THE UNIVERSITY OF NAIROBI

SCHOOL OF COMPUTING AND INFORMATICS

INTEGRATED ANALYSIS OF STUDENT FEEDBACK, A BUSINESS INTELLIGENCE APPROACH

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OCTOBER, 2016

DECLARATION

DECLARATION BY THE CANDIDATE

I, Kinyua Wallace, hereby declare that this research project report is my original work and has not been submitted for any award in any other institution.

_____ _____

Wallace Muchiri Kinyua **Date**

P52/72624/2014

DECLARATION BY THE SUPERVISOR

I, Dr. Opiyo of the University of Nairobi do confirm that this research project report has been presented for examination with my approval as the University Supervisor.

_____ _____

Dr. Opiyo Elisha T. Omulo **Date**

School of Computing and Informatics

DEDICATION

To my family, thank you for your prayers.

ACKNOWLEDGEMENT

This has been not only a computational lesson where I have learnt how to do some more tech stuff but rather a lesson in not giving up even in the face of failure, to always get up and work to the last moment then get up and defend your work.

I give thanks to God wholly because this is his world, his working and ultimately all glory is his and I rejoice in Him receiving all glory for that is my true satisfaction.

Dad and Mum thank you for your sacrifice to see me through this tumultuous time.

Gratitude to my panel examiners (Dr. Oboko and Dr. Wausi) who were ready to tell me to my face when my work was not up to standards, it was painful like an injection but for good since it brought healing. Special thanks to Dr. Opiyo for being so patient with me especially when some concepts were not getting home and enabling me to grasp a deeper understanding of what was required and all this done with a touch of humor.

A special thanks to Mr. Andrew Nyamu, Ms. Lucy Nguti, Ms. Isabel Wamuyu Mr. Benard Alaka, Mr.Gichure, Ms. Njeri, Mr. Munyi, Ms. Mukami and Mr. Rugendo who God weaved in my life and have been instrumental in the completion of this postgraduate degree through their words of encouragement and warning at the right time.

Finally, may God bless (everyone I have mentioned and those whom I may have forgotten and the ones in the background offering up prayers for me) - abundantly and may you find Christ and know him as the source and goal of all knowledge and learning.

Kinyua, Wallace M.

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LIST OF ABBREVIATIONS

Ajax	Asynchronous JavaScript
AMS	Academic management system
ANN	Artificial neural networks
BI	Business intelligence
BIS	Business intelligence system
CRM	Customer relationship management
CSS	Cascading style sheets
DSS	Decision support system
DW	Data warehouse
EE	Executive education
ER	Entity relationship
ETL	Extract, transform, load
HF	Historical feedback
HOLAP	Hybrid online analytical processing
HR	Human resource
HTML	Hypertext markup language
IFAS	Integrated feedback analysis system
IHL	Institutions of higher learning
ISO	International organization for standardization
MBA	Master in business administration
MOLAP	Multidimensional online analytical processing
OLAP	Online analytical processing
OO	Object oriented
PHP	Hypertext preprocessing (programming language)
QA	Quality assurance
RDBMS	Relational database management system
SBS	Strathmore business school
SERVQUAL	A quality management framework
UML	Unified modelling language

UX/UI	User experience and user interface

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ABSTRACT

Over the years the negative notion that people have held about feedback is quickly changing and now more than ever we are using our customer feedback as a way to assess our current market placement and improve our services. Institutions of higher learning are on the influx in Kenya since the promulgation of the new constitution and also as a result of the demand.

In view of this, there is a need to differentiate oneself in terms of the value that you offer to your students not only in terms of your faculty and lowered prices but also by listening to your students as a way of assessing your organization and taking steps in the positive direction to improve any areas that may be found wanting.

Currently many universities collect feedback from their students however this feedback once collected is either saved somewhere in a document or on online solutions that are singular in their nature of analysis. There are some universities (almost all surveyed are not from Africa) who actually have functioning feedback systems which they use in collection of data from their participants, the nature of analytics composed in these systems are however not open to the general public.

The aim of this research was to identify the key processes that constitute an optimal feedback process with a keen focus on educational institutions and thereafter implement an integrated (holistic) analysis tool that allows capture and analysis of student feedback efficiently with the overall aim of improving the service given to students by aiding decision making based on the reports given.

The output of this research has been the successful implementation of the integrated feedback analysis system at SBS with the successfully incorporation of the historical feedback that existed prior to make visible trends that were earlier unknown. It was established that the system could serve as an aid to the decision making process due to the fact that the top management rated the system very well and through the reports they could quickly identify gaps in terms of information that could be catered for by the reports given by the system such as making decisions based on the performance of the persons or departments in question as informed by the trend. Furthermore, it was clear that the use of online feedback system increased the efficiency of the administrator responsible for the dissemination of feedback since it significantly reduced the time spent on the preparation and distribution of the forms to the students plus the other manual tasks involved in the entire process. Finally, the system ratings were commendable thus signaling the high likelihood of full adoption in the feedback ecosystem of the Strathmore business school and the possible implementations to other institutions of higher learning.

1.0 INTRODUCTION

1.1 Background

In the recent past we have seen the emergence of many public and private institutions of higher learning (IHL) offering post graduate education in the business field and differentiation of the existing schools in the given organizations that target this niche in the market. In Kenya specifically, we have never seen such an increase in Universities as fueled by the new constitution through the formation of county governments. This has resulted in the increased competition among IHL thus resulting in a paradigm shift of the service they offer, it is no longer students but "customers who are our students" and not only customers, but customers who are in the working environment having the necessary financial muscle to pay for education in any part of the world or even take on-line courses on the internet from prestigious ivy league universities.

The business world has always faced such stiff competition from the external environment and has overcome this challenges by formulating processes and models that are focused on customer retention such as Customer relationship management, this according to Reinartz et al (2004) is a process that should be customer-facing which involves the "building of a single view of the customer across all contact channels and the distribution of customer intelligence to all customer-facing functions. This view stresses the importance of coordinating information on contact channels over time to manage the entire customer relationship systematically." Feedback by the customer is a key component of the CRM process since the customer will always give their thought on many aspects both on request or randomly e.g. in conversations on various platforms, how the organizations respond to this feedback is critical to the retention of that customer and attraction of new ones.

IHL in view of stiff competition both locally and internationally can benefit from the application of the tested and proved business practices such as CRM and in this case the management of the feedback process to improve the student satisfaction by fast response to any issues raised and continuously improve their service delivery while doing so. The feedback given by the student can be on request to them by way of questionnaires or random, in conversation and nowadays mostly on social media thus for total mastery of the art there is a need for the integrated analysis of student feedback from the various sources using business intelligence techniques and have a management dashboard for visualization.

1.2 Problem Statement

With the proliferation of computer systems for education and social media, there has been a change in the way in which customers (in this case our students) give feedback from being limited to just the forms administered and the suggestion box at the reception but more is on these online platforms. According to Mangold and Faulds (2009) the impact of feedback for example on the business is very significant and can lead to hundreds or even thousands of customers being drawn away from your brand in the case of negative concerns that go unresolved or unnoticed by the organization, also as noted it has significant impact on the Marketing mix with potential for

negative and positive outcomes however, not many IHL take the initiative to monitor these platform as part of their feedback.

Secondly, the current feedback process i.e. how the feedback is carried out in itself is a challenge to the fast response of the mitigation of the issue raised. Feedback is mostly collected as hard copy forms administered in class which have to be manually input onto a processing software tool for analysis, this causes slow delivery and communication of the feedback thus resulting in inefficiency. This spills over leading to slow rate of notifications of the issues raised by the respondents to the respective departments.

Thirdly, the lack of integration of the various feedback sources both to and from students can hinder service improvement efforts for a number of reasons: 1) various in-house departments may be gathering, reporting and acting upon similar student feedback using separate channels in silos. 2) The textual unformatted and unstructured data is not usually analyzed in a timely and satisfactorily manner. 3) Student experiences in form of sentiments as expressed via chat, email and telephone, are usually not integrated with structured data (Whyte, 2015).

Finally, the lack of student performance monitoring can lead to the perception that the organization does not care about the progress of its students and thus the loss of contact with the customer at a personalized because of inefficient means of affirming successful performance and following up to improve average performance.

1.3 Goal

The outcome of this project will be a dashboard for integrated organizational student feedback analysis.

1.4 Objectives

1. To carry out a comprehensive analysis of the current feedback process at the Strathmore business school in consultation with all the stakeholders with an aim of identifying the needs in line with the proposed system.
2. To design the integrated feedback analysis system (IFAS) based on the requirements gathered to provide an organizational dashboard.
3. To implement the IFAS based on the design documents.
4. To carry out an evaluation of the system acceptance and usability by the SBS team.

1.5 Project Justification

A student today is offered a number of options to give feedback regarding their experience using products or services. Top organizations use this student feedback to continually improve their product design or service delivery to make the student experience more beneficial / enjoyable. In order to produce continual customer service improvements, focus should be given to four areas regarding the student feedback process: capturing, storing, analyzing and acting on feedback.

Student feedback can be obtained through a variety of channels, such as social media, e-mails, web-based learning systems and online questionnaires. The many different methods require IHL to integrate all sources of student feedback. Lack of integration of the various feedback sources can impede improvement efforts since multiple internal departments collect, report and act on student feedback using separate channels in a silos, lack of timely and complete analysis and sometimes none altogether of feedback, Student sentiment experiences and as expressed via mail message, chatting and telephone, may not be at all or correctly integrated with the quantitative / structured data (Whyte, 2015)

Lastly IHL exist not only to make surplus but also to propel their students to greater heights by way of imparting knowledge and expertise to them, this is monitored by their performance which is the mandate and responsibility of the institution and should thus be attended to with care both for the achievement of the institutions societal obligation and the student fulfilment.

1.6 Scope and Limitation

This study focuses on IHL and specifically the Strathmore Business School in Kenya and is limited to the automation of the student feedback loop with an aim to continuously improve service delivery.

1.7 Achievements

A research at SBS has been successfully conducted as informed by literature review and data collected from interviewed persons on the requirements that consist in a feedback system and implemented an integrated analysis tool that allows the capture and analysis of student feedback efficiently with the overall aim of better serving our clients. Integration means that the data was viewed as a whole i.e. historical feedback data was used so as to reveal information that was previously hidden and also provide the data in a manner that is easily consumable by the management for decision making using business intelligence components i.e. dashboards.

1.8 Definition of Important Terms

Business Intelligence refers to the "processes, technologies and tools required to turn data into information, information into knowledge and knowledge into plans that drive profitable business action, it encompasses data warehousing, business analytics and knowledge management" (Ariyachandra and Watson, 2014).

Dashboards is a term which had its inception in the 80's when the executives sought the ability to chart the direction of their organizations in the boardroom through executive information systems, it can thus be described as a tool that assists the executive arm of organizations in performing the functions of monitoring, analyzing and managing and more specifically in this case IHL.

"Feedback is a generic term which disguises multiple purposes which are often not explicitly acknowledged. The roles given to feedback fall widely into five, but not completely discrete categories; correction, reinforcement, forensic diagnosis, benchmarking and longitudinal development / feed-forward" (Margaret Price et.al, 2010). In this scope it refers to "information presented that allows comparison

between an actual outcome and a desired outcome" by students (Poulos and Mahony, 2008).

Customer relationship management is a "set of practices and techniques that provide an integrated view of customers across all business functions to make sure that each customer receives the highest level of service" (Karakostas et al., 2005).

Student refers to the customers of an IHL and thus these terms will be used interchangeably in this project.

Service delivery in this context refers to the efficient and timely response and mitigation of all raised concerns by the student without neglecting the expected.

2.0 LITREATURE REVIEW

2.1 Student Related Services and Satisfaction Assessment

2.1.1 The student as a customer

In this day and age, it has become a norm for marketing to be undertaken among marketing IHL due to the proliferation of educational institutions and the growth in the number of students. Jurkowitsch et al (2006) views marketing ‘‘as an excellent way to attract students. For many institutions, student satisfaction remains stuck in the process of admissions, and fulfills strictly a sales and promotional function.’’

The idea of student satisfaction which is in the education sector is derived from the business world namely from customer satisfaction. Parasuraman et al. (1988) described how the satisfaction of a customer can be measured as the gap between consumption experiences i.e. what the customer feels, perceives as he/she is rendered the service or product and expectations held prior to this. In educational institutions however, this concept needs to be altered a little so that it can be applied to services offered by educational institutions in order to take into consideration factors such as constitutional amendments, administrative policies, and educational goals. In addition to this, Oliver and Swan (1989) pointed out that satisfaction is an emotional issue that can be perceived as an individual consideration based on beliefs and personal experiences. In light of this when we apply emotional issues to students’ satisfaction in this context students’ satisfaction can be defined as the attitudes or views toward learning activities as perceived by the student, according to this view, students’ happiness in the service or product is an index of their satisfaction. Thus, students’ satisfaction can be viewed as a key outcome of their education (Sanders and Chan, 1993).

In order to monitor student satisfaction, educational institutions must collect data periodically over time from students about what they think about the services offered. This information can be used by IHL to better understand student needs and make modifications in their service offers to meet some of this students’ desires. This ability of IHL to continuously collect feedback from students is considered by majority of authors as an indicator of their ‘attractiveness’ to students and a measure of efficiency and success (Amran Rasli et al., 2011), therefore those that get this right are bound to be more successful since they attract more students whom they satisfy leading to more fulfillment both for the institution in terms of achieving their goals and the student in their quest for holistic growth and development.

2.1.2 Factors affecting student satisfaction

A survey conducted in England reported on the influence of infrastructure on the undergraduate student choice (Islam et al., 2011; Price et al., 2010). The average two year findings were really similar to the recently quoted surveys, the most important reasons found are; it had the relevant courses, availability of ICT equipment and facilities, quality of library services, teaching and industry repute, availability of “silent” study, availability of personal and group study areas, good transport facilities in the area and administrative staff friendliness to the students.

University facilities are one of most critical factors that affect the decision to enroll to a certain institution by students. There is a decrease in student satisfaction if class sizes are larger than earlier groups, and if there were compulsory enrollment into modules as opposed to optional ones (Islam et al., 2011).

All the various aspects or perspectives of the interaction with students via the services offered or products should be managed closely involving all staff in order to deliver high quality services to their students. Services are delivered to people by people and the moment of truth e.g. a complaint from the customer or a flaw in the delivery of a given service can ruin or enhance the image of the university (K and Datta, 2003). "In order to deliver total student satisfaction, all staff of the university should adhere to the principles of quality of customer service, whether they be on the front-line of contact involved in teaching or administration, or non-contact in management or administrative roles" (Islam et al., 2011).

In the king Fahd University of Petroleum and Minerals a survey was carried out by Sadiq Sohail and Shaikh (2004) with those being interviewed being 310 male students, it was established that the "contact persons" were the most influential factor in the evaluation of the service quality by the students. How staff (lecturers, administration etc.) involve the students in the various offering o service. However, the environment, layout / design, lecture theaters, design of the buildings and playing fields plus the overall cleanliness of the institution also contributed significantly to student's concept of service quality.

An additional study done by Douglas et al. (2006) about the role of the faculty administration office in one England University with regard to the student perception of service quality. It was found that it had a direct impact on students in that it influenced their perceptions of service quality. The faculty academic and technical staff had an influence on the office performance. It was found that the front-office staff had an influence on student satisfaction and other customers. The most important factors of quality were found to be; i) The office has a professional appearance; ii) The staff dress smartly; iii) Availability to offer assistance; iv) Convenient opening hours. Satisfied customers are always loyal, and similar to this, students who are happy with the service given have a higher likelihood to participate in additional lectures taught by the same lecturer or chose to attend others units facilitated by the same lecturer. (Islam et al., 2011; K and Datta, 2003).

2.1.3 Student satisfaction assessment

In order that any assessment to be done on the services offered one must know what it is that leads to a satisfied student, as we have seen above. In this literature, we will explore two of the widely used assessment techniques of satisfaction, with both being natively used the assessment of services generally in the business world but transformed so that they can be used in our current context

2.1.3.1 The Kano Model

Kano classified product/service attributes into six groups depending on their significance to customer satisfaction (Lillrank and Kanō, 1989) :

Must-be (M) (dissatisfiers): These requirements are considered by customers as must-have factor therefore, their presence doesn't grow a customers' satisfaction level on the contrary lack of them leads to dire dissatisfaction

One-dimensional (O) (performance factors): If the performance of this factors is high then it results in satisfaction whereas the opposite i.e. when low, causes dissatisfaction. These attributes have a symmetric and linear relationship since they are connected to customers' desires and needs.

Attractive (A) (satisfiers or excitement factors): If this are delivered they lead to greater satisfaction whereas a lack of them does not cause dissatisfaction. Any given company can use this factors as differentiators from the competition since their presence leads to greater customer satisfaction.

Indifferent (I): These are factors of which the customers do not care about i.e. their presence or absence makes no difference.

Reverse (R): This refers to attributes which are not wanted by the customers but of which the opposite is expected namely; an opposite of the undesired product attributes.

Questionable (Q): There is no clarity in terms of if whether customers expect these attributes since they gave uncertain feedback responses due to a lack of understanding of the questions on the survey or errors when filling out the questionnaire.

Luca Petruzzellis et al. (2006) carried out an exploratory research at the University of Bari in Italy with the goal of understanding the perception or rather views of what a student considers an "excellent university", with the purpose of enabling universities to deliver the best education services possible as informed by the factors considered as must-have by the students (Veloutsou et al., 2004).

The results were fitted in a Kano model which is the tool we used as an indication of the various student related services and as a means by which we can measure the satisfaction of our students thus showing the suitability of the Kano model both as a modeling tool and measure of student satisfaction

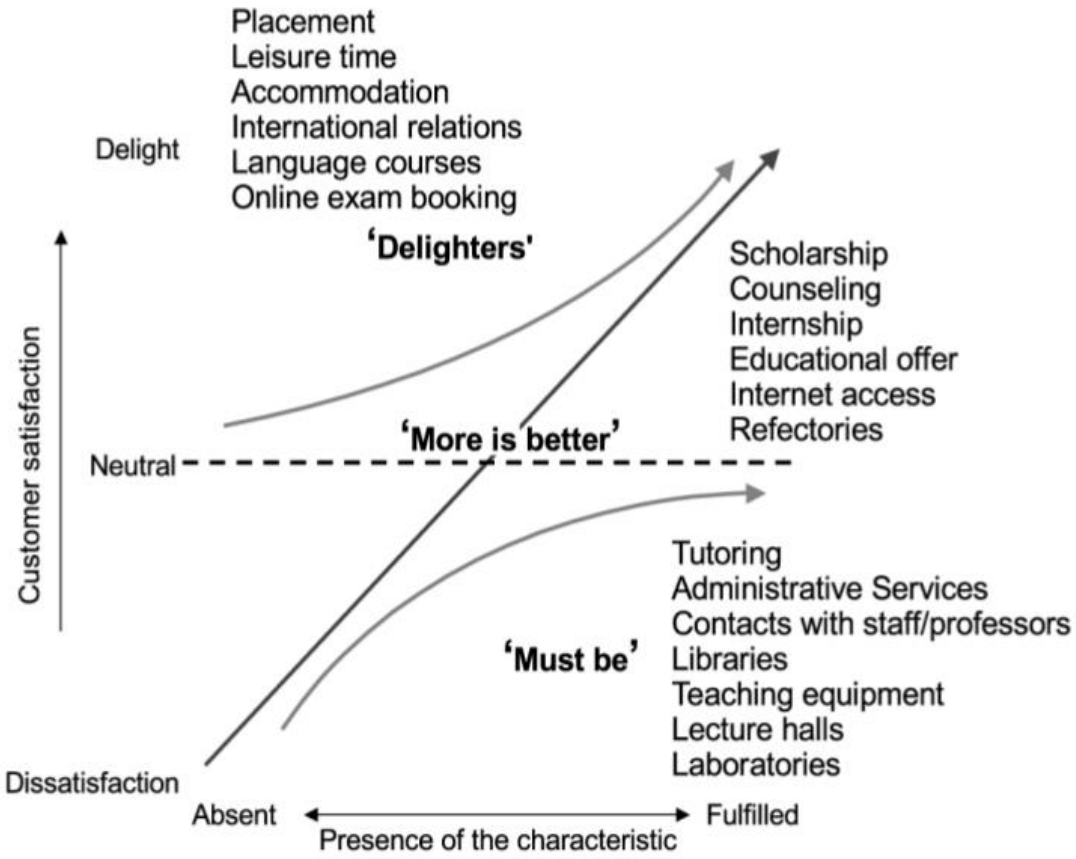


Figure 1 : Kano model as a satisfaction tool (Dominici and Palumbo, 2013)

2.1.3.2 SERVQUAL Model

SERVQUAL was developed by A. Parasuraman, Leonard Berry and Valerie A Zeitham in the 1980s. "SERVQUAL is a multi-item scale developed to assess customer perceptions of service quality in service and retail businesses" (Parasuraman et al., 1988). The five years' qualitative and quantitative research resulted in a scale segments service quality into five dimensions.

SERVQUAL measures service quality as the difference (gap model) between a customer's expectations for a service offering and the customer's perceptions of the service received (Parasuraman et al., 1988).

There are five gaps identified by this model as described below and shown in figure 2;

Gap 1 – the variation between what is expected by the customer and the organizations managers.

Gap 2 - occurs when there is a failure by management to design service standards that meet customer needs.

Gap 3 - occurs when there is a failure to deliver expected standards by the company's service delivery systems.

Gap 4 - occurs when promises made by a company via communication to the customer are unachievable given their resources; and

Gap 5 - usually seen as a product of Gap 1, 2, 3 and 4

Furthermore, in order to assess the level and extent of the fifth gap an additional five core components of service quality were identified, namely;

Tangibles - has to do with the physical appearance, equipment, staff appearance and communication materials;

Reliability - the capacity to deliver a service as agreed and in line with the expectations.

Responsiveness - the readiness to aid the needs of the customer in line with the outlined standard.

Assurance - ability of staff to inspire confidence and trust of the customer; and

Empathy - the extent to which caring individualized service is given.

SERVQUAL can be used to measure service quality in a variety of service environments and also for the comparison of competitors.

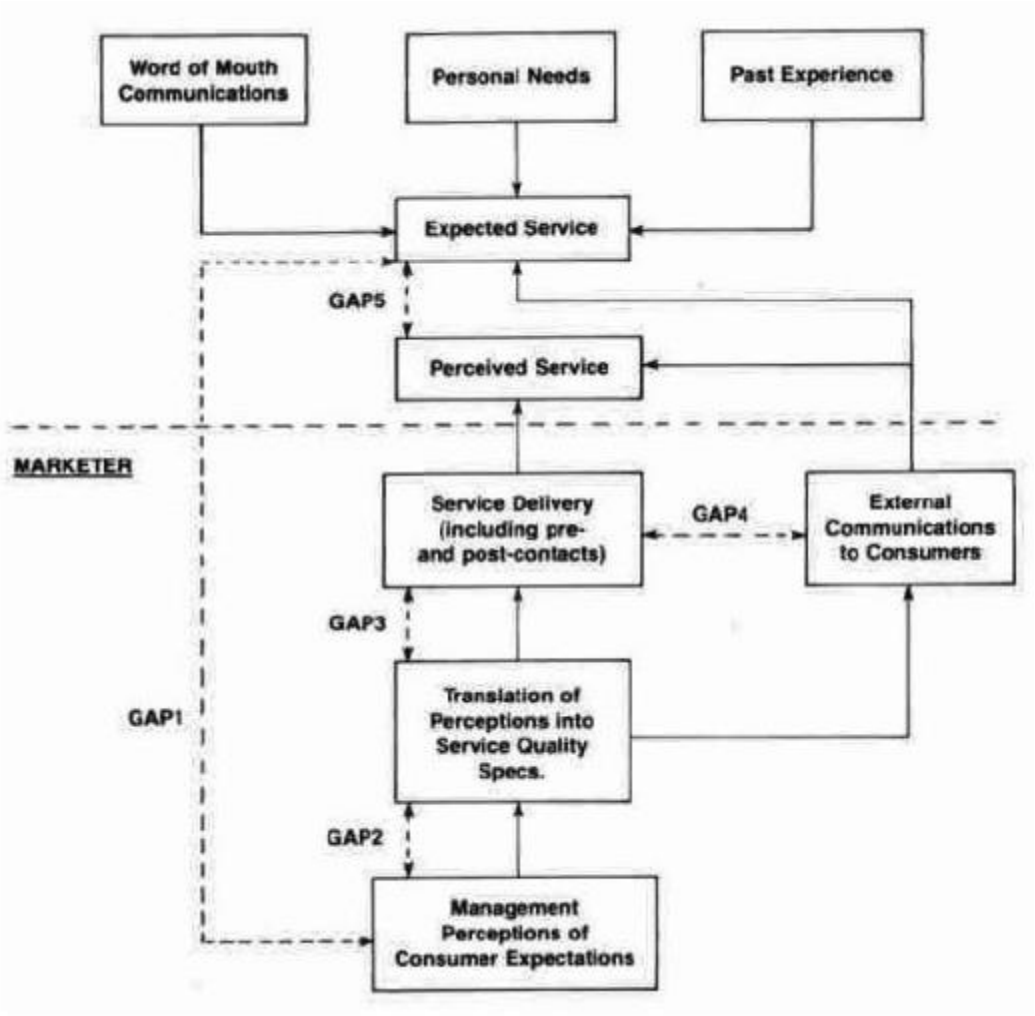


Figure 2 : The Gap Model (Anon, 2007)

2.2 Student Feedback

2.2.1 The feedback cycle

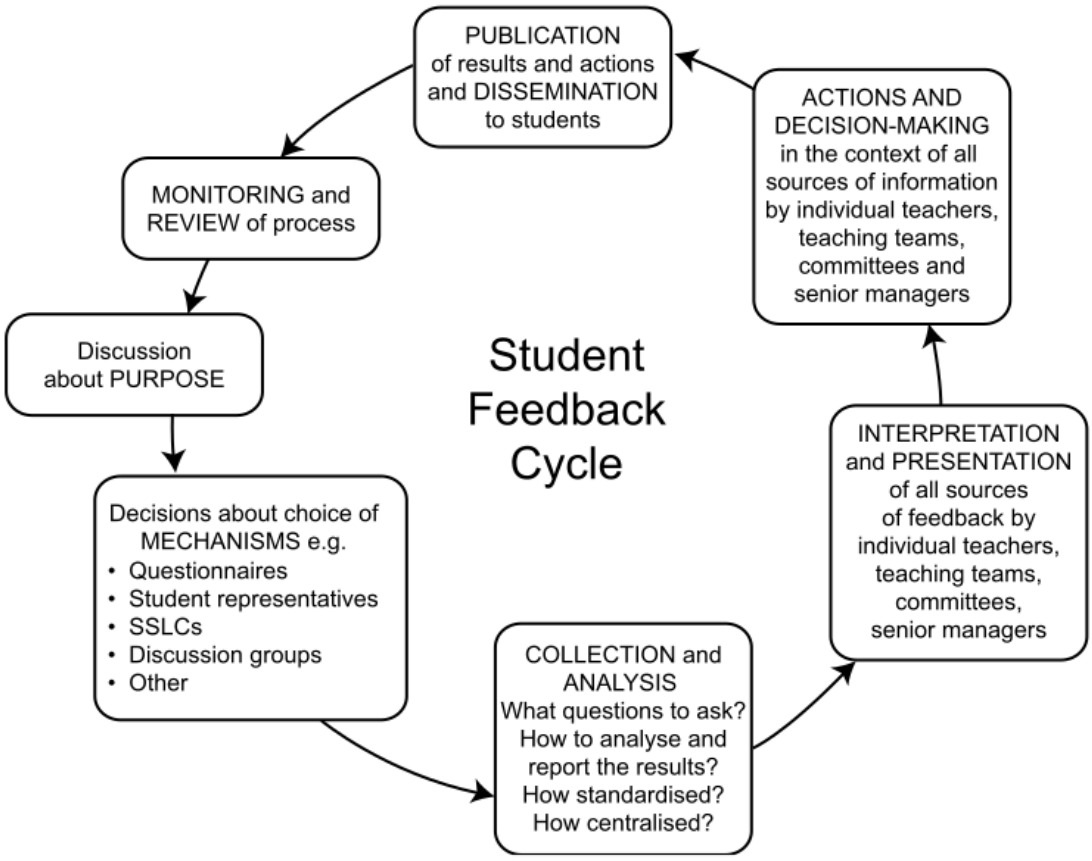


Figure 3 : The Student Feedback Cycle (Brennan and Williams, 2004)

The above figure summarizes the process of student feedback whereas highlighting the most important areas that one has to focus on for successful results as outlined by (Brennan and Williams, 2004).

This can be divided into six main categories as follows;

1. Goal; the reason for the feedback.
2. Channel selection; the way the feedback is administered.
3. Design of questionnaires; the questions must be effective.
4. Student representation and their methods
5. Feedback response actions.
6. Relay of the feedback and results.

2.2.2 Feedback strategies and response rates

Feedback strategies refer to the various methods (means and timing) that are used nowadays to get an assessment from the student about the services offered, in this study they range are hard copy (paper based) and online which is not only limited to

the administered questionnaires but includes social media and specific systems feedback e.g. e-learning.

There are multiple merits of using ICT in supporting the various mechanisms of evaluation (Dommeyer et al., 2004; Salmon et al., 2004). As examples, the use of online survey assessments can eliminate many hurdles that exist in the manual process such as entry of data and move to a more efficient model. In addition to this, the avoidance of physically administering surveys in class (Dommeyer et al., 2004). There is an increase in the use of online feedback techniques for both lecture modules and faculty assessment (Seal and Przasnyski, 2001).This growth is occurring irregardless of some concerns raised by students i.e. the confidentiality and anonymity of respondents, and staff i.e. the insufficiency of response rates (Dommeyer et al., 2002).

There are quite a number of similar characteristics to the online feedback mechanism used by various institutions. They reported that a typical online evaluation entails: assuring students anonymity of their responses and that the generated reports will be availed only after the process is completed; providing students access via a shared URL to the survey, generally using their student identification number as the unique attribute; students responding quantitatively to multiple feedback items and providing free text answers to open-ended questions; providing students with a message or notification verifying that they have successfully completed the evaluation; and a grace period of at least two weeks in which the students can give an additional response / modification to the feedback , usually this is near the end of the given education period.

It would make sense to collect feedback on students' experience from an activity in education at the end of the given activity because the entire activity experience is what is of value and interest. In other words, it would be most profitable to gather student feedback at the end of a course unit or session of study. However, some other suggestions have been made, it was noted that seeking feedback at the end of a course could not benefit the students themselves and that feedback collected earlier would be of more immediate benefit to the students since change would be effected before the class ends. Indeed, results show that students' perceptions and attitude as collected in the feedback at the mid-term had an impact on the following study and course scores. There have also been suggestions that the feedback be collected as such since the effects of the views given will not benefit those who give it at the end of a course and therefore it is prudent that be collected multiple times in the course duration and even beyond the session for a holistic view of whether or not there has been progressive improvement (Richardson, 2005).

Generally as found in a study by (Richardson, 2005) the response rates for online surveys are much lower than hard copy mainly due to the way they are administered i.e. mostly supervised and in a class session.

The argument paused by some is that the goal of feedback forms was to give students a chance to voice their learning experience both for specific course modules and in general terms. In light of this argument, students who fail to give feedback do not bring about any challenge in terms of the data. Nevertheless, majority of researchers

hold the assumption that the goal of feedback surveys is to find out the experience of all the students being sampled, and in this context non-respondents cause a major problem for the conclusion must be based on the entire target students.

Inferences derived from samples may have some errors because of the following reasons: sampling bias and sampling error. Sampling error comes about since some properties will differ from the population in the entirely random samples collected leading to a variance in the generated responses from those of the population. This error can be reduced by increasing the sample size. Sampling bias is caused by not selecting a random sample from the population such that those selected greatly influence the results either positively or negatively. In such circumstances the findings the responses will vary with those that would have been gotten from the whole population (Richardson, 2005).

In the quest to propose methods of increasing the response rates, the most widely used methods for increasing online survey response rates are:

1. Repeated email reminders to those who do not respond.
2. Email reminders to survey administrators as dictated by the event.
3. Motivation to the respondents in form of prizes.

The figure below shows the practical outcome of the use of the above strategies as an aid in improving the response rates.

University	Methods used	Online survey response rate (%)
Murdoch University (Ballantyne 2005)	1, 2 & 3	47
Canterbury University (Ogier 2005)	1 & 3	30
Monash University (Nair et al. 2005)	1	31
Griffith University	no measures taken	20
QUT (Sweep 2006)*	no measures taken	23

Figure 4 : Strategies for increasing response rates in five universities

2.3 Business Intelligence

2.3.1 The concept of business intelligence

Business intelligence (BI) is “an umbrella term that combines architectures, tools, databases, analytical tools, applications, and methodologies”(Turban and Volonino, 2010).

Taylor et al. (2007) links business intelligence with utterances like “better data for decision making”, “access to the right information for the right individual in a timely manner”, “the unified source of correctness / truth” etc. The main function of business intelligence covers all the quoted points above; these functions are conversion of data to information which can be analyzed from various angles by top managers and hence made use of in making decisions.

The major variation between conventional databases that are used in day to day systems and business intelligence repositories i.e. the storage systems used in BI is that the former are not tweaked for reporting purposes whereas BI data repositories are optimized for reporting in addition to acting for the purpose of storing data. (Turban and Volonino, 2010). Therefore, the implementation of BI systems allows the companies to harmonize sparse data, bringing it into a one format and by using several tools to access the real-time databases concerning defined performance measures concerning marketing, financial wellness, sales made etc. to aid in decision making.

According to Turban and Volonino (2010), an organization's responsiveness to the changing environment is dependent on two major points: secure information view and high level systems for reporting. Therefore, conventional day to day applications with their data are unable to give the top level management with the required information because of the reality that companies usually use multiple systems for each unit which are usually different in terms of how they are implemented hence the data cannot be consolidated easily. In addition to this, the main purpose of such application is usually to store information and not aid decision making through analysis of the same information.

The major challenges that users of the day to day information systems encounter due to data silos include (Turban and Volonino, 2010):

1. Late receipt of data.
2. Incorrect levels of data view (too high or low level).
3. Information overload that is not relevant for decision making.
4. Lack of inter departmental or organization wide data sharing and coordination for greater insights.

Successfully implemented BI systems have the ability to eliminate the challenge of data consolidation, presentation and standardization and thus provide a credible and timely view of the information for top level managers and directors to aid in decision making.

2.3.2 Evolution of business intelligence tools

Figure 3 illustrates the evolution of the BI tools covering all the facets which are grouped under the BI concept in this day and age (Turban and Volonino, 2010).

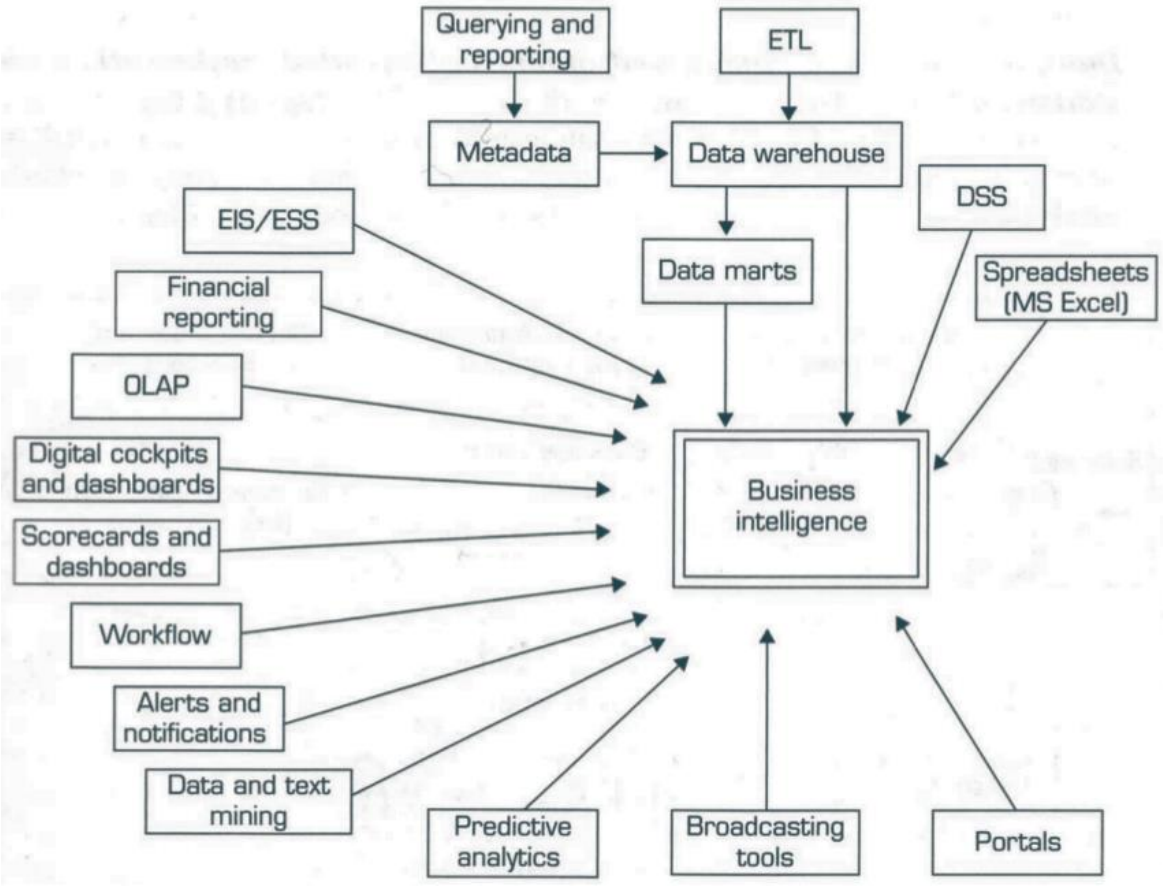


Figure 5: Evolution of BI (Turban and Volonino, 2010)

The most common modern BI features and functions that are used nowadays are represented in the figure 6 below.

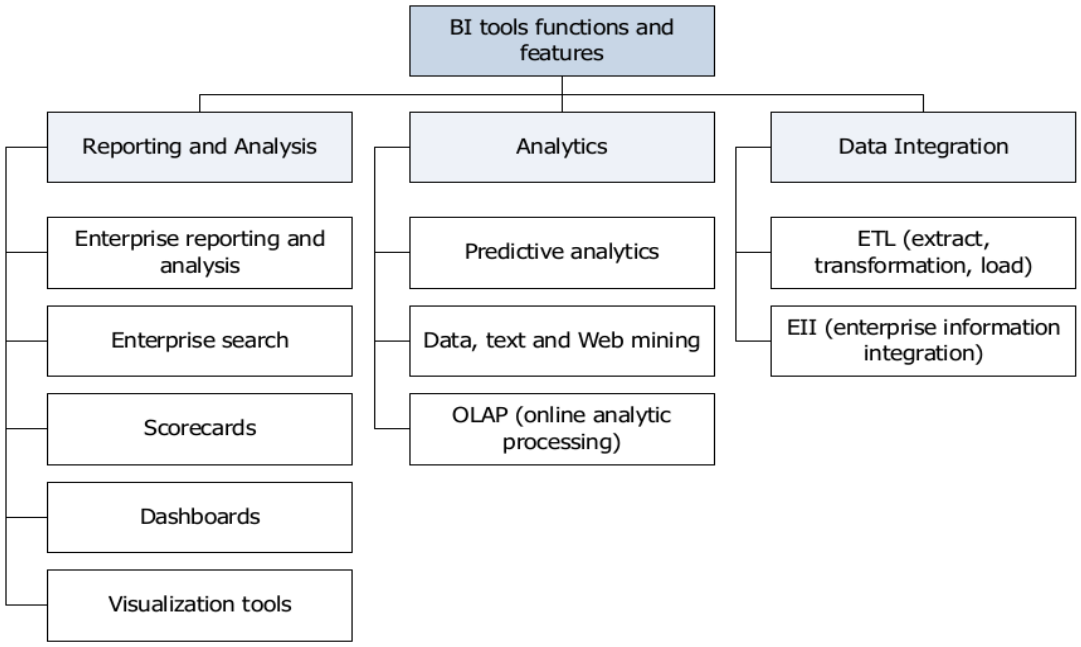


Figure 6: Commonly used BI functions and features (Turban and Volonino, 2010)

Analytics in BI can be broken down into the following: 1) data mining, 2) predictive analytics and 3) OLAP.

Data mining is the process that reveals formerly unseen patterns in data (Turban and Volonino, 2010).It is not only restricted to structured data as the only source for pattern mining. Mostly companies need to mine the text data from files, online transaction data, browsing history logs among others. It is strongly held that unstructured data is most valuable source of new information for companies. (Turban and Volonino, 2010).The overall goal of data mining is to identify four main patterns, namely; associations (co-occurrence of things), predictions (as seen in historical data), clusters (subsets of data based on known traits in the data – e.g. customer groups based on age, income level etc.) and sequential relationships (predictions based on past similar occurrences, e.g. customers who bought a laptop may require a portable storage hard disk etc.). Artificial neural networks (ANN) are commonly used to bring out patterns in data especially in areas like consumer purchases, finance among others. (Turban and Volonino, 2010).

Predictive analytics is "the branch of the data mining which is focused on forecasting trends (e.g. regression analysis) and estimating probabilities of future events" (Turban and Volonino, 2010). It is mostly used by top level executives to speculate what may future occurrences as informed by the historical data. Predictive analytics has its foundation in mathematics and demands a high level of knowledge of the field and skill to be implemented. OLAP systems are put in place to give day to day users with the ability to run an "adhoc analysis of organizational data more effectively and efficiently, the main operational structure in OLAP is based on a cube concept – a multidimensional data structure (actual or virtual) that allows fast analysis of data" (Turban and Volonino, 2010). Such a structure of the data allows fast and efficient handling and analysis of the data from a multidimensional angle and, therefore, due to this the issue of the slow two-dimensional analysis in relational databases is done away with.

The sources of data for OLAP processing are the data warehouse or data marts depending on the context. The following are the main operations of the OLAP systems: slice (slices of data through cube rotation the resulting in a two-dimensional table) and dice (slice on greater than two dimensions of a data cube), drill down/up (navigation through and between levels of data from most general to most specific and vice versa), roll up (computation of all relationships between data dimensions) and pivot (modify the orientation in terms of dimension of adhoc queries and reports display page). The implementation of OLAP servers is done either using a multidimensional storage engine (MOLAP); a relational DBMS engine (ROLAP) as the backend; or a hybrid combination called HOLAP (Chaudhuri et al., 2011).

Finally, most essential in BI tools concerns data extraction and integration (ETL-Extract, Transform and Load). This is the 3-phase process through which data is integrated. The data is accessed from the various sources; disparate and varying data is transformed into a structured and analyzable form and finally it is loaded to the data store being used.

2.3.3 Business intelligence implementation methodologies

2.3.3.1 The Kimball BI Lifecycle Methodology

The Kimball Lifecycle methodology was a product of the Kimball Group. It has had commendable success in industry since it has been used by many data warehouse and business intelligence (DW/BI) project teams.

There was a focus on delivering value in the whole organization by structuring the data in dimensions that is consumed in the business iteratively whereas developing the DW/BI environment in a manageable lifecycle increments rather than attempting to do everything in one big release. At the time the approach was initially published in the 1990s, most alternative approaches were not giving an emphasis on the proposed Kimball principles. However, since then, largely due to their success there has been a broad uptake leading to them being mainstream industry best practices.

The Kimball Lifecycle approach is shown in the figure below. It gives an overall roadmap showing the steps of the high level tasks needed for a successful DW/BI project. (Kimball, 2016)

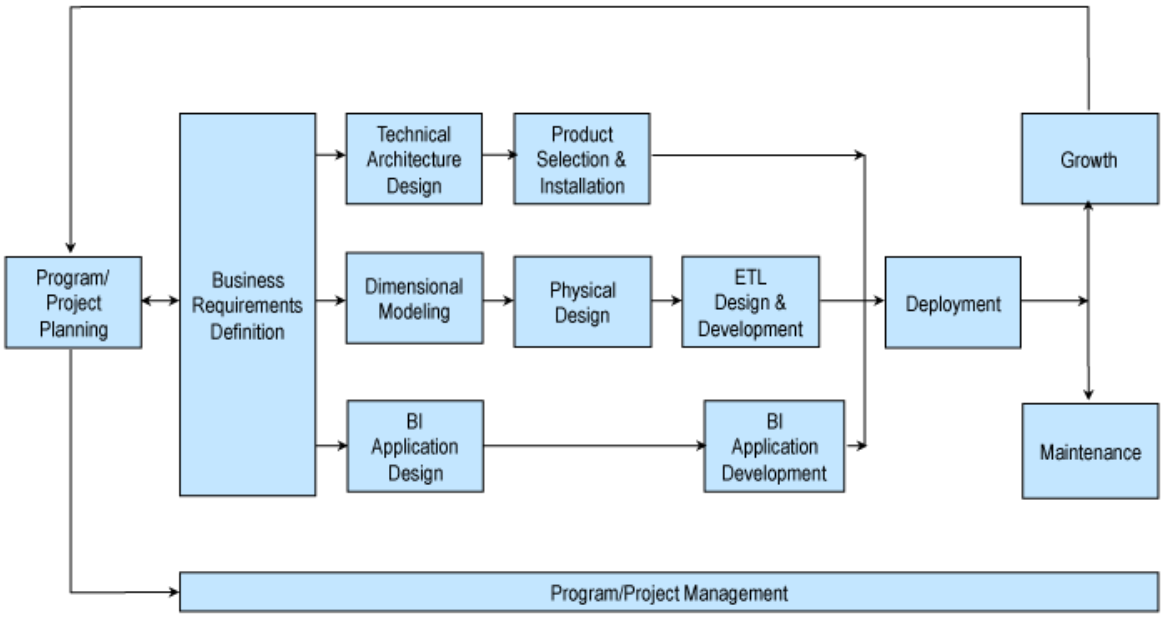


Figure 7 : Kimball DW Lifecycle

According to Ross (2016), the above steps are as follows;

- Program/project planning; in this stage the focus is on launching the project with the scope, justifications and the required staff being hired, this step is iterated to again and again through the entire project.
- Business Requirements; requirements are collected to determine the major factors influencing the business by concentrating on the current or expected future actions of the business users. Priorities are documented and a

requirement document is generated.

- Technology Track; In this section, the required technologies are identified and a system architecture developed followed by a selection and installation from the shortlisted ones as they suit the architecture specified.
- Data Track; This involves the design of dimensions to capture all the business needs while taking the actual data into consideration. Physical design, ETL design and development is done in this stage.
- Business Intelligence Track; this involves the development of reports, dashboards, data mining apps with the interfaces required to visualize the results.
- Deployment, Maintenance, and Growth; The convergence of the tracks occurs at the deployment stage, combining the data, technology and BI applications ready for use.

2.3.3.2 The Larissa Moss and Shaku Arte Methodology

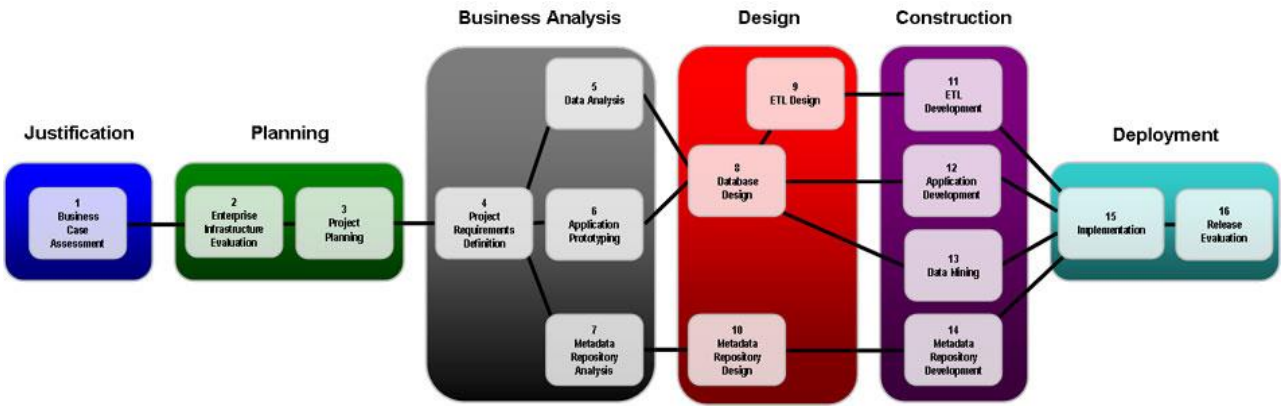


Figure 8 : The Larissa Moss and Shaku Atre methodology

According to Bara et al.(2009) the steps above are detailed as follows;

Step 1: Business case assessment – at this stage there is an identification of needs in the business and requirements after which the tasked team proposes a tentative solution as justified by the cost and benefit. A draft report is compiled.

Stage 2: Planning

Step 2: Enterprise infrastructure evaluation - this step involves estimating and valuing the organizations capabilities to carry out to the end a BIS project with regard to infrastructure, components, devices, network needs and any future needs among all the listed items. In this step the organization's infrastructure is built.

Step 3: Project planning – BIS entails dynamic project planning. This leads to changes in the various departments of the organization. There is generated a detailed project plan with documentation for each stage and step with the necessary check points alongside the test documents and reports required at each stage.

Stage 3: Business analysis

Step 4: Defining business needs – ordinary data collection techniques such as interviews and meetings are made with all stakeholders to identify and define business needs and requirements. There is proposal, discussion and adoption of an initial solution as the output of this process.

Step 5: Data analysis – In this step data sources are identified and the associated designs made in the form of detailed ER diagrams. The output is the logical model design.

Step 6: Application prototyping – A demo prototype is implemented and tested to validate the identified business needs a report is written detailing the findings.

Step 7: Metadata analysis – metadata which is data about data are designed. Sources of data are mapped to the structure of the metadata using CASE.

Stage 4: System design

Step 8: Data design – the logical model is broken down into details, refined and this is used in designing the physical model. The processing and storage data models are selected from the relational, object oriented and multidimensional model.

Step 9: Designing the ETL process (extract, transform and load) – this step is the most technically challenging in the whole cycle and it depends largely on quality of data sources and expertise of the BI practitioner. The recommendation is that the process be built in a single unified environment that integrates all modules of the organization and not separately components, on each department or unit. The rule should be: share one coordinated ETL process.

Step 10: Design metadata repository – if used, a pre-defined solution for metadata repository then at this step it is modified for project needs, and if not, a design of the metadata repository is made in terms of the metadata logical model based on the data model either relational, object oriented or multidimensional.

Stage 5: Development

Step 11: ETL development – this is composed of the filtering tools, procedures and operators that are used for building

ETL process. Data extraction, filtering and transformations largely depends on the data sources quality and the expertise of the BI practitioner. These sources may vary from files to databases even to online sources such as emails.

Step 12: Application development – once the validation of the prototype is complete then the building of the production application may be a simple process. There is also rebuilding of procedures templates and interfaces and the granting of user rights and privileges are granted.

Step 13: Data Mining – decision support systems must implement data mining functionalities to succeed and accomplish top level management requirements. At this stage algorithms, data mining techniques such as clustering, predictive and organizing methods are tested.

Step 14: Developing metadata repository – if this is needed then the interfaces and metadata dictionary are built.

Stage 6: System implementation

Step 15: Implementation – This is the delivery process in which the development team organize training sessions for stakeholders, final documentation and technical support are compiled. The data loading and application setup is also set up.

Step 16: System testing – once system implementation preliminary findings are done, costs are approximated and the system development team builds a final report in which a description of system performances and any parts that have to be improved based on the system tests that they carry out.

2.3.4 Business intelligence dashboards

User interface design is critical to any computing application since it affects the end-users productivity and efficiency (Few, 2006; Hansoti, 2010). A dashboard gives a rich and intuitive interface that displays the information graphically using a number of multiple elements including charts, tables and gauges. These elements significantly reduce the amount of time spent on analyzing the data using relational databases and hence assisting in the automation of the process of business decision (Hansoti, 2010; Malik, 2005).

Different vendors have different proposals for dashboard designs. A typical dashboard contains graphs, reports and tables that allow data to be displayed in a different manner and in a way that can be easily filtered and exported in various formats for further analysis. A dashboard should provide the end-user with the ability to drill down the information using graphs and access additional information that could be harder to do when using raw data, the goal being to provide useful data in a simple manner. There are some characteristics that should be considered when designing an dashboard interface. The features stated by Hall (2003) in a report are as follows:

1. Ability to filter, sort and analyze the data.
2. Drag-and-drop functionality.
3. Drillable charts, tables and graphs.
4. Support for multiple languages.
5. Ability to modify scenarios easily using the existing data.

There are some common mistakes made that ought to be avoided when one is designing the user interface for a dashboard:

1. Information overload: Giving too much information will make the dashboard cluttered hence distracting the users from what they need to be focused on. Detailed information should be provided based on users‘ demand. (Cleverley, 2001).
2. Limited Information: The opposite of the above is also undesired since the dashboard should have a quantity of data both historical and current that can

be used for generating relevant reports and this combination should be well communicated to the users through relevant designs

3. Complex user interface: The target users for dashboards are usually high level executives who have no need to spend a considerable amount of time learning new technologies and non-intuitive UI designs therefore the aim should be to give simple and understandable design that is easy to use and learn even by novice users (Collier et al., 2008).
4. Security: The dashboards have highly sensitive information across the board since it is strategic in nature hence there should be a role-based access of the system with the relevant authentication put in place to prevent breaches of data e.g. multifactor authentication (Eshraghi, 2008).

2.4 Software Quality

Once a system has been delivered within time and cost, it is important to take a critical look at the product, in this case the software artefact to ascertain whether it meets the laid-out requirements and that the end users are satisfied.

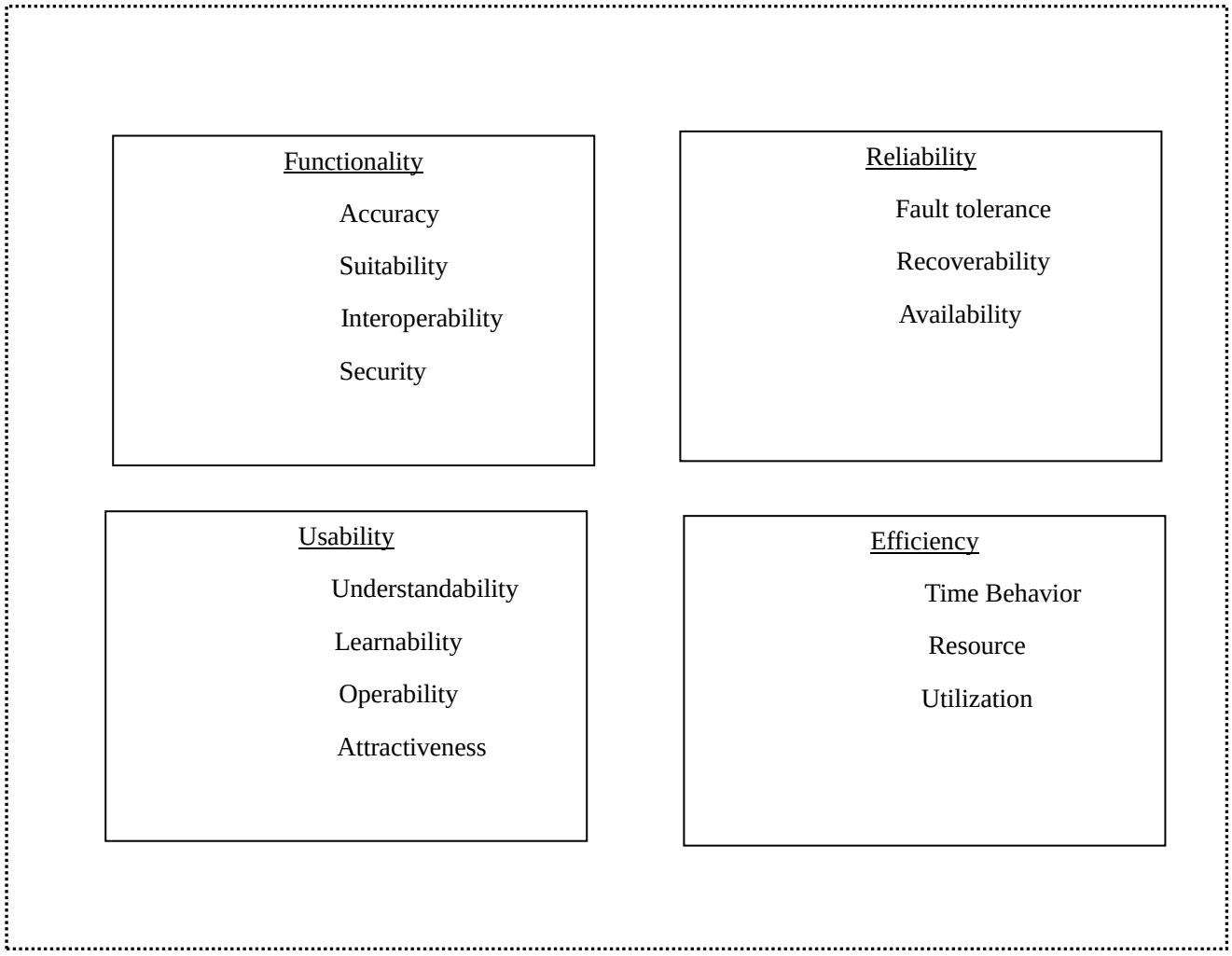


Figure 9 : Quality in use (Bevan, 2006)

2.4.1 System evaluation

System evaluation is “the process of assembling evidence that a system meets, or fails to meet, a prescribed assurance target.” (Evaluation often overlaps with testing, and is sometimes confused with it.) (Knudsen and RENO, 2011)

The major goal of system evaluation is to ensure that a system does what it is supposed to do measured alongside a list of requirements generated in collaboration with the target system users.

According to Knudsen and RENO (2011) some of the things to look out when evaluating a system;

1. Efficiency; how does the system operate with regards to time and the task done? One needs to access given the task performed if there is wastage and whether time is actually saved in comparison to the previous way in which things were done.
2. Appropriateness; one needs to make sure that the system performs what it was intended to do.
3. User responses; find out what the users think of the system by using the common data collection techniques such as questionnaires and interviews.
4. Correctness; this refers to the validity of a result given an input. This is sometimes also done in system testing however it is prudent to ensure that even in the production system there is correctness.

Once the system evaluation is completed, an iterative process begins in remedy to the identified challenges and the courses of action range from user training to system updates in which the whole development lifecycle is repeated (although on a smaller scale).

2.4.2 System usability

System usability is the “capability of the software product to be understood, learned, used and attractive to the user, when used under specified conditions. The phrase ‘when used under specified conditions’ is to clarify that a product has no intrinsic usability, only a capability to be used in a particular context”.(Bevan, 2006)

The key factors in assessing system usability according to the ISO standards body as cited by Bevan (2006) are;

1. Understandability; the extent to which the system can be mentally grasped by the users i.e. can the intended system functionality be perceived by the users.
2. Learnability; this refers to whether the system functions can be taught to the target users in an acceptable time.
3. Operability; the target users should be able to use the system with ease.
4. Attractiveness; this refers to the user interface design in relation to the target user. There should be a degree of interest brought by the system for the target users.

2.5 Related work

2.5.1 General feedback systems

The most common systems for surveying and analysis of feedback were selected through the "Google" search engine using the keyword "Survey Poll University Feedback system" chunked differently for every search. The results were considered based on the criteria below;

- Simplicity; how easy is it to complete registration, login and filling of the feedback.
- Convenience of the results' storing; this refers to how the result are stored.
- Availability of feedback reports;
- Cost of the service;

The results were as indicated below;

Service	Focus	Simplicity	Convenience	Reports	Cost
Easypolls	Survey generation for websites	Yes	Yes	Yes (minimal)	Free
QuestionPro	Professional survey too with advanced reporting including GIS capabilities	No	Yes	Yes (advanced)	Paid
CollegeSurveyServicesInc	Focused on generating surveys for assessment of training courses.	No	Yes	Yes	Paid
SurveyMonkey	Multipurpose survey tool	Yes	Yes	Yes	Free and paid
PollDaddy	Advanced embeddable surveys	Yes	Yes	Yes	Free and paid

Figure 10 : Comparison of available online solutions

2.5.2 Feedback systems in Universities

Universities such as Princeton University, Newcastle University, National University of Singapore, University of Sunderland, University of Kuopio, University of York and other higher education institutions have functional online feedback systems.

Close to all the reviewed systems are "closed" for study and analysis, since the online-resource contains only brief description of its functionalities, or simply has a login form for authentication. The system analysis below is courtesy of the University of Kuopio.

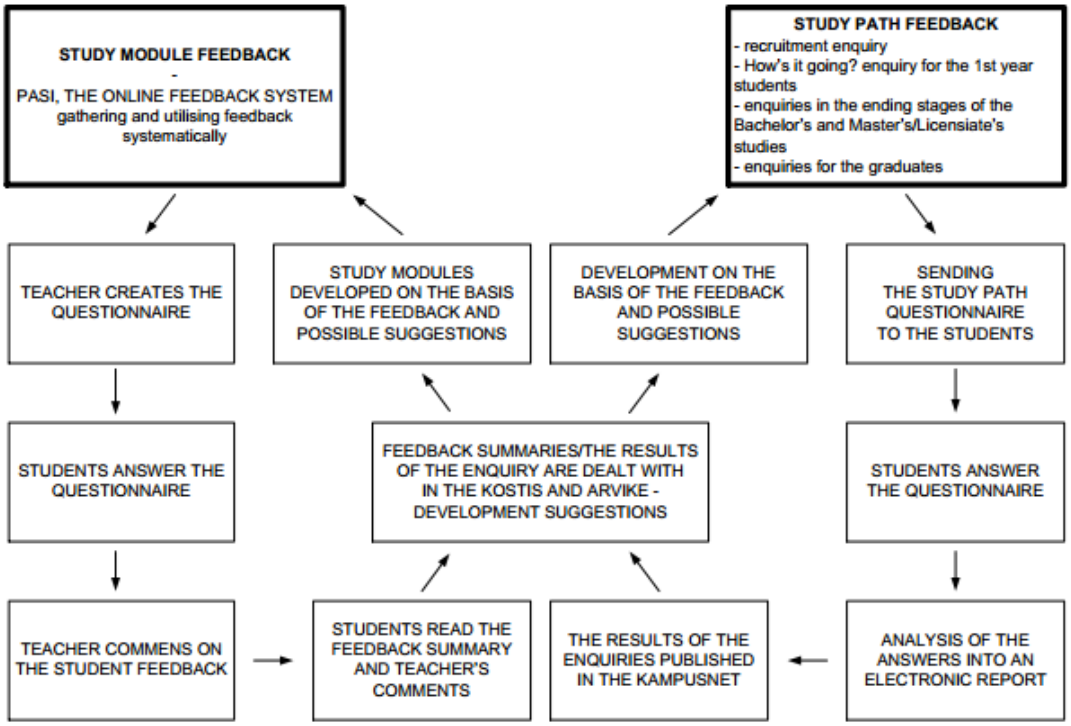


Figure 11 : University of Kuopio Feedback System ("University of Kuopio," 2016)

It is important to note that the main familiarity of the feedback system usage of the majority of the reviewed universities is its implementation into all the departments of activity of the IHL establishment.

Transparency of surveys' results, their constant update and organization of additional feedback by using online-resources, electronic mail and constant update and improvement of services shows the relevance of their usage by the IHL and positive attitude to survey passing by all the class participants in the training and administrative processes.(Evgeniya et al., 2016)

Consequently, most of the systems are coping very well with its responsibilities within its class. Besides the above services considered, some educational institutions and the organizations were developed and a number of its own services of feedback with enough large difference in characteristics (anonymity, open access and user orientation among others). (Evgeniya et al., 2016)

In conclusion, the gaps identified are;

- Majority of the solutions that exists deal with the evaluation of the students themselves and are usually about the courses only.
- Lack of an integrated system that deals with feedback from more than one angle i.e. the course, the faculty, departments and any other interacting factors that a participant experience in his time of study.
- The lack of a well-documented process for feedback in IHL.

2.6 High Level System Architecture

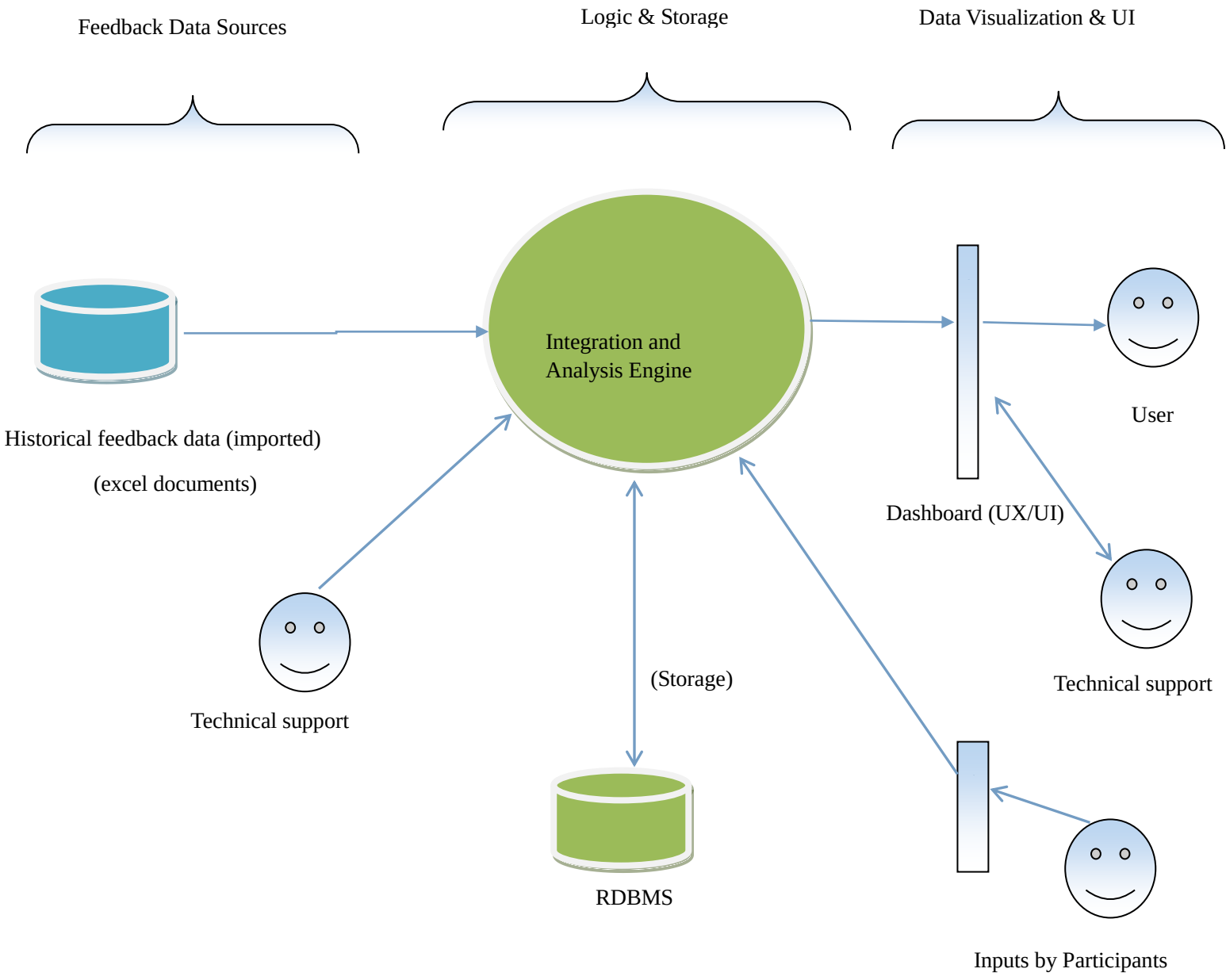


Figure 12: Integrated Analysis High Level System Architecture

3.0 METHODOLOGY

3.1 Introduction

Research methodology can be defined as a way to systematically solve a problem. It involves brief description of methods and procedures of study (Kothari, 2004).

3.2 Research Design

Research design is the conceptual structure within which research is conducted (Kothari, 2004).

IFAS has some aspects of business intelligences i.e. the dashboards and the methods applied in terms of analytics in the generation of this dashboards. In view of this, a hybrid approach in terms of the methodology using some aspects of the Kimball life cycle and OO analysis and design so as to address all the aspects of the system satisfactorily.

3.2.1 Motivation for hybrid approach

Object oriented analysis and design uses the UML notation for both analysis and design which has the following advantages;

UML covers the entire software development lifecycle from the requirements capture to the implementation whereas encompassing both dynamic and static elements. It also provides standardization since it has brought together three object oriented notations and it is widely accepted in the software development community.

In addition to this, since there are BI aspects to this implementation, it is important that they too be captured therefore the incorporation of some aspects of the Kimball lifecycle.

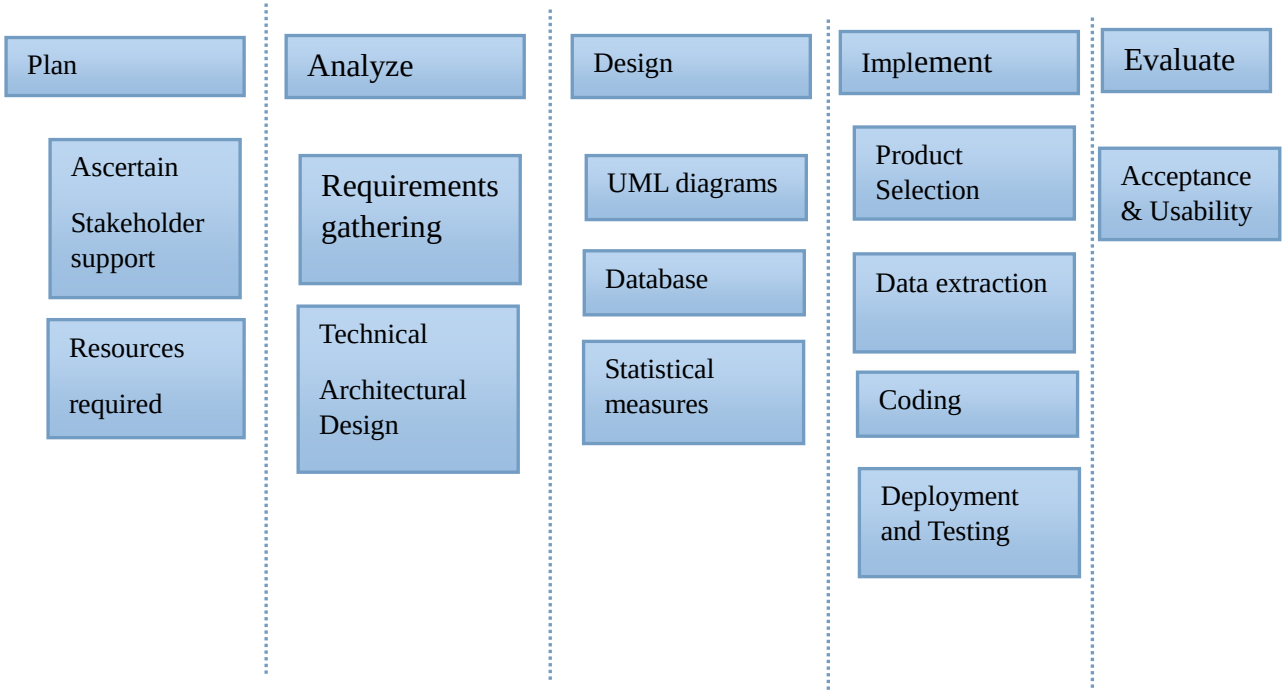


Figure 13: Hybrid Methodology

3.3 Hybrid approach phases

The hybrid methodology used in IFAS is shown to be used is shown in figure 13 on the previous page;

3.3.1 Planning phase

In this phase we assess whether or not the organization is ready for a business intelligence project by establishing;

- If there is a strong executive sponsor at SBS for the project.
- If there is a strong business case for the project.

This will be done by carrying out verbal interviews with the mid and top level management.

In addition to this, a feasibility study will be done to ascertain whether there are enough resources to enable the development of the new feedback process and system, the following will be assessed within the scope of this project;

- Technical feasibility; this will answer the question, "Do we have enough technological resources to execute the project?".
- Economic feasibility; this deals with the monetary aspects not only in implementation but in the implied changes that will be caused by use of the system i.e. costs in the whole project cycle.
- Strategic feasibility; assess whether there will be any value from a business perspective when the solution is implemented i.e. will this lead to a higher market share as a result of improved service?

The expected outputs of are;

- Validation of the presence of the success factor outlined above.
- Feasibility study results.

3.3.2 Analysis

Project stakeholders will be identified with considerations made to three major groups of people;

- Users; this refers to the individuals who will be using the system.
- Developers; the designer and implementer o the system.
- Decision-makers; individuals with the ability to influence the development of the system, they are usually managers and directors.

Secondly, an identification of the business scope will be done to ensure that we understand what processes will be affected to have a clear picture of the impact. Once this is done, requirements will be gathered by carrying out interviews with all the stakeholders to make sure that the system captures all their needs. This will be done with consideration of the difference in users i.e. as differentiated in the groups

indicated above by use of brainstorming sessions and interviews as a means of data collection.

Finally, I will do a thorough evaluation of the current feedback process pointing out both advantages and disadvantages as collected from the stakeholders and then generate a requirement specification list given as the final outcome.

In a nutshell, the expected outcomes of this phase are;

- A feedback process that will be optimal to SBS.
- Have clarity of scope by way of requirements specification.

3.3.3 Technical architectural design

Once the analysis is complete, considerations will be made on architecture and based on the requirement gathered a high-level system architecture will be designed that will depict the proposed system on a bird's eye view.

The output of this system is;

- A high-level system architecture.

3.3.4 Design

The system will then be designed as guided by the analysis outcomes using the UML to conceptualize the system.

The database will also be designed alongside the user interface to be used for IFAS.

There also exist historical feedback sources which should be imported into the relational database as guided by business intelligence techniques, we will come up with a way of cleaning, consolidating and importing the data.

The user interfaces will also be designed and represented as wireframes to show the general layout of the system.

Finally, as informed by the reports required in the analysis stage, we will select and explain the statistical measures we will use in the analytics engine.

The outcomes of this phase are as follows;

- Design diagrams (use case, sequence, activity, class and deployment diagram).
- Data cleaning and import strategy for historical feedback.
- Database design diagrams.
- Generic wireframe diagrams.
- Selection of statistical computations to be used in the analytics engine for reporting.

3.3.5 Product Selection

Once the design in complete then a selection will be done so as to find out what third party software tools will be required for cleaning and consolidation of the historical

feedback plus implementation of the system.

In addition to this, the programming and scripting languages and database implementation RDBMS will be selected.

The outcomes of this phase are as follows;

- MySQL shall be used for implementation of the database with MariaDB as the relational database engine (since it is the open source version of MySQL server) via the MySQL workbench tool.
- MS Excel shall be used for preliminary testing and validation of the initial data to be imported.
- R shall be used in cleansing the data and presenting it in an importable manner as described in the design. R studio development tool shall also be required.
- HTML, CSS and JavaScript scripting and markup languages shall be used in the development of the UI/UX.
- PHP programming language (specifically the laravel framework) shall be used for implementation of the analytics engine using the PHPStorm integrated development environment.
- Codeception (powered by PHPUnit) will be used for testing the system.
- Apache web server shall be used as the application server.
- Ubuntu shall be used as the host operating system on which the web server will be installed.
- Finally, MS Word will be used for all document processing as it related to the implementation of the IFAS.

3.3.6 Coding and testing

The relational database will be implemented using the tools selected in the previous phase, after which the user interfaces will be implemented using the scripting and markup languages selected.

The implementation of the rest of the system including the importing of the historical feedback into the database will be done in line with the UML design diagrams using the tools in the previous phase.

Finally, in this phase I will test the system for general errors using testing tools available in the programming language in readiness for deployment.

The outcomes of this phase is as follows;

- A developed and tested system as per the specifications.

3.3.7 Deployment

The system will be deployed at SBS in “pilot mode” to a closed number of users i.e. the main stakeholders in readiness for system evaluation.

Secondly, a user training will be done in the form of a concise a group / individual training to the closed user group to familiarize them more with the system.

The outcomes of this phase are as follows;

- Deployment of IFAS to a closed number of users.
- User training.

3.3.8 System evaluation

The final stage involves an evaluation of the system acceptance and usability by the SBS closed number of users by conducting interviews.

The variables to be used in evaluation will be efficiency, appropriateness, user responses, correctness, understandability, learnability, operability and attractiveness.

The outcomes of this phase are as follows;

- System evaluation results

4.0 ANALYSIS AND DESIGN

4.1 Planning

4.1.1 Critical success factors

I made an interview with the current administration and support director early this year then the quality assurance manager Mr. Were on the possibility of having an integrated system for managing and analyzing feedback and it came out strongly that this was a great need in the organization given the current challenges that were faced in the current technology used in terms of understandability and scalability.

The ICT manager, Mr. Gichure, held the same view, supporting the development of a system that would streamline the feedback process. His major outcry was the delay that exists between the collection of feedback from the participants to the dissemination of the same to the various departments.

Given the above results of the interviews it was clear that the project has strong project sponsors who would were at the fore front of the implementation, however they were not so comfortable with the idea of having a fully-fledged data warehouse kind of solution due to the most pressing need at the moment.

Finally, as gathered from literature, the implications of improving the collection and follow up of the feedback given by participants and following them up are crucial to the business, this not only lead to faster mitigation of the issues raised if any but also aiding in making it plain to our participants who are the clients of SBS that they matter hence a strong business case for the proposed system.

4.1.2 Feasibility study

4.1.2.1 Technical feasibility

Having the privilege of working in the ICT department at SBS, the technical feasibility was carried out in conjunction with the ICT manager and it was clear that the project was feasible with minimum risk as outlined in the figure below;

Technology required	**Current availability**	**Risk**	**Action**
Application server	Available	None	N/A
Relational database software	Available	None	N/A
Programming and scripting language	Available	None	N/A
Active directory authentication	Available	None	N/A
Access to historical feedback	Available on authorization	Denial of authorization	Seek authorization

Figure 14 : Technical feasibility

4.1.2.2 Economic feasibility

In terms of the cost implications there was no significant cost to SBS since all the technologies required were open source. The only cost that would result during the project phase would have been the developer salary in which for this case is a non-factor given the nature of this project. Furthermore, although there would be no cost in terms of salary, there was identified an opportunity cost since the time spent on the project in terms of man hours could have been used in implementation of other systems at SBS, this was agreed to be catered for during free time and study leave as a privilege given during this period.

In addition to this, the restructuring required in terms of the feedback cycle as analyzed would not have any cost implications in terms of new staff hires or any other therefore it was concluded that there the project was economically feasible.

4.1.2.3 Strategic feasibility

The strategic feasibility was analyzed in the light of the comments gathered during the interviews with the Director who is one of the key decision makers at SBS. It was inferred that support from him as the strategic decision maker was a direct communication that the project was one that will add value to the feedback cycle process and at the end of the day to the participants themselves which is the goal.

4.2 Analysis

4.2.1 SBS feedback management process

The SBS feedback management system has been drafted to ensure that there is continuous improvement in the delivery of programs and courses as well as of the operations within SBS. Feedback may be received from the program participants, the faculty members, the program directors, and the academic director or even from other program team members or other staff members within SBS. Feedback is administered in various ways, which may be formal or informal.

Informal feedback

This is feedback that is received informally by way of conversation either face to face, by phone or even via e-mail. The recipient of the feedback needs to ensure that this feedback is recorded formally through sending it by e-mail to the most appropriate recipient to ensure that the feedback is acted upon. This could be the program manager, or the academic director, the program director, a section head or director, or the office of the vice-deans if this is warranted. Any informal feedback received that is then shared via e-mail needs to be brought up in the program team meeting for discussion and documentation in the meeting minutes, including the proposed way to address the feedback (correction and corrective action), the implementer of the action as well as the proposed time lines. In the absence of a formal meeting for the program team, then this feedback should be shared with the proper person or office that needs to act on the feedback with expedience to ensure the matter is addressed in a timely manner, depending on the gravity or urgency of the issue.

Formal feedback

This is feedback received from the program participants by way of the feedback forms administered in class in hard copy or via electronic format, kindly see appendix for sample forms and feedback summary.

4.2.2 Current roles

The program manager's role

The program manager shall be charged with the responsibility of ensuring that the formal feedback is administered efficiently and effectively to ensure that:

i) All the program participants are given the opportunity to submit their feedback of the program.

ii) The scheduled date and time of the formal feedback is known in advance by the program participants and the faculty.

iii) The feedback is received by the Planning & Logistics Team within 24 hours of being administered so that it can be summarized and submitted for analysis.

iv) The team has the requisite meetings held to ensure that the feedback summary is discussed, together with the required minutes of the meeting being taken and made available for the necessary parties' review and follow-up.

v) All action points agreed upon during the feedback analysis meetings (correction as well as corrective action) are assigned to the correct offices for follow-up and conclusion.

vi) The program participants as well as their class representatives receive SBS' official response to the feedback and receive feedback for them from SBS, the faculty and the program team.

The academic director/ course leader's role

The course leader or academic director shall also be charged with the responsibility of ensuring that all the faculty members receive their feedback in a timely manner. The dissemination of the feedback shall be the responsibility of the course leader or of the office that the course leader shall share this responsibility with, be it the program director (academic programs) or the section heads (executive programs), or the respective offices of the vice-deans for academic or executive programs. The course leader shall also be charged with the responsibility of discussing feedback with the faculty members of the program as and when there shall be the need to do so. They shall also be required to discuss any proposed improvement plans for faculty with the program director or offices of the respective vice deans, whose suggestions or recommendations shall be shared with the SBS HR office.

The program director's role

The program director shall ensure that the feedback management system is adhered to within the program and the department, and that all necessary communication on feedback is expedited as expected. The program director shall therefore be charged with the task of ensuring that the whole team fulfills their role in upholding feedback administration and dissemination. Being the custodian of quality within the program and department, the program director shall be answerable for the status of quality and continuous improvement within the department. This office shall also be required to supervise and review to ensure that all documentation and minutes pertaining to meetings and discussions are maintained for continuity and follow-up.

The Quality assurance administrator's role

The quality assurance administrator is responsible for preparation of the feedback forms, compilation of the same (from hardcopy to soft or consolidation with the proper metrics) and sharing to the program heads for discussion.

4.2.3 The current feedback process

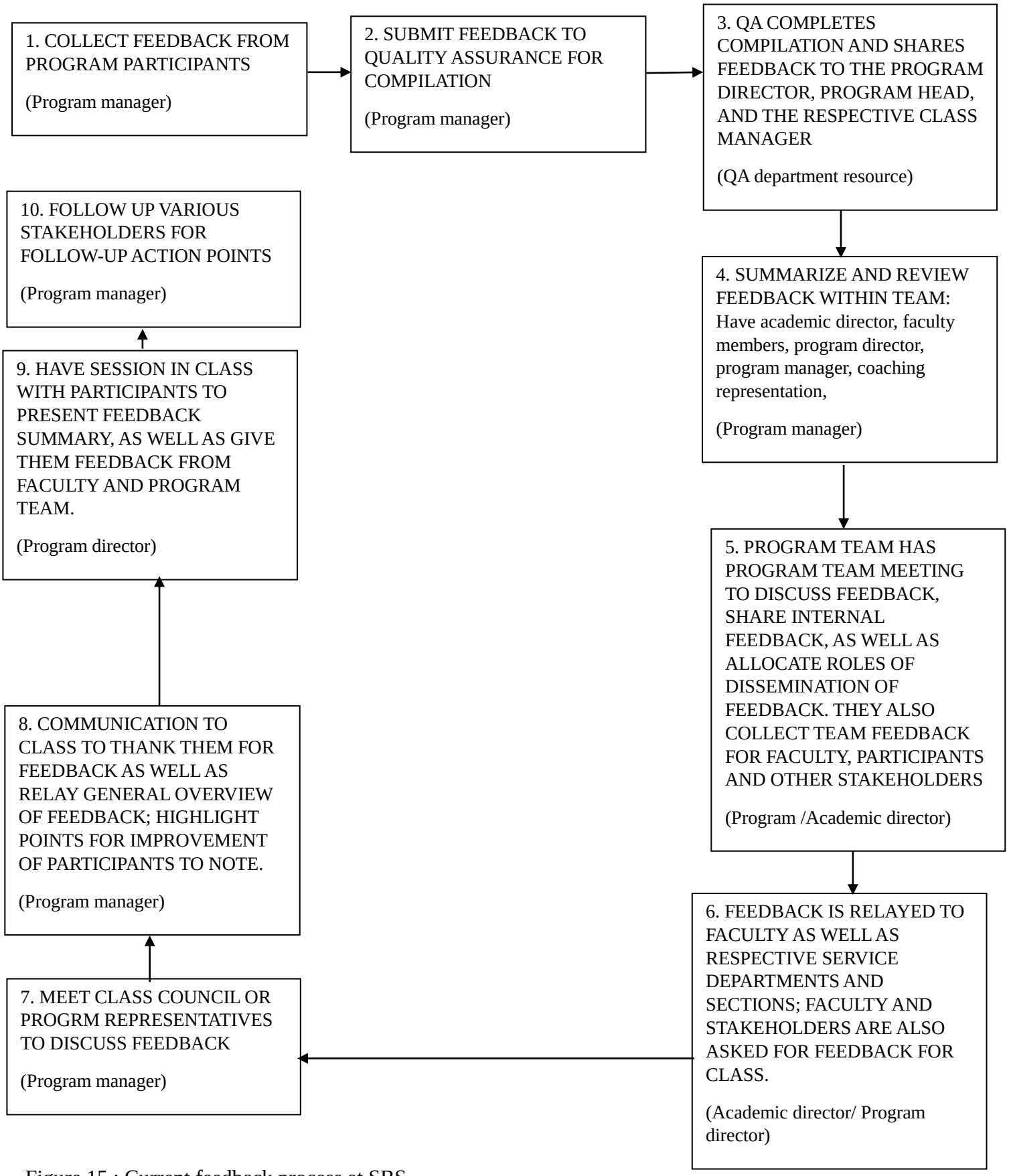


Figure 15 : Current feedback process at SBS

4.2.4 Requirements analysis

In this stage, we used stakeholder interviews to ascertain the system requirements the output being a requirements specification list to offer a way of measuring project success.

Stakeholder Identification; the individuals that have a stake in the project are as follow;

1. Participant; responsible for filling the feedback form and changes are effected via the system with the goal of ensuring that our participants are satisfied.
2. Quality assurance administrators; responsible for first level support and administration of the IFAS i.e. management of feedback forms, they have total access to all the feedback that is in the system and can generate reports of the same.
3. Program administrators; responsible for management class feedback for their programs. They are also in charge of student notifications of available feedback
4. Academic / Program Director; overall approver of feedback per program before distribution to the assessed stakeholders.
5. Faculty; this form one of the factors about which students give their feedback and to which consequent follow up is done to ensure that changes are effected accordingly.
6. Support departments; this are the SBS teams that partner with the program departments in the successful delivery of the course, they include but are not limited to the IT department, operations and quality assurance department. They form part of the factors which are assessed by the participants.

4.2.3.1 Data collection

This was done in line with the project objectives raised in the previous chapter, where a needs analysis was carried out in close connection with all stakeholders in the feedback process to provide a relevant solution at the Strathmore Business School.

I collected data using the following;

- Focus group discussions were done with some members of the quality assurance department who are the ones directly involved in the administration of the feedback.
- Interviews carried out with the other stakeholders who hold the following dockets; program manager, program administrator, administration and support director, quality assurance manager and the information technology manager.

The formulation of the questions asked during the interviews were as guided by the broad goals as indicated below;

- Find out if the stakeholders are familiar with the current process as it exists and the role they play. (Familiarity with current process)

- Ascertain the current challenges of the current system (Current system challenges).
- Identify possible solutions to these challenges from the stakeholders from the different levels (Suggested solutions).
- Find out if participants think that their feedback is taken seriously and the reasons behind it (Participant view on feedback).
- Find out from the participants their view on use of manual forms and what they think of use of online platform on varied devices (Participant view on online feedback).

Questions asked during this interviews can be found in the appendix section of this report, they are combined for all the groups interviewed however in reality each was asked separately.

The results are as follows;

Assessed Item	General comments
Familiarity with current process	All the staff members interviewed were familiar with the current feedback process and the role that they played in it.
Current system challenges	Lack of understanding of the questions by some participant due to lack of help texts. Repetition Illegible handwriting from some students leading to difficulty in digitizing of the manual forms. Poor response rates Inadequate analysis provided, stakeholders felt that they should be able to see performance over years in an on demand way. Delay in relay of the feedback to departments was also raised against the program managers. The surveyed items need to be modified constantly as per the need i.e. ability to modify the feedback forms in conjunction with the program directors (who approve the same on need basis) Lack of on-demand feedback channels (students have to wait for in class sessions to give their feedback) Anonymity in feedback leading to the inability to follow up students who have not filled in feedback.
Suggested solutions	Online platform for feedback collection is compatible with smart phones. Lay a greater emphasis on the understandability of the feedback

	forms by providing guides on the form and more careful formulation of the system. Departments should be allowed to formulate their own questions since they know better how to convey their questions to the participant. Richer analysis should be provided especially trends. A way of follow up for the feedback should be provided for. Ensure that the feedback is not anonymous to allow follow up of participants that have not filled in feedback.
Participant view on feedback	General feeling that their feedback is not taken seriously due to a lack of response on some issues hence poor response rates / filling the form as a formality.
Participant view on online feedback	Participants were comfortable with this since most of them owned a smart gadget i.e. either a tablet (provided on enrollment for long programs) or a smart phone (personal).

Figure 16 : Findings of data collection from interviews

Using the insights of literature review and the data collected above from the interview process with the stakeholders, I identified the following weaknesses with the current feedback process that can be either automated in the proposed system or completely done away with since they would not be required, figure 17 on the next page illustrates;

4.2.5 Evaluation of the current feedback process

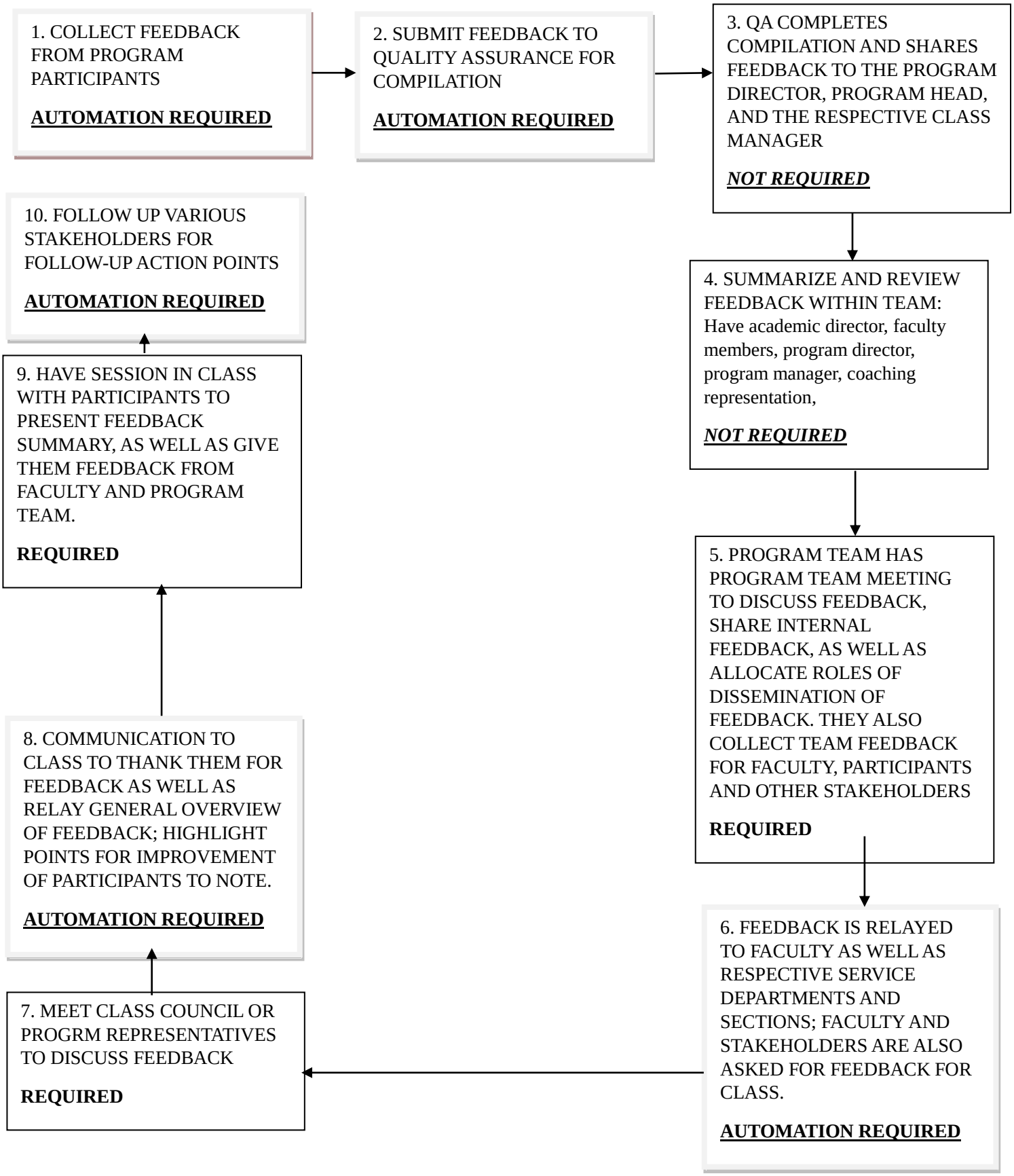


Figure 17 : Evaluation of current feedback process

In addition to the above process analysis, the following summary can be made of the limitations as collected from the interviews;

1. Inefficiency; the feedback forms should be manually digitized into soft copy for analysis which consumes a lot of time and man hours.
2. Lack of analysis engine; the feedback is analyzed on a group basis and where consolidated analysis is done it is often very user unfriendly and difficult to read for a normal staff member
3. Lack of understanding of feedback by respondents leading to improper evaluation
4. Difficulty in communication in the preferred language due to hand writing and lack of enough time leading to difficulty in consolidation of the feedback.
5. Limitation of current online system (Google forms) to large screen devices i.e. computers and laptops and thus inability to be widely used in all the programs since it is not consumable on a wide range of devices
6. Lack of proper follow up strategies with the stakeholders to implement the changes suggested in the feedback as well as communicate the same to the participants
7. Poor response rates due to feeling by the participants that their feedback is not taken seriously due to lack of proper response mechanisms to the participants about their feedback.
8. Lack of taking into consideration the respondents profiles in the analysis of the feedback; a key issue raised by one of the program administrators is the analysis of feedback and the respondents profile need to be taken into consideration for a richer analysis. This does not exist in the current system where only the responses are of importance.

In addition to this the positive thing about the current system was that it is run using purely day to day software products namely google apps and Microsoft excel hence it can be viewed as somewhat cost effective.

4.2.6 The proposed system

The information gained from the literature review on what consists a good feedback system and some of the strategies employed to increase the response rates and the specific needs of the SBS team resulted in the following requirements list that will ensure efficiency in the feedback process, namely;

Functional requirements

1. Simple creation of feedback forms programs based on duration and need
2. Role based access
3. Notifications to the specific users for;
    a. Availability and expiry of feedback forms.

b. User notifications for feedback review and reminders for action points

c. Reminders to program managers to administer feedback for every cycle.

4. Dashboard analytics engine;

    a. Trend analysis

    b. Respondents analysis

    c. Performance analysis (faculty and departments)

5. Tracking of feedback action points to the respective departments.
6. Easy look and fill with guiding information for every question asked.
7. Real time response i.e. the ability to see the tally of filled forms in a session
8. Response mechanism of action points to the participants.

Technical requirements

1. Ensure up to 100% availability of the feedback system between 0700 – 2100 hours since it will be accessed by the whole organization and most important of all by the student in the submission of feedback.
2. Availability of the platform for filling by student on PC / laptop, tablet and mobile.
3. The system should only be accessible on campus due to the sensitivity of the information held.
4. Inclusion of access to the feedback system on the available systems used by the participant namely; the SBS e-learning web and mobile platforms.
5. Compatibility; the dashboards should be best viewed on Chrome and Firefox web browsers which are the most widely used at SBS.

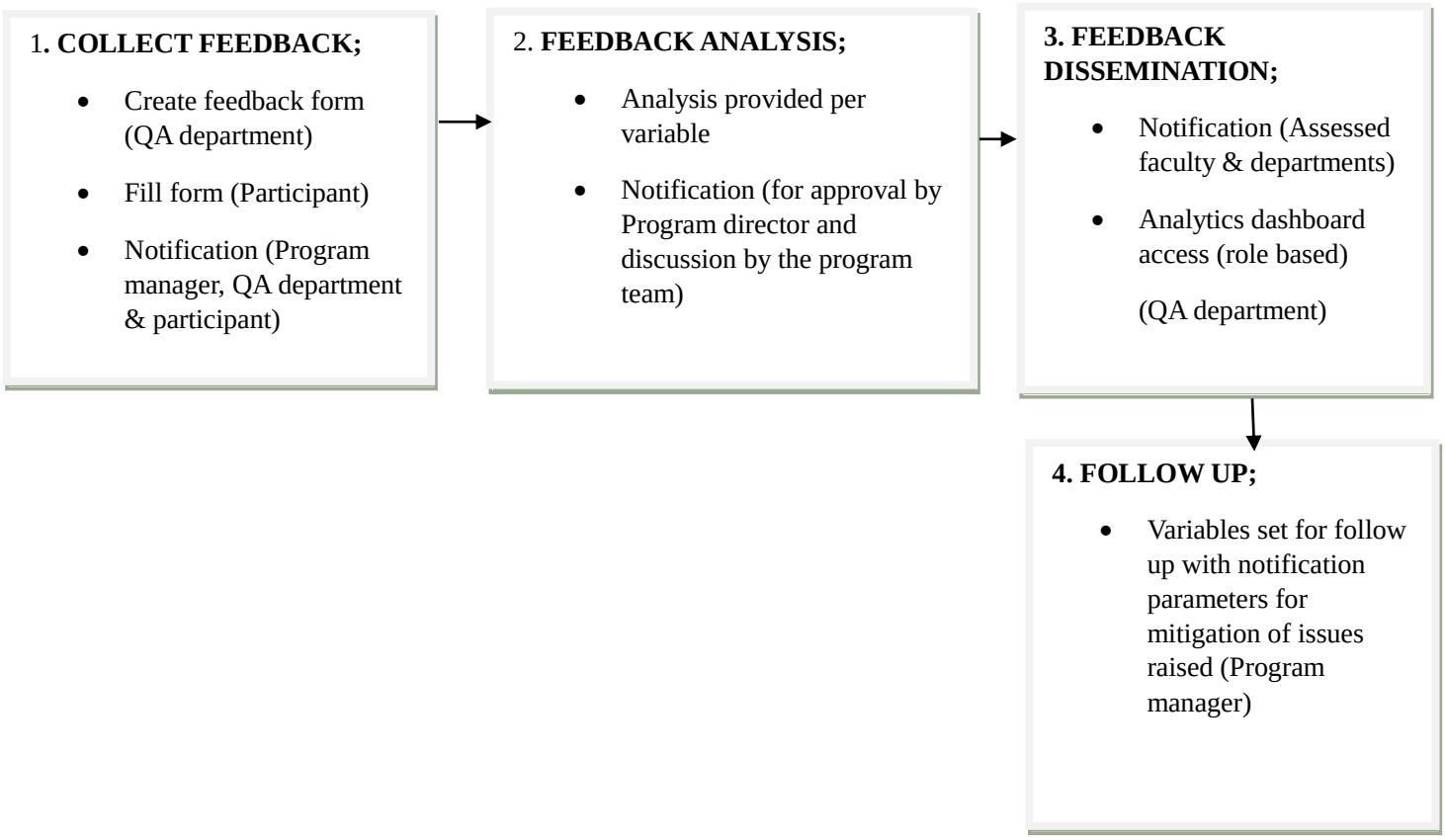


Figure 18 : Proposed System Process

Advantages of proposed System

1. Efficiency; the IFAS provided a one stop shop for feedback collection, analysis, dissemination and tracking and thus saving on time and man hours by elimination of the need to use different system or application for the different aspects in the feedback management process
2. Provision of simple rating for free text responses
3. Aid in understanding feedback by inclusion of quick tips at the beginning of the feedback forms and for each question to guide the respondents
4. Multi-platform availability of IFAS thus ease of deployment across most if not all programs
5. Dynamic; addition of new questions, analysis variables will be easier since all the aspects of the feedback management process are available in the system.

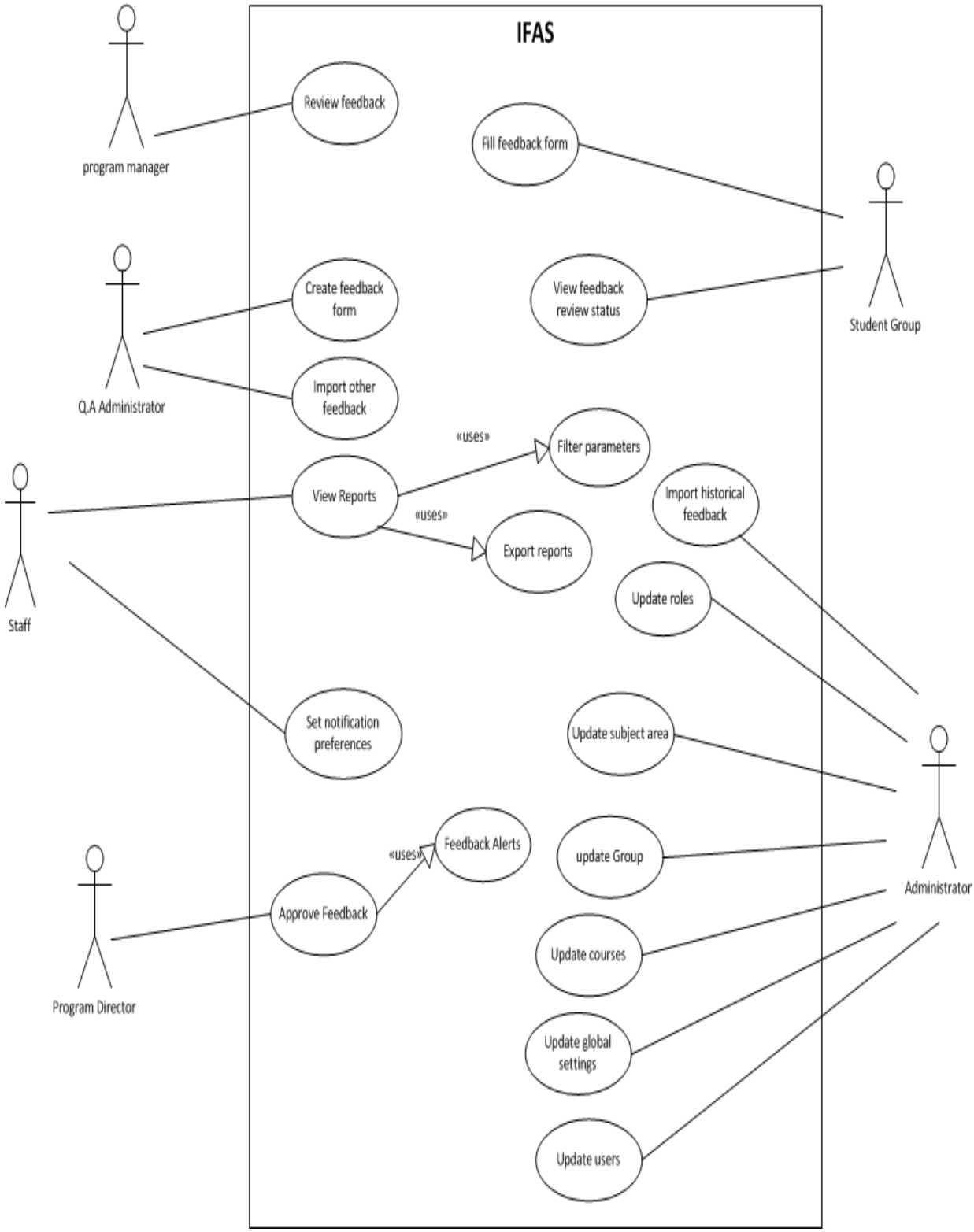
4.3 Technical Architectural Design

The recommended technical architectural design was maintained as indicated in figure 12, however the discussion of the same is as follows below;

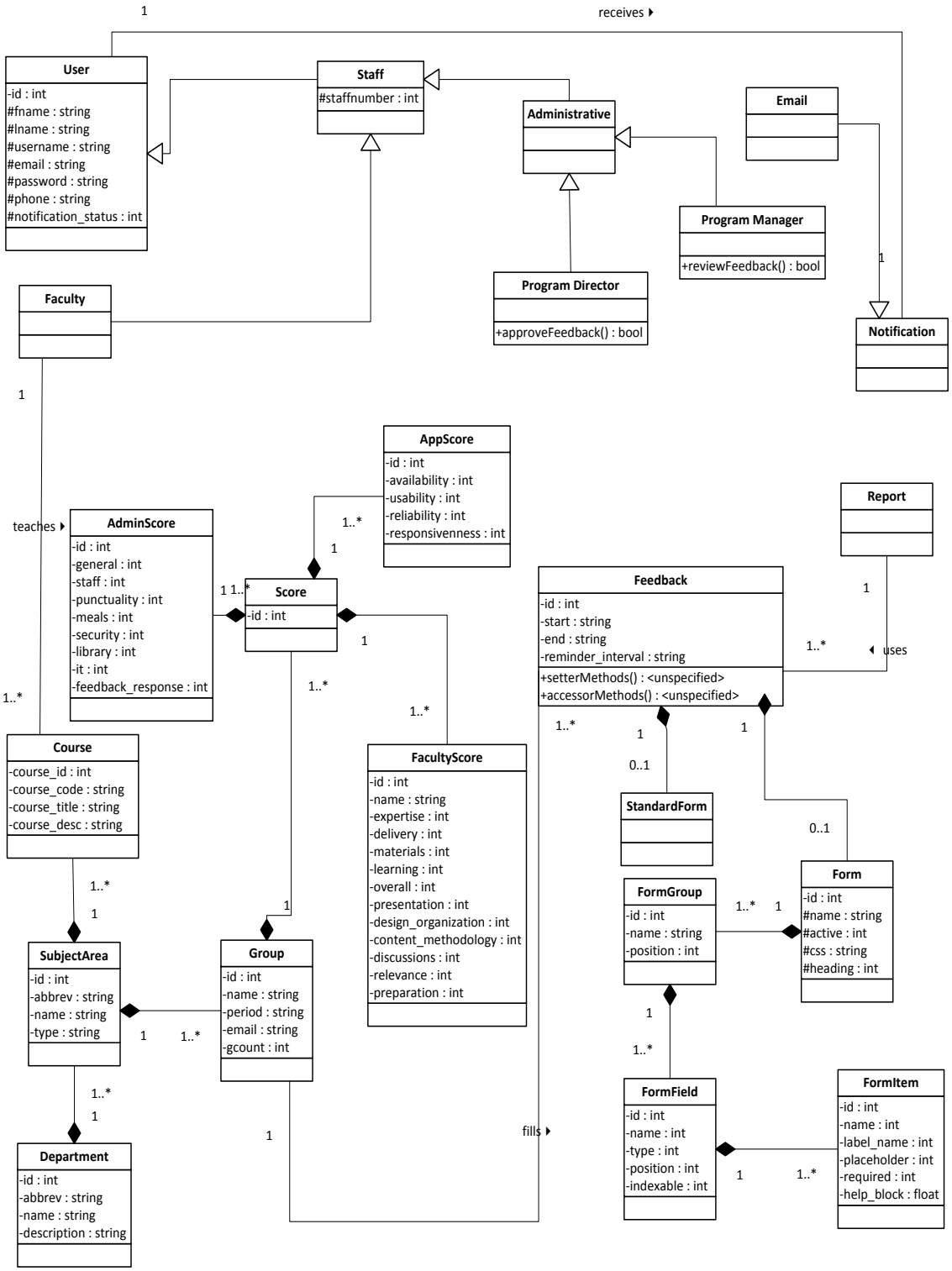
- Feedback sources; this refers to the sources of feedback data, initially in the commencement of the project the idea was to use feedback from a more than one source however this was not possible due to limitation in time. In view of this, the main feedback source for the system is the historical feedback from the students since 2013, this is due to the fact that it was considered important not only to ensure the richness of the analysis done but also to show the progression of faculty over the years (performance improvements or vice versa). The second source is the ongoing inputs by the user through the IFAS UI.
- Storage component; this refers to the database selected to store the data both the imported historical feedback and the continual inputs by the participants.
- Application logic; this is the "brain" of IFAS since it ties both the data and the visuals that the users of the system sees as the final output.
- Visualization; this is simply the interface through which the users of IFAS interact with the system, it contains also the dashboard components of the system.
- System users; from the high-level architecture, the users are identified likewise in an overview, those identified are the technical support referring to the administrator of the system, the users of the system who will be further personalized in the design stage and the participants who provide continuous feedback.

4.4 Design

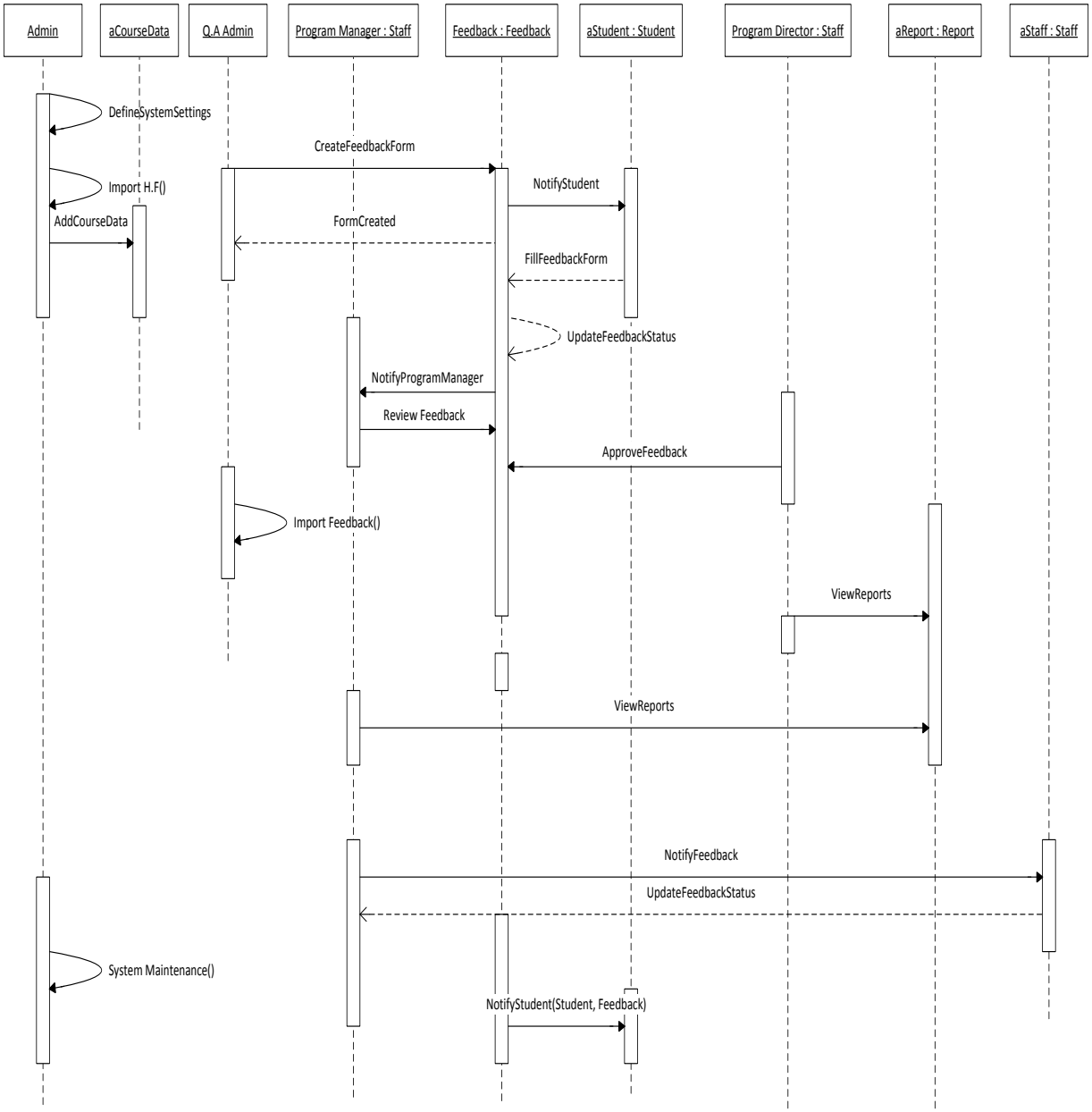
4.4.1 Combined high level use cases



4.4.2 Class diagram

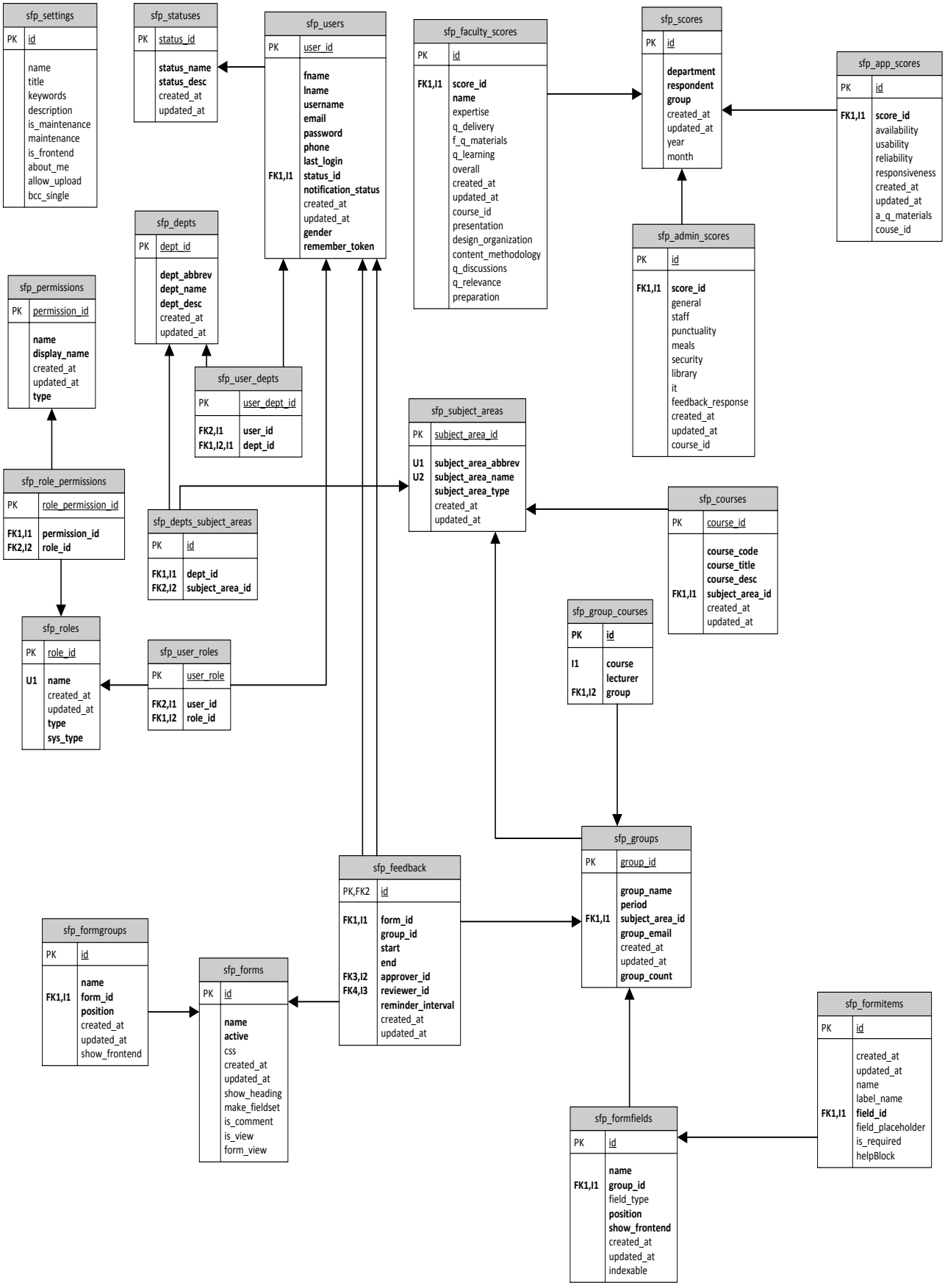


4.4.3 Sequence diagram

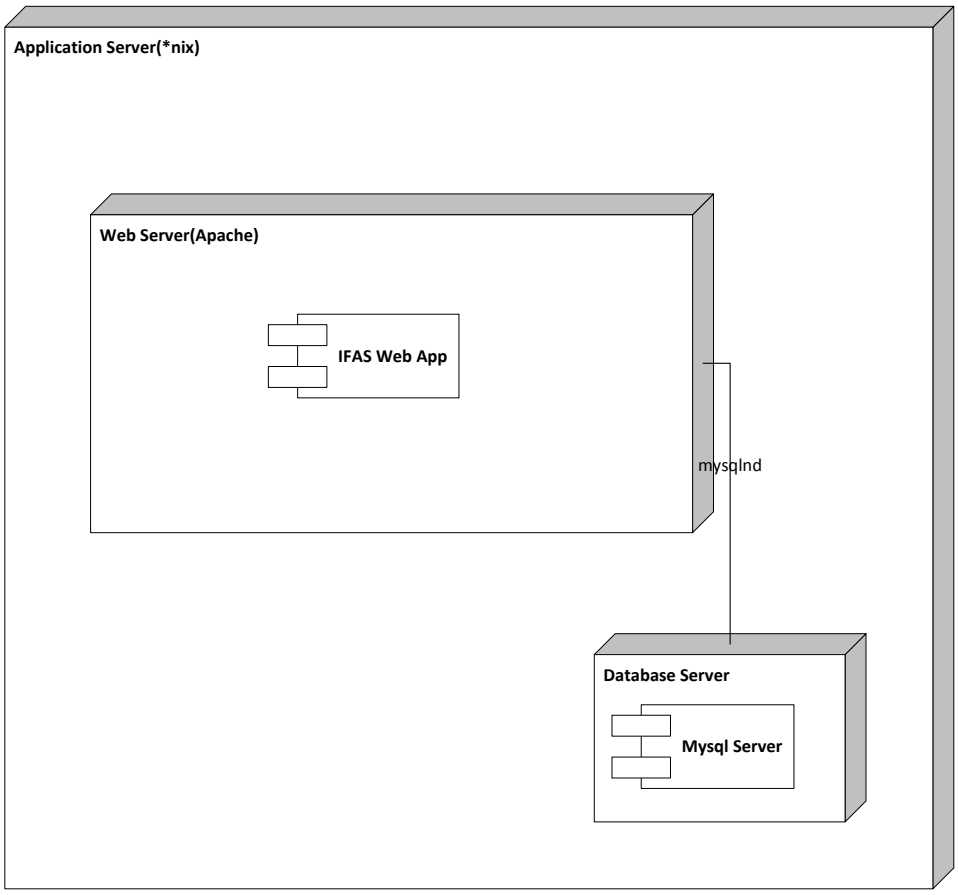


4.4.4 Activity diagram

4.4.5 Database design: Entity relationship diagram



4.4.6 Deployment diagram



4.4.7 User interface design

Wireframes were used to define the general layout of the IFAS as shown below. Color schemes were chosen considering their closeness to the current SBS official colors.

4.2.7.1 Login page

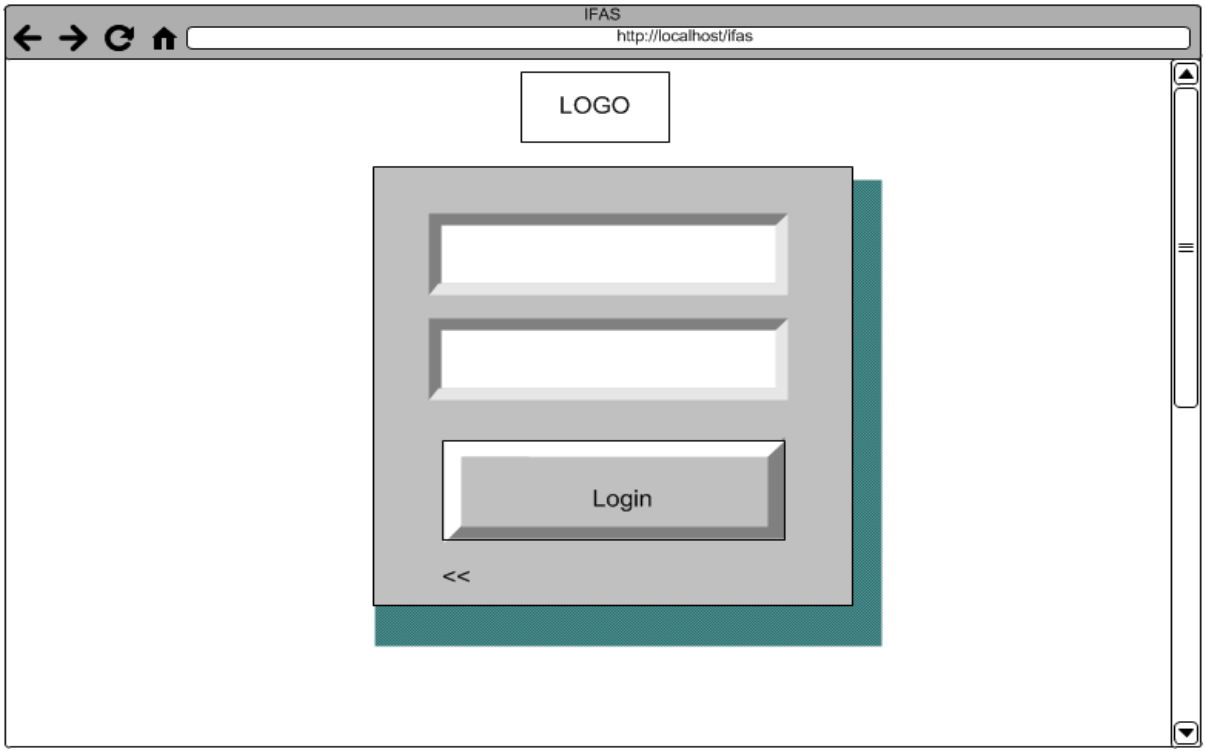


Figure 19 : Login page wireframe

4.2.7.3 Inner page interface

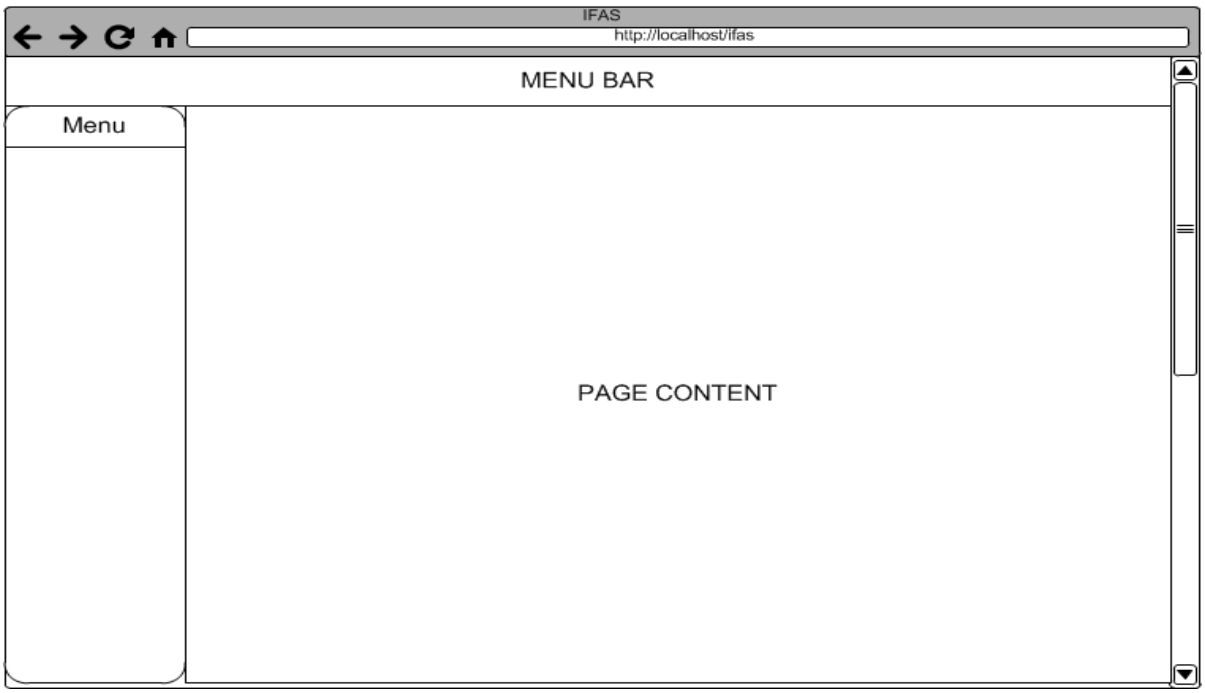


Figure 20 : Inner page wireframe

4.2.7.3 Dashboard Interface

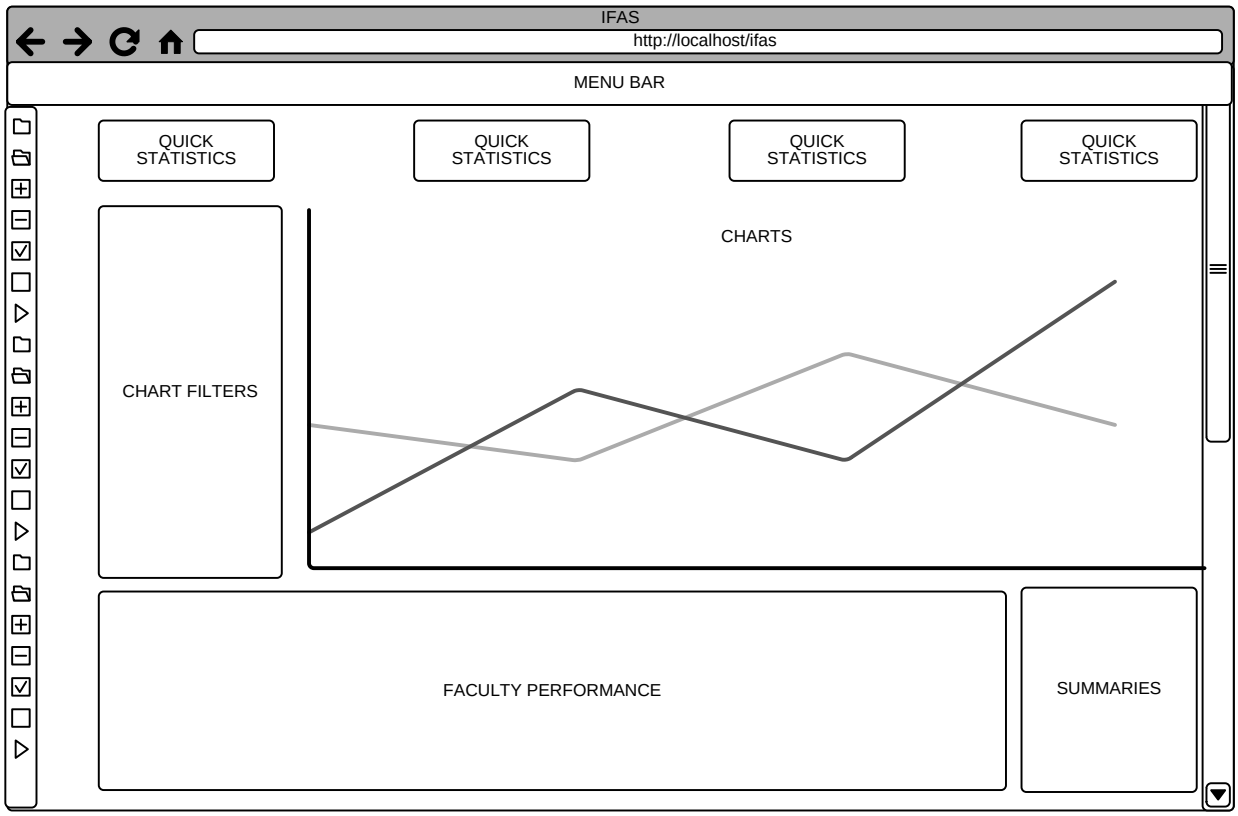


Figure 21 : Dashboard user interface

4.4.8 Data import design

There is a substantial amount of historical data that exists from previous participants' feedback that we need to import into the IFAS.As guided by the business intelligence techniques of consolidating data from varied sources as explored in the methodologies in the literature review we came up with the following steps in preparation for data import. We will carry this out in three steps.

- Extracting the data from the source; I will transform the data from excel (.xlsx) to a comma delimited text file that is easier to handle computationally.
- Performing cleansing; the figure on the next page shows how the data cleaning will be done;
- File size reduction; the cleansed data will then be split into manageable file sizes (less than two megabyte) in readiness for import (which occurs in memory) to minimize the memory consumed by the machine as it imports i.e. so that they are importable by a standard machine.

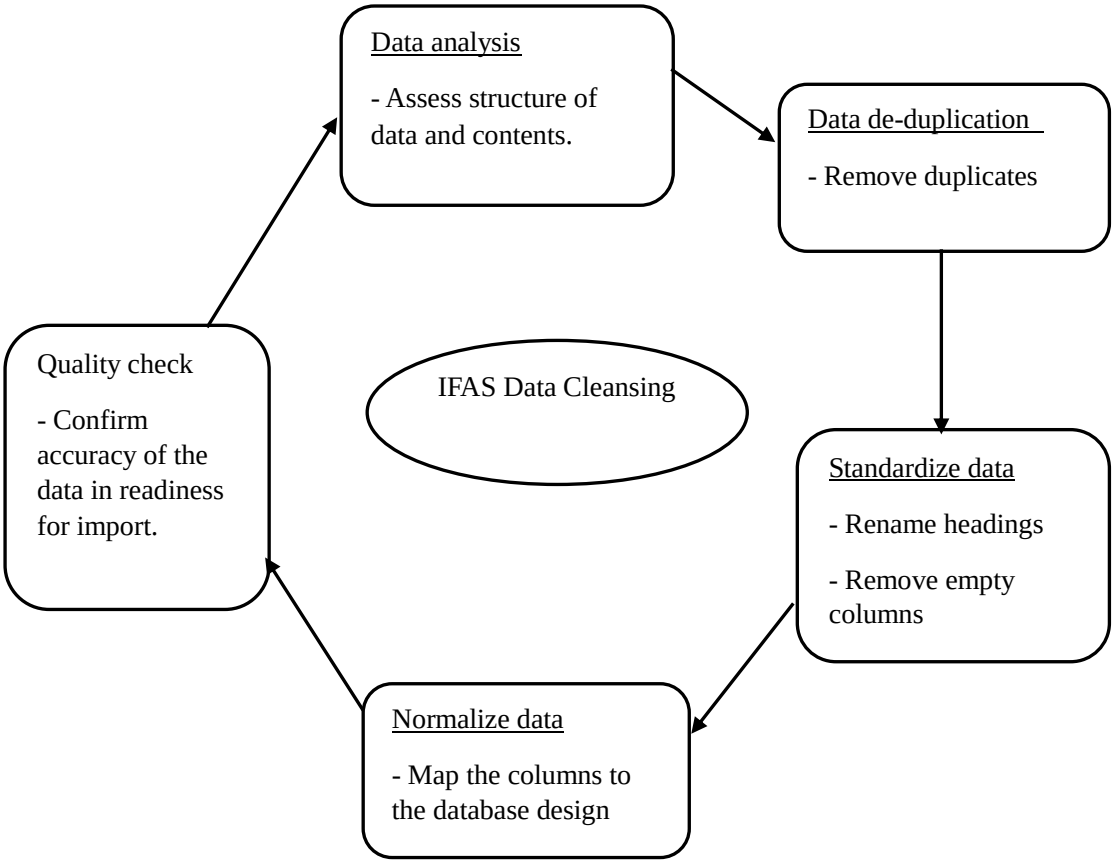


Figure 22 : Data cleansing steps

4.4.9 Statistical measure selection

In the analysis stage, it was established which reports are required, using this I have indicated the statistical measure to be used and the motivation behind the same below;

- Respondent analysis; this is an analysis of results as they are given by the respondents;

  We will use the mean in this report, the general formula is as indicated below;

$$\overline{X} = \frac{\sum X}{N}$$

  Figure 23 : General mean formula

  Respondent analysis is easy given a set of variables, the average of all of them

for example will give the faculty score or any other as given in the report filters hence the mean is the most relevant.

- Trend analysis; this involves showing a trend for a given variable in examination for a given period for decision making.

  The trend will be shown using a time series in this section first by plotting the scores against time for a given variable.

- Performance analysis; show the performance of faculty and departments as rated by the participants.

  In this reports comparisons will be done of the mean score of the faculty and the top will be the one with the highest score.

  In addition to this, we will analyze their performance based on the coefficient of variance which gives a measure of the spread (standard deviation relative to the mean), the reason for choosing this is that it is unitless hence this figure can be compared across different student groups as a way of comparing the performance of faculty.

$$Coefficient\ of\ Variation = \frac{Standard\ Deviation}{Mean} \times 100$$

$$Coefficient\ of\ Variation = \frac{\sigma}{\mu} \times 100$$

Figure 24 : Coefficient of variance formula

5.0IMPLEMENTATION, RESULTS AND DISCUSSION

5.1 Implementation

This phase involved the conversion of the design documents into computer readable program using programming, scripting, query and markup languages. Detailed steps of how each item was implemented is discussed as outlined in the methodology.

5.1.1 Setting up implementation tools

5.1.1.1 Development environment

The following software and tools were installed in readiness for development;

- The apache web server, MariaDB and PHP was set up on an Ubuntu Linux distribution.
- Laravel 4 PHP framework.
- Codeception PHP testing framework.
- PHP Storm with a free educational license.
- R and R studio.
- MySQL shall be used for implementation of the database with MariaDB as the relational database engine via the MySQL workbench tool.
- Microsoft office licensed by SBS R shall be used in cleansing the data and presenting it in an importable manner as described in the design.
- MySQL workbench.

5.1.2 Database

The database was implemented using the MySQL workbench tool that was the connector to the MariaDB relational database engine. Figure 26 shows the generated diagram from the implemented database;

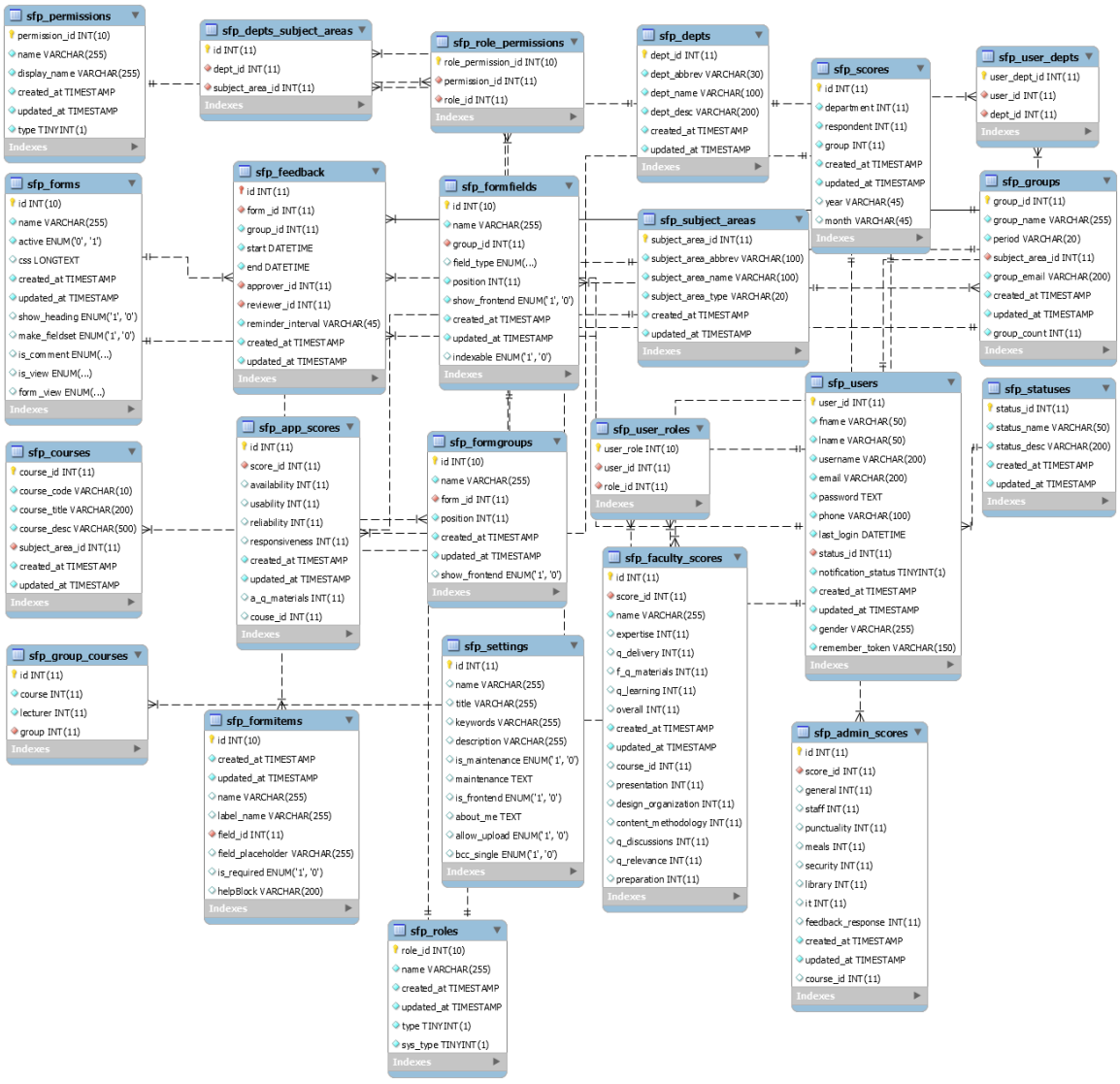


Figure 25 : Implemented database

5.1.3 Historical data import

5.1.3.1 Authorization and data acquisition

First I had to get authorization from the ICT manager to get access to the historical feedback from participants, the letter requesting this approval can be found in the appendix section of this report. Secondly, I had to liaise with the quality assurance department who are the custodians of the feedback to ensure that the variables that I was interested in were captured in the document that they were to share with me.

It is important to note that there were instances where there was missing data for some departments for example either due to a lack of filling of the same at that point in time or just historical reasons such as the non-existence of that item as at that time or changes in the form capture itself i.e. that specific item was not being captured in those years. This was dealt with in how the database was designed to incorporate all possible variables that existed even in previous years.

5.1.3.2 Data cleansing and reduction

Data Analysis

The historical feedback as earlier indicated was in MS Excel format with more than one tabs since they also did some summaries of the data in terms of analytics on the single excel document that was more than 30 MB in size.

Careful consideration was given to the structure of the data and thereafter I converted the document from excel format (.xlsx) to csv using MS Excel in readiness for data cleansing.

This allowed me to remove the unnecessary tabs that were in the document since they were irrelevant namely; the summarizations.

Finally, the data was imported into R using the *read.csv()* function as shown in the figure below;

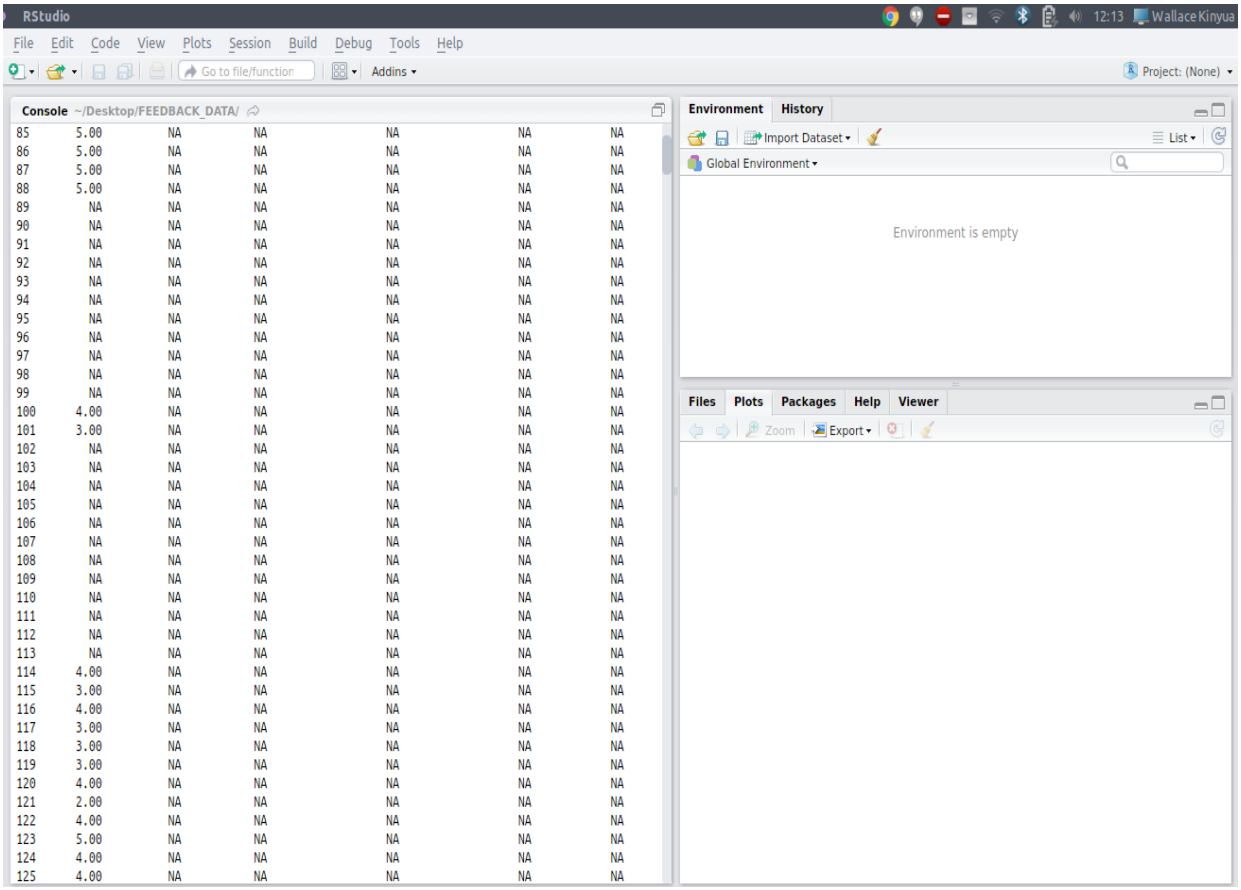


Figure 26 : Historical feedback import in R

Data De-duplication

In this stage I removed all the duplicate entries. First it was noted that there could be multiple entries for some attributes e.g. faculty would appear more than once since they taught multiple times therefore for a record to be considered a duplicate we had to consider the following combination of attributes;

- Faculty name, course, group, month and year.

All entries that had multiple records, the next entry was deleted as a duplicate. In R this was done using the *unique()* function whereas passing the columns to be considered in this.

Data Standardization
I then renamed the columns so as to ensure compatibility with the syntax of PHP which was going to be used in importing using the *colnames()* function. The columns were renamed as indicated in the appendix section of this report.

In addition to this, I removed all the empty columns which as observed had actually contributed to the growth of the document using a combination of R *filter()* function.

Data Normalization
The columns were then mapped into tables following the following steps illustrated in the figure below;

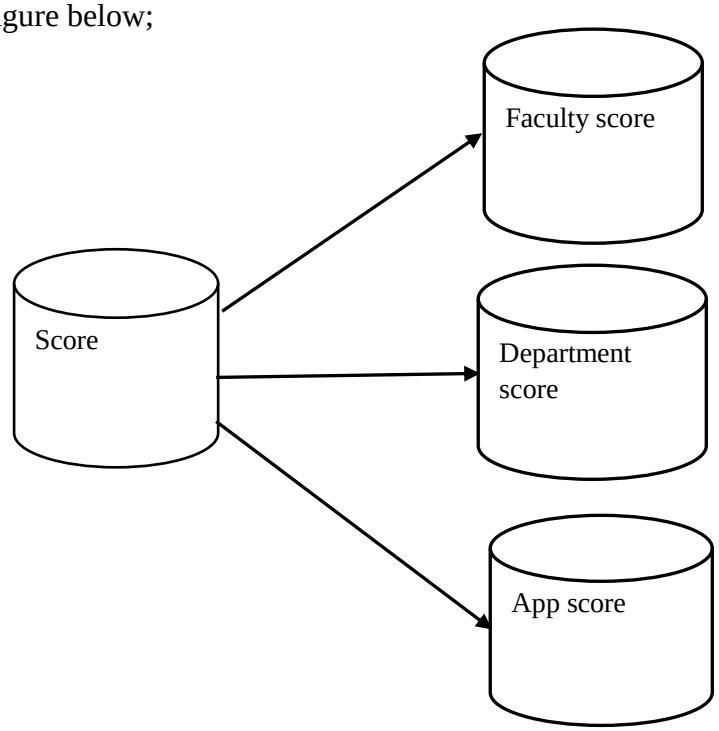


Figure 27 : Mapping of the data into the implemented database

In this stage, the data was not actually imported to the database, however just a conceptual mapping was done since the database had already been designed and it was just ensuring that the data "fit" into the tables in a way that would allow reporting.

Quality Check
In this last stage I walked through the above stages of data cleansing to ensure that I performed all the steps accurately.

The next step done with regards to the historical feedback was to file size reduction in which the cleansed data was split into a number files named "*score[number].csv*" of less than two megabytes in size so that they would be importable since the development machine was limited in computing power and would take a long time for large file sizes given the computation to be carried out. This was done using the *sed* stream editor via the terminal in Ubuntu Linux for every 4000 lines.

The final step is that I implemented a script using PHP to import the script in bulk from the csv files into the database. The sample code for the import function can be found in the appendix of this report.

In addition to this, I implemented a frontend way to allow import of any other forms of feedback that may be collected in a manual way e.g. from other sources other than class set up. The figure below shows the import function just before execution.

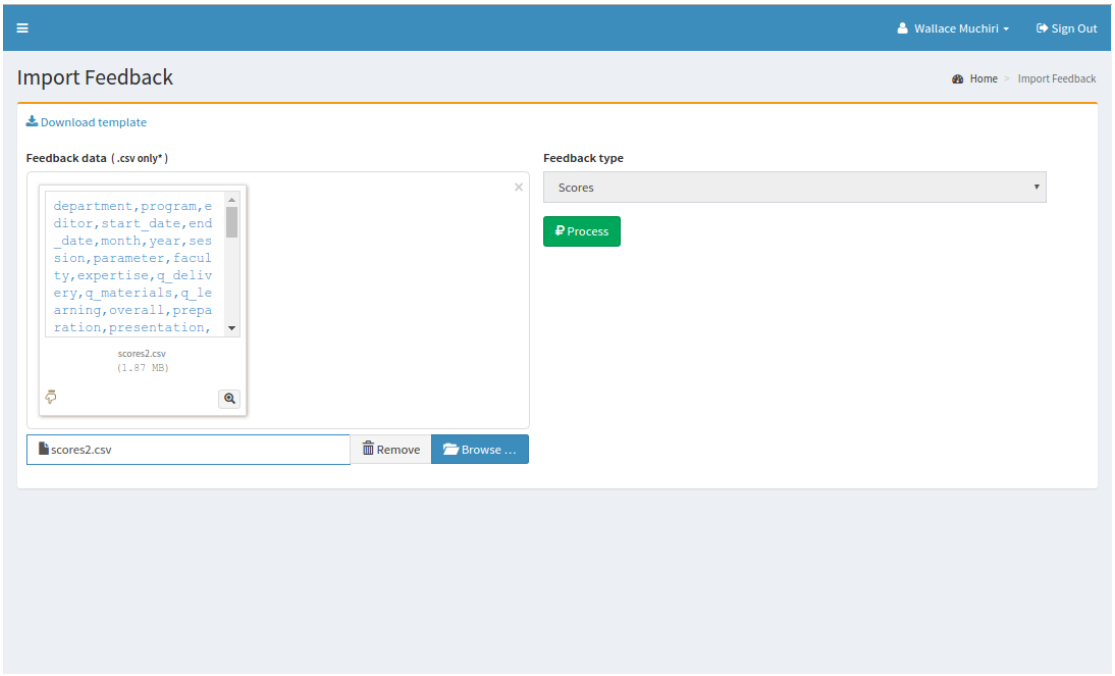


Figure 28 : IFAS front-end import implementation

5.1.4 Graphical user interface

The graphical user interface was designed using HTML and CSS specifically using the bootstrap framework. I used the blade template engine that is bundled in the PHP laravel framework so that I had only one master template and the rest of the pages inherited from it hence allowing me to reuse design components and minimize redundancy.

The figures below showing the login, landing and dashboard page displaying the general UX/UI design layout concept used and as evidence of the design of the interface.

The login page

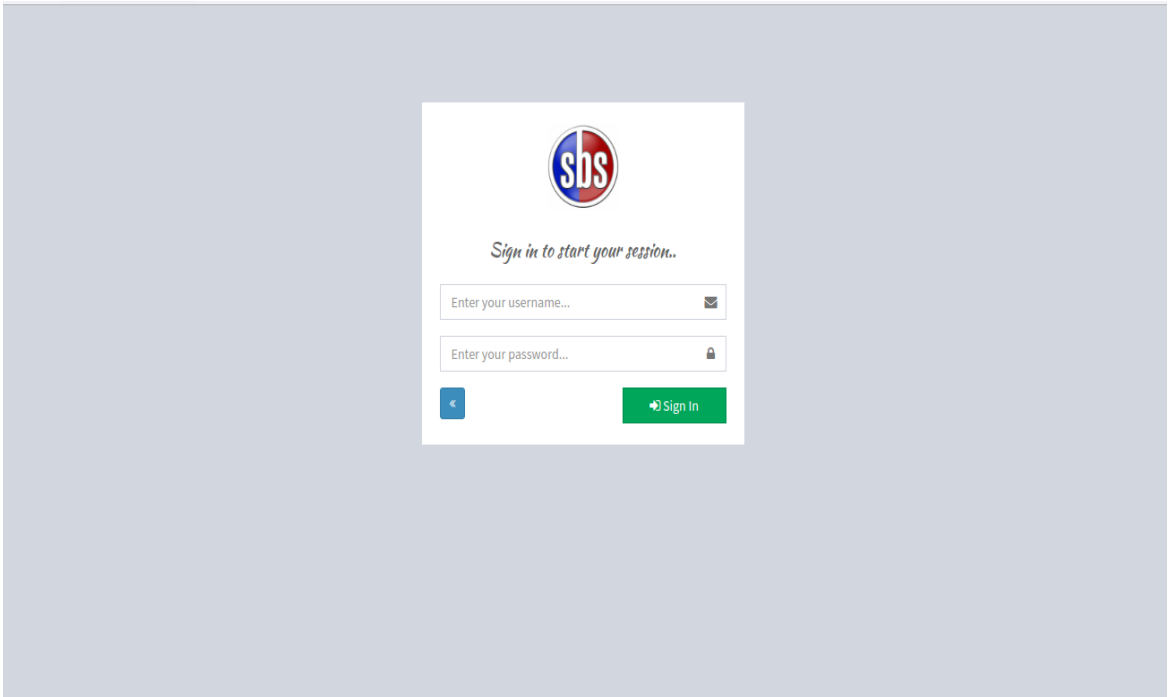


Figure 29 : Implemented login form

The landing page

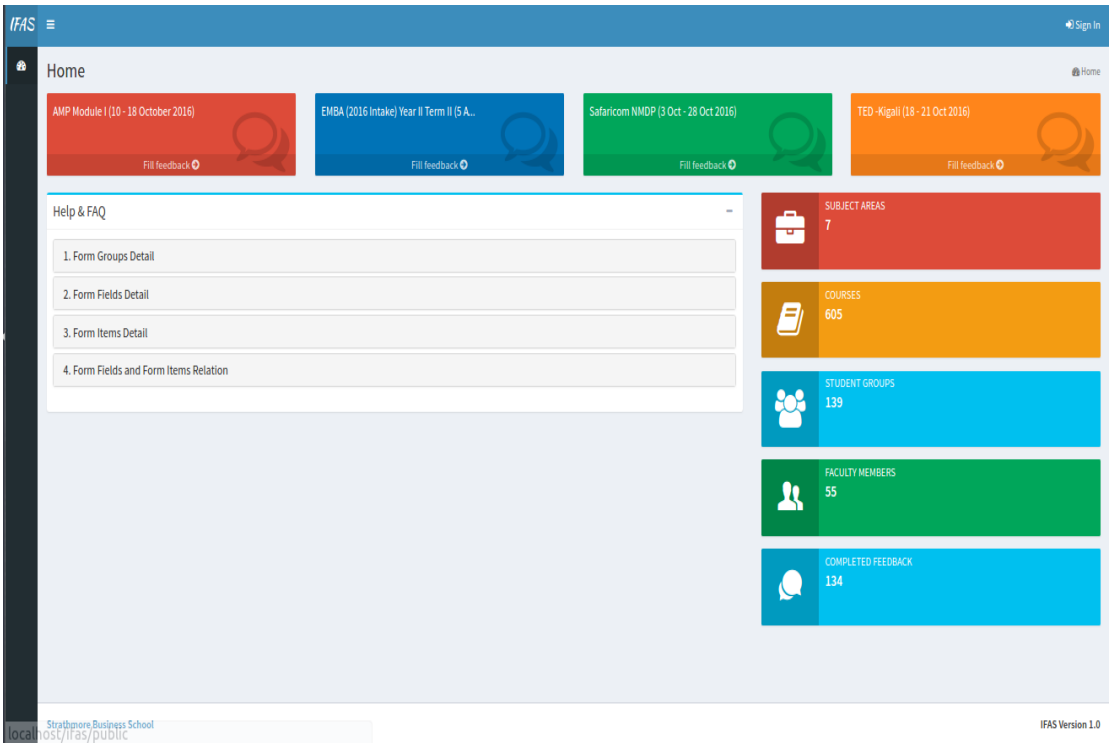


Figure 30 : Implemented landing page before login

Dashboard page

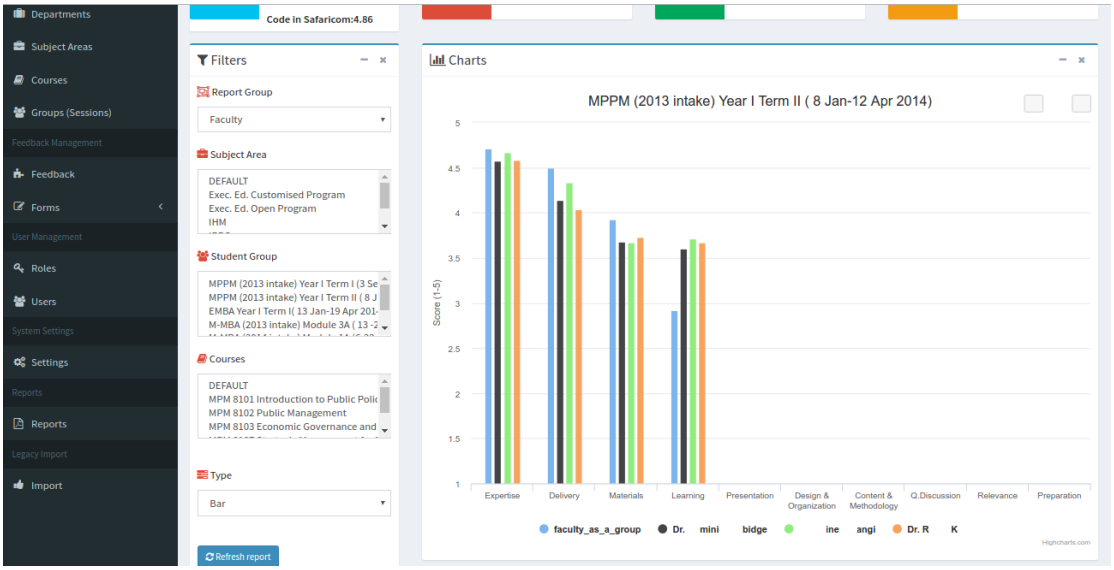


Figure 31 : Implemented dashboard page on login

5.1.5 Feedback capture

The feedback capture is composed of all the components required to facilitate the entry of feedback from a participant into the system. The implementation is done in modules as indicated below.

Users module

This is for the management of the users in the system together with the roles and permissions that are assigned to them. The roles are mapped to all the stakeholders i.e. there is a program manager role, administrator, program director and so forth with each of them having various access levels and views.

Users belong to a given department e.g. Quality assurance and this has been implemented likewise. The figure below shows a dummy user being added.

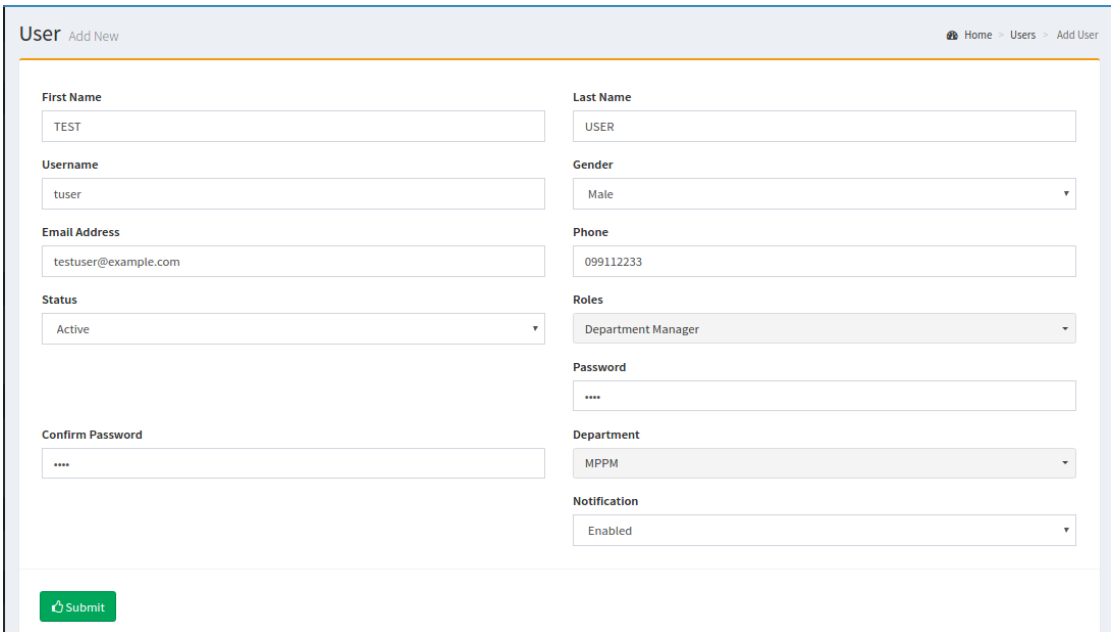


Figure 32 : Implemented user module – adding user

Course module

The implementation of the course module has been done as is such that a student group is usually enrolled in a certain course which belongs to a subject area.

Both subject areas and courses can be added separately and later the student group is enrolled in to that course.

This module therefore takes into consideration the student module as once who are represented in the system by the student group.

The figure below shows a dummy addition of a student group.

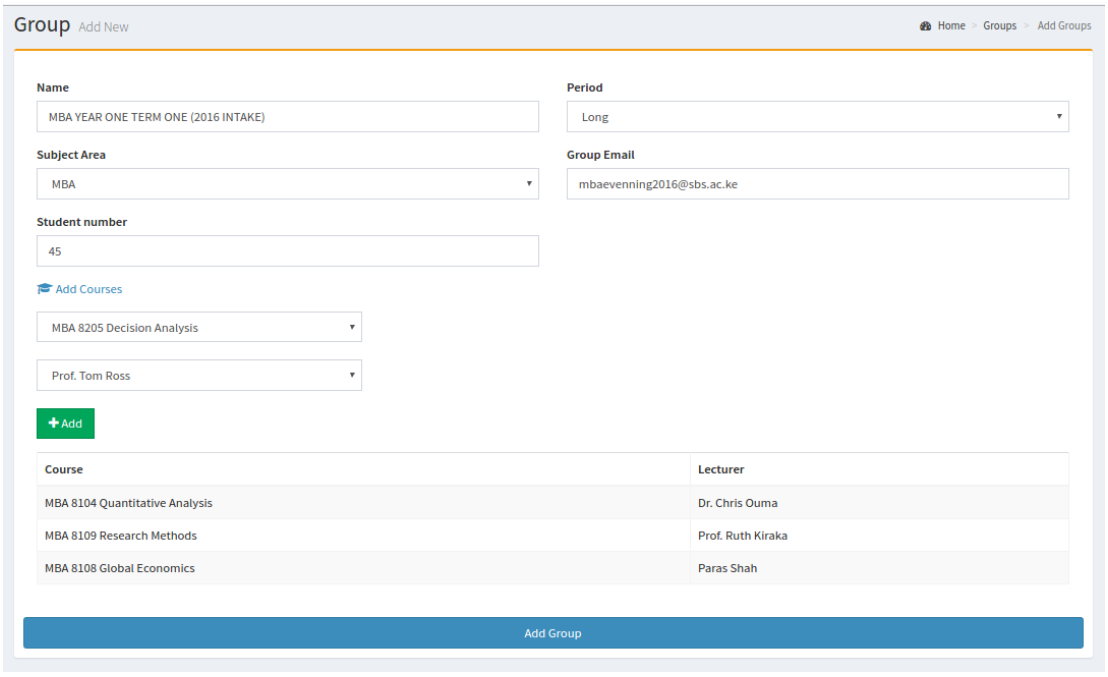


Figure 33 : Implemented group module – adding group

Settings module

This holds the IFAS global settings, implementation of this was done as shown below.

Feedback module

The feedback module is where all the earlier mentioned modules come together. A given feedback has a form, the form group which has form fields which has form items. This was implemented as shown in the figure below of a dummy feedback add with all its components.

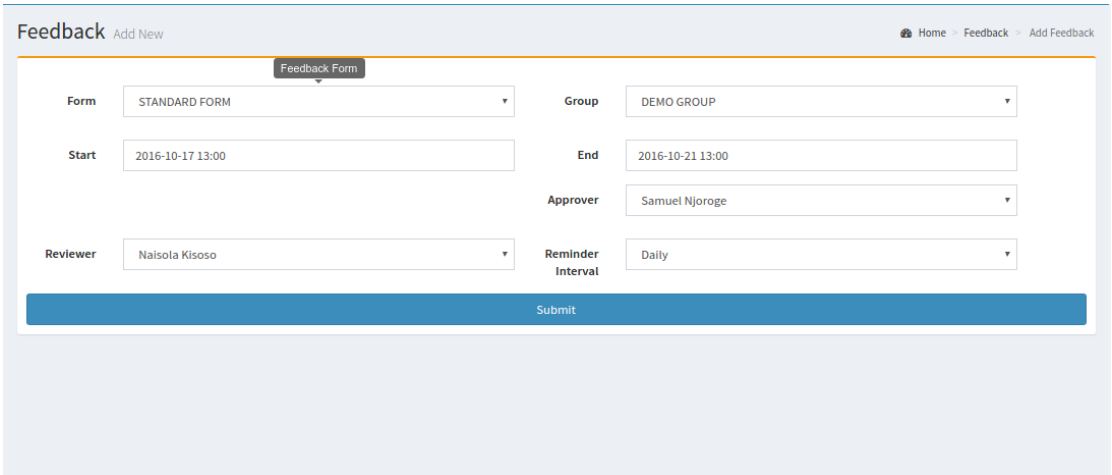


Figure 34 : Implemented feedback module – adding feedback

Notification module

This is responsible for communicating with the user when new feedback is available (on add), feedback reminders as configured and sending of departmental reports once feedback has been approved by the program director.

The figure below shows a sample notification sent to a student group prompting them to fill their feedback form.

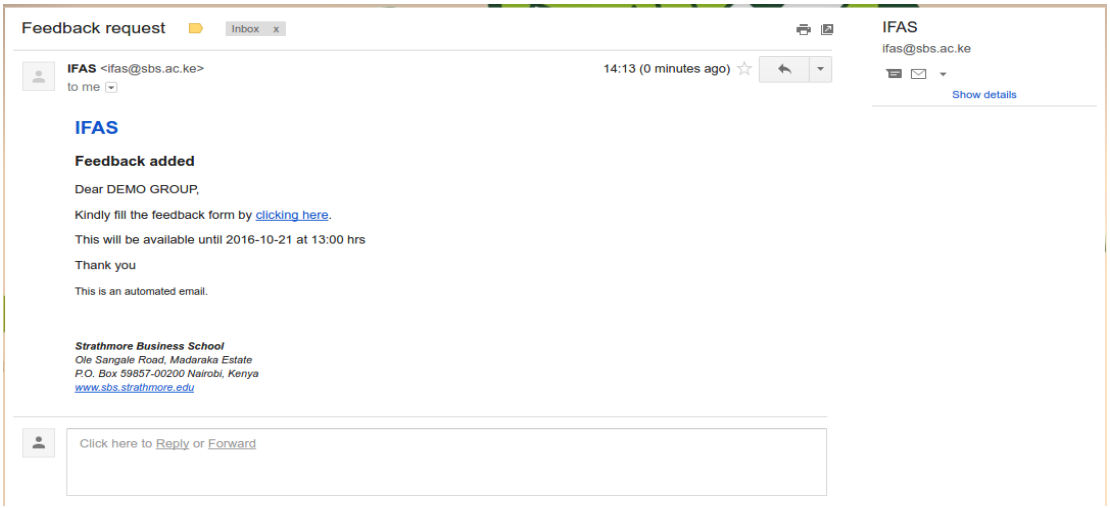


Figure 35 : Implemented notifications module – feedback fill request email

5.1.6 Analytics engine

The analytics are divided into three parts;

The summary graphs; this is composed of the charts that are generated from the application of various filters as provided on the systems which are dynamic in that they change depending on the chart type selected. Below is a figure showing the graph and the report view;

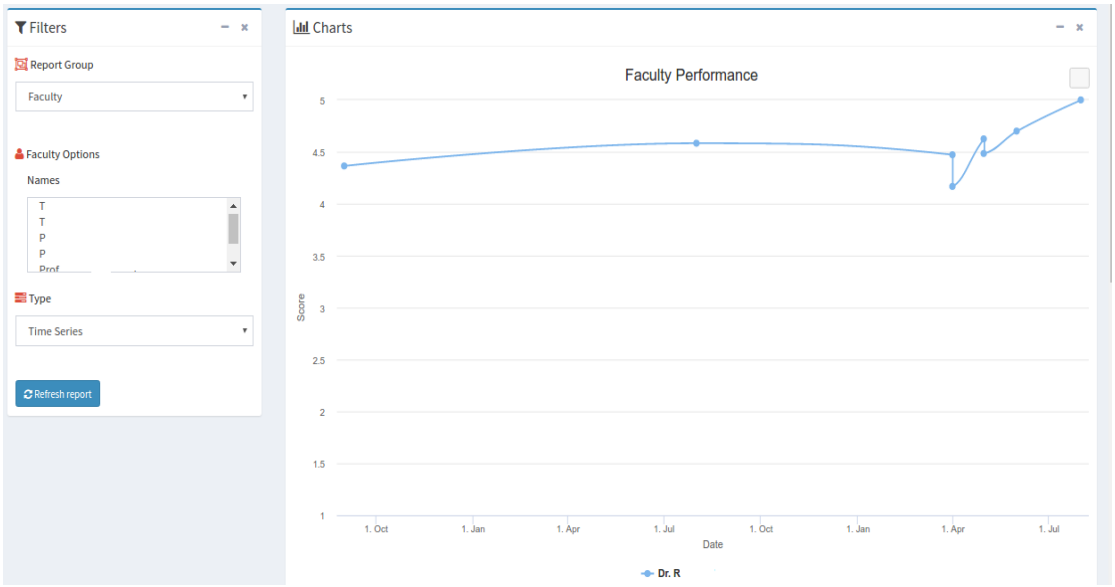


Figure 36 : Implemented dashboard graph – time series

Summary analysis

The summary analysis provides the best performances for faculty, course, department and quality / performance.

The top course, top faculty, best department are the best average scores respectively, however for the most satisfied group, it is important to note that the use of the term satisfaction is simply as a hint to the quality of the ratings given, higher ratings imply better satisfaction, if a tie exists in the averages, we calculate the coefficient of variance to find out the variability, the one with the least is then picked as the most satisfied student group.

Below is a figure showing the implementation.

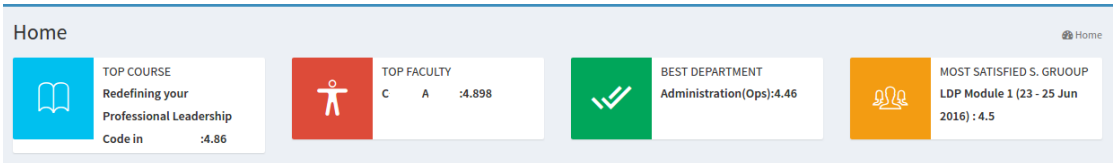


Figure 37 : Implemented summary statistics

Reports

The system also provides a way of downloading on-demand reports for faculty, departmental and ICT performance. This reports are downloadable as either in various

formats as configured in the system. This is also on the dashboard page as shown in the figure below;

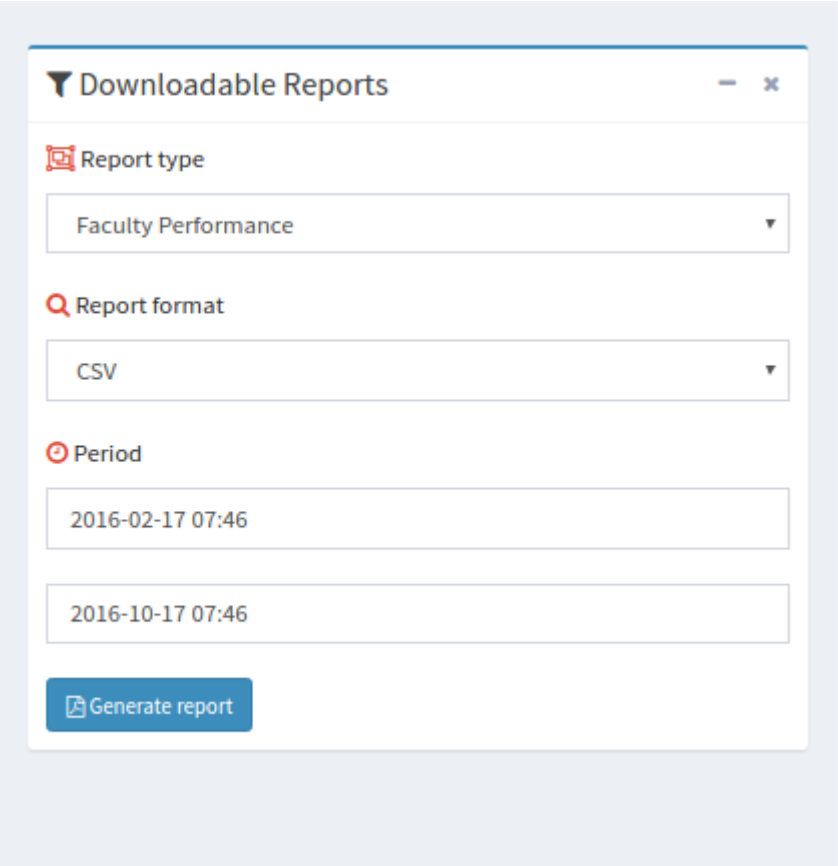


Figure 38 : Implemented downloadable reports

5.1.7 System testing

Once development was complete, I tested the system as shown by the results below;

5.1.7.1 Component / unit testing

Component / unit	**Purpose**	**Test Data**	**Expected results**	**Actual results**
Users	Add users	Sample user data	User added	User added
	Assign users to roles or department	Sample user data	User assigned to role / department	User assigned to role / department
	Error handling	Invalid email	Reject entry	Entry reelected
Course	Update course	Sample course data	Course data updated	Course data updated
	Error handling	Missing values	Reject entry with error	Entry rejected with error

			message	message
Settings	Update settings	Sample settings data	Update settings	Update settings
	Allow special character for description	Sample data with special characters	Settings saved with special chars	Settings saved with special chars
	Error handling	Missing values	Reject entry with message	Entry rejected with message
Feedback	Update feedback	Sample feedback data	Update feedback	Feedback updated
	Feedback auto close	Sample feedback data	Remove past feedback from view	Past feedback not present in view
	Feedback allow only one fill per participant	Sample student entry	Feedback can be filled more than once	Feedback fillable more than once.
	Error handling	Missing values	Reject entry	Entry rejected
	Ability to create custom form	Sample form data	Sample custom form	Form created but not viewable.
Notification	Send notification	Feedback added	Send notification to group	Notification sent to group
Dashboard	Analytics on dashboard	Demo user account	Login and see dashboard	Dashboard accessed successfully
	Role based access	Demo users with different roles	Dashboard should have different access levels	Dashboard has different access levels.
Downloadable reports	Ensure downloadable document is accessible	-	Document can be opened.	Document is viewable in third party software.

Table 1 : System testing results

5.1.8 System Deployment

Once testing was complete, the IFAS was deployed to a closed number of users primarily for evaluation of the final product of this research. The user training was done on an individual level to familiarize the target users with the system.

5.1.9 System Evaluation

The closed user group to which the IFAS was deployed were then used in the evaluation of the system. The questionnaire used in evaluation is attached in the appendix section of this report.

The closed user group that evaluated the system consisted of the following;

DESIGNATION	FREQUENCY	PERCENTAGE (nearest 10)
Director	1	20
Middle level manager	3	30
Administrators	5	50
Total	**9**	**100**

The summary results of the evaluation are as shown below;

ITEM		AVERAGE SCORE (1-5)	PERCENTAGE (%)
Efficiency	It helps me analyze data faster and effectively.	4.33	86.6
	It saves me time when I use it.	4.67	93.4
	It helps me collect data faster and effectively.	4.89	97.8
	The analysis done is sufficient.	3.78	75.6
Total		**4.42**	**88.4**
Ease of Use	It is easy to use.	4.89	97.8

	It is user friendly.	4.89	97.8
		AVERAGE SCORE (1-5)	**PERCENTAGE (%)**
	It is responsive (can be used on small screens)	4.78	95.6
	I like the design (colors and layout)	4.89	97.8
	I have gotten none or few errors using it.	4.67	93.4
Total		**4.82**	**96.5**
Ease of Learning	I learned to use it quickly.	4.11	82.2
	The layout makes sense.	4.89	97.8
	There is consistency in the design.	4	80
Total		**4.33**	**86.67**
Satisfaction	It meets my expectations.	4.22	84.4
	I will be willing to use it again.	4.89	97.8
	I am content with it as designed.	3.89	77.8
	The results are accurate.	4.22	84.4

	AVERAGE SCORE (1-5)	PERCENTAGE (%)
I would recommend it to other departments to use it.	4.78	95.6
I am content with the entire experience of using it.	4.22	84.4
Total	**4.37**	**87.4**
FINAL	**4.48**	**89.7**

Table 2 : System evaluation results

The above evaluation results show that the IFAS was usable and accepted by the sampled users from the various departments hence the successful accomplishment of the project as r as the scope of this research is concerned. However, there were some issues raised during the evaluation process which are addressed in the chapter on recommendations.

5.2 Results

5.2.1 Efficient feedback process

This research has seen the successful inquiry into what consists a good feedback process i.e. the various elements that need to be considered in such a system and contextualized this to meet the needs of SBS by way of optimizing the current process.

5.2.2 Functionality of the prototype

The new process developed largely depends on the IFAS for automation of the former manual processes. The prototype was implemented successfully to allow the capture of feedback from participants and analysis of the same by the various users that have rights to the system.

In addition to this, the aspect of business intelligence has been brought into fruition by the fact that the generated reports can be used to make decision e.g. faculty training needs based on performance, promotion decision among others since the analysis is availed for a large period hence richness in value.

The achieved functionalities of the prototype visa vi the requirements list are as outlined below;

Requirement	Prototype	Comment
Creation of feedback forms	Implemented	-
Role based access	Implemented	-
Notifications	Implemented	-
Dashboard	Implemented	-
Tracking of feedback action points.	Partially implemented	Scope creep
Aesthetic appeal (responsivity)	Implemented	-
Real time feedback submission response	Not implemented	Scope creep
Response mechanism of action points to the participants.	Not implemented	The participants exist as a group as per the design of the system therefore this was omitted to be dealt with as a future work.

Table 3 : Comparison of the prototype implemented features to requirements.

5.2.3 Comments by users

The system evaluation brought wonderful insights into how the system was perceived by the users as was reported. The thing that was most valuable to the users was the ability to see a trend for a given report e.g. faculty. In addition to this, there was an appreciation of the emphasis given on user feedback as integral to the growth of the business school and that the IFAS would play an important role not only in SBS but also in the university at large.

In conclusion, there was an air optimism and excitement at the potential of a much more advanced IFAS from what was achieved in the scope of this project.

5.3 Discussion

The goal of this research has been met in all the four objectives as outlined.

The first objective was to carry out a comprehensive analysis of the current feedback process at the Strathmore business school in consultation with all the stakeholders

with an aim of identifying the needs in line with the proposed system. This was successfully done as the results are seen in the output of the analysis stage as a list of concise system requirements for the IFAS as fits to the needs of SBS.

It is important to note that the over 60% of the solutions surveyed in the literature review focused on the feedback to the student/ participant in terms of their assessment, very few of the active solutions focus on getting feedback from the student as a way of continuously improving the services that are offered to the participants hence a gap was identified. In addition to this, there was close to no system that we found that was open for study in terms of all the features hence the inability to ascertain if there is the use of functional feedback systems that are used in decision making in IHL.

Secondly, was to design the integrated feedback analysis system (IFAS) based on the requirements gathered to provide an organizational dashboard. This was successfully using the procedure laid out in the methodology with keen interest also on incorporating historical feedback into the system for better quality reports. This designed focused on all the aspects from the capture of the feedback to the analysis and dissemination of the results.

In addition to this, the designs were translated into a working prototype which was tested to verify various functionality as indicated in the requirements list. Furthermore, it was deployed to a closed number of users who were among the stakeholders identified in pilot mode. During this time a simple one on one training was conducted with each of the to familiarize them with the various functions of the system in readiness for usage.

Finally, was to carry out an evaluation of the system acceptance and usability by the SBS team. This was done by way of a questionnaire which was developed as guided by the factors that need to be considered when performing a system evaluation as outlined in my literature review. The results were a remarkable success from all the individuals sampled showing that the project was successful in its attempt to solve a real-life problem at SBS.

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

There is tremendous power in feedback, IHL can benefit in very profitable ways if they began to take feedback from their student as seriously as they want the feedback they give their students to be taken seriously not only at an institutional level but also a personal one especially for the persons who directly interact with the participant in their day to day routine.

In terms of efficiency IFAS scored 88.4% which clearly indicates that the system aided the routine work of majority of the users who would not have to waste time as compared to the earlier performing tasks that could be done by the system as aided by the feedback process. This was also key since the analysis given by the system was beneficial to the users depending on the level at which each user was at. This score was also as a result of the time series analysis which everyone thought was fantastic as far as words can go and the fact that you could also have this data on-demand on a role-based access.

More to this is that the users found IFAS usable, with a score of 96.5% owing largely to the time invested in the design of the user interface, this is important especially for participants whom it was required to make provision for them to fill the feedback from multiple devices hence the design had to be responsive as well as attractive and this was achieved.

In terms of satisfaction which a score 84.4%, this being the lowest was influenced by the fact that some users felt that the system could do more (scope creep) in terms of more dynamic analysis. This was clearly seen with the questionnaire item “The analysis done was sufficient” and “I am content with it as designed” having a score of 75.6% and 77.8% respectively. However, the was general satisfaction in the use and also the urge to recommend the same to the other departments that were not part of the pilot.

The overall score of 89.7% as far as the overall project is concerned is a success in that it shows that the provision of analytics for decision making is valued at SBS therefore I can generalize this to IHL in that there should be investments made to ensure that not only the process of feedback is streamlined as per suggestion made in this report but also that there exists a system that brings to life this process as per the need of each of the IHL.

The above accomplishments have shown that the capture of feedback is indeed needed for IHL in an attempt to improve service delivery to their students. In addition to this, the automation of this feedback process is highly beneficial and strategic from a business point of view since administrators can concentrate their efforts on other more important things that administering of feedback forms and digitizing the same. Furthermore, the top-level management can make decisions from the analysis given by the system for example of the training need of faculty based on their trend in terms of performance, weak departments or staff can also get training as informed by the IFAS.

6.2 Recommendations for future work

Sentiment Analysis; the feedback has free text components that can be automatically analyzed by the application of machine learning algorithms to give an even more richer analysis of student feedback. This was something that the operations and administration director was keen to request for as the system evaluation was being conducted.

In addition to this as the word “integrated” connotes, there should be an automatic feed from social media which would lead to an even wider range of feedback which is beneficial as far as analysis goes, this is as inspired by the culture nowadays where the social media platforms have evolved into being used as a form of marketing tool.

6.3 Challenges

The major challenges that was faced during this research are as follows;

- The lack of “open” existing project that I could analyze especially in IHL as I enquired into what consists in a good feedback system.
- Scope creep was also a challenge as I carried out the analysis and design, new features that seemed mission critical came up and thus some of the things even though stated in the requirements of the IFAS could not be implemented due to time constraints.
- There were also gaps in the historical feedback data that I received thus leading to lower quality reports in certain areas mainly by way of missing / empty results returned.

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APPENDIX

Appendix 1 – Requirements gathering interview questions

Interview questions

Quality Assurance Department

1. What are the current challenges you face in the feedback process?
2. What solutions have been suggested / effected to solve this challenges?
3. What would you like to see in the ideal feedback management system?
4. What is really valuable for the participant as the respondent of the feedback?
5. What bottlenecks exist in the current feedback process and what suggestions can you propose to mitigate the same?
6. What is your service charter with regard to student feedback?

Program Administrator / Manager / Director

1. What would you like improved in the management of feedback at SBS?
2. What, in your years of experience is most important aspect of feedback to the participant?
3. What would you like to see in the ideal feedback management system?
4. How do you communicate the progress / status of the feedback issues raised to the participants? Do proper channels exist for feedback of feedback?
5. Are you satisfied with the current feedback analysis?
6. What is the one thing that you should be improved in the process?
7. What bottlenecks exist in the current feedback process and what suggestions can you propose to mitigate the same?
8. What is your service charter with regard to student feedback?

Participant

1. Do you feel that your feedback is taken seriously? Why?
2. What would you like done to engage you more in the feedback cycle?
3. Do you get feedback of feedback concerning the issues raised in class?
4. What would you like improved in the feedback process?
5. Would you be comfortable filling the feedback on your phone / laptop / tablet as opposed to a hard copy form? Why?
6. Please elaborate what would consist acceptable feedback time of a normal issue according to you?
7. What is satisfaction to you when it comes to the feedback you give i.e. when would you say you are satisfied and happy?

Appendix 2 - Sample feedback summary

FACULTY EVALUATION

Program name: PROGRAM NAME

Date: 3rd - 4th September, 2015

Venue: SBS

No. of participants: 21

Name of faculty: Overall

INDIVIDUAL FEEDBACK

Key	Rating
Unsatisfactory	1
Satisfactory	2
Good	3
Very good	4
Excellent	5

Faculty members as a group.

	(X/5) Individual Faculty Score	(%) Individual faculty Score
Faculty expertise	4.82	96
Quality of delivery	4.82	96
Quality of materials	4.82	96
Extent of your learning	4.82	96
Overall faculty evaluation	4.82	96
Average scores	**4.82**	**96**

Comments and suggestion

- Great.
- Well versed Lectures.
- Good and shared before the classes.
- An eye opener, can't wait for second module.
- Excellent.

LECTURER NAME: Understanding your Personal Leadership Code

	(X/5) Individual Faculty Score	(%) Individual faculty Score	(X/5) Overall Faculty average	(%) Overall Faculty Average
Faculty's Degree of preparation for the sessions	4.86	97	4.85	97
Faculty's Presentation of course material	4.86	97	4.82	96
Content and methodology	4.90	98	4.80	96
Quality of discussions	4.81	96	4.74	95
Were the key objectives of the session met	4.86	97	4.78	96
The information presented in the course was relevant to my work	4.86	97	4.81	96
Average scores	**4.86**	**97**	**4.80**	**96**

Comments and suggestion.

- Presentation of content using the case studies and exercises e.g. writing about your past regrets and the things to do before one dies were a good reality check.
- brought out the real aspects that related to personal, social and professional life and how they are all related.
- Great reminder on simple ways of raising the bar on my personal code.

Overall Evaluation

	Average marks	Percent
How would you evaluate the program's course design and content?	4.81	96
How would you evaluate the program?	4.81	96
Average scores	**4.81**	**96**

Comments and suggestions

How would you evaluate the program's course design and content?

- This is a great initiative, great learnings, came at the most important time in my career and life.

- The program is well designed deep and thought out. The cases really reflect our work environment.
- Excellent. Being the first of king it was wow.

How would you evaluate the program?

- Excellent and relevant.
- There should have been more time to the program. So much learnt in such a short time. So much to work on outside this session.
- I loved it! Keep up the good work.
- Very practical.

Which areas in this module do you find most practical?

- Leadership code (Spiritual, Emotional, Social etc.)- Will directly impact me as a leader. Activities that helped facing the past and prioritizing to the future.
- Leadership code. Areas/ Circle of influence.

What topic would you recommend to be expanded/improved upon/included in/ excluded from the module?

- More time on the emotional intelligence. The examples are too many questions.
- I loved it all.

Programme administration/social activities/Accommodation/Facilities

	Average marks	Percent
General administration	4.80	96
Administrative staff	4.80	96
Quality of coffee/tea/lunch	4.67	93
Security	4.80	96
Average scores	**4.77**	**95**

Comments and suggestions

- Snacks are great. Lunch is not.

- Fantastic Delivery. Could we next part have some practical sessions that can help us practice what we have learnt in safe environment. These are general comments not for Patricia.

SUBMITTED THROUGH:

NAME: DIRECTORS NAME

TITLE: DIRECTOR – EXECUTIVE EDUCATION

SIGN: 

DATE: **14TH SEPTEMBER, 2015**

Appendix 3 - Sample daily feedback form

Daily Evaluation Form

Advanced Management Program Module III (17th Sep 2015)

* Required

Individual faculty members

Please evaluate the overall quality of instruction provided by the course faculty. This question relates to teaching ability and in class performance. Please evaluate using this scale (1-Unsatisfactory, 2-Satisfactory, 3-Good, 4-Very good, 5-Excellent)

Prof. A **Lean & Agile Operations - Lego game** *

	1	2	3	4	5
1. Punctuality (commencement and completion of sessions)	○	○	○	○	○
2.Clarity of presentation of concepts, course material, content and use of practical examples.	○	○	○	○	○
3.Degree of preparation for the session (s)	○	○	○	○	○
4.. Course design and organization	○	○	○	○	○
5.Content and methodology	○	○	○	○	○
6. Quality of discussions	○	○	○	○	○
7. The					

information presented in the course was relevant to my work					

Further Comments

Prof. A Lego game debrief *

	1	2	3	4	5
1. Punctuality (commencement and completion of sessions)					
2.Clarity of presentation of concepts, course material, content and use of practical examples.					
3.Degree of preparation for the session (s)					
4.. Course design and organization					
5.Content and methodology					
6. Quality of discussions					
7. The information presented in the course was relevant to my work					

Further Comments

Participant details

Name

Title/ Job

Institution/

May we use your comments & photographs as quotations in brochures?

- [ ] Yes
- [ ] N

Submit

100% You made

Appendix 4 – Sample data from consolidated excel document

No.	Department	Program	Editor	Sheet no.	
1	IPPG	MPPM (2013 intake) Year I Term I (3 Sep -10 Dec 2013)		1	
2	IPPG	MPPM (2013 intake) Year I Term I (3 Sep -10 Dec 2013)		2	
3	IPPG	MPPM (2013 intake) Year I Term I (3 Sep -10 Dec 2013)		3	
4	IPPG	MPPM (2013 intake) Year I Term I (3 Sep -10 Dec 2013)		4	
5	IPPG	MPPM (2013 intake) Year I Term I (3 Sep -10 Dec 2013)		5	
6	IPPG	MPPM (2013 intake) Year I Term I (3 Sep -10 Dec 2013)		6	
7	IPPG	MPPM (2013 intake) Year I Term I (3 Sep -10 Dec 2013)		7	
8	IPPG	MPPM (2013 intake) Year I Term I (3 Sep -10 Dec 2013)		8	
9	IPPG	MPPM (2013 intake) Year I Term I (3 Sep -10 Dec 2013)		9	
10	IPPG	MPPM (2013 intake) Year I Term I (3 Sep -10 Dec 2013)		10	
11	IPPG	MPPM (2013 intake) Year I Term I (3 Sep -10 Dec 2013)		11	
12	IPPG	MPPM (2013 intake) Year I Term I (3 Sep -10 Dec 2013)		1	
13	IPPG	MPPM (2013 intake) Year I Term I (3 Sep -10 Dec 2013)		2	
14	IPPG	MPPM (2013 intake) Year I Term I (3 Sep -10 Dec 2013)		3	
15	IPPG	MPPM (2013 intake) Year I Term I (3 Sep -10 Dec 2013)		4	
16	IPPG	MPPM (2013 intake) Year I Term I (3 Sep -10 Dec 2013)		5	
17	IPPG	MPPM (2013 intake) Year I Term I (3 Sep -10 Dec 2013)		6	
18	IPPG	MPPM (2013 intake) Year I Term I (3 Sep -10 Dec 2013)		7	
19	IPPG	MPPM (2013 intake) Year I Term I (3 Sep -10 Dec 2013)		8	
20	IPPG	MPPM (2013 intake) Year I Term I (3 Sep -10 Dec 2013)		9	
21	IPPG	MPPM (2013 intake) Year I Term I (3 Sep -10 Dec 2013)		10	
22	IPPG	MPPM (2013 intake) Year I Term I (3 Sep -10 Dec 2013)		11	
23	IPPG	MPPM (2013 intake) Year I Term I (3 Sep -10 Dec 2013)		1	
24	IPPG	MPPM (2013 intake) Year I Term I (3 Sep -10 Dec 2013)		2	

Appendix 5 - Feedback request letter

1st June 2016.

Mr. Gichure,
Manager, ICT
Strathmore Business School.

Dear Mr. Gichure:

I request for the historical feedback data collected from our participants as at June 2016 for the purpose of implementing the integrated feedback system. This data will be used in testing the analytics functionality of the system which i'm developing as a requirement for the conferment of the degree I'm pursuing at the University on Nairobi.

I will ensure that confidentiality is adhered to seeing the nature of the data. Kindly consider my request.

Yours Sincerely,

Kinyua Wallace Muchiri.

I Michael Gichure hereby accept the following request as signed below.

Signature & Stamp

Strathmore Business School

Date

August 2016

Appendix 6 - Column renaming in R

Column name	New Column name
Department	department
Program	program
Start date	editor
End date	start_date
Month	end_date
Year	month
Variable 1	year
Session	session
Evaluation parameter	parameter
Faculty type	faculty
Faculty expertise	expertise
Quality of delivery	q_delivery
Quality of materials	q_materials
Extent of your learning	q_learning
Overall individual faculty evaluation	overall
Degree of preparation for the sessions	preparation
Presentation of course materials	presentation
Course design and organization	design_organization
Content and methodology	content_methodology
Quality of discussions	q_discussions
The information presented was relevant to my work	q_relevance
Evaluation of the program by course design and content	c_design_content
Overall program evaluation	c_overall
Punctuality	punctuality
Availability of materials-at SBS app	app_availability
Quality of materials uploaded-at SBS app	app_quality
Usability(Ease of Use)-of SBS app	app_usability
Reliability of app	app_reliability
Responsive-of sbs app	app_responsivenness
Quality of course work, assignments, syndicate work, etc.	c_quality_materials
General Administration	general
Administrative Staff	staff
Response to feedback	feedback_response
Quality of meals	meals
Security and other facilities	security
Library services	library
IT Support	it

Appendix 7 - Sample Code

```
public function _initImport(){
    ini_set('max_execution_time',0);
    ini_set('memory_limit',-1);

    for ( $i = 1; $i < 6; $i++ ){

      $filePath = app_path('resources/scores'.$i.'.csv');

      Excel::load($filePath, function($reader) {

        // Getting all results
        $results = $reader->get()->groupBy('program');

        foreach (  $results  as $program_feedback ){

          $respondent = User::getUserByUsername('cmutisya');//set to CMutisya (QA Team).
          $department = $program_feedback[0]['department'];
          $group = $program_feedback[0]['program'];
          $year = $program_feedback[0]['year'];
          $month = $program_feedback[0]['month'];

          $subject_area_id = SArea::getOrSave($department);
          $department_id = Department::getOrSave($department);
          $group_id = Group::getOrSave($group,$subject_area_id);
          $score_id = Score::saveScore($department_id,$group_id,$respondent,$year,$month);

          foreach( $program_feedback as $row ){.....[clipped]
```

Appendix 8 - System evaluation questionnaire

This questionnaire seeks to assess the usability and acceptance of Integrated Feedback Analysis System (IFAS). Please evaluate using this scale (1-Unsatisfactory, 2-Satisfactory, 3-Good, 4-Very good, 5-Excellent)

		1	2	3	4	5
Efficiency	It helps me analyze data faster and effectively.					
	It saves me time when I use it.					
	It helps me collect data faster and effectively.					
	The analysis done is sufficient.					
Ease of Use	It is easy to use.					
	It is user friendly.					
	It is responsive (can be used on small screens)					
	I like the design (colors and layout)					
	I have gotten none or few errors using it.					
Ease of Learning	I learned to use it quickly.					
	The layout makes sense.					
	There is consistency in the design.					
Satisfaction	It meets my expectations.					
	I will be willing to use it again.					
	I am content with it as designed.					
	The results are accurate.					