

Research-informed design: learning to balance the books

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Abstract

There is a great shortage of some professionals like chartered accountants, while the standards of the professional body are relentless in denying the unsuitably qualified. Low pass rates in the first year challenge Higher Education's eventual delivery of adequate numbers of candidates in order to balance the book of supply and demand.

In this paper we outline the results of the research that informed the design and piloting of new teaching initiatives in Financial Accounting, the rationale and instructional design principles behind them, and briefly describe the approaches aimed at increasing the success of first-year students.

At the end of 2010, the Department of Financial Accounting sought to uncover the reasons for the unacceptable attrition levels in the first year. Research entailed semi-structured focus-group interviews with students across all levels of achievement. Students also completed a questionnaire consisting of both open-ended and structured questions. The results of this mixed-method investigation were triangulated with a larger longitudinal study of student expectations and experiences in the Faculty.

One of the most salient findings was that students had unrealistic perceptions of the subject. What they learnt at school did not prepare them to think wider and to solve problems. Students eschewed the lecturers' recommended approaches to solving problems because of ill-perceived expertise (based on high marks at school). Students also underestimated the importance of studying the theory of accounting before attempting solutions. The findings of this research provided the second research question that called for learning innovations to address those. The lecturers therefore provided a wish-list that constituted the third research question, namely how to design and implement in a learning management system the required educational innovations.

Some of the initiatives that were designed primarily for implementation in the learning management system (LMS) are

- a clickable mind-map of all the courses in the 4 years of study, explaining how they articulate horizontally and with the next academic level
- a scrolling banner and pop-up windows reminding students to study their theory before attempting problem-solving
- online glossaries of terms explaining subject terminology in lay language
- a weekly multiple choice test with explanatory feed-back
- online tutoring questions-solving in the Discussions.

Implementation of the newly designed Accounting pilot course is taking place during 2011 with about 120 students, with some of the practices already being replicated in other classes in this Department.

Keywords

Higher Education, First-year student challenges, learning management system

1. Introduction

There is a sizable shortage of some professionals like chartered accountants, while the standards of the professional body are relentless in denying the unsuitably qualified. Low pass rates in the first year challenges Higher Education's delivery of adequate numbers of candidates in order to balance the book of supply and demand.

At the end of 2010, the Department of Financial Accounting embarked on a project to improve the larger than expected attrition level in the first year. This called first for research on the reasons why students did not perform as expected. Based on those results, lecturers envisaged innovative teaching interventions to address those problems. The role of instructional design was to interpret those ideas into implementable design.

In this paper we present a snapshot on the research results that informed the design and piloting of a few of the teaching initiatives implemented in Financial Accounting, the rationale and instructional design principles behind them, and describe the approaches aimed at increasing the success of first-year students.

The following Research Questions frame the article:

1. Why do many first-year Financial Accounting students fail?
2. How can the Department improve the throughput of first-year students?
3. How can instructional design bring those ideas into practice?

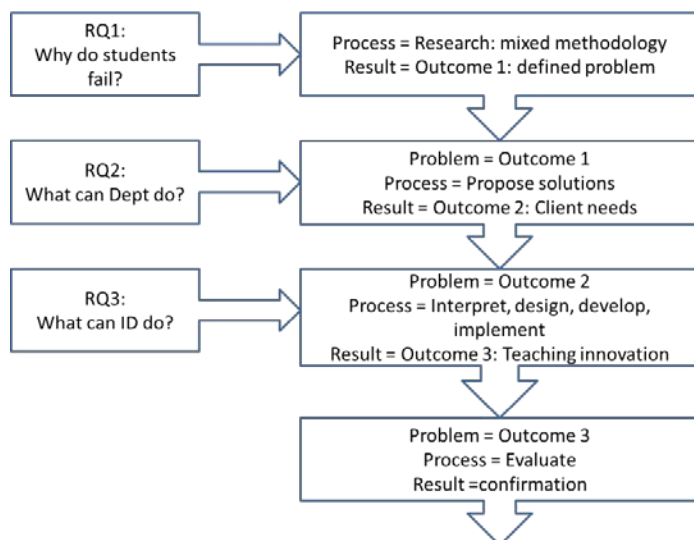


Figure 1: The research questions

The article describes a home-grown solution to a particular problem and proposes a path towards solving similar problems. In the article we describe the research questions one at a time. Figure 1 shows the iterative process whereby the solution of each question becomes the problem for the subsequent question. As the course is currently in progress, we only address the research and design phases, as reflection on and evaluation of implementation will only ensue at the end of the year. The first question leads into the research phase, and has a methodology, results and discussion section. When we discuss the results from the first question, we create research question number two, and the proposed solutions to RQ 2 become the problem for question number three.

As framework, we interpreted the first three stages of the conventional ADDIE instructional systems design framework (Kruse, n.d.; Watson, 1981).

2. Context

Financial Accounting is a compulsory subject for all first-year B Com students. For students in the Chartered Accountancy (CA) stream specifically it is one of their “main/major” subjects and the only major taken in their first year at university. We focused in this research on the CA stream, as these students have to pass FRK 100 or 101 to continue with their other majors in their second year. 117 first-year students, who met the selection criteria for entrance into the CA course, but did not take Accounting at school or did not attain the required mark for Accounting at school, therefore had to register for FRK 101. FRK 101 is a separate course taken by these students with supplemental teaching and tutoring. The supplemental teaching prepares them for the examinations imminent at the end of the year, as all first year students have to write the same examinations for entry into the second year. Because of the smaller numbers, this specific group was chosen as a pilot to explore ways of improving the pass rate of the course. Implementation of the newly designed Financial Accounting pilot course commenced during 2011 with this group of about 120 students.

3. Literature Review

3.1 Problems first-year students face

“Students have different levels of motivation, different attitudes about teaching and learning, and different responses to specific classroom environments and instructional practices. The more thoroughly instructors understand the differences, the better chance they have of meeting the diverse learning needs of all of their students” (Felder & Brent, 2005, p. 57). First-year students are often not adequately prepared for the rigours of University studies, do not have adequate pre-knowledge to guide them through the new content, and therefore need sufficient guidance to be successful (Kirschner, Sweller, & Clark, 2006). There are numerous factors that undermine their commitment to spend time with the books. Many are first-generation University attendees, with little or no personal support networks to ease the transition from school to University. First-year students therefore often manage their time ineffectively and bunk classes indiscriminately. Furthermore their social life, feelings of loneliness particularly in large classes where they do not know other students influence studies negatively (Nagel & Haupt, 2009). Study skills are often lacking or inadequate. In this country, English is not the first language of the majority of students, and they have a limited vocabulary resulting in rote memorisation of facts that they cannot interpret or otherwise apply. Motivation is a precondition for successful learning (Deci, Koestner, & Ryan, 2001). Students are more motivated when they know how the outcomes of their courses are situated in real-world situations, and can see how it will enable them to practice their profession. When the needs of the students have been analysed, the teacher can formulate purposeful interventions. that can inform the instructional design.

3.2 Contextualising learning

Dewey criticizes traditional education for lacking in holistic understanding of students and designing curricula overly focused on content rather than context (Dewey, 1938). Contextualising learning for distance and campus students alike (Anderson & Dron, 2011) helps them to see a bigger picture, and contributes to motivation. If students know that certain subjects are going to provide skills they will need in particularly important subjects later in the course, they will not see those as unnecessary. By indicating the horizontal alignment between subjects in a curriculum, students can understand the necessity for certain content. Constructive alignment between outcomes, teaching and assessment (Morrison & Howell, 2007) is necessary to guide students to use their time productively. Assessment drives learning, therefore, stressing the importance of certain aspects of the work through assessment, ensures that students master the associated outcomes. Though LMSs are often under-utilised in Africa, they have the functionalities to support educators in providing a much more supportive learning environment (Unwin et al., 2010). When the teachers and subject matter experts, in conjunction with the instructional designer have formulated the needed learning interventions, the practical aspects of design can commence. “Achieving the end goal is the important thing—enabling students to gain knowledge of how to use information to achieve their desired outcomes” (Hunt & Moore, 2005). The instructional design should focus on the student as end-user of the design.

3.3 Instructional design

Variations of instructional systems design on the ADDIE framework are in use in different guises, and remain a safe framework to guide the process (Kruse, n.d.; Watson, 1981). In this context, the first phase, or Analysis, corresponds to the first

research question, and encompassed comprehensive research, as the crucial parameters to address were not evident. The analysis in this case followed a mixed methodology research process, as described in the methodology under Question 1. The first process that followed on the analysis was the proposing of innovative solutions for the educational challenges, which was the contribution of the teaching department. This introduced the first phase of Design. Thereafter design and development of custom-made artefacts in the electronic environment followed. The educational design principles we used were to grab attention, explain, and provide feedback, foster metacognition. We used the LMS to implement the interventions discussed here. "An LMS can support or hinder active engagement, meaningful connections between segments of the course, easy communication, and formative feedback by making it easier or more difficult for faculty to communicate course requirements, provide open-ended feedback, and place course elements that are used together contiguous to one another" (Rubin, Fernandes, Avgerinou, & Moore, 2010, p. 82). While enabling many much needed activities with numerous benefits to the students (Unwin et al., 2010), the architecture of the LMS posed the greatest limitation on what could be customised, as LMSs are notoriously rigid and allow little innovation (Feldstein & Masson, 2006). Therefore we exploited the html areas inside the LMS as far as possible.

3.4 Tutoring and the Discussion tool

Human individual tutoring is both the most effective and most expensive way of improving student learning. Using LMS-based discussions to provide a first line of communication between students and tutors, makes better use of this scarce resource. Online discussions can provide a platform for higher-order thinking, if the right leading questions are posed and suitable facilitation accompanies the discussion (Bhagyavati, Kurkovsky, & Whitehead, 2005; Meyer, 2003).

Unfortunately students are unaware of their own misconceptions and do not know what they do not know. Online quizzes with automated feedback provide students the means to perform better than they would on their own (Corbett, 2001). Early assessments also show students whether their knowledge and study efforts are sufficient, providing timely warnings to adjust their learning strategies (Campbell, 2006).

4 Addressing the research questions

4.1 Research question 1

4.1.1 Methodology

We used a mixed-method of investigation to find the reasons for the unsatisfactory pass-rate. All the first-year lecturers on the CA Stream provided questions on study methods and other issues that might influence student performance. Researchers from a support department (Education Innovation) compiled a semi-structured focus-group interview protocol and a concomitant questionnaire based on the lecturers' questions. The Department identified a purposeful sample of 61 students across four levels of achievement, and representing those with and without prior learning in Accounting to attend the interviews. Students with similar marks were grouped for interviewing. Beforehand the students also completed a questionnaire consisting of both open-ended and structured questions. The results of this mixed-method

investigation were triangulated with a larger longitudinal study of student expectations and experiences in the Faculty.

After qualitative analysis of the interviews and open-ended paper-based questions, and quantitative analysis of the Likert-style items, we presented the report to the Department for discussion. Creative discussions resulted in several suggestions on possible innovations in teaching practice, the implementation of a few which are discussed in this paper. In the following section we describe the most salient findings from the research, the educators' suggestions for solving those problems, and the instructional designer's interpretation into design.

4.1.2 Results

We previously found that the biggest problem amongst first-year students in this faculty was that they did not manage their time well enough to cope with the lecture and assessment load of eleven subjects (Nagel & Haupt, 2009). We therefore asked this group in the interviews how they managed the work-load, and asked in the questionnaire how well they balanced their academic time-table. We found that students who performed poorly were particularly vulnerable, and told us that they neglected their core/major subject, namely Financial Accounting, due to the workload. Students often bunked classes on days they wrote or prepared for tests in other subjects. When they realised they were in trouble in Financial Accounting, they had already missed too much work to catch up.

Table 1: Grade averages in 3 Accounting tests

Grade averages in 3 Accounting tests at UP					
Grades	n	UP			improvement
		Test1	Test2	Test3	
<50%	10	26	35	45	19
50-59%	20	37	50	52	15
60-69%	19	51	59	60	9
>70%	8	73	64	77	4

Students were placed in an interview group based on their semester mark. The results across three tests at UP (results obtained from the Department) in table 1 show that students in the lower performing three of the four focus groups initially did poorly and improved their performance thereafter. The students in the lowest category made the most dramatic recovery and their last test was nearly on standard, alas, it was too late and they failed the subject. The second category who averaged 37% in the first test, did recover dramatically and sufficiently to pass the subject. The group of students who attained more than 50 in the first test were safe and showed lesser improvement after that, similar to the fourth group. These results suggested that exposing students to tests earlier would probably hasten the improvement and allow more students to pass the course.

The interviews revealed that numerous students did not realise the importance of studying from the beginning of the year, consequently they only woke up after failing the first one or two semester tests, after which it was too late to catch up on lost theory. It was therefore necessary to remind students to study theory on a constant basis and to compel them to start studying right from the beginning of the academic year. In Accounting at school students learnt how to calculate new numbers in established formulas; they were therefore poorly prepared to think wider and to solve new types of problems, as they explained in the interviews. Therefore they had difficulty to understand questions in tests. Students eschewed the University lecturers' recommended and widely propagated approaches to solving problems because of exaggerated self-perceptions of their own competence, based on high marks at school. Questionnaires confirmed the interview findings that students particularly underestimated the importance of studying the theory of accounting before attempting solutions. Students admitted that their marks improved significantly when they adopted the recommended method of working, but said that early in the year they did not believe how important it was.

Students in the middle group tried to study the theory, but found that their understanding of the theory was inadequate, and spending more time preparing for tests and working on problems by themselves did not really help. They often complained about the terminology and how they did not understand test questions, and gave wrong answers because of that. Those who worked in study groups found it very beneficial. They had to be helped to comprehend the terminology and to unlearn some of the erroneous methods they learnt at school.

The well-performing group were more self-reliant, diligent and self-motivated than the other groups. They knew where they were headed; the most had significant role models and mentors in the profession, and used effective study methods. Some of them needed more confirmation and feedback on their efforts.

Because students did not realise the relative importance of their main/major subject, and how important passing FRK 100/101 was to proceed with their main/major subjects in their second year, the Department suggested that we develop an electronic mind map that showed the relationships between subjects, and how subjects articulated with each other.

4.2 Research Question 2

Department's lecturers proposed several initiatives, a number of which were suitable for implementation in the learning management system (LMS). We discuss the following list that required immediate implementation:

- To show students how their courses contribute to the ultimate course goals, lecturers proposed an electronic mind-map of all the courses in the 4 years of study. This map should explain how courses articulate with other courses in the same year and with those in the next academic level, and what the selection criteria at the different levels are.
- Prominent artefacts in the LMS should remind students to study their theory before attempting problem-solving.

- Students' poor command of English coupled to misconceptions learnt at school could be rectified by explanations of key terms in lay language.
- Online quizzes present a way of addressing misconceptions and focusing on core concepts. The explanatory feedback included in the tests could function like electronic tutoring. The Department decided that students had to complete a weekly quiz on the theory that had been discussed in class that week. As incentive, quizzes would count towards the semester mark.
- Students also had to be encouraged to attend more tutor classes; alternatively they needed more avenues to find answers to a variety of questions, as not all had well-informed or helpful study partners.

4.3 Research Question 3

The instructional design challenge was then to interpret the lecturers' needs into workable ICT-based practices that would be effective within a blended learning environment supported by a learning management system (LMS). An LMS can make it easy to communicate course requirements (Rubin et al., 2010).

4.3.1 Design to provide an overview of the course.

After examining the suitability of several metaphors to help portray the mind map of the course subjects, we chose a line diagram of a tower with four legs that gradually merge into a single structure.

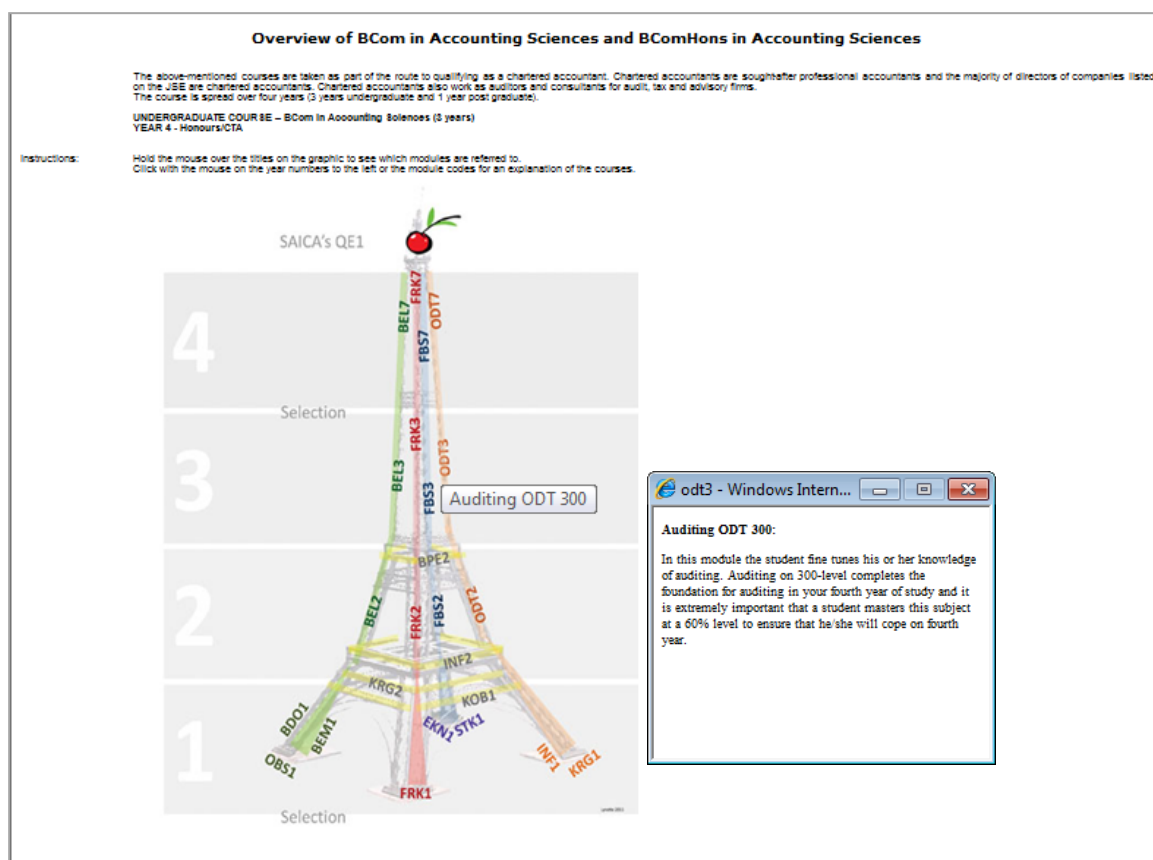


Figure 2: Clickable mind map to provide an overview of the programme

An image of the Eiffel tower in Paris presented a useful metaphor on which to superimpose the diagram of the four-year Chartered Accounting course, as shown in figure 1. The four distinct vertical columns (legs of the tower) represent their four main subjects that continue until graduation with their BCom(Hons)/CTA, which serves as the entrance to the professional body's exams. Those columns divide downwards into eight supporting beams representing eight first-year subjects that are grouped according to streams that articulate with main subjects in the same or later years. Horizontal structures (beams) that bind the ascending legs together represent the remainder of the first and second year subjects that articulate and support learning in all those subjects. Three groups of horizontal bands also separate the academic progress into four years. To provide a lighter, inspirational note to the map, the cherry on top presented entry into the SAICA QE1 qualification that would contribute to eventual qualification as a chartered accountant.

Each vertical leg is presented in a different colour, towards the top merging and further visually binding together the subjects on that grouping. In the diagram itself, only the subject codes are given, with the full subject names appearing as mouse-overs. When clicked, a small window opens containing an explanation of the module and how it fits into the programme.

On the map, module codes indicate each subject. Upon movement of the mouse over the codes, the full name of each subject is shown, and clicking on the module code, opens another window with text that explains of what the subject entails, its prerequisites and where it leads. Selection criteria for the first and fourth years are also given as clickable areas on the map.

The Accounting Tower, as many refer to it, is available in both Afrikaans and English on the LMS homepage of Financial Accounting 100 and 101. It is also available on the Departmental website that is open to the public and prospective students. Having access to this mind map should highlight the relative importance of Financial Accounting in the first year, as it becomes a future main subject, in an understandable visual format.

4.3.2 Design for reminding students to study theory

An LMS can provides meaningful connections in the course and easy communication (Rubin et al., 2010). According to in ID principles, one can use several techniques to grab attention. Those include: bright colours, blinking text or images, scrolling text or images (Alessi & Trollip, 2001). In order to focus attention on the important message of studying theory, we decided to create a scrolling banner and pop-up window, using red and orange text to further grab attention, as shown on the screen-capture in figure 2.

Figure 2 shows the course homepage on the LMS, where the html area in the header allows one to add a scrolling banner. We therefore added the slogan compiled by the Department, which is a pun on the University name, as banner that scrolls from right to left: "UP Success Generation: Understand before Practical". To keep that message constantly in their view, we also fashioned a self-opening viewlet in a separate window with a similar message on the homepage.

The screenshot shows a web browser window with the URL <http://elearn.up.ac.za/>. The page title is "success generation". A prominent message box at the top left contains the following text:

You are part of the Accounting Success Generation
Have you studied your theory? Make sure that you understand the theory before doing any practical exercises!

Jy is deel van die Rekeningkunde Suksesgenerasie
Het jy die teorie al bestudeer? Maak baie seker dat jy die teorie verstaan voordat jy enige praktiese oefeninge aanpak!

The main content area features a header with the University of Pretoria (UP) logo and the text "FRK 100 & 101: Financial Accounting / Finansiële Rekeningkunde" and "Department of Accounting". Below this is a scrolling banner with the text: "UP Accounting Success generation: Understanding before doing Practical exercises. UP Rekeningkunde Suksesgenerasie". A navigation menu includes links for "FRK 100 - English", "FRK 100 - Afrikaans", "Lecturers FRK100", "B Com Rek Oorsig", "Hostel students 12 April", "FRK 101 - English", "FRK 101 - Afrikaans", "Dosente / Lecturers FRK 101", and "B Com Accounting overview". At the bottom, there are links for "Install Java", "Technical support", "Plagiarism", and "SOS".

Figure 2: Scrolling banner text in header on homepage

4.3.3 Design to explain terminology in plain English

The most suitable LMS tool to support students with difficult terminology was to create an online glossary of terms explaining subject terminology in lay terms, which would help them understand the textbooks. In this instance, the availability of tutors was an asset, as with the lecturers the tutors also devised and loaded explanations of much-used terminology into the Glossary tool in Blackboard. The list self-organises into alphabetical order.

4.3.4 Design to encourage students to start studying in time

An LMS can support active engagement and provide formative open-ended feedback (Rubin et al., 2010). Online tests encourage students to study the associated theory, particularly if accompanied by incentives in the form of semester marks. The objective for using online tests was to encourage engagement with theory, rather than an evaluation function. Students had several days to attempt the quiz, could do so in a location of choice, and even had two attempts. Online quizzes can run on their own with minimal lecturer input, but creating large banks of multiple-choice questions are initially time-consuming, particularly if they contain feedback. As the lecturers did not have capacity to create enough questions for such an extensive databank, they appointed tutors, who were senior students who would remember what they experienced as difficult or confusing in the subject. After training the tutors in the theory and method of compiling high quality valid and reliable multiple choice items, they created questions with comprehensive feedback that addressed the underlying concept being tested in each question, all compiled in deliberately simple layman's terms. After loading the questions as quizzes in a

training course where only the tutors had access, they all had to answer all questions. Rigorous quality control consisted of rephrasing and correcting items; thereafter were they loaded into the live course, and a set of 5 questions released to the pilot students. Students had two attempts at the quiz, with the best effort captured in the Grade Book. The quizzes served multiple purposes: they encouraged students to start studying right from the start, they provided an early indication of the real state of each student's progress, they highlighted tricky sections of the work; they provided easy explanations on those sections of the work and reassured strong students that they understood the work.

4.3.4 Design to encourage students to communicate with tutors

Despite contact time in classrooms and tutoring sessions, students still struggled with understanding some key concepts. The most convenient way to answer student questions outside class times and tutoring sessions was to use the Discussions tool in the LMS. As the size of the class precluded facilitated discussions, we used the tool for an answer forum driven by the students with specific questions. In order to speed up the solution of problems, we created a discussion topic in the LMS after training the tutors how to respond to students in an online discussion. We encouraged tutors to follow a Socratic style to pinpoint the root of the problem, rather than typing mini-lectures as responses. The use of this tool is evident in the number of questions students asked in the discussion forums, where during the first semester, 109 discussion posts ensued.

5 Conclusions and the future

The aim of this article was to establish a methodology to address those challenges in an authentic and valid way that takes into account the circumstances and preferences of students in this Faculty, the provision and funding for teaching and tutoring staff and the available ICT resources and skills. Often, the decision of which tools to use in an LMS and which learning interventions to implement, are taken arbitrarily, informed by the teaching style, enthusiasm and computer literacy of the lecturer. Whether any of these interventions address real learning challenges, or are mere decorations, few know, adding to the criticism of the e-learning industry (Woodill, 2004). If we wish to use the LMS to improve teaching, we can should first uncover and check the real needs in a class, then balance the learning books with the right entries in the right columns.

The measure of success in addressing the problem of first-year Financial Accounting students not completing their first year successfully will only emerge at the end of the academic year, when the pass rate becomes known. Only at that stage can we make assumptions regarding the feasibility and scalability of each initiative, as those are key to future implementation with the rest of the first year Financial Accounting class. The most productive learning interventions are also destined for implementation in other B.Com first year subjects at this University, where classes ranging between two and three thousand students display similar challenges, though on a larger scale. Research results will in future inform the curriculum, selection criteria, the design of blended learning that allow for student learning preferences, professional development of lecturers and student support. Classes are already enormous, and may continue growing. First-year students do not have a sound theoretical basis in Accounting after school; most do not know how to manage their time effectively, and

the temptations to lure them from their books are bound to increase. There are too few Academics and they are overloaded; a situation that is likewise unlikely to improve in the near future. We concur with Unwin (2010) that electronic learning solutions in Africa should be home-grown and suitable for a particular context. A few well-situated ICT solutions can go a long way towards improving the quality of learning in the first-year classes.

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