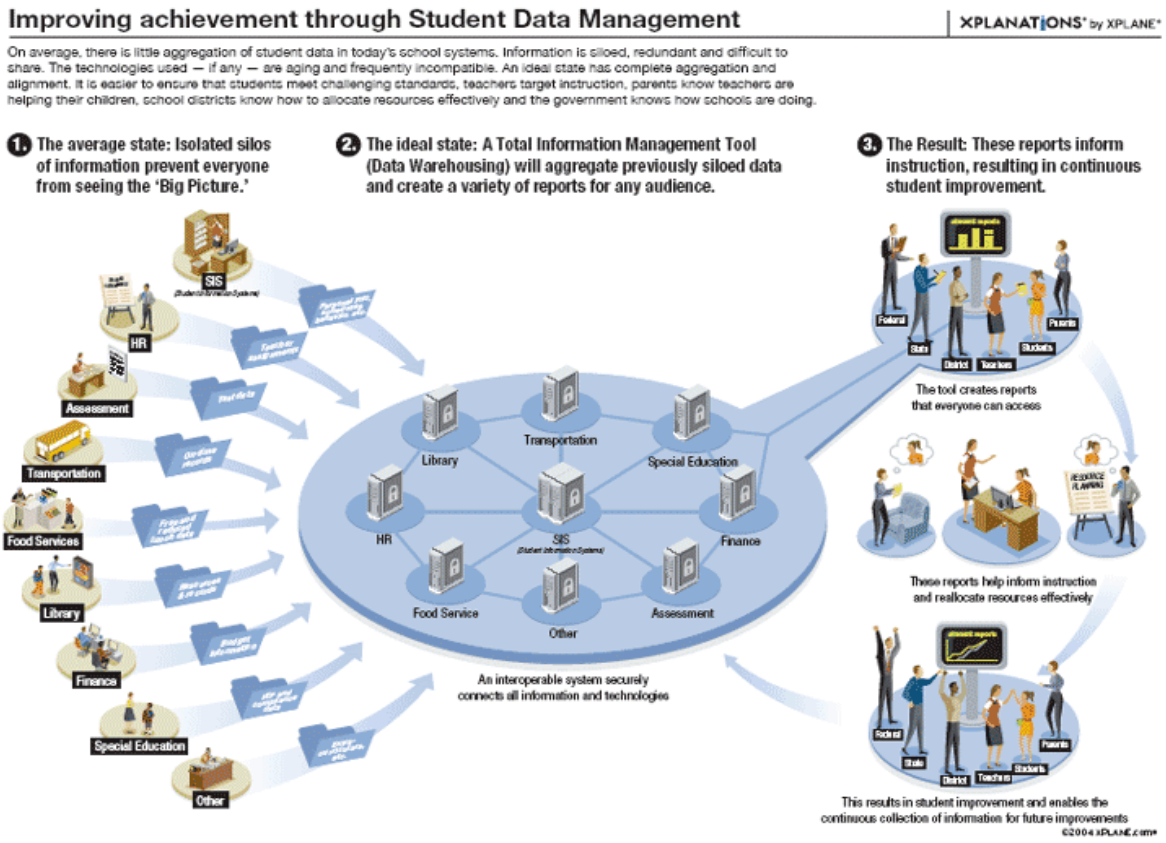


Figure 2 - School Information System Overview (XPLANE, 2007)

Barrett (1999) defines SMIS as "an integrated software package that maintains, supports, and provides inquiry, analysis, and communication tools that organize student accountability data into information to support the educational process". With SMIS been clearly defined, the reasons for why learning institutions need it, and what are the effects of implementing such a system are investigated below.

2.1.2 Need, Benefits & Challenges of Implementing an Information System

2.1.2.1 Need for SMIS

"Knowledge is the result of a continuum of how we process raw data into useful information" (Whitten and Bentley, 2007). To transform data into useful information for knowledge-based decision-making at any level, data must be collected, organised, analysed and reflected upon (Tolley and Shulruf, 2009).Information is perpetually increasing in all organizations. To manage and utilize this information effectively is a growing concern to any organization. By storing useful information in an Information System which can organize and consolidate organizations' information will lead to far better management decisions. Schools can effectively maintain records of staff and students profiles, grades, marks, timetables, absences, behavioural statistics, medical records and demographics.

Organizations utilize information systems so that accurate and up-to-date information will be available when it is required. As it is not always possible to predict when and what information will be needed, most organizations use computers to record and store the details of all their business transactions. When a report must be produced, this raw data can be retrieved and manipulated to produce the required information (Eccles et al., 2003).

Another reason why an Information System is needed by management at an education institution is to schedule classes of students with respect to their teachers and rooms. As the number of students increase in the school, the harder this procedure becomes. With an Information System this scheduling process can be done effortlessly.

By integrating financial data into the SMIS, budget, costs and other financial reports can be produced to effectively manage how funds and resources are utilized within the school. Collaboration between staff can occur if lesson plans are stored in a centralized location within the SMIS. Through this, teachers can share lessons that will improve student's performance on a particular topic and thus improve the quality education by allowing the ability to share expertise. In the past, parents would only receive students' grades until progress time or a report card was sent home. With a SMIS, parents and guardians can view their child's grades and progress online at any given time. This association of parents into the system can assist working together to help the learner succeed. (Webster, 2010)

2.1.2.2 Benefits of an operational SMIS

The key benefit of an operational school management information system is the ability to deliver the users with data and information required to accomplish a duty or task efficiently & effectively. Paper records and computer databases can only provide data in a basic raw form, whereas an information system can arrange data in several formats to best suit the needs of the user and the task at hand.

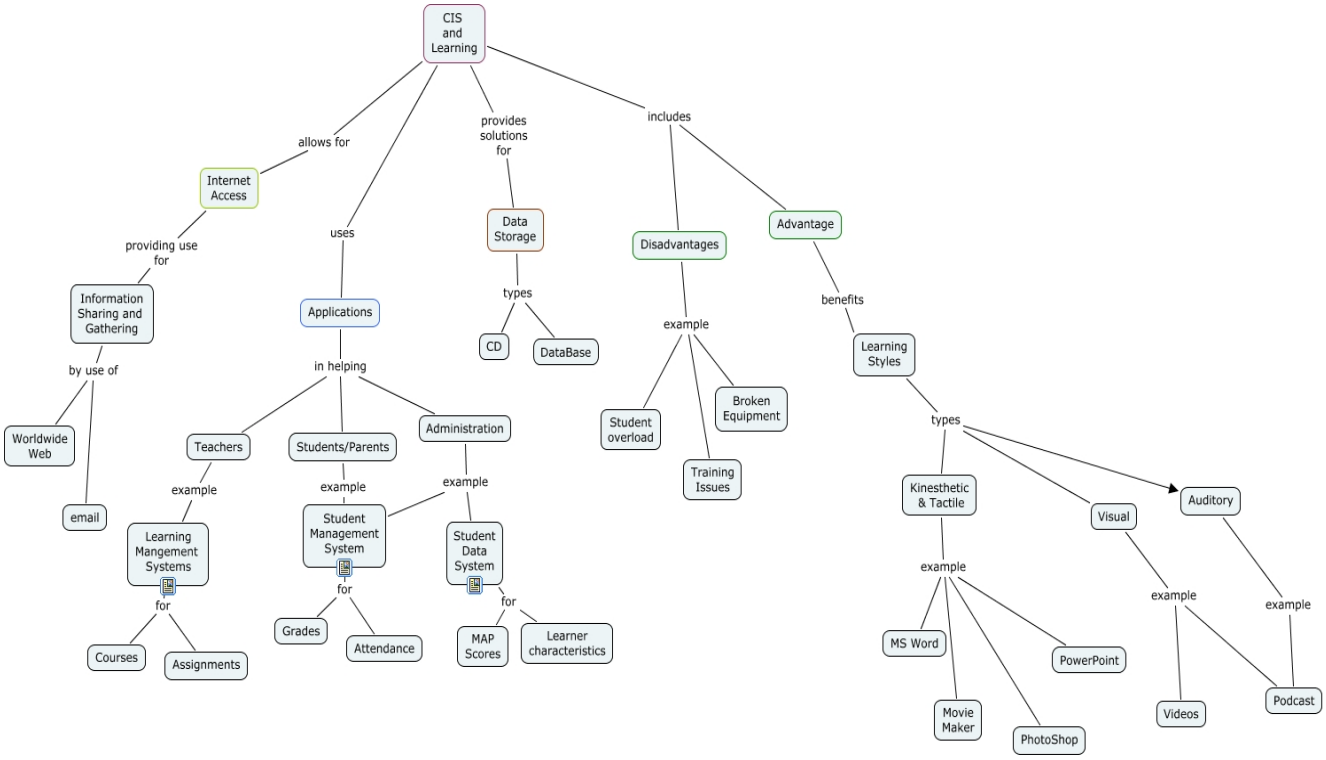


Figure 3 -Concept Map of a typical SMIS (Webster, 2010)

The Concept Map shown above in Figure 2 shows how a SMIS can incorporate many aspects of a school and how it can encompass a wide variety of information gathering tools, such as videos and podcasts for example.

Through improved quality of information, better management decisions can be made. This is due to the fact that decision making relies on the information present, and if this information can be accurate, current, relevant and retrievable at any time the decision making process will be certainly enhanced.

If the SMIS supports electronic communication, this can boost the quality of internal and external communication. Teachers can communicate using the system to interact with parents, other teachers and therapists while conveying critical information available on the system.

Planning in a school is critical in maintaining the curriculum requirements set out by the education department. With a management information system in place, the process of planning can be improved as all information will be embodied in one location and can be seen from a holistic view which will also allow progress to be tracked on a continuous basis.

With an adequate SMIS, control and supervision of the school environment can be constantly monitored whereby changes can be made to improve and streamline the current processes, procedures and activities.

A flexible SMIS will provide adaptability to allow for reprogramming, upgrades, and maintenance of the system without disrupting the over-all system.

2.1.2.3 Challenges of developing & implementing an Information System

Table 1 - Reasons for Success & Failure in Developing an IS (Gupta and Malik, 2005)

Top Five Reasons for Success	*Top Five Reasons for Failure*
User involvement	Lack of user input
Executive management support	Incomplete requirements and specifications
Clear statement of requirements	Changing requirements and specifications
Proper planning	Lack of executive support
Realistic expectations	Technological incompetence

In Management Information Systems, Gupta and Malik (2005) have outlined five reasons for success and failure in developing an Information System, these are outlined in the table above. It is apparent that user involvement is critical to the success of any system, as the users are the main association to the system. Planning of the system with realistic expectations is a key characteristic of developing a successful system. Another important factor is equipping the organization with the appropriate technological components, such as adequate internet bandwidth or reliable hardware components capable of sustaining the data and information loads of the system.

Some of the costs and risks of implementing an information system are presented below:

Costs:

- Basic Utilities such as Electricity Account
- Telecommunication (Data – wireless or wired)
- Networking (routers, hubs & cables)
- Cost of training
- Back-up power supplies & servers
- Cost of software, hardware, firmware, technical support

Risks:

- Incompatibility
- Exceeding the Budget
- Natural Disasters
- Power outages
- Sabotage
- Information theft
- Employees resistance to change
- Lower social interaction between personnel
- Exceeding time constraints in delivering the system

2.1.3 Current Trends in South Africa and the Rest of the World – Available COTS Software

2.1.3.1 SA-SAMS (South African School Administration and Management System)

A well stated overview of the SA-SAMS software on the developer's website states: "SA SAMS is a robust computer application specifically designed to meet the management, administrative and governance needs of public schools in Southern Africa. The programme has a strong EMIS(Education Management Information System) focus to assist schools in the completion of the Annual School Survey"(SA-SAMS, 2011). SA-SAMS is made available to all schools free of charge, and offers training and support as well.

This software is specially designed for the South African education system, and incorporates all aspects of the school in one system. It includes a scheduling assistant to help schools with the complicated task of allocating teachers to subjects and classes. It caters for non-computer literate users with a very simple user interface. It is compatible with LURITS[1] (Learner Unit Record Information and Tracking System)(Department of Education, N.D).

2.1.3.2 ADAM

ADAM is a web-based SMIS designed especially for South African schools. The core function is the management of academics and the data belonging to it. Some of the features are listed below: (ADAM, 2013)

- Academic Management (Reporting, Analysis, Class lists & enrolments, OBE compliant)
- Pupil Management (Reports & Labels, Points & Records System)
- Family Management
- Co-Curricular Management (track sports teams, manage awards & performance)
- Staff Management (Security, Absentees, Reports & Data management)
- LURITS Compatible
- Absentee Records (Staff & Pupil)
- Attendance Registers
- Mail Logging
- Questionnaires
- SMS features
- Web Based & Open Source Architecture

2.1.3.3 Moodle

Moodle is a school management information system, which is available online. This web-based platform has several features such as grading, assignment submission, discussions, file sharing, instant messaging, online news, calendars and announcement. The key factor of Moodle is that developers can extend the functionality by creating new plugins. These are for creating and setting test papers, by selecting different question types such as multiple choice, true or false, or fill in the blanks. Also different enrolment methods can be designed to fit the needs of the school as well as other several plug-ins.

[1] The Learner Unit Record Information and Tracking System (LURITS) aims to collect unit record data for each learner in the country from grade R through to Grade 12. The system also tracks the movement of each learner from school to school, even inter-provincial movements of learners can be traced. Each learner is to eventually be assigned with a unique learner tracking number which remains with the learner throughout their schooling. By law, all South African schools are required to submit data to the LURITS system maintained by the Department of Basic Education (DBE). (Department of Education, 2013)

2.1.3.4 Fedena

Fedena is an online school management system developed in India and is used by over 40,000 Institutions globally. This system can be adapted to the system and processes of the organization it will be used at, via the various plugins available. The basic system of Fedena includes modules that relate to Courses, Student information, User Management, News Management, Event Management, Human Resources, School Calendar, Attendance, Multiple Dashboards, Employee login, Student Admission, Student/Parent Login & Timetable Management. The various other add-ons include Discussions, Polls, Online Examinations, Inventory & Registrations, Placement, Data Management just to name a few.

Clearly, all of the software mentioned above as well as numerous other SMIS cater for more or less the same type of requirements due to the similarity of the methodology and processes from school to school. Most of the available software do not take into consideration the special needs and therapeutic aspects of a remedial school, for instance a behavioural module to record and manage the behaviour of the students. In addition, site visits to other remedial schools in South Africa, mostly around Pretoria suggest that a Management Information System specifically designed for a special needs school is very rare, if not practically non-existent.

2.1.4 Constructing an IS versus Commercially off the Shelf (COTS) software

The performance of an organization is highly influenced by how well the software meets the operational needs. For the average school, the daily operations are quite similar from school to school but with niche markets, such as the remedial school under investigation, unique and unparalleled processes occur. By selecting the right software to suit the enterprise's needs is a critical step in directing the organization to a position on the market stream. To select an option of either purchasing COTS software or designing a tailor made solution could either make or break the organization as a whole. The following are the advantages and dis-advantages of the two options presented in a table:

	COTS	Custom
Pros	Development cost shared by users, so software costs is lower.	Competitive advantage with unique ability
	Features you might not know you need are included.	Glove fit to specific needs
	Software is more reliable	No obsolence
	Less bugs as there are more users	Immediate fixes, quick support
	Available Immediately, Already developed	
Cons	Limited Functionality	High Cost in developing, designing, deployment, training
	Adjust Processes to match software	Future compatibility and changes are challenging
	Ever-changing updates & versions	Difficulties in supporting new technologies
	Excess , Redundant and unnecessary features	Long time to develop and implement

Table 2 - Pros & Cons of COTS vs. Custom Software (Eccles et al., 2003)

Obviously deciding on the right software, depends on the context. To summarize the table above, COTS software is ideal for organizations that have standardized or regular procedures and operations, and can be implemented immediately at a lower cost. Custom software on the other hand may cost more and take more time to develop and implement but can provide a unique system which can create a competitive advantage.

2.2 Measures & Metrics for Special Needs Education

"It is not possible to manage what you cannot control and you cannot control what you cannot measure." – Peter Drucker

2.2.1 What are Metrics & Measures

Essentially what Peter Drucker is implying is that if you can't measure it, you can't manage it. Therefore by enabling useful and effective measures, management can see how and where the organization is heading or not heading. With a SMIS, the ability to track and measure anything of importance is highly improved, as information is retrievable and available all in one hub.

Firstly we need to look at what exactly is a measure and a metric. A measure is something with simple dimensions and usually involves no calculations. In a school, an obvious measure is that of class size, or number of permanent staff. A metric on the other hand, is something which is defined, and usually involves a calculation of a combination of measurements, in the context of a school, a simple metric will be the ratio of staff to learners or average class size. To develop or select a measure, the measure should meet a certain criteria or attain certain attributes as suggested in the figure 3 below.

Figure 5-1 Characteristics of Good Measures

A GOOD MEASURE	DESCRIPTION
• Is quantitative	• The measure can be expressed as an objective value.
• Is easy to understand	• The measure conveys at a glance what it is measuring and how it is derived.
• Encourages appropriate behavior	• The measure is balanced to reward productive behavior and discourage "game playing."
• Is visible	• The effects of the measure are readily apparent to all involved in the process being measured.
• Is defined and mutually understood	• The measure has been defined by and/or agreed to by all key process participants (internally and externally).
• Encompasses both outputs and inputs	• The measure integrates factors from all aspects of the process measured.
• Measures only what is important	• The measure focuses on a key performance indicator that is of real value to managing the process.
• Is multidimensional	• The measure is properly balanced between utilization, productivity, and performance and shows the tradeoffs.
• Uses economies of effort	• The benefits of the measure outweigh the costs of collection and analysis.
• Facilitates trust	• The measure validates the participation among the various parties.

Source: *Keeping Score: Measuring the Business Value of Logistics in the Supply Chain* (CSC, University of Tennessee, CLM): 8.

Figure 4 - Characteristics of good measures (Keebler et al., 1999)

Due to the fact that EduExcellence is paper based, they can only utilize very simple measures such as grades of students, but it culminates there unfortunately, as the principal and director cannot see the pass rate or class average without calculating it manually as each report is done separately. Thus we see this concept of measures and metrics will be rather new to the entire organization and further analysis will be completed later on in the report to suggest useful quantitative metrics from looking at the qualitative reports & forms used to assess students. The process of establishing metrics is a complex problem, and requires much time, as measuring the incorrect metric can lead employees chasing the wrong goal.

Guidelines for Performance Measurement

Performance Measurement must:

- be consistent with overall corporate strategy,
- focus on customer needs and expectations,
- focus on processes and not functions,
- encourage throughput, not just output,
- clarify accountability, not just blame,
- be made highly visible,
- focus on relative, not absolute values,
- not be inflicted from outside,
- measure against own planned target, and
- follow consistent procedures.

In figure 4 we see that in order to measure performance, consistent procedures need to be followed. This means that for metrics to be useful, metrics need to be engineered into the process through the procedures so that measurement can take place.

Figure 5 - Guidelines for Performance Measurement (Coyle et al., 2008)

2.2.2 Performance Dashboards & Scorecards

In his book, Performance Dashboards, Eckerson (2011) explains how he changed his focus of his book from business performance management to *dashboards* and *scorecards*. The reason for this was Eckerson believed that Dashboards & Scorecards were part of a larger performance management system, which he described as a Performance Dashboard which can enable an organization to measure, monitor, and manage business performance more effectively (Eckerson, 2011). Dashboards are graphical and visual display tools that deliver performance information in a manageable and useful way. To illustrate what a dashboard looks like, Figures 6 & 8 below depicts typical dashboards of a school. The primary difference between a scorecard and a dashboard is the former is more strategic in nature. The differences are compared in Figure 7 Below.

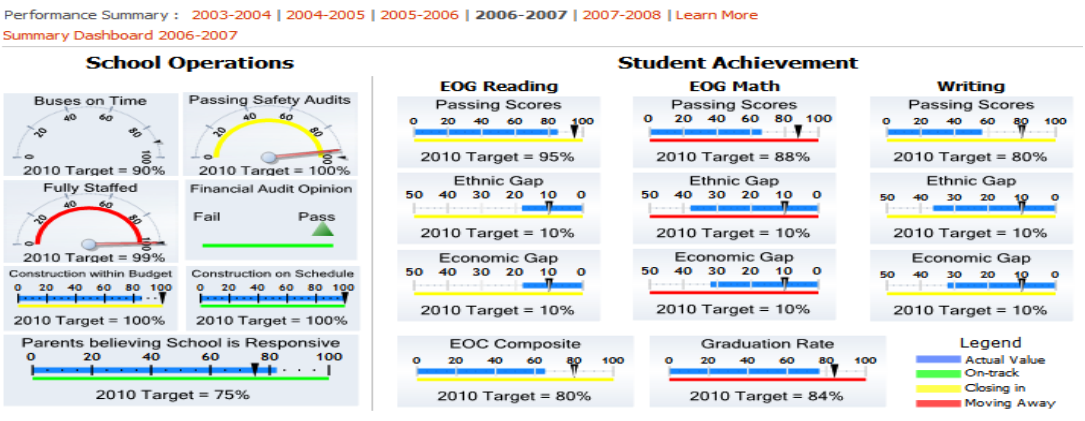


Figure 6 – School Operations Dashboard (Dashboard Zone, 2012)

Figure 8 – Dashboard of a School (Pedagogical Reflections, 2009)

Figure 7 - Dashboards versus Scorecards (Eckerson, 2011)

	Dashboard	Scorecard
Purpose	Measures Performace	Charts Progress
Users	Supervisors, Specialists	Executives, Managers
Focus	Act	Review
Updates	Daily	Weekly, Monthly
Data	Details	Summaries
Display	Charts/Tables	Charts/Comments

Now the question that arises is how will a balanced set of metrics be chosen to provide a comprehensive measurement of organizational performance. The answer is within the *balanced scorecard* framework. Kaplan and Norton (1996) set out four perspectives that can segment the organization and thus metrics can be developed from these different viewpoints. This framework as illustrated in Figure 9 below will be used to develop metrics in these four categories, as this provides a well-rounded, balanced approach to the organization.

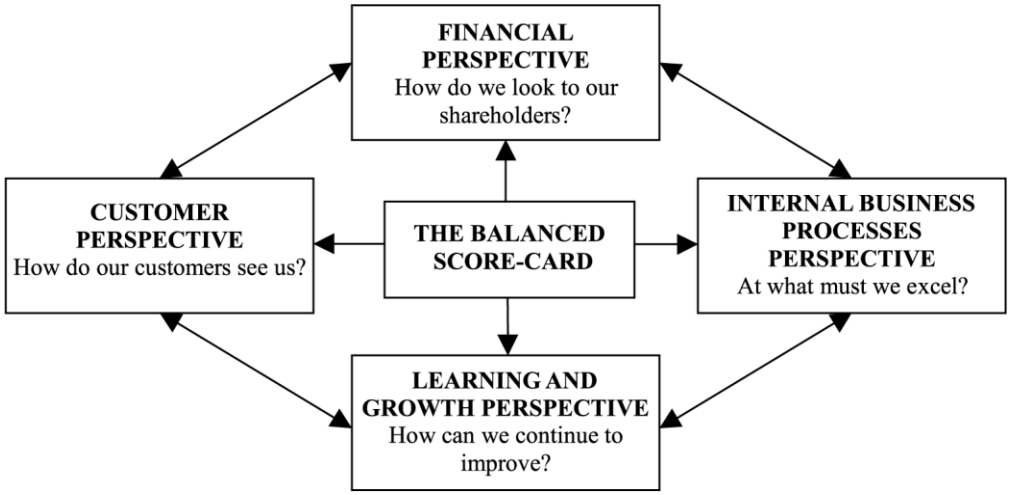


Figure 9 - The Balanced Score-Card Framework (Amaratunga et al., 2002)

After gathering all the requirements suggestions on simple metrics can be given for measuring overall organizational performance. These user defined metrics can be used in the system in a form or a dashboard to assess performance and create reports for management and the director to manage the organization more effectively and make the relevant decisions where necessary.

2.3 Standard Operating Procedures Manual

"*Without a standard there is no logical basis for making a decision or taking action*."
-Joseph M. Juran

A Standard Operating Procedure (SOP) is a set of written instructions or chart that documents step by step information on how to execute a task (EPA, 2007). The task could be a routine, repetitive or infrequent in nature that may occur within an organization. A manual consisting of these SOP's plays a significant role in the quality of how operations are executed. It provides a guide to employees on how to perform a job accurately and enables uniformity in the final outcome. In essence, it provides a standard to the processes and activities allowing for measurements to be collected with a lower standard deviation between them, thus enabling decision making.

The operations of any organization are constantly changing due to a plethora of reasons. Hence, the SOP's will always change. With this in mind, writing out SOP's for each of the processes within EduExcellence will be mundane and unsustainable for the future, and therefore not an optimized solution toward the deliverables. A rational solution will be to rather develop a template, or even better, to develop an element within the SMIS that will enable SOP's to be created, modified and stored within the system. This will enable a SOP manual to be developed and maintained whenever procedures are changed and allow employees to view the manual whenever the need arises. The system will require the appropriate details to be entered in a sequential input mode, whereby a dropdown list can select the classification of the process step (Decision, Input, Start End Etc...). Designing an SOP manual within the SMIS will be looked at in *Section 6: Conceptual Design.*

2.4 Problem and requirements discovery techniques

2.4.1 Fact-finding Techniques – Observations, Questionnaires, Interviews, Sampling of existing documentation forms & JRP (Joint Requirements Planning)

Gathering accurate and meaningful data when investigating a problem is a necessary step towards understanding the problem both qualitatively and quantitatively. Decision-making is dependent on true and precise data (Bedward, 1999). Questioning, experimentation and observations are the three main methods of collecting primary data. During observation, information is collected by observing, measuring output and watching what actually goes on in the process. Experimentation is the way of obtaining data by conducting tests on either the processes or the workers in the system. Questioning is the process of asking questions either through an interview or through written means. All of these methods have their benefits and need to be selected with care to achieve the best data without excessive variance. To gather the correct data for the right scenario, the appropriate technique should be used in order to get the real and true data of the process in focus. To gather information of the processes of EduExcellence, sampling of existing documentation, interviews of staff and management, a questionnaire, and a JRP session was conducted.

By sampling existing documentation first, unbiased facts can be obtained rather than from staff and management. As EduExcellence has no information system, or rather, they have a collection of individual files and documents stored in different locations, large volumes of paperwork and forms

are inherent to the organization. Samples of these documents were studied and analyse to understand the process and operations at EduExcellence.

A questionnaire was designed with both free and fixed format questions to obtain as much information as possible. This technique is advantageous as individuals remain anonymous and can communicate the facts of the current operations without fear of being criticized. Also as the school is very small, the entire population can be sampled thereby giving a thorough representation of the school. Interviews are very similar to questionnaires as more information can be obtained face-to-face but they do take more time. Therefore interviews with a selected few were conducted.

Joint Requirements Planning (JRP) is a process in which structured group meetings are conducted to identify and analyse problems and define requirements (Whitten and Bentley, 2007). The participants of a JRP session include the users and managers, a facilitator, a sponsor, scribes and IT staff who work on the development of the system. As this project has limited resources with respect to workers and funding, a small scale JRP session was conducted that included the director, the principal, staff and to facilitate proceedings. I, as the systems analyst and designer headed the session. JRP sessions can span over a long time, but due to limited time and resources, for the planned session a brainstorming technique was used as well as formation of groups to interact between grade teachers to discuss matters of how they would interact with the system using Use Case Diagrams (See *Section 2.5.7*) will be arranged.

2.4.2 Process Modelling using BPMN (Business Process Model & Notation)

Process modelling is capturing an ordered sequence of business activities which is done through process maps, process descriptions, and process models(White, 2006). To represent a process many notation methods may be used. One of these methods is Business Process Model and Notation (BPMN), formerly known as Business Process Modelling Notation. BPMN is a graphical representation technique for presenting business processes.

To model the processes of EduExcellence, Bizagi Process Modeller was used. Bizagi is a freeware software that uses the BPMN standard notation to document and model processes (Bizagi, 2013). Through this modelling technique and graphical representation, business processes can be improved by carefully analysing and modifying processes by removing unnecessary steps which do not add value to the process. Bizagi can illustrate clear and comprehensive depiction of the processes as a flowchart using the process modeller.

2.4.3 Cause & Effect Diagram

The cause and effect diagram also known as the Ishikawa or Fish-Bone Diagram outlines all the potential causes that create a certain effect within the various segments of an organization, and thus we can explore further into the problems within the processes (Frievalds and Neibel, 2009). The causes are usually divided into several categories (6M's, 5S's, 7P's)[2] depending on the industry. A school can be seen to offer a service rather than a product, however there is great flow of information which can be viewed as product flow in an organization similar to that of the

[2] 6M's – Man, Machine, Methods, Material, Management, Measurement + (7th M=Mother Nature)
5S's – Surrounding, Suppliers, Systems, Skills, Safety
7P's – Product, Price, Place, Promotion, People, Process, Physical Evidence

manufacturing industry, therefore appropriate categories can be selected from both the 6M's and the 5S's.

2.4.4 SWOT Analysis

SWOT analysis is an acronym for the Strengths, Weaknesses, Opportunities and Threats of an organization (Pahl and Richter, 2007). The SWOT model is a useful tool for decision making and understanding the internal abilities and external issues of the organization. This can help in determining what areas need to be focused on, as well as what core abilities can be used as an advantage. This tool can help uncover opportunities and strengths that might never have been observed in the past as well as creating awareness of the weaknesses and threats that might mature into obstacles during the project.

2.4.5 PIECES Framework

The PIECES framework is an excellent tool for classifying system requirements and analysing the current system in place at an organization (Whitten and Bentley, 2007). The framework can analyse both manual and computerized systems and applications. 'PIECES' is an acronym for Performance, Information, Economy, Control, Efficiency and Service. This framework was used to analyse the manual system currently utilized at EduExcellence.

2.4.6 Requirements Modelling - Use Case Diagram, Context DFD (Data Flow Diagram) & ERD (Entity Relationship Diagram)

Use case modelling is the process of modelling the system requirements. It is a tool of documenting the requirements from the perspective of the users in terms of business events, and illustrates who initiated the events and how the system responds to those events(Whitten and Bentley, 2007). Use case modelling is beneficial when there is input from the system users, which is critical to the success of the project. Thus this tool was key in the JRP session, as discussed earlier. A Use Case diagram was used during the JRP session, and finalized in the *Conceptual Design: Section 4*.

Data modelling is a technique for defining and documenting data requirements for a database. There are several models that may be used to model the data. To model the data that will make up the SMIS of EduExcellence, an *Entity Relationship Diagram (ERD)* will be utilized. An ERD depicts data in terms of entities and relationships described by the data (Whitten and Bentley, 2007). Entities represent data which the organization needs to store, for example, student data. The ERD describe several attributes that are associated with a certain entity, also called properties and characteristics of an entity, for example Student Name, Date of Birth, Gender etc. An ERD was compiled in *Section 6* as well.

To document the initial scope of the system, which is the communication focus from the perspective of the system owners, a *context data flow diagram* can be used. (Whitten and Bentley, 2007) This was compiled to document the flow of data in and out of the SMIS.

2.5 Methods of Evaluation & Selection

2.5.1 Six tests for Feasibility, Candidate Systems Matrix & Feasibility Analysis Matrix

Whitten and Bentley (2007) discuss how to analyse each candidate system solution using feasibility as the defining criteria. The criteria they mention are known as the 'Six Tests for Feasibility', which are discussed below:

1. Operational feasibility – This is a measure of how well the solution meets the system requirements.
2. Cultural (or Political) feasibility – This is a measure of how people feel about a solution and how well it will be accepted at an organization.
3. Technical feasibility – This is a measure the practicality and the availability of technical resources and expertise to implement and maintain it.
4. Schedule feasibility – This is to measure how reasonable the project time frame is.
5. Economic feasibility – This is a measure of the cost effectiveness of the solution.
6. Legal feasibility – This is a measure of how well the solution may be implemented within the legal and contractual obligations.

These six criteria were used to evaluate the selected alternatives as it provides a thorough analysis of each possible solution.

A *candidate systems matrix* allows for several alternatives to be compared on the basis of several characteristics. This is ideal for documenting the similarities and differences, although it offers no real analysis.

To complement the candidate systems matrix, an analysis can be completed using the *feasibility analysis matrix*. This will weigh and rank each criterion and thus each alternative according to the importance of the criteria.

2.6 Implementation Methods

Introduction of new systems usually mean the culmination of numerous operations, methods and procedures. To do away with these superseded operations and to introduce new systems require a smooth and welcomed transition. In order to accomplish this, Whitten and Bentley (2007) outline several key tasks that are elementary to carrying out the implementation phase. They are as follows:

1. Conduct System Test – This test is to ensure all additional systems work together without any glitches.
2. Prepare Conversion Plan – This plan includes databases to be installed, user training documentation and a strategy for converting from the old system to the new one. This might also include a systems acceptance test whereby a thorough real time audit takes place.
3. Install Databases – This is where all the data needs to be transferred to the new system.
4. Train Users – Training and guidance of the new system is vital to the success of the system. This may include group training or one-on-one and providing a detailed training manual.
5. Convert to New System – Ensure all testing, audits and training was a success.

3. Problem Analysis

"If you can't describe what you are doing as a process, you don't know what you are doing."
- W. Edwards Deming

3.1 Questionnaires, Interviews & Sampling of existing documents & forms

3.1.1 Sampling of existing documentation, forms & databases

3.1.1.1 EduExcellence Organogram (Organizational Chart)

EduExcellence is a very small enterprise and has only three levels of hierarchy in the school, viz. Principal, HOD and Teachers. *See Appendix D*. The principal reports to the director who is usually off-site. The organogram portrays the chain of command, span of control and how decisions, tasks and duties need to be carried out. This will help in understanding the Processes mapped out in *Section 3.2*.

3.1.1.2 ILT, Conner's Sheet, Byderhand and Storyline Books

The documents and books used at EduExcellence such as the ILT, Byderhand and Storyline are for recording daily student data. These are standard A4 books that are stored in the office and classrooms of the respective students. *Appendix E* shows a typical Conner's Sheet as well as images of how the teachers need to cut out small pieces of paper to stick in the ILT Book to assess students. This system of having multiple books to record a single student's data is cumbersome, out-dated, wastes time and highly reduces efficiency of operations. To get more feedback on these methods, interviews and a questionnaire were conducted.

3.1.2 Interviews

As the Director and Owner I would like to have access to everything at any stage of the day – Beulah (Director of EduExcellence)

Interviews with the director, principal, heads of departments and therapists were conducted to discover the current processes and thoughts on the current operations and ideas on improvements. The information gathered from these interviews is summarized in the As-Is Process Flow Charts in *Section 3.2 As-Is Processes* and *Section 4.1 Bringing it all together – SMIS Requirements*. The interviews allowed for thorough insight of the duties and responsibilities of the positions mentioned above. It also allowed for first hand feedback on what needs to be changed, and the difficulties currently experienced.

3.1.3 Questionnaire

A questionnaire (see *Appendix B*) was prepared to acquire information from all the staff of the current processes at EduExcellence. Summaries of the data obtained are illustrated below using tables and charts. All of the employees including the director are unsatisfied with the current system and find it very difficult to complete their tasks and duties. More than 87% of the staff know what do just by asking and cannot find standard operating procedures to refer to. Approximately 88% of staff works more than 2 hours after school, which is non-remunerated time. Around 90% believe that the current methods used at EduExcellence are outdated.

What are the major problems you face on an average day?	
• Work is tedious • No time for remedial work • Data is not always readily available, it's there but difficult to access	• No advanced communication • Too many tasks and duties, and no time • No standard formats • Too much paperwork and printing
Do you find any tasks repetitive, cumbersome or challenging? If Yes what are they?	
• Byderhandboek, Conners, Storielyn • Marksheets • Storyline • ILT	• Therapy Process notes • Progress Books • AIT Schedule • Reports & planning

Table 3 - Questionnaire Data

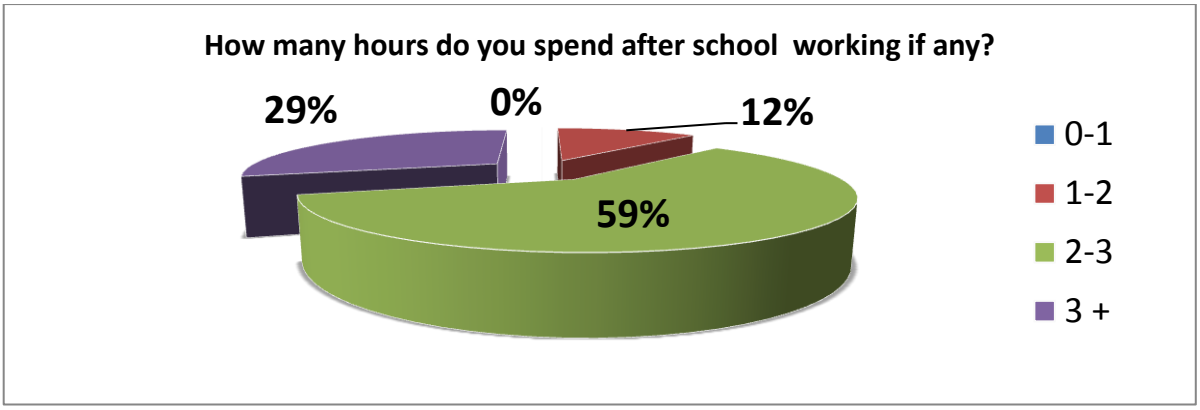


Figure 10 - Pie Chart: Hours spent working after hours

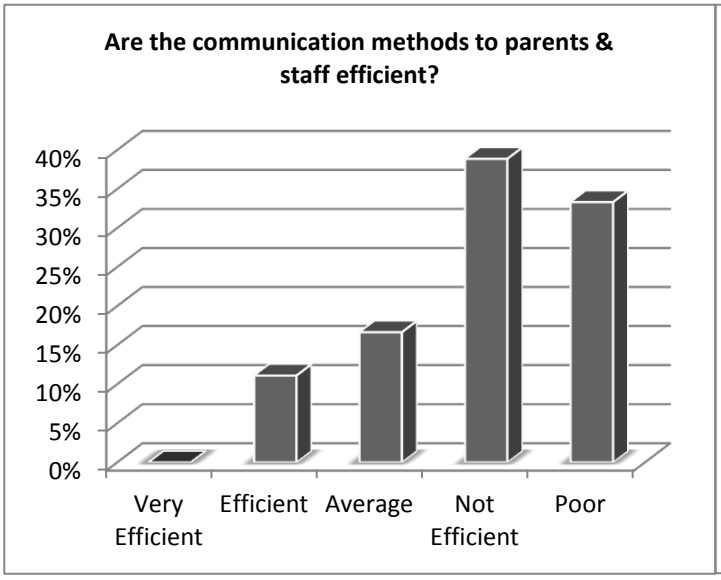


Figure 12 - Bar Chart: Communication Methods

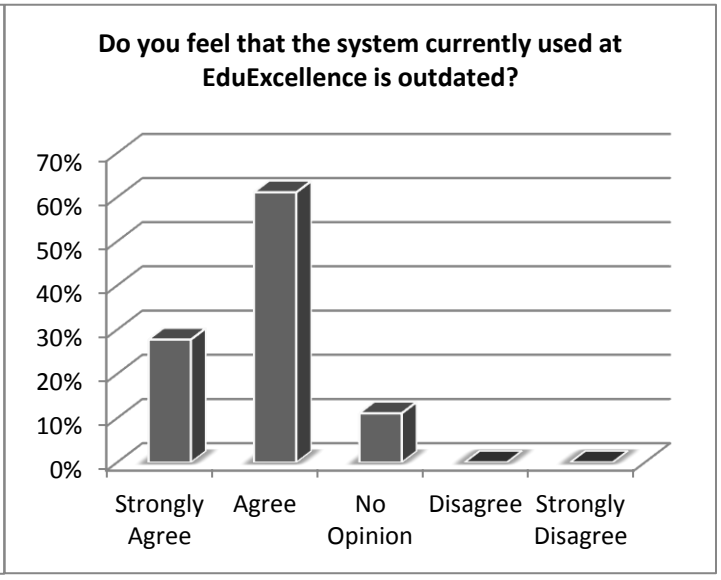


Figure 11 - Bar Chart: Opinions of current system

3.1.4 Joint requirements planning (JRP)

The information gathered from the JRP session is summarized *Section 4.1 Bringing it all together – SMIS Requirements* as well as *Section 4.2.1 Use-Case Diagram*. The JRP allowed for user integration and gathered different ideas of what the system should entail. This involved removing unnecessary steps from the process as well as what can and cannot be included on the system.

3.2 As-Is Processes (BPMN)

3.2.1 Enrolment/Admissions[3]

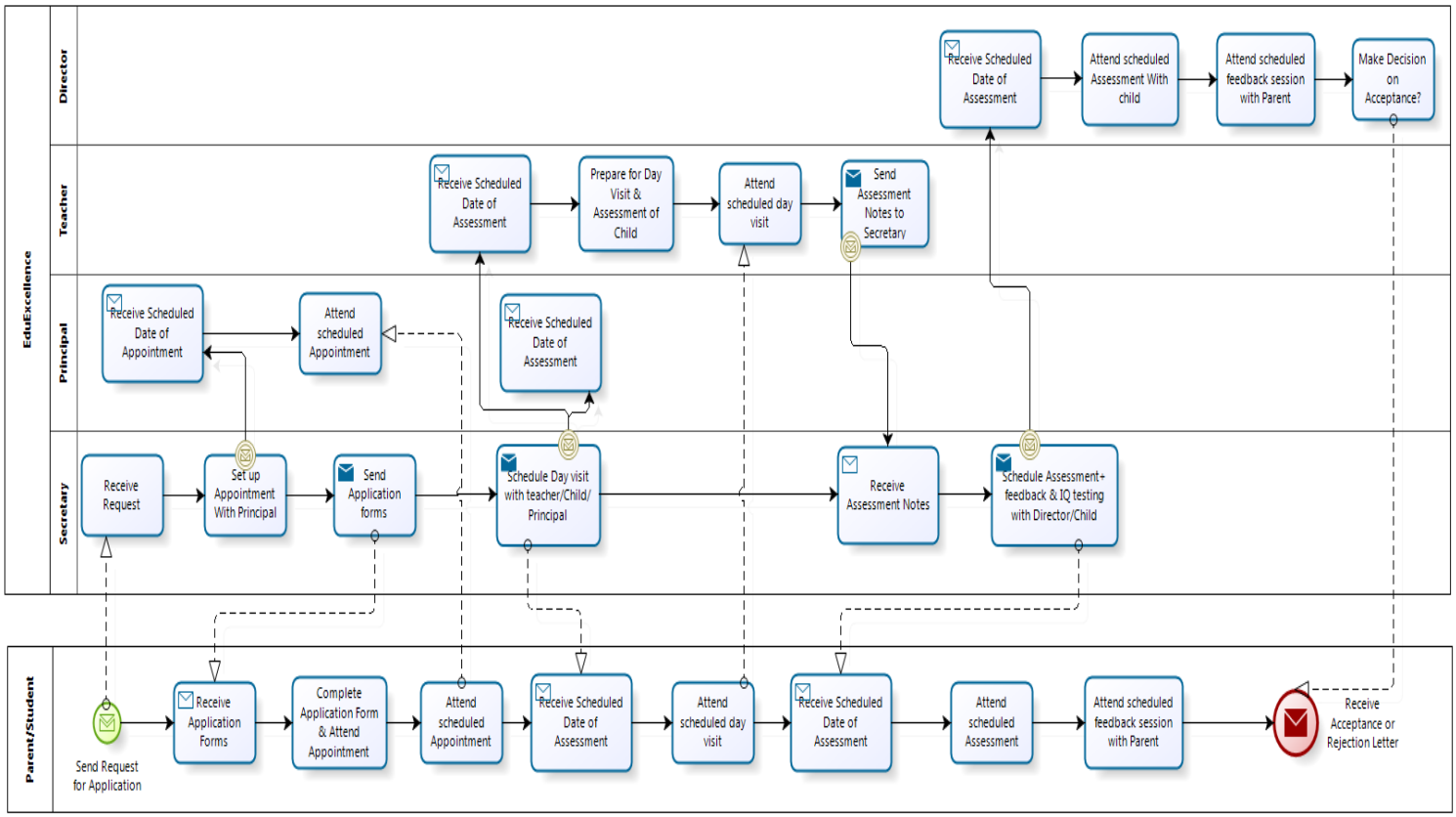


Figure 13 - Enrolment/Admissions Process

3.2.2 Weekly Planning

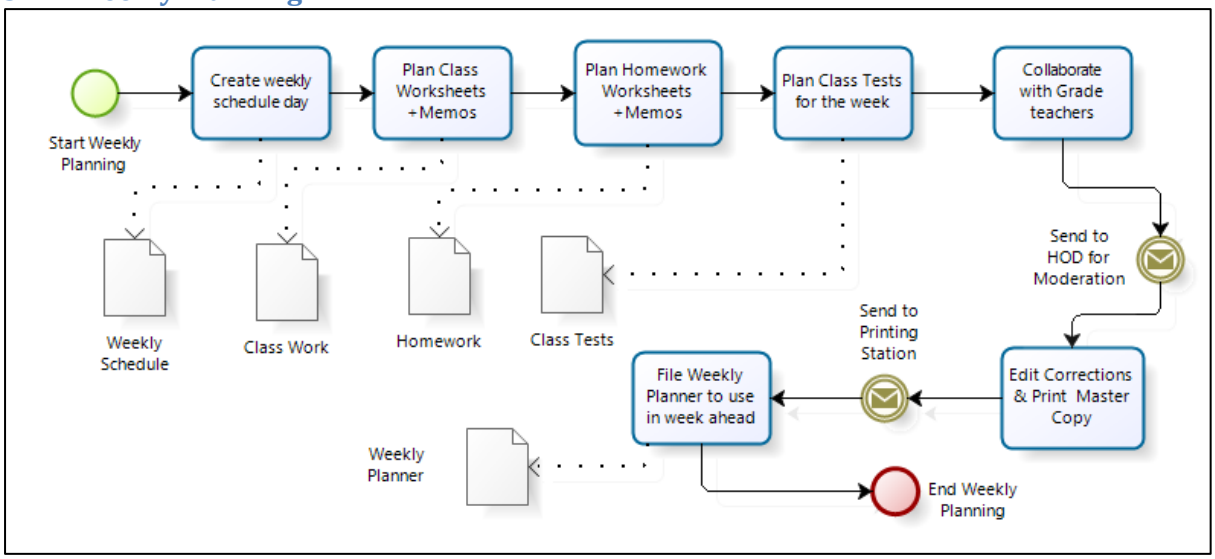


Figure 14 - Weekly Planning Process

[3] For a larger image, Please see Appendix B

3.2.3 Term & Year Planning

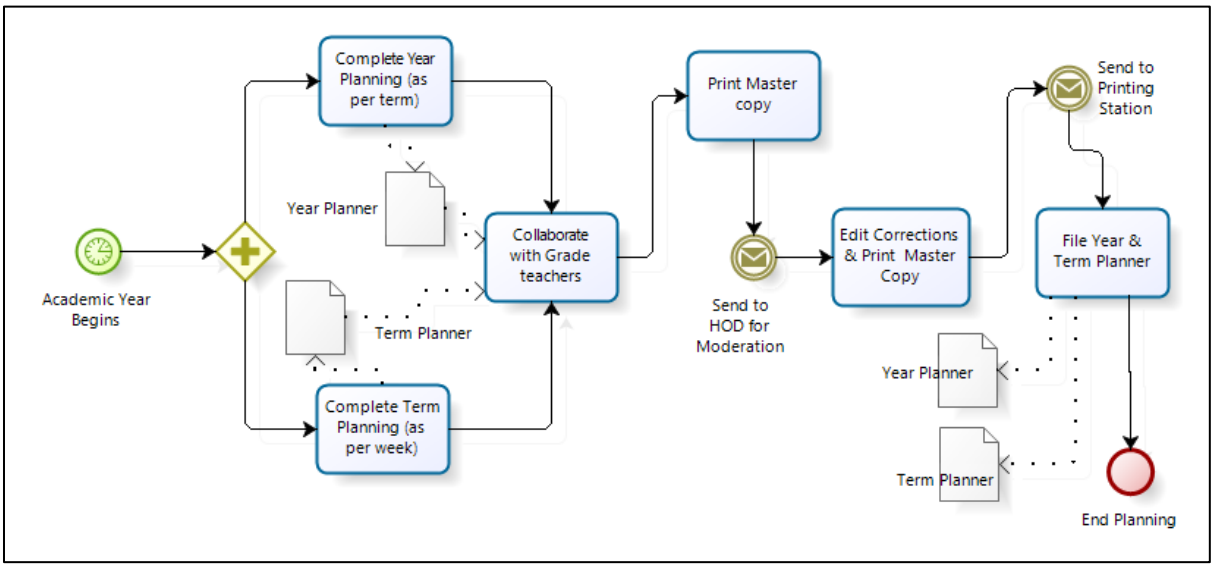


Figure 15 - Term & Year Planning Process

3.2.4 Assessment – Demarcation & Exams

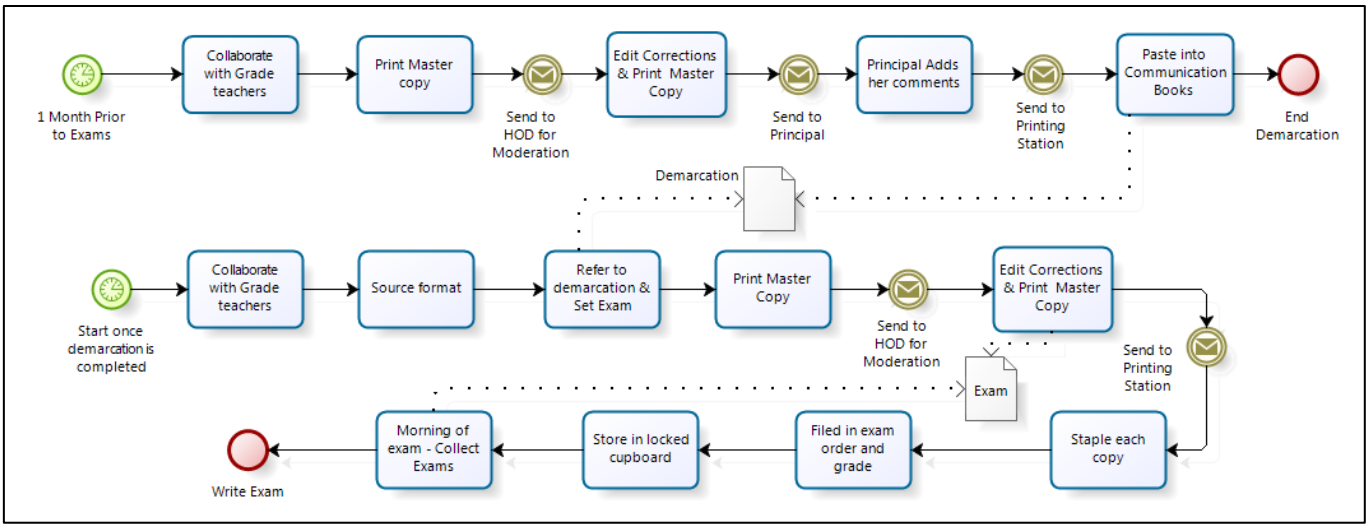


Figure 14 - Demarcation & Exams Process

3.2.5 Assessment – Therapy Reports

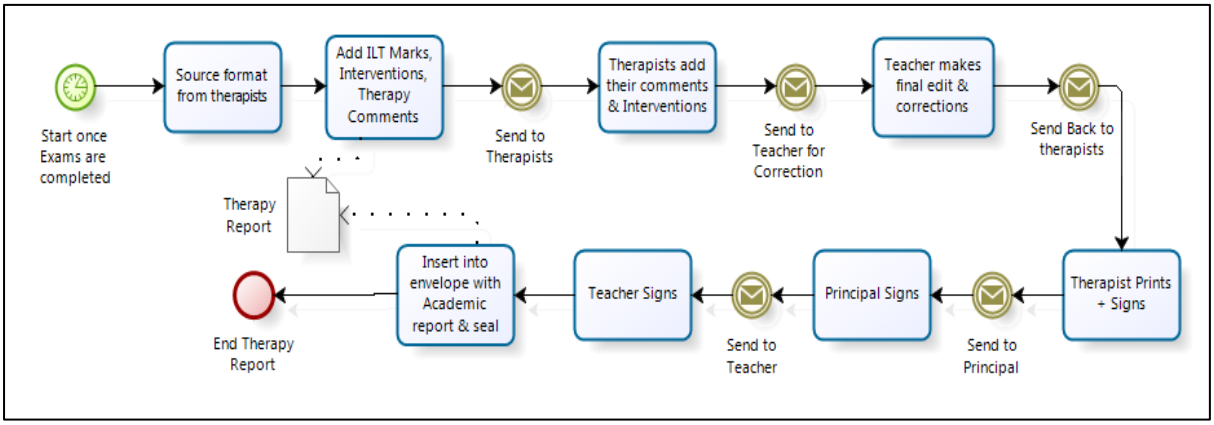


Figure 16 - Therapy Reports Process

3.2.6 Assessment – Academic Reports

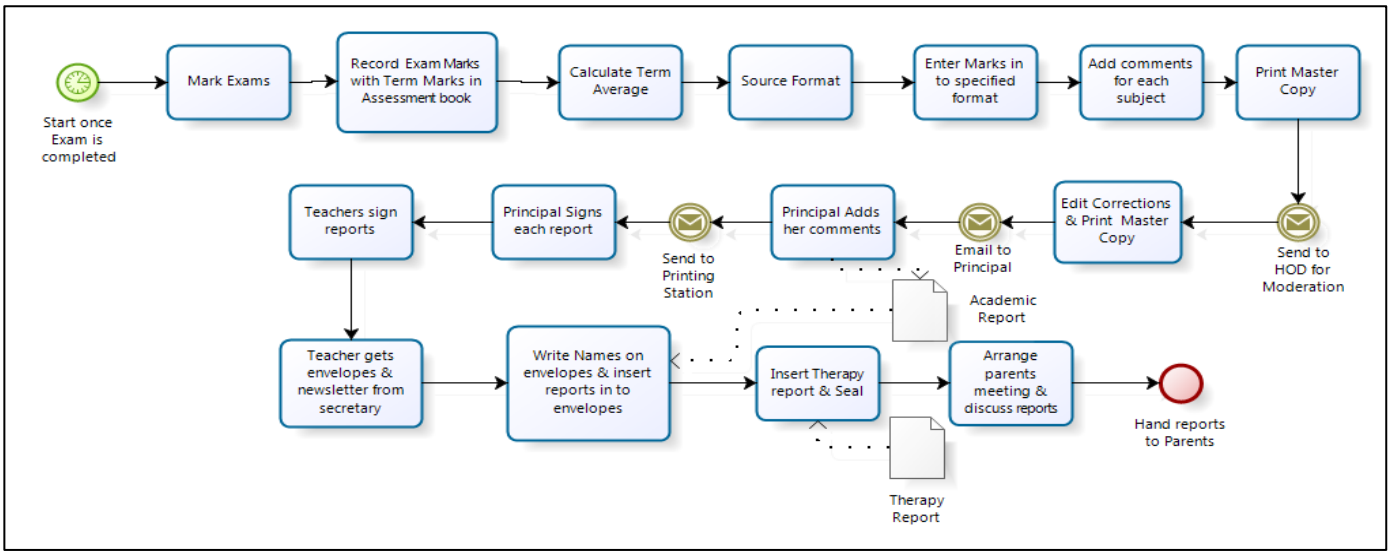


Figure 17 - Academic Reports Process

3.2.7 ILT Book

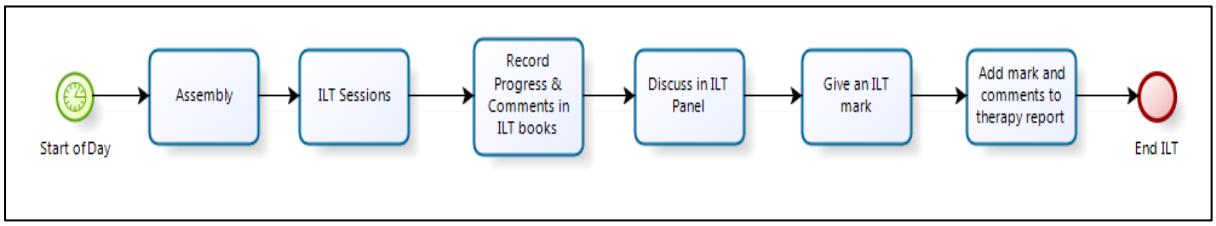


Figure 18 - ILT Process

3.2.8 Byderhand book, Panel, Conners and Storyline book

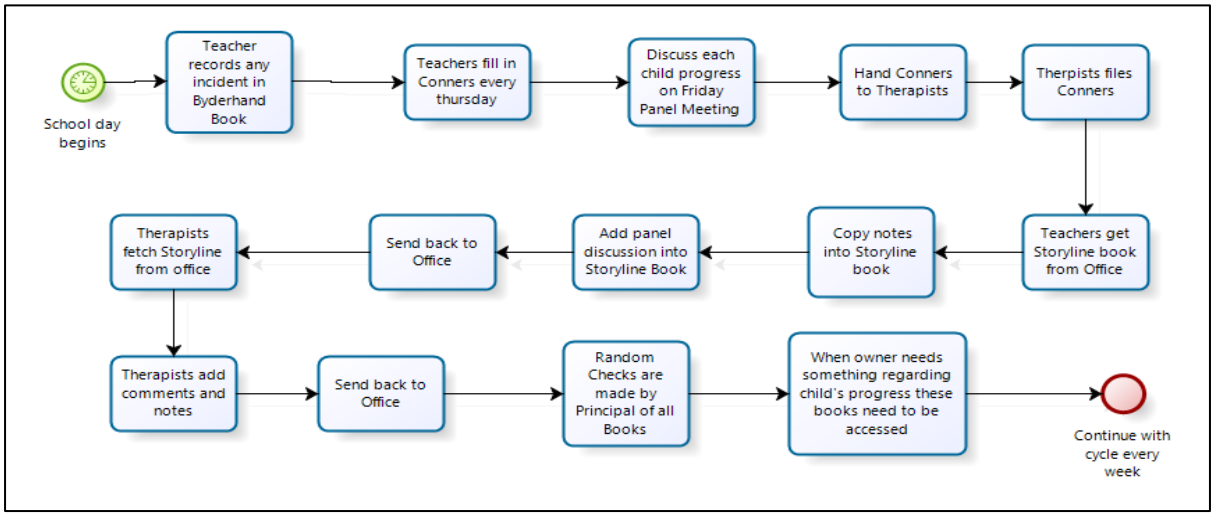


Figure 19 - Byderhand, Panel, Conner's & Storyline Process

3.2.9 Communication Books

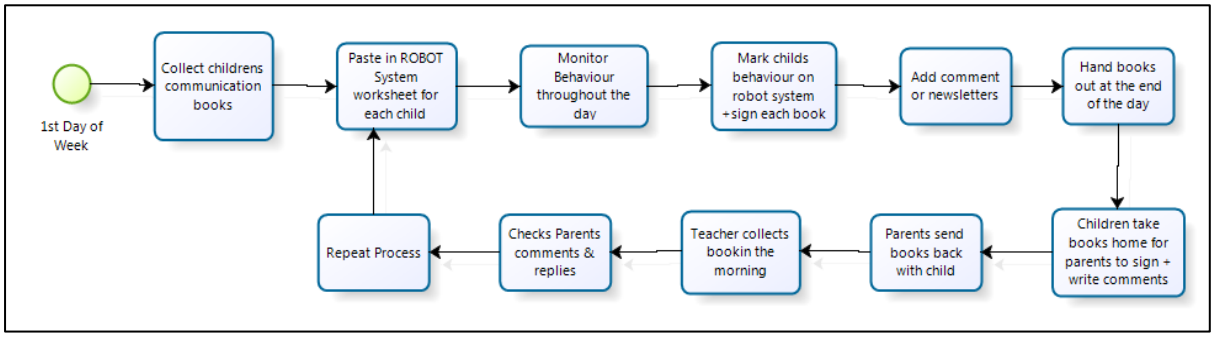


Figure 20 - Communication Books Process

3.2.10 Homework Books

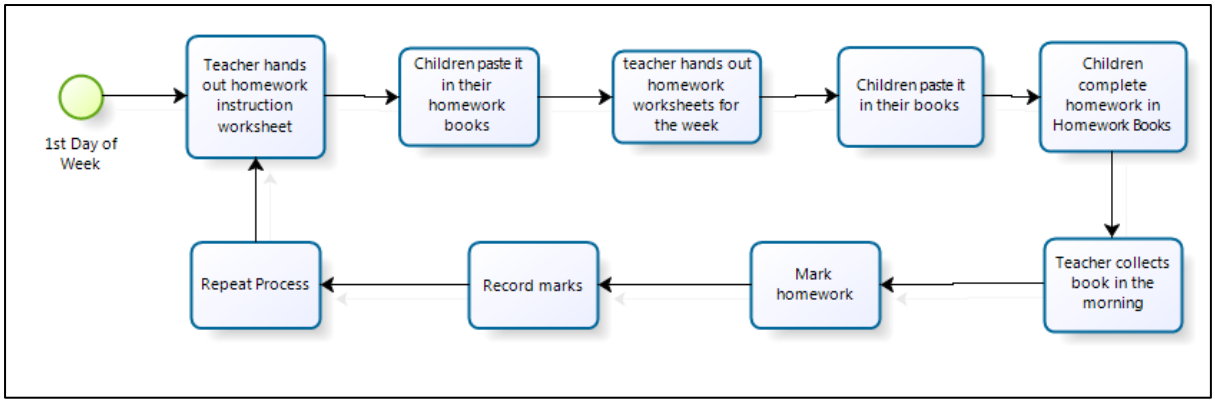


Figure 21 - Homework Books Process

From the above processes it is clear that the processes practiced at EduExcellence involve abundant repetitive, cumbersome and waste of time steps, thus decreasing productivity immensely. The fact that forms and papers have to be printed, cut and paste into books is also a clear indication of how inefficient the operations are at EduExcellence. These trivial steps should be eliminated from the process once an SMIS is implemented.

3.3 Cost Implications

Costs to run current system in place at EduExcellence (ZAR per month incl. VAT):

Relevant Cost	Cost per Month (ZAR)
Printing	R 1,450.55
Photo-Copying	R 2,153.20
Profile Books	R 704.25
Stationery	R 509.00
Other	R 358.27
TOTAL	R 5,175.27

Table 4 - Relevant Costs

3.4 SWOT Analysis

The SWOT analysis highlights important factors of the organization, which can assist in the undertaking of this project or become obstacles to the implementation of the system. The school employs a highly qualified and skilled staff within their expertise, yet they have limited knowledge and skills in the field of information technology, which can pose a threat to the implementation of

the system due to resistance of change. However, this can be remedied through explaining the various benefits the system will bring to the school, such as reducing the high level of workloads.

Figure 22 - SWOT Analysis

3.5 Cause & Effect Diagram

The cause and effect diagram clearly points out the main causes that hinder productivity. As we see the root cause is due to the fact that there is insufficient systems in place, or rather lack thereof. This leads to decreased levels of employee morale, no time to complete duties, tedious and repetitive work and difficulty in measuring performance.

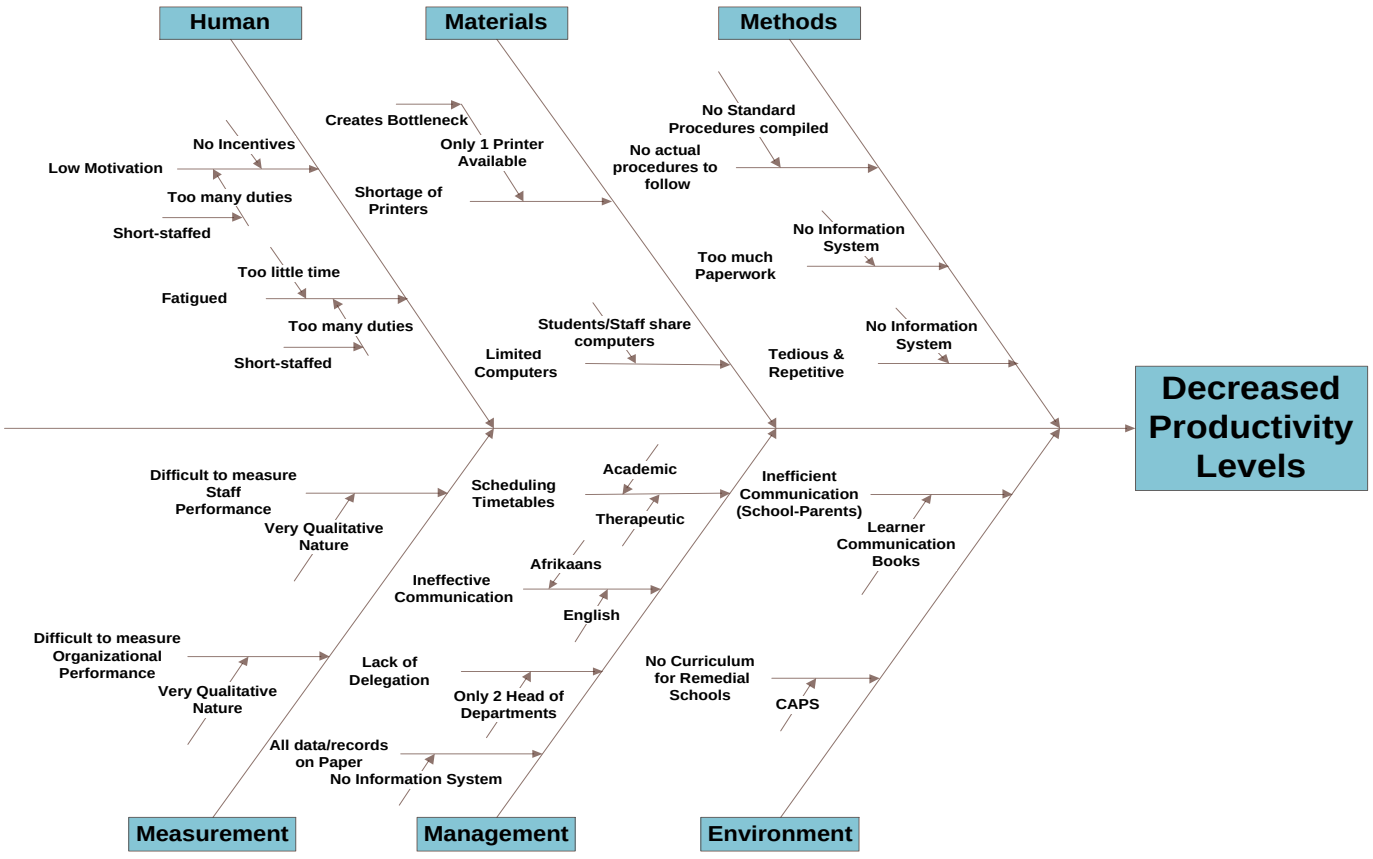


Figure 23 - Cause & Effect Diagram

3.6 PIECES

This framework analyses the manual system currently utilized at EduExcellence. As shown below, the current manual system is highly incapable on every level of the PIECES framework. Due to the manual nature of the system, information is highly inaccessible, inflexible, disorganized, and cannot be used optimally to make decisions. Performance of the system is also very poor, and endures a high cost due to large amounts of paper, books and printing. The system offers very little control on the information and access thereof. This leads to highly inefficient processes and thus lowering productivity on all levels within the organization.

Performance

- No real-time measure of performance of teachers & therapists (& students)
- Performance of actual tasks & duties are hindered by the overload of recording data into books
- All recording of data is manually done

Information

- Data is captured redundantly, data needs to be jotted down in Byderhand Book & transferred to the storyline book
- Low level of accessibility of data
- Low level of reliability of data
- Information becomes redundant after recorded in books and stored in multiple files/books
- Information is not timely
- Data is not well organized, in useful formats
- Data not entirely secure
- Large amounts of qualitative information
- Data is not flexible
- Useful data is collected but unfortunately it cannot be optimaly utilized

Economy

- Costs of printing and paper are too high
- Unnecessary administrative costs
- Costs are untraceable due to high loads of paperwork and different books being used
- Each student has 2 x admin files, 1 x communication , 1 x byderhand, 1 x storyline as well as books for Process Notes, AIT, and ILT and 1 homework book

Control

- Cant control and monitor who edits books
- No control on when exactly the book was taken out from the office and filed.
- Too little security or control
- Ethics are breached on data or information - Student remedial confidentiality is of high importance
- information getting to unauthorized people
- Difficult to monitor if staff are doing the work, recording in correct books etc.
- Books are collected randomly by principal to check if they were updated and correctly done

Efficiency

- Teachers waste time doing unnecessary work
- Data is redundantly duplicated
- Employees have no choice but to utilize large amounts of paper to fulfil duties
- Effort & material required for tasks are highly excessive (simple tasks are made complicated and difficult)

Service

- The current manual system is tedious
- The current manual system is difficult to learn
- The current manual system is highly inflexible
- The current manual system is not in-sync with the operations of the school

4. Conceptual Design

4.1 Bringing it all together – SMIS Requirements

4.1.1 Functional Requirements (High-Level, Business Requirements)

(Function that the system must perform)	
• Registration & Enrolment	• Statistical analysis charts and reports.
• SMS & Email Service, Send Emails to selected Phase, Grades & Classes	• Performance analysis over academic life cycle
• Student Information & Profile	• Dashboards for Students & Teachers
• Family Information (Birthday messages)	• Day, Weekly, Term & Year planning
• Class register/Attendance	• Store Students Marks, Grades & Reports
• Timetable Formulation	• Assign Homework online
• Generate Progress Reports, Academic & Therapy	• Communicate with other Staff, Students, Parents –all via Email
• Discipline monitoring & management	• Allow schedule integration
• Automated Reports & Emails	• Record and Schedule After-Care Duty
• Planning Tests, Exams & Homework	• Prospective Students
• Set Formats for tests & reports	• Panel Discussion
• Bulletin Board, Pop-up Notifications	• Events Module
• Track Students Attendance & Behaviour	• Retrieve Attendance Records
• Creation, editing & viewing of SOP's	• Plot behavioural patterns
• Medicine Register	• Therapy process notes
• Dietary Register	• Supplement Register
• Allergies Register	• Child performance analysis and progress.
• Parents can view their Grades and Attendance, Report Cards and Progress & Therapy Reports	• Parents can track the Progress of their Children in School by gaining immediate access to their Grades and Performance
• Parents Communicate with Teachers online	• Parents can check their children's Homework Assignments online
• Allow uploads such as PDF's, MS Office documents	• Track Teachers Performance, Usage, journal
• Byderhand Book	• Update early departure & late arrivals
• Storyline Book	• Journal Module for teachers
• Click Robot System	• Automatic deadlines
• Click Conners Sheet	• Activities Module
• Click ILT Assessments	• CRUD[4] Extracurricular activities
• CRUD Subjects, Classes, Grades	• LURITS Compatible

4.1.2 Non –Functional Requirements

(A property or quality the system must have)	
• High storage capacity	• Remedial Friendly feel & look
• Fully Web-Enabled (on + offsite)	• Ease of Use
• Security	• Compatibility with different platforms
• Passwords facilitated per user	• Multiple users
• 24 hour operational	• Backup facility & Cloud Storage

[4] CRUD – Create, Read, Update & Delete

4.2 Requirements Modelling

4.2.1 Use-Case Diagram

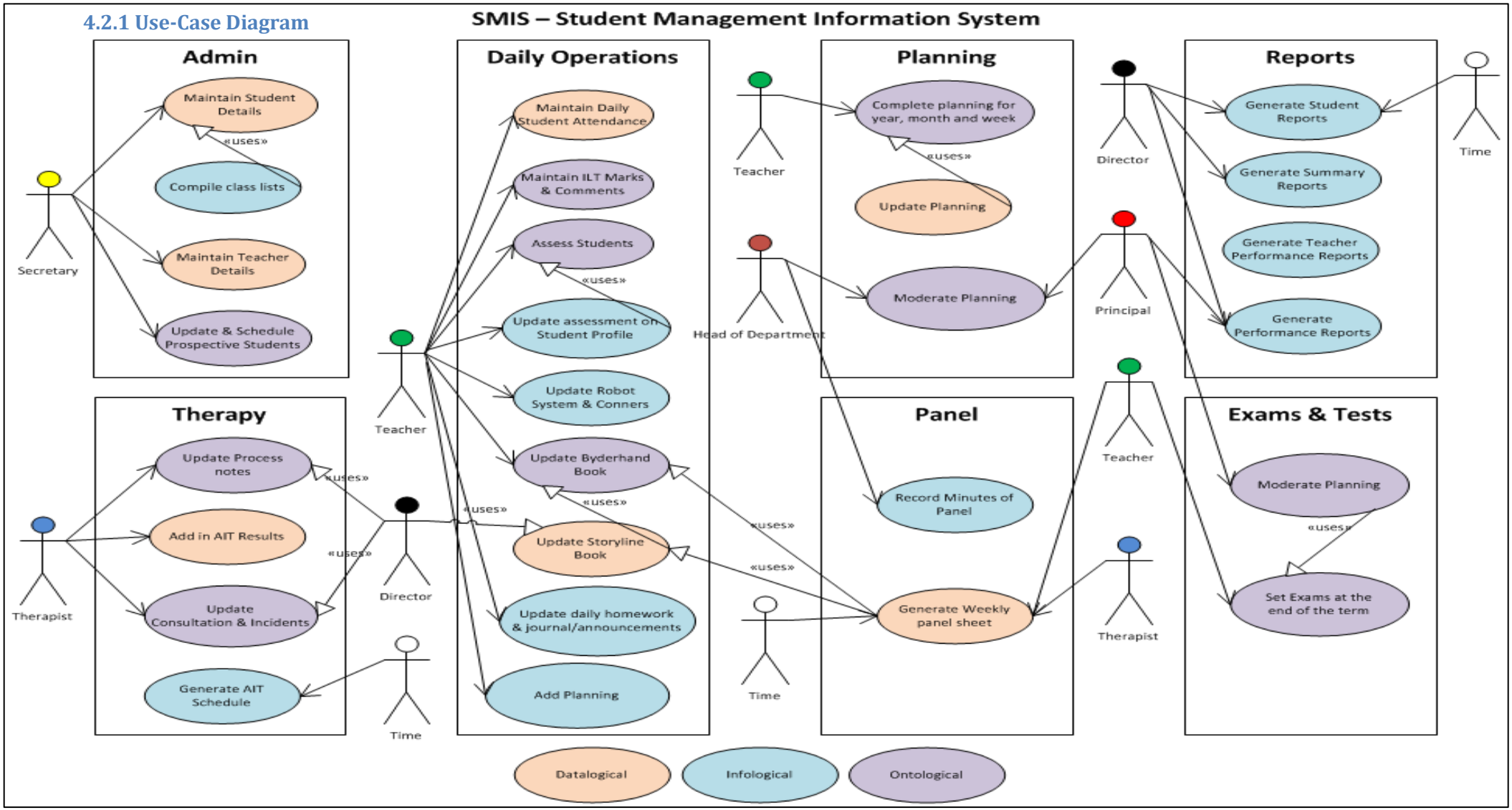


Figure 24 - Use Case Diagram

4.2.2 ERD (Entity Relationship Diagram)

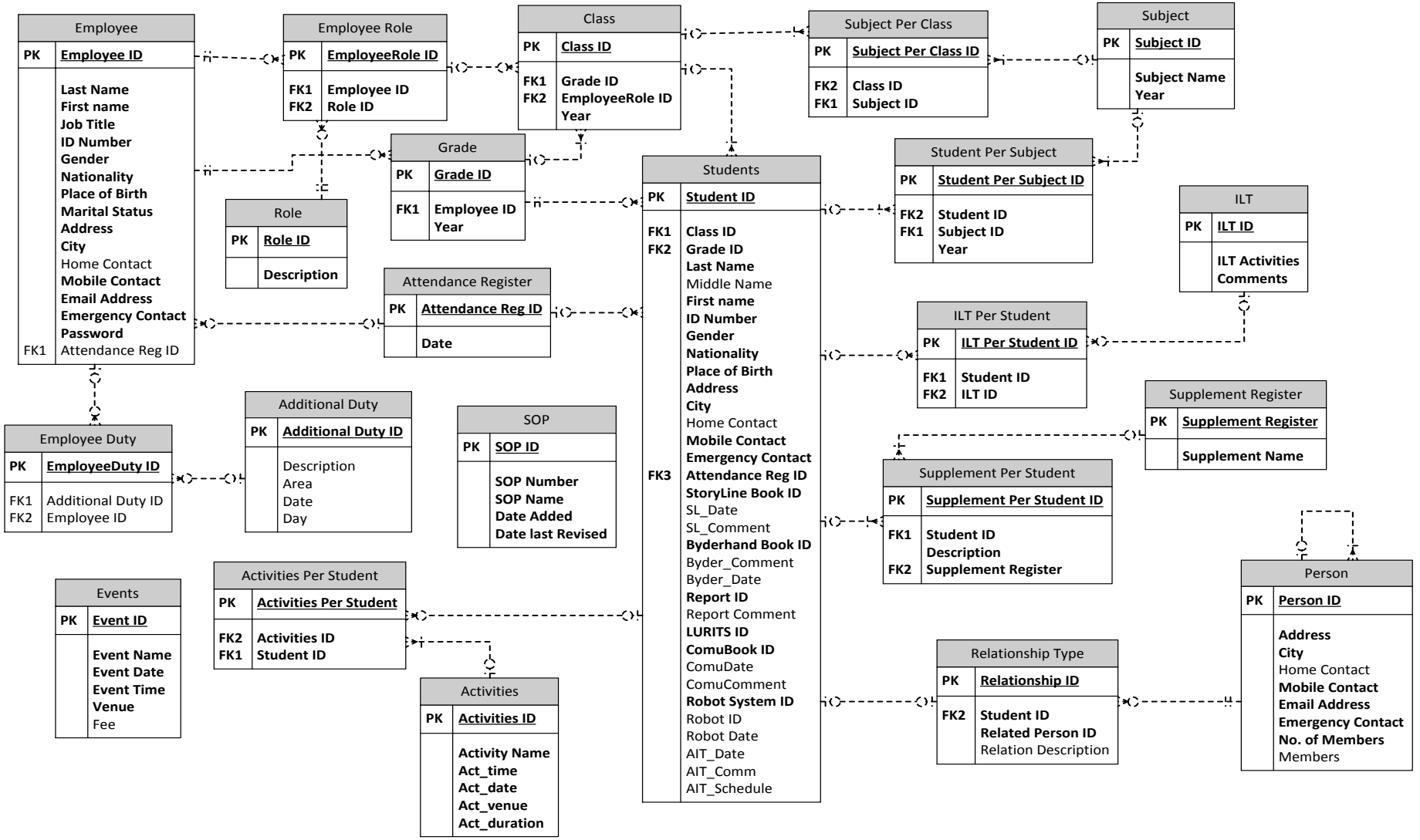


Figure 25 - ERD

4.2.3 Context DFD (Data Flow Diagram)

The context DFD depicts the various data flows in and out of the system. This diagram shown below highlights the importance of teacher and therapist feedback regarding the SMIS, as these two users will be the most frequent and most vital users of the system.

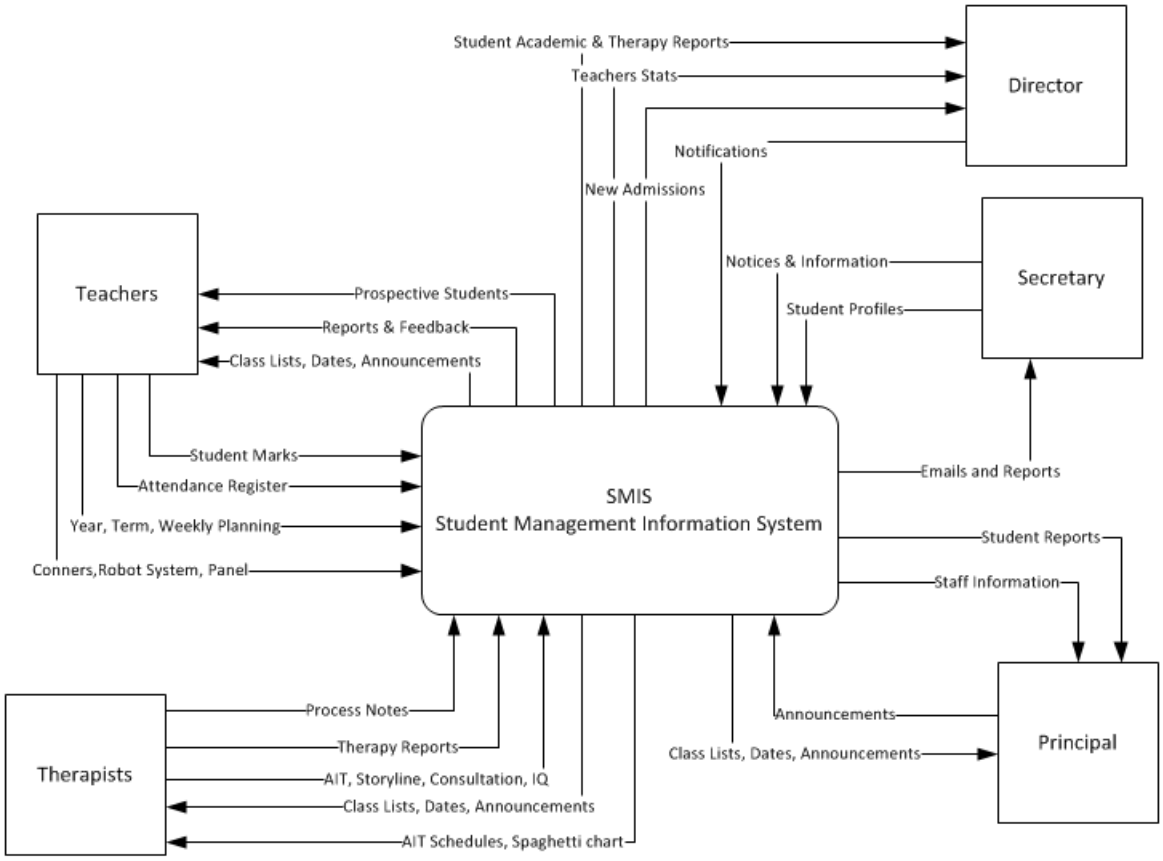


Figure 26 - Context DFD

4.3 SOP Template

Appendix F demonstrates what the required SOP template should look like. This template will be integrated into the system and will allow addition, modification and deletion of SOP's on a database within the SMIS. The template will allow for the several other modifications, such as, last revised date, name, author, and allow it to be saved under the relevant area or theme. For example the sample SOP in Appendix F will be saved directly in the Staff Folder within the SOP Folder.

4.4 Metrics Development

Dialogue with the schools management assisted in gathering the metrics illustrated below. The metrics are broken down into the four categories suggested earlier using the balanced scorecard. The table below suggests a relevant metric under each group along with the rationale behind it and which users will utilize the metric. The last two columns suggest when each metrics needs to updated and how it will be displayed as a dashboard within the SMIS.

Table 5 – Suggested Metrics using the Balanced Scorecard Framework

	Metric	Purpose	Users	Updates	Display
Customer	Parent evening Attendance	To monitor parent-teacher interaction	Admin, Therapists, Teachers, Parents	Quarterly	Checklist
	Event Attendance	To monitor parent-school interaction		Monthly	Checklist
	Parent Perceptions	Customer Opinion	Admin, Therapists, Teachers	Weekly	Polls
	Student Perceptions	Customer Opinion		Weekly	Polls
Internal Business Processes	# of Suspensions	Therapeutic	Admin, Therapists, Teachers	Monthly	% of school
	# of Incidents	Therapeutic		Weekly	Incidents/child
	# of Failures	Academic		Quarterly	Failure/Subject
	Behaviour Chart	Therapeutic		Weekly	Graph
	AIT vs. Grades	Therapeutic		Weekly	Graph
	ILT vs. Grades	Therapeutic		Weekly	Graph
	Robot Chart	Therapeutic		Daily	Graph
	Teachers : Students	Therapeutic		Monthly	Ratio
	Subject Average/Grade	Academic		Quarterly	%
	Truancy Rate	Therapeutic		Daily	Graph
Learning & Growth	Employee Training	Competency	Admin	Monthly	Checklist
	Employee Skills	Competency		Monthly	Checklist
	Employee Motivation	Enterprise Culture		Monthly	JML[5] Inventory
	Employee Appraisal	Enterprise Culture		Monthly	Scheduler
	No. of Computers per Students	Technological Growth		Monthly	Ratio (PC:Student)
	Position at enterprise	Motivational	Admin, Therapists, Teachers	Weekly	Rating (1st-nth)
	Time Idle on System	Productivity		Hourly	% of Time
	Time Busy on System	Productivity		Hourly	% of Time
	Staff Absenteeism	Productivity		Weekly	Avg. Days/staff
	Enrolment per Grade	Growth		Monthly	No. of Students
	Average Class Size	Growth		Quarterly	Average
	Deadlines Missed	Productivity	Admin, Personal	Weekly	# of Deadlines
	Incomplete Forms	Productivity		Weekly	# of Forms
Financial	Expenses	Manage and track financial and budgetary elements	Admin	Monthly	ZAR
	Cash Flow				
	Net Income				
	Revenue				
	Data Tracking	Track Internet Usage	Admin, Teachers	Daily	MB/day or GB/month

[5] Job Motivation Level (JML)

5. Decision Analysis

As discussed earlier in Section 2.1.3 regarding the various COTS software available, selecting an existing standard software application alone is not an option due to the distinctive activities and processes at the organization. Hence, a tailor made option is the only way forward to a successful product, this may either be an existing software which is modified through various add-ons and patches or a first of its kind developed software (this option is highly unlikely due to the high cost implications).

5.1 Entry Level Criteria

To select three possible alternatives, a set of minimum requirements need to be met. This will ensure that a feasible set of alternatives are evaluated. These entry level criteria were identified by the managers and directors of EduExcellence, they are as follows:

- ✓ Cost: Less than or equal to R45,000 once off & less than R2,000/month
- ✓ Customizable: The software should be adaptable to the requirements of the school (Open Source)
- ✓ Web Based: The system should be accessible from anywhere in the world.

With this in mind various options were looked at, first development options were investigated. A request for quotation (RFQ) on the system was sent out to four different software developers around South Africa. After various meetings and interactions with these companies, an approximated figure of around R400,000.00 was quoted. This obviously is way over the schools budget, and thus other avenues will need to be considered. The next option is to look at existing software which allows for modifications or uses open source software.

From the various COTS software available, the following three packages were identified as these best met the criteria above. Table 6 outlines the various capabilities of each alternative when compared to the functional requirements.

Table 6 – Requirements vs. Software Alternatives

	ADAM	EduAccess	fedena™
Software	ADAM	PencilBox	Fedena
Initial Cost	R6,500	R12,500	R15,000
Support & Maintenance Monthly Cost	R1,300/month	R1,160/month	R1,334/month
Cost Per Add-On Module	R1,500	R3,500	R3,000
Country	South Africa	South Africa	India
Training	☑	☑ Added Cost	☑
Framework	Apache, MySQL and PHP (AMP)	SQL	Ruby on Rails (RoR)
Registration & Enrolment	☑	☑	☑
SMS & Email Service	☑	☑ Added Cost	☑ Added Cost

Student Information & Profile	☑	☑	☑
Family Information (Birthday messages)	☑	Requires Add-on	☑
Class register/Attendance	☑	☑	☑
Timetable Formulation	☑	☑	☑
Generate Progress Reports, Academic & Therapy	☑	Requires Add-on	☑
Discipline monitoring & management	☑	Requires Add-on	☑
Automated Reports & Emails	☑	☑	☑
Planning Tests, Exams & Homework	☑	☑	☑
Set Formats for tests & reports	☑	☑	☑
Bulletin Board, Pop-up Notifications	☑	☑	☑
Track Students Attendance & Behaviour	☑	☑	☑
Creation, editing & viewing of SOP's	Requires Add-on	☑	☑
Parents can view their Grades and Attendance, Report Cards and Progress & Therapy Reports	☑	☑	☑
Parents Communicate with Teachers online	☑	☑	☑
Allow uploads such as PDF's, MS Office documents	☑	☑	☑
Byderhand Book	Requires Add-on	Requires Add-on	Requires Add-on
Storyline Book	Requires Add-on	Requires Add-on	Requires Add-on
Click Robot System	☑	Requires Add-on	Requires Add-on
Click Conners Sheet	☑	Requires Add-on	Requires Add-on
Click ILT Assessments	☑	Requires Add-on	Requires Add-on
CRUD Subjects, Classes, Grades	☑	☑	☑
Statistical analysis charts and reports.	☑	☑	☑
Performance analysis over academic life cycle	☑	☑	☑
Dashboards for Students & Teachers	☑	☑	☑
Day, Weekly, Term & Year planning	Requires Add-on	☑	☑
Custom Reports	☑	☑	☑
Assign Homework online	☑	☑	☑
Communicate via Email	☑	☑	☑
Allow schedule integration	☑	☑	☑
Record and Schedule After-	☑	☑	☑

Care Duty			
Prospective Students	☑	Requires Add-on	☑
Panel Discussion	☑	☑	☑
Events Module	☑	☑	☑
Retrieve Attendance Records	☑	☑	☑
Plot behavioural patterns	Requires Add-on	Requires Add-on	☑
Therapy process notes	Requires Add-on	Requires Add-on	Requires Add-on
Supplement Register	Requires Add-on	Requires Add-on	Requires Add-on
Child performance analysis and progress.	☑	☑	☑
Parents can track the Progress of their Children in School by gaining immediate access to their Grades and Performance	☑	☑	☑
Parents can check their children's Homework Assignments online	☑	☑	☑
Track Teachers Performance(Usage, journal)	☑	☑	Requires Add-on
Update early departure & late arrivals	☑	Requires Add-on	☑
Journal Module for teachers	☑	☑	☑
Automatic deadlines	☑	Requires Add-on	☑
Activities Module	☑	☑	☑
CRUD[6] Extracurricular activities	☑	Requires Add-on	☑
LURITS Compatible	☑	☑	Requires Add-on
Password Enabled	☑	☑	☑
24/7 Operational	☑	☑	☑
3rd Party Plugins	☑	☑	☑
Action search	☑	Requires Add-on	☑
Custom Metrics	Requires Add-on	Requires Add-on	Requires Add-on
# Req. Add-on Modules	8	16	10

[6] CRUD – Create, Read, Update & Delete

5.2 Decision Criteria

Demo Versions of all three candidates were acquired and tested at the school with the director, principal and several teachers. Basic tasks were completed using each system in order to get a feel of the system, thereafter a feedback session was held in order to evaluate the true running capability of each system.

5.2.1 Candidate Systems Matrix

1. Benefits
2. Servers & workstations
3. Software Tools needed
4. Application Software
5. Method of Data Processing
6. Output Devices
7. Input devices
8. Storage Devices & Implications

5.2.2 Feasibility Analysis Matrix

To complement the candidate systems matrix, an analysis can be completed using the feasibility analysis matrix. This will weigh and rank each criteria and thus each alternative according to the importance of the criteria.

As discussed in Section 2.6 the several feasibility criteria to be used to analyse the alternatives are listed below:

1. Operational feasibility – This is a measure of how well the solution meets the system requirements.
2. Cultural (or Political) feasibility – This is a measure of how people feel about a solution and how well it will be accepted at an organization.
3. Technical feasibility – This is a measure the practicality and the availability of technical resources and expertise to implement and maintain it.
4. Schedule feasibility – This is to measure how reasonable the project time frame is.
5. Economic feasibility – This is a measure of the cost effectiveness of the solution.
6. Legal feasibility – This is a measure of how well the solution may be implemented within the legal and contractual obligations.

5.3 Economic Feasibility

Implementation of an improved system at EduExcellence will not only allow for more efficient processes, lower workloads and enhanced decision making through effective use of information but improve the financial position of the organization. By introducing the new system and disposing of the current system, many redundant and costly process steps will be eliminated. The new ‘paperless’ system will drastically reduce printing, photocopying, stationery and other relevant costs to the current system in place. Table 7 below estimates what reduction in costs will become evident once the new system is implemented. The new system will result in an estimated cost reduction of around R3000 per month.

Table 7 - Relevant Costs

	Cost per Month (ZAR)			
Relevant Cost	Current	New System		
Printing	R 1,450.55	R 600.00		
Photo-Copying	R 2,153.20	R 800.00		
Profile Books	R 704.25	R 0.00		
Stationery	R 509.00	R 300.00		
Other	R 358.27	R 358.27		
TOTAL	R 5,175.27	R 2,058.27	Costs Avoided	R 3,117.00

5.3.1 Cost-Benefit Analysis

The cost-benefit analysis below illustrates what savings will be realized while viewing the total cost of ownership of each candidate software in relation to the cost reductions mentioned above. Table 8 shows the various costs that will be incurred if the respective software packages are procured. It also includes how many modules need to be added on for each package as well as the cost per module.

Table 8 - Software costs

	ADAM	PENCILBOX	FEDENA
Initial Cost	R6,500	R12,500	R15,000
Monthly Cost (month)	R1,300	R1,160	R1,334
Cost Per Add-On Module	R1,500	R3,500	R3,000
# of Modules to be Added	8	16	10

Table 9 - Cost-Benefit Analysis

	ADAM	PENCILBOX	FEDENA
Purchase Cost	(6500)	(12500)	(15000)
Add-On/Module - A	(1500)	(3500)	(3000)
# of Modules - B	8	16	10
Cost for Add-Ons (AxB)	(12000)	(56000)	(30000)
Total Cost	(18500)	(68500)	(45000)
Costs Avoided	3117	3117	3117
Monthly Costs	(1300)	(1160)	(1334)
Savings or Inflows(month)	1817	1957	1783
Yearly Savings	21804	23484	21396
Payback(Months)	10.2	35.0	25.2
Payback(Years)	0.8	2.9	2.1

Table 9 compares the various packages and indicates that PENCILBOX will permit a yearly savings of R23,484 but with a payback period of almost three years. ADAM, although affording a lesser saving of R21,804 the payback period is just under a year.

5.3.2 Net Present Value

The analysis below compares the net present value of each alternative over a period of 10 years. The table below shows the cash inflows and outflows for each year, and compares the investment of each package utilizing the prime interest rate as listed by the South African Reserve Bank.

Table 10 - Net Present Value Analysis

Net Present Value over a 10 Year period			
	Cash Flow	Rate[7] =	8.5%
Year	ADAM	PENCILBOX	FEDENA
0	R -18,500	R -68,500	R -45,000
1	R 21,804	R 23,484	R 21,396
2	R 21,804	R 23,484	R 21,396
3	R 21,804	R 23,484	R 21,396
4	R 21,804	R 23,484	R 21,396
5	R 21,804	R 23,484	R 21,396
6	R 21,804	R 23,484	R 21,396
7	R 21,804	R 23,484	R 21,396
8	R 21,804	R 23,484	R 21,396
9	R 21,804	R 23,484	R 21,396
10	R 21,804	R 23,484	R 21,396
NPV	R 124,563.63	R 85,586.70	R 95,386.60

[7] The Interest rate is the Prime lending rate (predominant rate) or the Benchmark rate at which private banks lend out to the public taken from the official website of The South African Reserve Bank on the 17/09/2013. (South African Reserve Bank, 2013)

5.4 Evaluating Alternatives

To condense and apply the various decision criteria discussed earlier, the matrices below assist in the evaluation process and allows for a complete assessment of the nominated packages.

5.4.1 Candidate Systems Matrix

Table 11- Candidate Systems Matrix

Candidate Systems Matrix			
Characteristics	ADAM	EduAccess	fedena™
Portion of System Computerized	All requirements satisfied	All requirements satisfied	All requirements satisfied
Benefits	A local product and thus on-site support Can create a forum for remedial schools and procure the benefits through economies of scale No initial cost of capital	A local product and thus on-site support Can create a forum for remedial schools and procure the benefits through economies of scale	Support will be online or telecommunicated, Although 24/7 support Established and already on a huge scale - 20 million+ teachers and students Mobile Apps
Servers & workstations	1 PC/User with Internet Connection (128kbps+) and a Web Browser.	1 PC/User with Internet Connection (128kbps+) and a Web Browser.	1 PC/User with Internet Connection (128kbps+) and a Web Browser.
Software Tools needed	Basic MS Office suite to export reports etc.	Basic MS Office suite to export reports etc.	Basic MS Office suite to export reports etc.
Application Software	Tailored Package	Tailored Package	Tailored Package
Method of Data Processing	Client	Client	Client
Output Devices	N/A	N/A	N/A
Input devices	Keyboard & Mouse	Keyboard & Mouse	Keyboard & Mouse
Storage	250GB for onsite Backup (Optional) Cloud Storage My SQL Server	250GB for onsite Backup (Optional)	250GB for onsite Backup (Optional) Cloud Storage

5.4.2 Feasibility Analysis Matrix

Demo Versions of all three candidates were acquired and tested at the school with the director, principal and several teachers. Basic tasks according to the use-case diagram were completed using each system in order to get a feel of the system, thereafter a feedback session was held in order to evaluate the true running capability of each system. The weightings were formulated through discussions with the management and staff on which criteria is most essential in comparison to the others.

Table 12- Feasibility Analysis Matrix

Feasibility Analysis Matrix				
Criteria	Weighting	ADAM	EduAccess	fedena™
Operational feasibility	30%	90	65	85
		Developers can create customized plug-ins and add-ons to fully meet requirements	Developers can create a few customized plug-ins and add-ons to meet requirements	Developers can create a few customized plug-ins and add-ons to fully meet requirements
Cultural feasibility	10%	97	50	90
		Users were very satisfied with the product and user interface.	Users were frustrated with the product and user interface.	Users were satisfied with the product and user interface.
Technical feasibility[8]	20%	95	60	70
		Vast expertise in programming and based locally, ADAM is developing very rapidly.	Hesitant to develop more and new modules.	Limited programmers use & understand Ruby on Rails, but support from India is available.
Schedule feasibility	10%	95	85	80
		3 Months	4 Months	5 Months
Economic feasibility	20%	90	50	75
Total Cost: Savings: Payback: NPV (10 Year Period):		R 18,500 R 1,817 0.8 Years R 124,563.63	R 68,500 R 1,957 2.9 Years R 85,586.70	R 45,000 R 1,783 2.1 Years R 95,386.60
Legal feasibility	10%	80	80	60
		No foreseeable problems	No foreseeable problems	Maybe issues of tax and duties etc… if there is change in laws in the future
Total Points	100%	91.2	63	77.5
Ranking		1	3	2

[8] See Section 5.3 Economic Feasibility

Table 13 - Feasibility Analysis Matrix Scores

Feasibility Analysis Matrix Scores					
Criteria	Weighting	ADAM	EduAccess	fedena™	
Operational feasibility	30%	90	65	85	RAW SCORE
	0.3	27	19.5	25.5	WEIGHTED
Cultural feasibility	10%	97	50	90	RAW SCORE
	0.1	9.7	5	9	WEIGHTED
Technical feasibility	20%	95	60	70	RAW SCORE
	0.2	19	12	14	WEIGHTED
Schedule feasibility	10%	95	85	80	RAW SCORE
	0.1	9.5	8.5	8	WEIGHTED
Economic feasibility[9]	20%	90	50	75	RAW SCORE
	0.2	18	10	15	WEIGHTED
Legal feasibility	10%	80	80	60	RAW SCORE
	0.1	8	8	6	WEIGHTED
Total Points	100%	91.2	63	77.5	
Ranking		1	3	2	

5.5 Preferred SMIS Software Package

From the above Candidate System & Feasibility Analysis Matrix evaluation of the three SMIS software alternatives, ADAM was selected as the best balanced package for EduExcellence. A set of screen shots taken from the Demo version of the ADAM software package is given below:

[9] See Section 5.3 Economic Feasibility

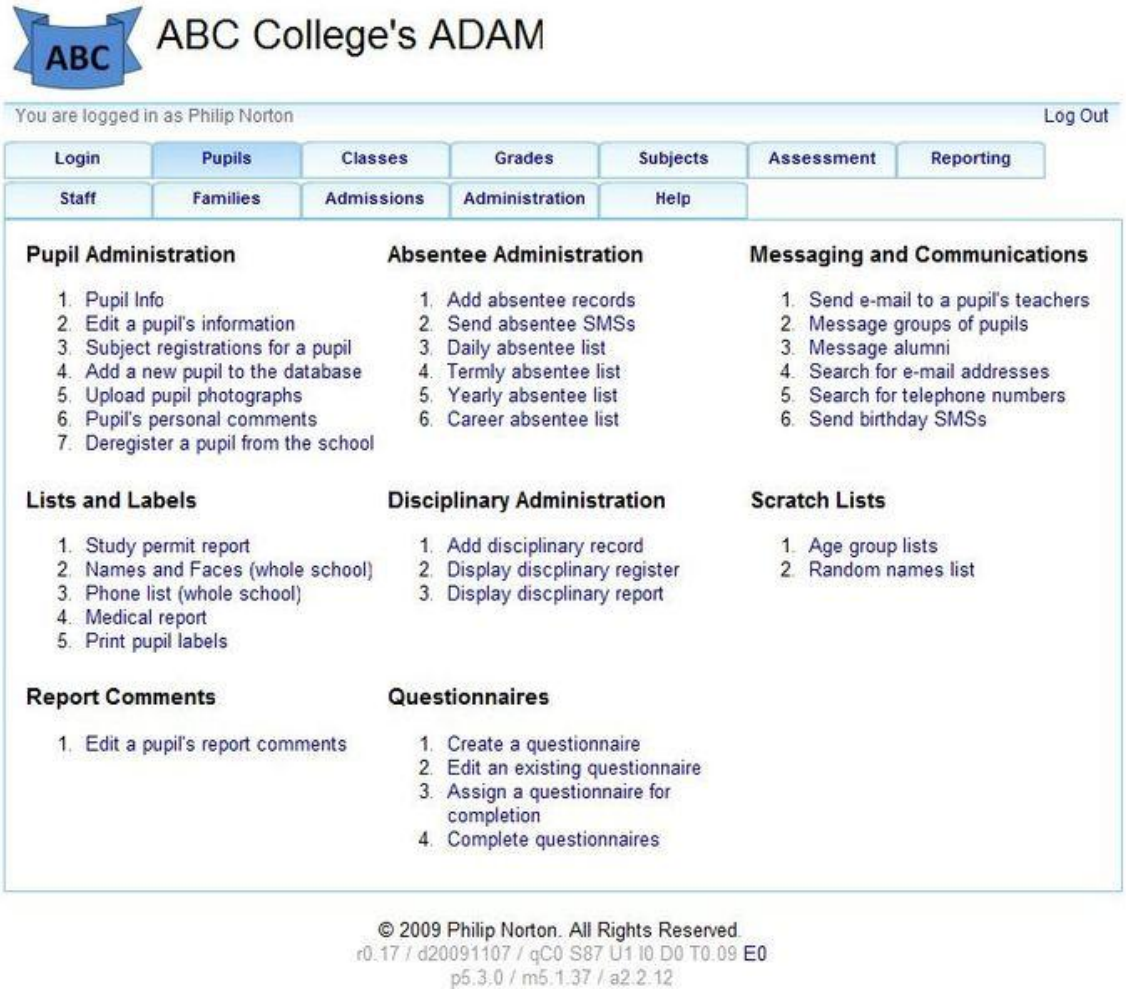


Figure 27 - The Pupil Management Menu

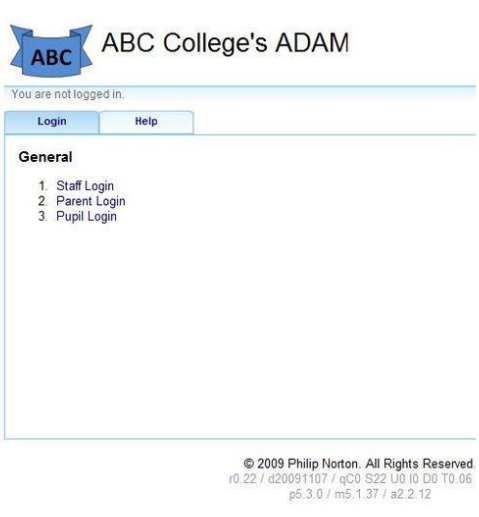


Figure 29 - Login Screen

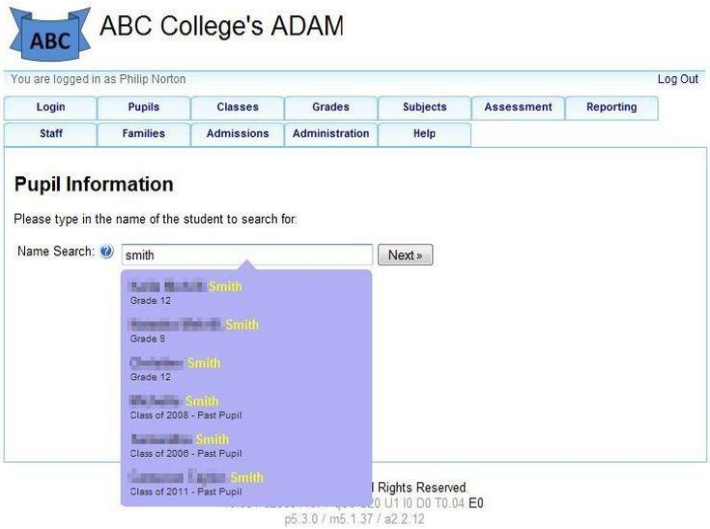


Figure 28 - Action Search Function

ABC College's ADAM

You are logged in as Philip Norton Log Out

Login | Pupils | Classes | Grades | Subjects | Assessment | Reporting
Staff | Families | Admissions | Administration | Help

Pupil Information

» [redacted] Smith (Choose a different pupil)

General Information | Academic Records | Subject Choices | Absentee Records | Discipline Records | Comments
Questionnaires

General Information

Admin No:	BC00[redacted]
Full Name:	[redacted] Smith ([redacted])
Date of Birth:	08 Oct [redacted]
Age:	18 years, 76 days
Gender:	Female
ID Number:	[redacted]
Population Group:	White
Home Language:	English
Disabilities:	(No disability)
Matric Year:	2009
Date of Entry:	01 Jan [redacted]
Date of Exit:	31 Dec [redacted]
Qualification:	National Senior Certificate
Prep School:	
E-mail:	[redacted]@gmail.com
Cell Phone:	082 582 [redacted] Send SMS
Username:	[redacted]
Allergies:	
Medical Conditions:	
Medical Aid:	Discovery, No: 0519[redacted], Principal member: Mr [redacted]
Doctor:	Dr [redacted] 011 704 [redacted]
Family Notes:	
School Fees:	Mr & Mrs [redacted] and [redacted]
Account Number:	
Term Residence:	Mr & Mrs [redacted] and [redacted]
General Notes:	[redacted]
Nationality:	South Africa
Study Permit:	Not required

Edit »

Details Form »

Family Information

[redacted] [redacted] Edit »

Cell Phone:	082 888 [redacted] Send SMS	**Cell Phone:**	082 872 [redacted] Send SMS
Work Phone:	011 465 [redacted]	**Work Phone:**	011 468 [redacted]
E-mail:	[redacted]@gmail.com	**E-mail:**	[redacted]@gmail.com
Home Phone:	011 465 [redacted]	**Home Fax:**	011 465 [redacted]

r0.11 / d20091107 / qC0 S38 U1 I0 D0 T0.1' E0
p5.3.0 / m5.1.37 / a2.2.12

Figure 30 - Student Profile

ABC College's A

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

You are logged in as Philip Norton Log Out

Login | Pupils | Classes | Grades | Subjects | Assessment | Reporting
Staff | Families | Admissions | Administration | Help

Pupil Information

» [redacted] Smith (Choose a different pupil)

General Information | Academic Records | Subject Choices | Absentee Records | Discipline Records | Comments
Questionnaires

Academic Progress

» Click here to see [redacted]s Subject Performance graphs
» Click here to see [redacted]s detailed academic history

Term 3, 2009

Subjects	NSA	SA	Ex	Term
English	81%	80%	N/A	**80%**
Afrikaans	N/A	53%	N/A	**53%**
Mathematics	100%	74%	N/A	**75%**
Mathematics Paper III	N/A	N/A	N/A	N/A
Geography	95%	79%	N/A	**86%**
History	92%	81%	N/A	**87%**
Physical Sciences	78%	67%	N/A	**71%**
Life Orientation	79%	N/A	N/A	**79%**

- NSA: Non-standardised Summative Assessment
- SA: Standardised Summative Assessment
- Ex: Examinations

Term	Result	Level		
Term 3, 2009	75.9	6	view	edit
Term 2, 2009	76	6	view	edit
Term 1, 2009	77.9	6	view	edit
Term 3, 2008	74.4	6	view	edit
Term 2, 2008	77.3	6	view	edit
Term 1, 2008	76	6	view	edit
Term 3, 2007	70.9	6	view	edit
Term 2, 2007	75.9	6	view	edit
Term 1, 2007	70	6	view	edit
Term 3, 2006	73.8	6	view	edit
Term 2, 2006	74.7	6	view	edit
Term 1, 2006	77	6	view	edit

r1.3 / d20091107 / qC0 S98 U1 I0 D0 T1.28 E0
p5.3.0 / m5.1.37 / a2.2.12

Figure 31 - Academic Summary

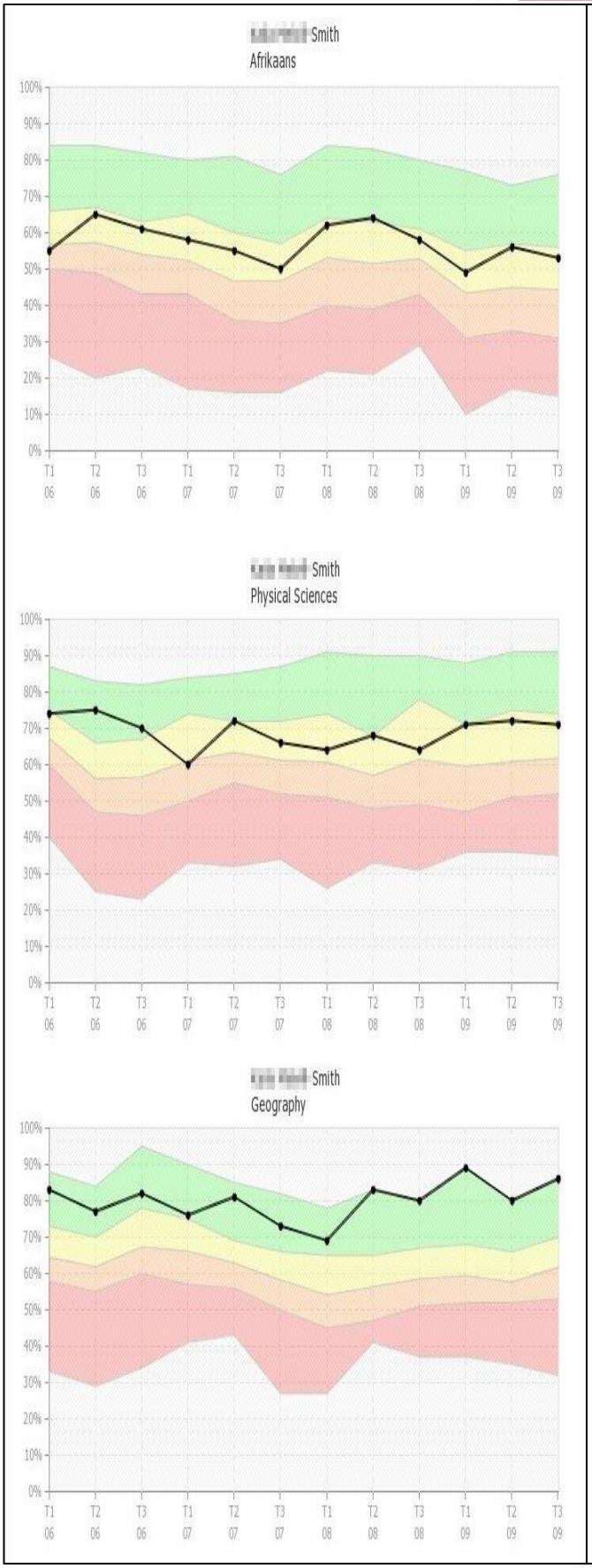


Figure 33 - Subject Progress Graphs

Figure 32 - Class Registration

6. Solution Validation

In order to test if the selected package has in fact fulfilled the requirements set out at the initial stages, a simple requirements mapping table to track if there is any misalignment. The use cases and functional requirements were combined to provide a thorough and comprehensive list of requirements. These were grouped together and matched alongside the ADAM functions to validate the selected solution.

6.1 Requirements Mapping

Table 14 - Requirements Mapping

eduexcellence	ADAM	
EduExcellence Requirements	ADAM Function[10](2011)	Requirement Fulfilled?
Total Initial Cost < R45,000	R18,500	
Monthly Cost < R2000	R1,300/month	
Support & Maintenance	10 hours PER MONTH	
Implementation & Training	Setup + 6 hours of training - INCLUDED	
Registration & Enrolment CRUD Subjects, Classes, Grades Retrieve Attendance Records Update early departure & late arrivals	✓ Perform class enrolments: enrol a new pupil into multiple classes or multiple pupils into a new class. ✓ Any type of group can be created on ADAM: academic classes, sports teams, society memberships, touring groups and more. ✓ Scratch lists for any group of pupils with highly customisable content.	
Student Information & Profile SMS & Email Service Assign Homework online	✓ Record and maintain each student's electronic file with personal information. ✓ Upload a picture for profiles. ✓ Use the messaging system to e-mail or SMS pupils. This can be used for sending homework assignments and reminders!	
Family Information (Birthday messages) Parents Communicate with Teachers online Communicate via Email Automatic deadlines	✓ Names and Faces list with parent contact information. ✓ All the data required to complete the Annual Schools Survey is included in ADAM. ✓ Phone lists. ✓ A variety of labels for pupils, parents, eldest / youngest children and more. ✓ Complex family structures can be established to reflect the true structure of each student's family. This includes	

[10] Functions are retrieved from ADAM official Website & Quotations

	multiple sets of parents, sponsors, and other relatives. There are an unlimited number of relationships that can be created between a pupil and many different family groups. ✓ Families can also have multiple children associated with them. This means that if a phone number changes, it needs to be updated in one place only. ✓ The messaging system allows easy and quick communication to parents. ADAM uses its flexible class groups to be able to send messages to any groups of parents: for example, sports arrangements and last minute changes can be sent to the team instead of the entire school.	
Class register/Attendance	✓ Record and manage staff absenteeism ✓ Absentee Records ✓ Attendance Registers	
Timetable Formulation	Custom Module Development	
Generate Progress Reports, Academic & Therapy Automated Reports & Emails Set Formats for tests & reports Custom Reports Click Robot System Click Conners Sheet Click ILT Assessments Child performance analysis and progress. Parents can view their Grades and Attendance, Report Cards and Progress & Therapy Reports	✓ Complete and detailed reports on subject changes. ✓ Report on Learning Outcomes, or even Assessment Standards (useful at foundation phase). ✓ Indicate levels for Assessment ✓ Indicate levels and/or comments for Learning Outcome's ✓ Indicate levels, marks and/or comments for the subject or Learning Area as a whole ✓ Ability to generate generic comments with pupil name personalisation ("^n has done well!" = "Johnny has done well!"). ✓ Reports can be e-mailed automatically to parents and guardians. ✓ Reports are PDF-generated to ensure consistent appearance. ✓ Reports are customised for customers to match their current or desired reporting requirements. ✓ This includes customisation to print on letter-head or special front covers. ✓ ADAM also allows parent and pupil logins. These logins are completely separate from the staff logins and parents and pupils have read-only access to very specific features. ✓ Using ADAM's points and awards system, awards and achievements (e.g. colours) can be tracked online.	
Planning Tests, Exams & Homework	Custom Module Development	

Track Students Attendance & Behaviour Discipline monitoring & management Statistical analysis charts and reports.	✓ Record Merits, Demerits, service points, cultural points or any other points system. ✓ The recording of points can automatically trigger further events (a certificate after 20 merits, or a detention after 5 demerits). ✓ Record Detentions, Awards, and any other event, with a built in register to see who still needs to attend.	
Byderhand Book Storyline Book Therapy process notes Panel Discussion	Custom Module Development	
Supplement Register	Custom Module Development	
Day, Weekly, Term & Year planning	Custom Module Development	
Journal Module for teachers	Custom Module Development	
Track Teachers Performance(Usage, journal)	Custom Module Development	
LURITS Compatible Creation, editing & viewing of SOP's	✓ All the data required to complete the Annual Schools Survey is included in ADAM. ✓ Electronic Document Repository LURITS ✓ Mail Logging ✓ Questionnaires	
Password Enabled Multiple Roles	✓ Create security roles with specific privileges and assign staff to those roles. ✓ Staff can have multiple roles within ADAM, providing for unlimited privilege possibilities. ✓ Authentication can be done internally using a separate password, or synchronised with your Active Directory Server, or a POP3 mail server. ✓ Staff can be messaged using e-mail or SMS through the messaging system.	

Hence we see that the ADAM software meets all the initial requirements that were set out in the analysis phase with exceptions to the modules that need development. These modules (currently under development) can only be tested and validated once they have been developed.

6.2 Demo Feedback & Questionnaire

Demo Versions of all three candidates were acquired and tested at the school with the director, principal, therapists and several teachers. Basic tasks were completed according to the use-case diagram using each system in order to get a feel of each system, thereafter a feedback session was held and questionnaire forms were given out in order to evaluate the true running capability and to gauge opinions of each system. Below is an abridged representation of the assessment of the several software as well as validation that the selected software package, ADAM, was the indeed the best candidate.

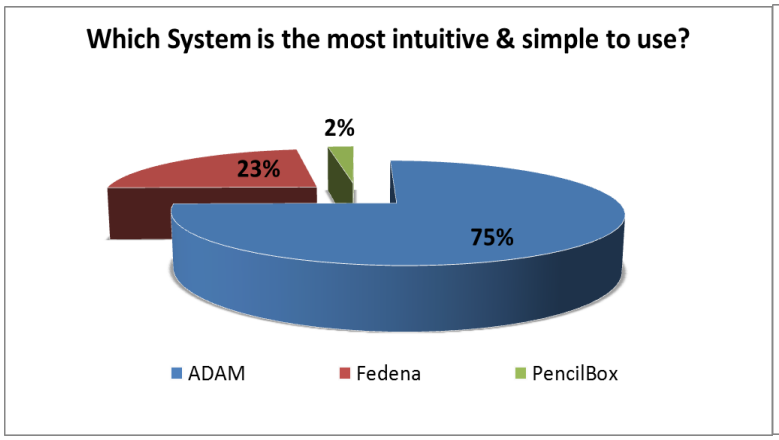


Figure 35 - Demo feedback pie chart 1

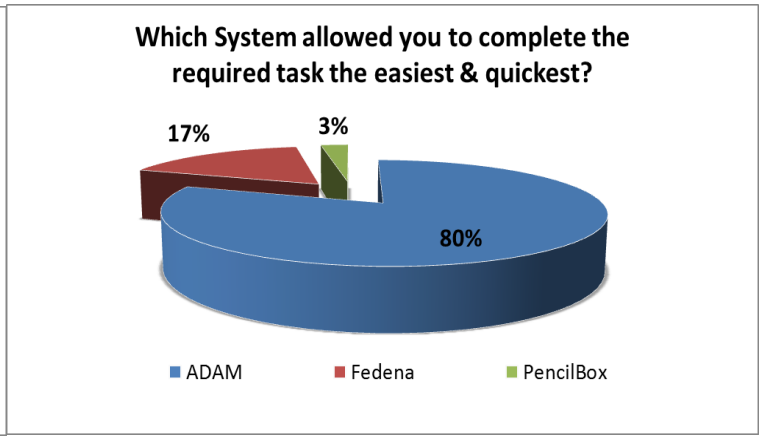


Figure 34 - Demo feedback pie chart 2

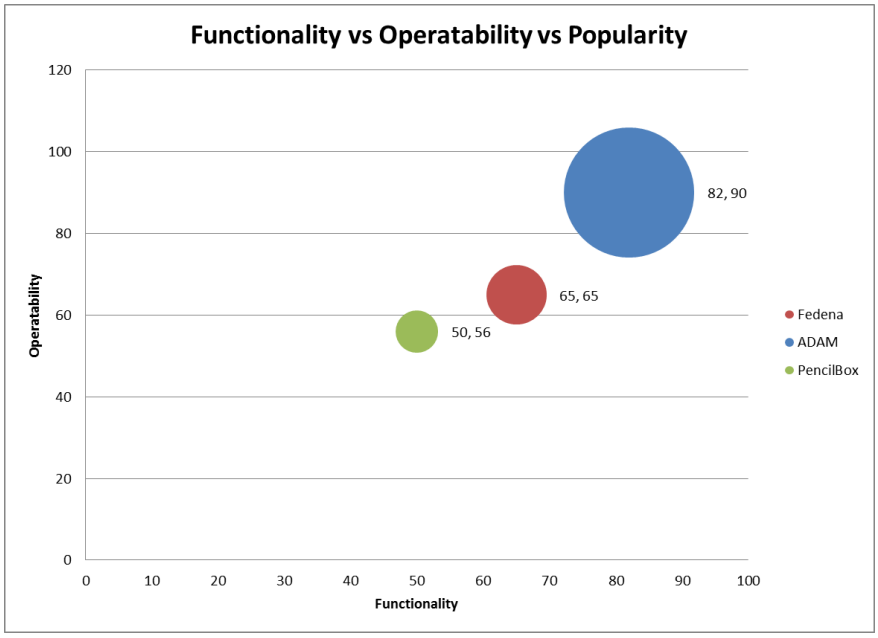


Figure 36 - Demo feedback bubble chart

6.3 Implementation Plan & Schedule

As the software is being purchased and tailor-made to the required specifications of the organization, included in the initial fee is a set-up and training fee. This is adequate in terms of installing the software and taking care of the core part of implementation, yet it does not ensure a smooth transition to the new system as explained in the Literature Review. Hence, below is a checklist formulated to ensure that these steps and important queries are resolved before the system trainers leave the premises after the initial set-up. An implementation schedule (see figure 37) is also provided to forecast when the complete system will be up and running and how long the development of the required add-on modules would take.

Table 15 - Implementation Checklist

	Checklist	☑	Persons Required
1 Conduct System Test	Ensure Internet Browsers are compatible		Analysts, Owners, Users, Builders.
	Ensure Internet Bandwidth is sufficient		
	Ensure Backup Storage is adequate		
2 Prepare Conversion Plan	Parallel Conversion – This will allow both the old and new system to be used for some time until the new system is fully operational. (All data transferred onto new system)		Analysts, Owners, Users, Builders.
	Verification or Alpha Testing – Already completed with the demo version. (Need to complete with full version)		
	Validation or Beta Testing – run using real data.		
	Systems Performance ➢ Is the response time acceptable?		
	Peak work load processing performance ➢ Can the system handle workload during peak processing workload periods? Early morning? Maximum users online?		
	Human Engineering test ➢ Is the system as easy to learn as initially expected		
	Methods & Procedures ➢ Do any processes fail?		
	Back-up & Recovery ➢ Create a scenario where data is lost due to a power failure for example, and recover thereafter?		
	Audit Testing -		
	Is system free of errors?		
3 Install Databases	Hire data capturers to transfer data from books/files onto system.		External Persons – Professional Data Capturers
4 Train Users	Ask whatever questions you are unsure about Don't be afraid if you do not understand. Receive all documentation ➢ Training Manuals ➢ FAQ ➢ Support Documentation ➢ Contact Details		ADAM Trainers
5 Convert to New System	If any support is needed once the system is implemented contact ADAM directly, they offer full time support.		ADAM

ID	Task Name	Start	Finish	Duration
1	Demo Testing	8/1/2013	8/14/2013	2w
2	Client Feedback	8/14/2013	8/20/2013	1w
3	Software Selection & Procurement	8/20/2013	8/26/2013	1w
4	Install Basic Software Package	8/26/2013	8/27/2013	2d
5	Add Databases (data capturers)	8/27/2013	10/21/2013	8w
6	Add-ons Development – Phase 1	8/26/2013	9/27/2013	5w
7	Add-ons Testing (4/8 modules)	9/27/2013	10/3/2013	1w
8	Add-ons Development – Phase 2	10/3/2013	11/6/2013	5w
9	Add-ons Testing (8/8 modules)	11/6/2013	11/12/2013	1w
10	Install all 8 Add-on Modules	11/12/2013	11/13/2013	2d
11	Training	11/13/2013	11/19/2013	1w
12	Make Changes before complete change-over for 2014	11/19/2013	12/2/2013	2w
13	Convert to New System for 2014	12/2/2013	12/4/2013	3d

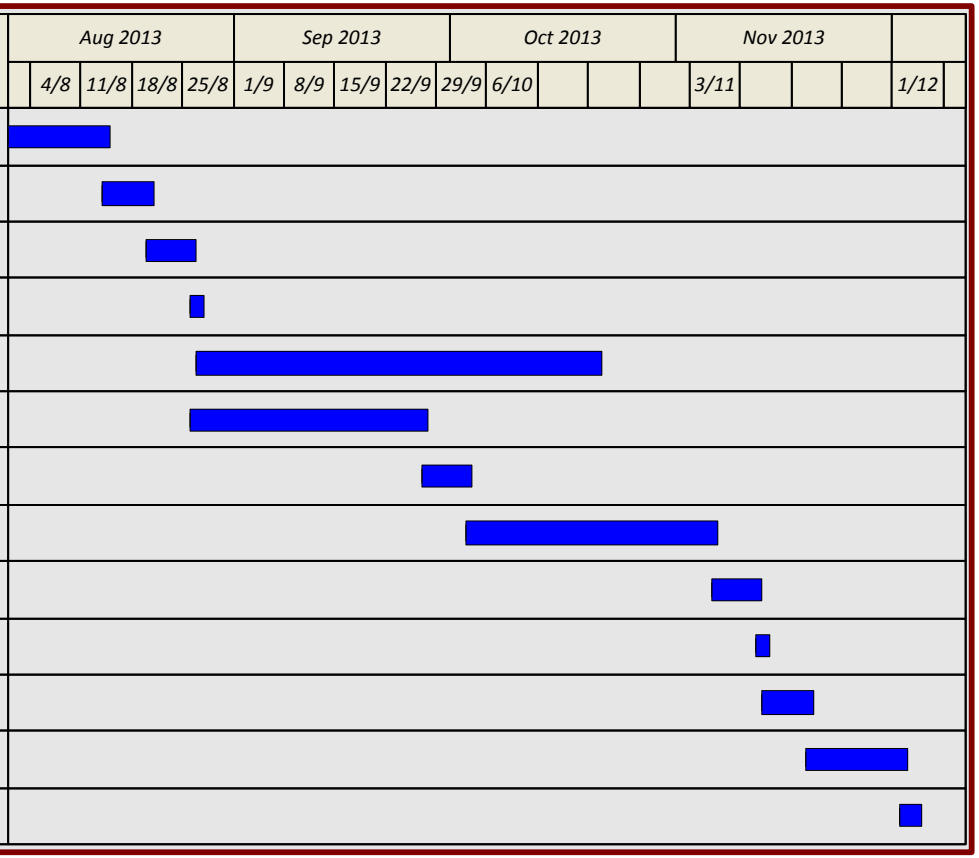


Figure 37 - Implementation schedule

7. Conclusion

The Literature Review provided vital guidance on what has been done in industry and which is the best way forward on delivering an optimized solution. A profound insight on what should an SMIS entail and deliver to a school was established. The current trends in South Africa and the rest of the world clearly show the lack of a specialized remedial school system and hence the need to develop or tailor a system to fit the requirements of EduExcellence. Research also showed the redundancy that a linear model would offer in this scenario at focus, and how a well-designed system can achieve and sustain scheduling requirements. Development of an SOP manual was also not pursued further but rather enabling integration into the system that will facilitate creating, modifying and viewing SOP's on the system which will lead to building an entire SOP database on the system. Research on measures and metrics paved the way to the discovery of applying and developing scorecards and dashboards to measure organizational performance.

Various fact-finding techniques were used to abstract information and understand the current operations at EduExcellence. This included interviews, document sampling and a questionnaire. Thereafter the as-is processes were constructed to portray the current activities at EduExcellence. This BPMN mapping strategy pointed out several deficiencies in the current processes. A cost investigation was completed to realize the relevant costs incurred as a result of the current system. A JRP session was held to obtain specific requirements from the potential users of the system, whereby these requirements were documented using various data illustration tools. These included a use-case diagram, an ERD and a context DFD.

With the problem analysis stage thoroughly completed, a comprehensive list of specifications was drawn up, which included both functional and non-functional requirements. This allowed for the Conceptual Design to be initiated, with a clearer focus on the design and evaluation of the Optimized Solution. With the requirements clearly defined and modelled, the development of metrics using the balanced scorecard framework will allow for these metrics to be utilized in the form of dashboards on SMIS for measuring staff, student and organizational performance. With this being completed, a standardized template of the standard operating procedures was formulated, which will be integrated into the system so creating and editing new procedures will be an effortless task.

Thereafter, alternatives were considered for the supporting solution. This included evaluating tailor made solutions that best suit the requirements drafted earlier as well as being financially viable and sustainable. The alternatives were tested for any further modifications and system capabilities through trial versions, whereby a survey and a focus group with a few of the users were engaged to attain feedback on the three alternatives. Subsequently a candidate matrix was used to define three alternatives prior to the evaluation of the candidates. The selected package, ADAM excelled in all the criteria and proved to be the most cost effective solution with the lowest payback period, and highest Net Present Value in 10 years. In addition ADAM was the firm favorite among the users in the demo testing sessions that were held. The selected alternative, was then verified and validated using a requirements mapping table and through feedback surveys. This made sure that there was no misalignment between what exactly was required to what was selected. With this step done, and all technicalities and finer details integrated into the system, the final step was to develop an implementation checklist and schedule to facilitate a smooth transition and to present the findings and recommendations to management where a decision can be made to implement the tailor made package with the various add-ons which will include hosting of servers, security and backup, training and maintenance.

Appendices

Appendix A: Signed Industry Sponsorship Form

Department of Industrial & Systems Engineering
Final Year Projects
Identification and Responsibility of Project Sponsors

All Final Year Projects are published by the University of Pretoria on *UPSpace* and thus freely available on the Internet. These publications portray the quality of education at the University and have the potential of exposing sensitive company information. It is important that both students and company representatives or sponsors are aware of such implications.

Key responsibilities of Project Sponsors:

A project sponsor is the key contact person within the company. This person should thus be able to provide the best guidance to the student on the project. The sponsor is also very likely to gain from the success of the project. The project sponsor has the following important responsibilities:

1. Confirm his/her role as project sponsor, duly authorised by the company. Multiple sponsors can be appointed, but this is not advised. The duly completed form will considered as acceptance of sponsor role.
2. Review and approve the Project Proposal, ensuring that it clearly defines the problem to be investigated by the student and that the project aim, scope, deliverables and approach is acceptable from the company's perspective.
3. Review the Final Project Report (delivered during the second semester), ensuring that information is accurate and that the solution addresses the problems and/or design requirements of the defined project.
4. Acknowledges the intended publication of the Project Report on UP Space.
5. Ensures that any sensitive, confidential information or intellectual property of the company is not disclosed in the Final Project Report.

Project Sponsor Details:

Company:	EDU EXCELLENCE
Project Description:	Developing Optimized Systems for Remedial schools in S.A: A closer look into EduExcellence
Student Name:	MUHAMMAD SEEDAT
Student number:	29122432
Student Signature:	
Sponsor Name:	DR. BEULAH VAN DER WESTHUIZEN
Designation:	DIRECTOR / OWNER.
E-mail:	beulah1@eduexcellence.co.za
Tel No:	012 3610086
Cell No:	083 417 2913
Fax No:	08666 19450
Sponsor Signature:	

Appendix B – Questionnaire: EduExcellence

Dear respondent,

I am a student from The University of Pretoria, majoring in Industrial Engineering. I am conducting research on the current systems, operations & procedures currently in place at EduExcellence.

The purpose of this is to find out what areas of the school need improvement, and what are the current day-to-day problems you are challenged with.

Your assistance in answering this questionnaire is critical for the development and solution of the study. The information and responses gathered will be strictly used for academic purposes and regarded as confidential. Finally, your sincere cooperation in completing this survey is much appreciated.

Thank you.
Muhammad Seedat

Please cross, circle, or fill in where applicable:

1. Are you satisfied with the current system in place at EduExcellence?

   Yes No

2. Do you find it difficult in completing your tasks & duties?

   Yes No

3. Do you feel that the system currently used at EduExcellence is outdated?

Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree

4. What are the major problems you face on an average day?

_____
_____
_____
_____
_____
_____
_____
_____

5. What suggestions can be done to improve the current processes and systems?

_____
_____

_____
_____
_____
_____

6. Are there guidelines where you can refer to the procedures of the school? If No, How do you know how & what procedures need to be followed.

Yes No

_____
_____
_____
_____
_____
_____

7. Are the communication methods to parents & staff efficient?

Very Efficient Efficient Average Not Efficient Poor

8. Do you have enough time during the day to complete all your work? How many hours do you spend after school hours working if any?

Yes No

0-1 hour 1-2 hours 2-3 hours 3 + hours

9. Would you like to see EduExcellence move towards a more technologically advanced school? If yes, in what ways can they move forward? Yes No

_____
_____
_____

10. If the time used for admin and paperwork was decreased and made easier, Do you agree that more time and focus would be allocated to the students, and this would be more beneficial?

Strongly Agree Agree No Opinion Disagree Strongly Disagree

11. Do you find any tasks repetitive, cumbersome or challenging? If Yes what are they?

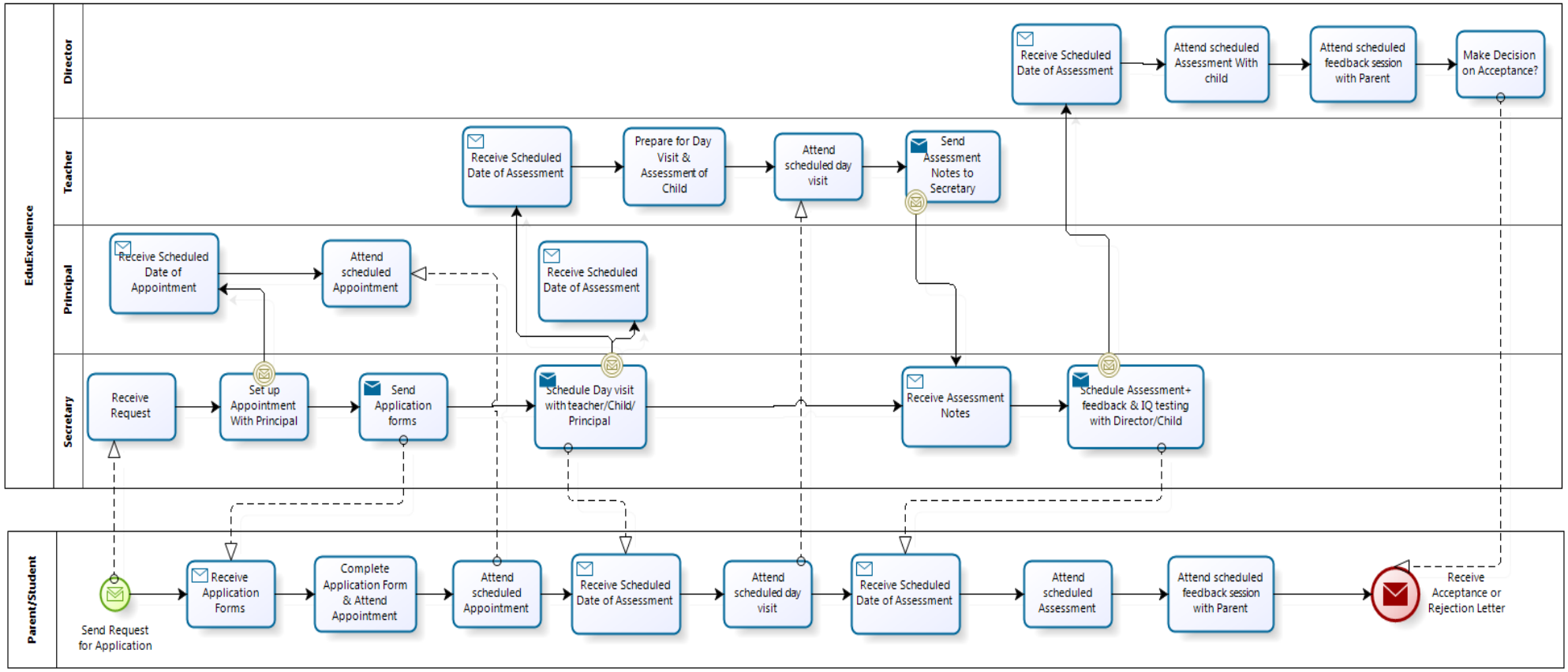
Yes No

12. What tasks do you think can be done on Computer as opposed to on paper?

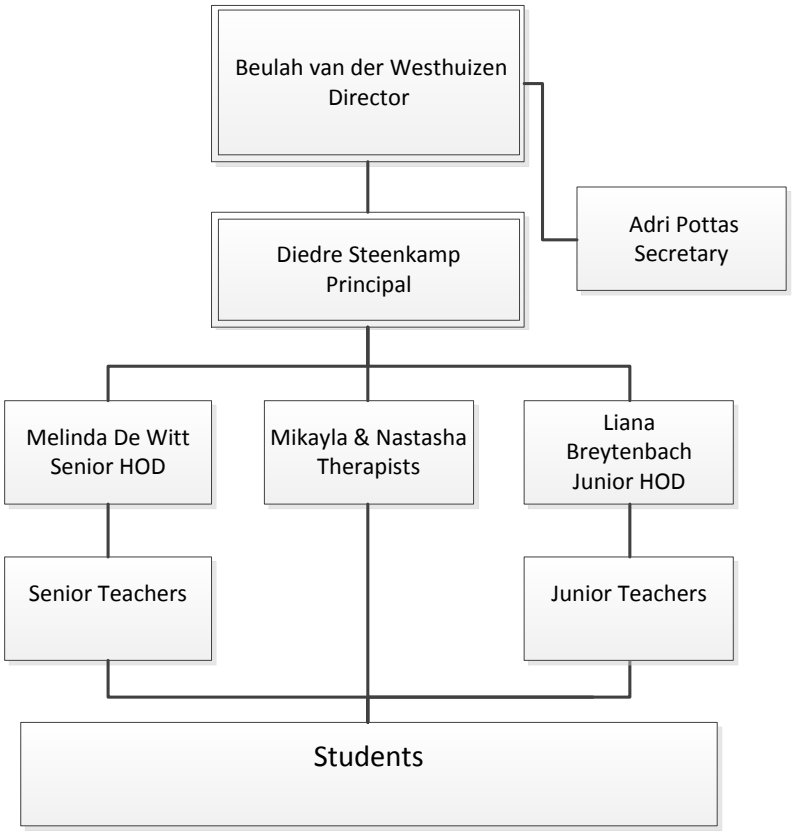
13. Please comment on any problems, issues, suggestions, remarks, or any other matter of importance that affects your job in any way that has not been addressed in the questions above. Please be honest, this is for your own benefit.

Appendix C – BPMN As-Is Processes

C.1 Enrolment Process

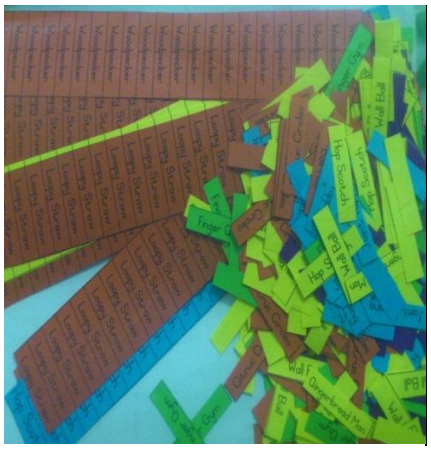


Appendix D– EduExcellence Organogram

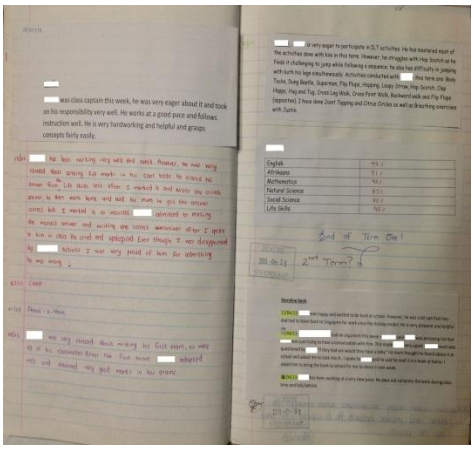


Appendix E – Sample Documentation

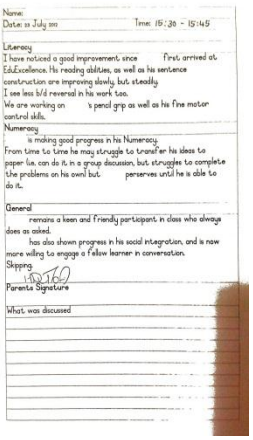
ILT Activities that need to be cut and pasted into student's ILT books.
Pictures of the byderhand and storyline book are also shown below to illustrate the cut & pasting of documents and papers.



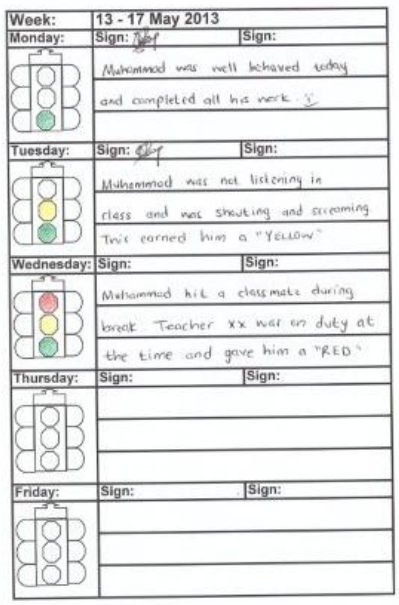
ILT



Storyline Book

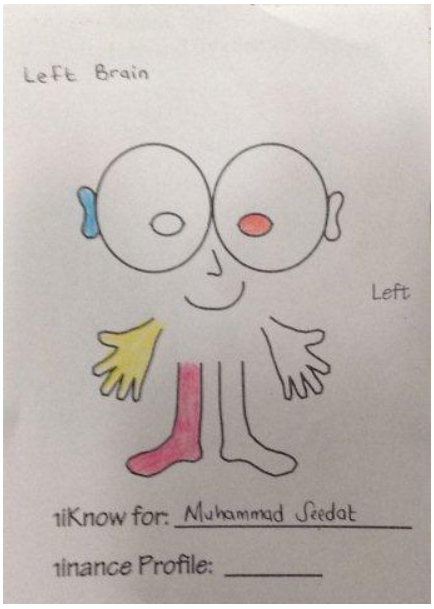


Byderhand Book

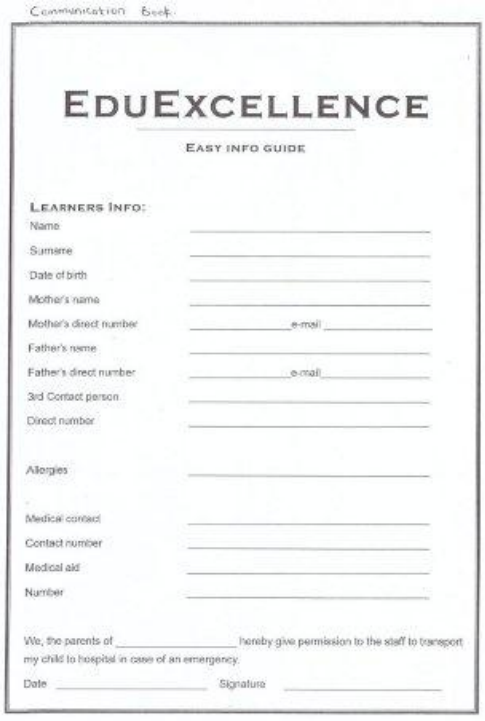


Week:	13 - 17 May 2013	
Monday:	Sign:	Sign:
	Muhammad was well behaved today and completed all his work.	
Tuesday:	Sign:	Sign:
	Muhammad was not listening in class and was shouting and screaming This earned him a "YELLOW"	
Wednesday:	Sign:	Sign:
	Muhammad hit a classmate during break Teacher xx was on duty at the time and gave him a "RED"	
Thursday:	Sign:	Sign:
Friday:	Sign:	Sign:

Robot System



Dominance Profiles



Communication Book.

EDUEXCELLENCE

EASY INFO GUIDE

LEARNERS INFO:

Name
Surname
Date of birth
Mother's name
Mother's direct number e-mail
Father's name
Father's direct number e-mail
3rd Contact person
Direct number

Allergies

Medical consent
Contact number
Medical aid
Number

We, the parents of _____ hereby give permission to the staff to transport my child to hospital in case of an emergency.

Date _____ Signature _____

Communication Book Information

eduexcellence

CONNER's ASSESSMENT RATING SCALE

Child's Name & Surname: Muhammad Seedat | **Age:** 23 | **Boy:** ✓ | **Girl:**

School: EduExcellence Remedial School

Date: 14/05/2013 **Teacher:** Camilla Essop

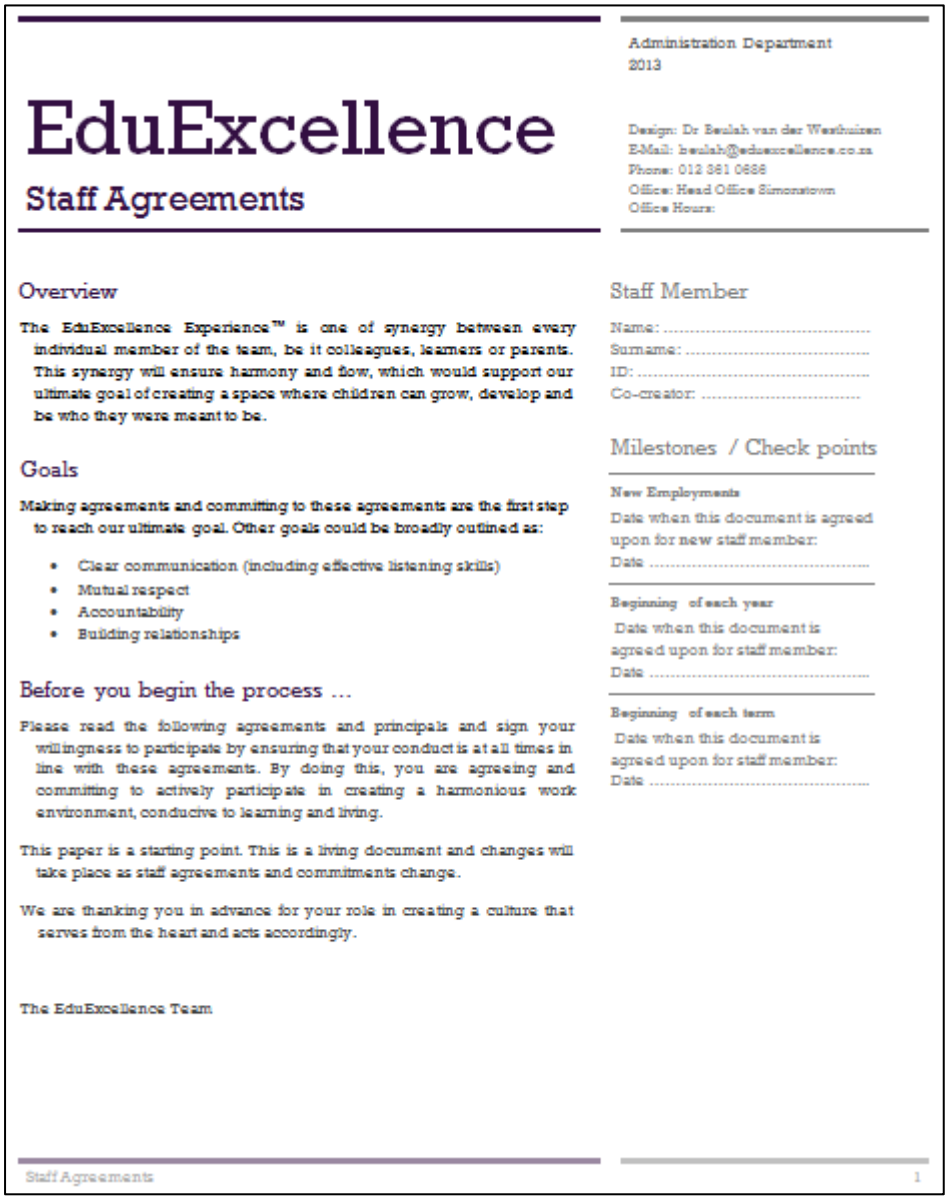
Medication: Ritalin (20mg), Concerta (15mg)

	A	B	C	D
OBSERVATION:	**Not at all**	**A Little**	**Pretty Much**	**Very Much**
Sits fiddling with objects		✓		
Hums and make other noises			✓	
Falls apart under stress/examination		✓		
Co-ordination poor	✓			
Restless and overactive		✓		
Excitable		✓		
Inattentive			✓	
Difficulty in concentrating		✓		
Over sensitive				✓
Overly serious or sad		✓		
Daydreams				✓
Sullen or sulky		✓		
Selfish	✓			
Distrubs other children		✓		
Quarrelsome	✓			
Tells tales	✓			
Acts "smart"	✓			
Destructive	✓			
Steals	✓			
Lies	✓			
Temper outburst			✓	
Isolates him/herself from other children		✓		
Unaccepted by group		✓		
Easily led				✓
No sense of fair play	✓			
Appears to lack leadership				✓
Doesn't get along with opposite sex		✓		
Doesn't get along with same sex	✓			
Teases/Interferes with other children		✓		
Submissive		✓		
Defiant	✓			
Impudent	✓			
Shy		✓		
Fearful		✓		
Excessive demand for attention			✓	
Stubborn	✓			
Overly anxious to please				✓

Comments: Muhammad's grandad has passed away this week. He is emotional and may need some emotional support in this regard. I would like to suggest a meeting with the senior therapist for this week, to get Muhammad emotionally settled.

Typical Completed Conner's Sheet

Appendix F – Standard Operating Procedures Template Example



Administration Department
2013

EduExcellence

Staff Agreements

Design: Dr Beulah van der Westhuizen
E-Mail: beulah@eduexcellence.co.za
Phone: 012 361 0686
Office: Head Office Simonstown
Office Hours:

Overview

The EduExcellence Experience™ is one of synergy between every individual member of the team, be it colleagues, learners or parents. This synergy will ensure harmony and flow, which would support our ultimate goal of creating a space where children can grow, develop and be who they were meant to be.

Goals

Making agreements and committing to these agreements are the first step to reach our ultimate goal. Other goals could be broadly outlined as:

- Clear communication (including effective listening skills)
- Mutual respect
- Accountability
- Building relationships

Before you begin the process …

Please read the following agreements and principals and sign your willingness to participate by ensuring that your conduct is at all times in line with these agreements. By doing this, you are agreeing and committing to actively participate in creating a harmonious work environment, conducive to learning and living.

This paper is a starting point. This is a living document and changes will take place as staff agreements and commitments change.

We are thanking you in advance for your role in creating a culture that serves from the heart and acts accordingly.

The EduExcellence Team

Staff Member

Name: .....
Surname: .....
ID: .....
Co-creator: .....

Milestones / Check points

New Employments

Date when this document is agreed upon for new staff member:
Date .....

Beginning of each year

Date when this document is agreed upon for staff member:
Date .....

Beginning of each term

Date when this document is agreed upon for staff member:
Date .....

Staff Agreements 1

Appendix G – ADAM Quotations

ADAM EduTech CC
technology solutions for schools

Quotation

37 St Helier Rd
Gillitts, 3610
about@adam.co.za

DATE 19 August 2013
Quotation # 2013/41
Customer ID

Prepared for:
Muhammad Seedat
Eduexcellence

Quotation valid until: 30 November 2013
Prepared by: Philip Norton

Comments or special instructions:
The quotation is provided with indicative pricing assuming that the school starts in January 2014

Description	AMOUNT	
Server licence: Prep school - PER MONTH	R	1 000.00
Staff, parent and pupil access licences (at 150 students) - PER MONTH	R	300.00
10 hours of support (no transport) PER MONTH - INCLUDED	R	-
TOTAL	R	1 300.00

If you have any questions concerning this quotation, contact Philip by e-mail on philip@adam.co.za.

Thank you for your interest in our business!

ADAM EduTech CC

technology solutions for schools

Quotation

37 St Helier Rd
Gillitts, 3610
about@adam.co.za

DATE 19 August 2013
Quotation # 2013/40
Customer ID

Prepared for:
Muhammad Seedat
Eduexcellence

Quotation valid until: 30 November 2013
Prepared by: Philip Norton

Comments or special instructions:
The quotation is provided with indicative pricing assuming that the school starts in January 2014

Description	AMOUNT	
Once-off setup fee	R	6 500.00
Report templates (price per template - grades can share templates)	R	1 500.00
Data import (indicative figure only - final amount will depend on data)	R	4 500.00
6 hours of training (excluding transport) - INCLUDED	R	-
TOTAL	R	12 500.00

If you have any questions concerning this quotation, contact Philip by e-mail on philip@adam.co.za.

Thank you for your interest in our business!

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