

Sustainable learning through formative online assessment: using quizzes to maintain engagement

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Due to pressure to deliver more Chartered Accountants, the pass-rate of first-year accounting students had to increase. Students who did not take accounting at school particularly needed extra tuition and support to reach the required standard. Poor success rates could be attributed to insufficient theoretical learning and poor time management characterized by cramming before tests. The intervention that aimed to redress those problems was weekly online quizzes that students could complete in their own time that contained feedback and easily understood explanations. In order to create and sustain an adequate database of suitable questions, the tutors who facilitated additional work sessions and understood the pitfalls in the theory, helped the lecturers to compile the questions and participated in quality control. Quizzes and feedback helped students to pace themselves, understand the terms and prepare for tests. The pass-rate increased from 57 to 75%.

Keywords: Financial Accounting, online quizzes, feedback, tutors

Introduction

Universities have a dual role in serving their communities: in the first place to produce knowledgeable adults who are flexible life-long learners, who can solve problems that do not yet exist, as well as very specifically trained professionals who meet the standards and ethics of their profession and serve a well-defined niche in the economy. Chartered accountants (CA) fall also into both categories. The University of Pretoria is under enormous pressure to meet their target of delivering a certain number of qualified students to this profession, irrespective of the quality of the first-year intake. At the same time, demand for chartered accountants increased and started to exceed the supply, while the professional body determined and maintained the standards and curriculum. Students were also entering university without adequate preparation. Recently the school curriculum has changed to outcomes-based education contributing the first group of scholars to tertiary education in 2010. One of the main objectives of the new school curriculum was to focus more on skills such as group-work and less on subject content. Numbers of matriculants who met the selection criteria of subjects and performance level to meet the demand, were dwindling. This university decided to allow students with enough credits into the CA stream, even if they did not take accounting at school and increase the student throughput.

The research questions for this paper are the following: Can online quizzes effectively stimulate engagement of students to study a theoretical subject? The second question is: Do students benefit from doing online quizzes in their own time?

Literature

Dewey (1938) criticizes traditional education for lacking in holistic understanding of students and designing curricula overly focused on content rather than context. If this approach is taken too far, students have inflated self-confidence that is not based on real abilities and knowledge of the subject. There is ample evidence that students master material ineffectively if they do not receive any guidance. "Instructional approaches that place a strong emphasis on guidance of the student learning process" (Kirschner, Sweller, & Clark, 2006, p. 75) are believed to be superior in preparing students towards acquiring sufficient prior knowledge to pace their own learning. While students perform best in situations where they are tutored individually, this is not feasible in very large classes.

Human individual tutoring is both the most effective and most expensive way of improving student learning, making it unsustainable when resources are limited. Bloom (1984) found that mastery learning in a class

allowed students to learn the material as well or better than the individually tutored students when they received the same instruction as a standard class, followed by formative tests with feedback and corrective procedures. He showed a 2 sigma improvement in learning over a standard class who did not do the mastery learning (Bloom, 1984). According to Frick (2008), students value tutored classes to the extent that they derived benefits from them. The different roles of tutors are consistent with Schmidt & Moust (2000) who propose that the goal of a tutor is to encourage critical thinking, help the students to organise their knowledge, clarify any misunderstandings and explain difficult concepts, providing quality and sustainability in the support of the learning process.

Using LMS-based discussions to provide a first line of communication between students and tutors, makes better use of the scarce resource of personal tutors. 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). The greatest limitation to using online discussions in large classes is time, both from a student perspective, if they have many other subjects to tend to, and facilitator capacity, having to fulfill the roles of social and pedagogical facilitator, manager, and technical specialist (Liu, Lee, Bonk, Su, & Magjuka, 2005). Class sizes can be prohibitive, as the ideal facilitated online groups is somewhere between 12 and 30 (Arbaugh & Benbunan-Finch, 2005; Orellana, 2006; Tomei, 2006). The larger a facilitated group becomes, the less engaged students become as they do not feel they have a voice (Roberts & Lowry, 2006). Online discussions are therefore unsustainable when resources are insufficient, or classes too big.

It is important that newly acquired data should be transformed into retrievable knowledge that is stored in long-term memory through rehearsal, retrieval and metacognitive monitoring. Metacognitive skills are responsible for setting learning goals, determining learning strategies, monitoring progress, and making adjustments as needed. Due to poor school instruction (Spaull, 2012), many South African students have been taught erroneous concepts and are unaware of their own misconceptions. Learners with poor metacognitive skills, who do not know what they do not know, profit from support in monitoring their learning. (Clark & Harrelson, 2002). For example, frequent skills tests to assess knowledge help these learners spot topics that require additional study (Clark & Harrelson, 2002). Diagnostic assessments early in a course also show students whether their knowledge and study efforts are sufficient, providing timely warnings to adjust their learning strategies (Campbell, 2006). Online quizzes with automated feedback provide students the means to perform better than they would on their own (Corbett, 2001). When classes are too large for using one on one tutoring or even facilitated discussions to pinpoint and correct knowledge gaps, online quizzes might fulfill the same function in a way that is more sustainable towards the future.

Context

Who are the students

Financial Accounting is one of the four core subjects in the studies for Chartered Accountancy (CA), a highly challenging, but rewarding course for which students are selected on merit of school grades. Proficient students, who obtained more than 60% for accounting at school, were eligible to enroll for the mainstream accounting subject FRK 100 in the CA stream. According to Thijs, van der Vlier & Zaaiman (2003) the validity of matric results can influence the effective selection of suitable candidates for higher education institutions. Teaching standards at the majority of South African schools are deteriorating, as only 38% of children who started school in 2000 passed matric in 2011, largely due to not acquiring foundation skills at school (Spaull, 2012). Students were therefore becoming less prepared for University study.

Over the years it also became evident that some students who were allowed into the CA stream on the basis of good school grades, were often not equipped to pass financial accounting. In order to identify more accurately the students who were at risk, the Department of Financial Accounting implemented a proficiency test at the beginning of 2012. All students who had passed accounting at school with an average of more than 60% had to write a very basic accounting proficiency test. This "screening" process categorised the students on the basis of their *actual* abilities.

The University of Pretoria is currently the only institution in this country that allowed students into the CA program without taking accounting at school. In 2001 it instituted FRK 101, a special course in accounting that offered supplemental instruction to students who did not attain 60% for accounting, but otherwise qualified for selection, as well as those with merit that did not take accounting at school. Students who did not get the

required marks in the proficiency test from 2012 on were also encouraged to transfer to FRK 101. The number of students increased steadily from 75 in 2006 to 132 in 2012 (figure 1). These students needed individual attention and additional help as they had to cover both the basic school accounting curriculum as well as the standard first year curriculum in one year. This differs from bridging programs in other faculties, like Engineering, where students could spread the first years of their studies over an additional year.

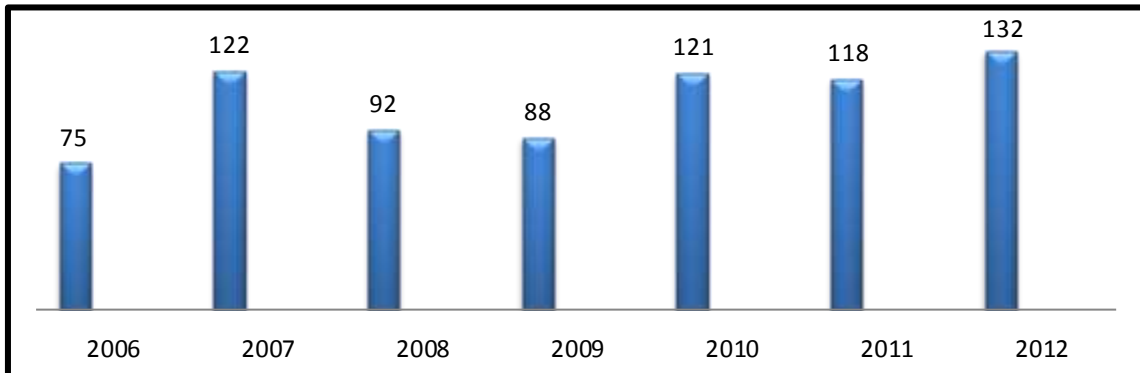


Figure 1: Number of students enrolled for FRK101 over 7 years

When throughput rates in first-year courses came under scrutiny in 2009, financial accounting was identified as a High Impact Module (HIM) due to high student numbers and a pass rate of less than 70%. The department therefore launched a project at the end of 2010 to improve the performance of the students. The project included focus group interviews with students stratified according to their semester marks, to shed light on their poor performance. The reasons mentioned most often were: underestimation of the amount of work, their inability to plan their time, underestimation of the importance of the subject for continuing to the second year of study (a pass grade was required for accounting), poor understanding of the importance of this subject in the overall qualification, and not studying the theory before attempting problems, as well as poor metacognition (Nagel & Oberholster, 2011).

Based on the findings of the focus group interviews a number of interventions were proposed for implementation in 2011 (Nagel & Oberholster, 2011, p. 382), namely

- 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
- an Accounting board game (not discussed in this paper).

The first three interventions were implemented immediately in the LMS for the benefit of all the CA students and required only maintenance thereafter. The latter two initiatives were earmarked for piloting in FRK101 (no accounting at school) during 2011, as their group was smaller and more manageable than the other group.

Teaching and learning

When the students were asked in the interviews in 2010 whether they would prefer to spread the workload of the first year over an additional academic year, they rejected it as a solution, as the total course already took so many years. They preferred a concentrated approach that was subsequently introduced. In order to cover both the school curriculum and catch up with the mainstream students, the FRK101 students had 12 lectures per week during the first quarter and 8 lectures per week during the second, third and fourth quarter, whereas mainstream students had only 4 lectures per week throughout the year. In addition they had 2 work sessions (tutor classes) of 2 hours each per week that was a problem-based discussion session. Much of the extra work was limited to the first semester. The FRK 101 students took the same formal tests as the mainstream students and wrote an additional 16 class tests during the year.

The board game required much time and effort during the first quarter of the academic year, and although it was perceived as very beneficial by the students, it will need streamlining to improve its sustainability before it can

be rolled out for the mainstream class, and is therefore beyond the scope of this paper.

Compiling and implementing the quizzes

In this paper we focus on the multiple choice tests (quizzes) with the feedback that were initially rolled out in 2011 for the hundred and thirty-two FRK 101 students, who faced the greatest learning challenge. The ongoing quizzes were aimed at sustaining students' engagement with the learning content, forced them to study the theory on time and to keep up with the pace of the course. Each of the 17 quizzes contained 5 randomly allocated questions with randomized options addressing the current week's theoretical classes, had to be completed in 10 minutes and was available for a period of six days. The quiz was selectively released only to FRK 101 students who received two attempts which they could complete at a computer of their own choice, whether on campus or elsewhere. The highest grade of two attempts was captured in the LMS grade centre, and the average of the quizzes would contribute 20% of the semester mark which also included class tests and formal tests.

The challenges regarding the creation of the questions were to have adequate numbers of high quality and relevant questions; to identify concepts that the first-year students had trouble understanding and to include questions that reflected the newest legislation. The last aspect was the lecturers' responsibility. Each test was compiled in two languages. The goal of the quizzes was to be a learning exercise for the student through the explanatory feedback associated with each question that elevated the quizzes to an important learning event. Feedback mostly contained clear explanations of the correct answer and the key concepts, or explained formulas for calculated questions. Care was taken to identify the "catch" in each question. The feedback was aimed at the majority of students because it was formulated in easy to understand language at the level of the students, did not repeat the textbook or the class notes, and would help those who did not know sufficient subject terminology. Lecturers did not have the time to compile such extensive questions; therefore the help of tutors were enlisted.

Tutors were selected from the previous year's FRK 101 class, and their prime task was to facilitate the twice-weekly work sessions. During these work sessions/tutor classes the tutors engaged in problem-based learning. They presented a problem that initiated the learning process, followed by discussion in a group of 15 - 25 students. The students came to the work session with only the knowledge that they obtained during formal lectures, while the tutors had a thorough preparation. At the beginning of the year the selected tutors received extensive training in how to set high quality valid questions and feedback. The tutors remembered which concepts were difficult for them and were up to date with the current first-year content through the work sessions, and knew which sections of the work were problematic. Being mostly second-language English speakers, they shared the linguistic challenges of the majority of the students. Tutors whose first language was Afrikaans were bilingual and translated the English questions into Afrikaans. Before each quiz opened for the students, the question bank on the topic was uploaded into a training course on the LMS (WebCT Vista in 2011) where the tutors and the lecturer had to answer all questions. After checking on the question statistics, overly difficult or ambiguous questions and feedback on which consensus was not reached, were corrected, after which the adapted question bank was exported to the student course. When some enterprising tutors used commercial questions obtained from textbook question banks, it was very difficult to match them with the current week's topic and their feedback did not meet the criteria, hence they were not used again. Tutors were therefore an excellent and sustainable source of valid questions.

Quizzes not only encouraged students to revisit notes before writing, teaching also improved due to the question statistics that were drawn from the LMS. The quality control before the students took the quizzes minimised mistakes and poorly formulated questions. When students consistently chose a wrong option in a question it rather indicated poor understanding, misconceptions, or unclear instruction, all of which could easily and quickly be remedied in class, instead of having to wait months for results of a semester test. Salient questions could be included in revision tests at a later stage to monitor the improvement in understanding.

Methodology

We followed a development research approach (Reeves, 2003), as the problem was ill-defined and needed a holistic approach towards improving the educational situation in a case study consisting of a first-year Accounting course. Numerous interventions were proposed to address specific aspects of the problem, which were then evaluated and refined, before further interventions were implemented. In 2010 we conducted focus group interviews with a total of 58 purposely selected students and after analyzing the data, interviewed the

lecturers on plausible innovations. We also investigated the quizzes in the LMS in 2011 and obtained the grades of the students who participated in the 17 quizzes and the semester and final examinations over three evaluation periods. In this paper we report on how 91 of the 118 FRK101 students experienced the online quizzes in 2011 as captured by a survey with objective and open-ended questions in the LMS. The objective items consisted of statements with 3 options ranging from affirmative, somewhat affirmative and negative, depending on the question wording. Quantitative feedback of 26 of the students who repeated the course were separated from and compared to those of the 65 first-time first-year students. The differences were analyzed using SPSS, and Pearson's R values and Chi square were calculated. We present only results of questions where highly significant results were obtained.

Findings and discussion

The suitability of using online quizzes was confirmed when students indicated that they all have access to computers to take the quizzes, and nobody said it is too much trouble, even in the light that they already had many more sessions and assessments than the mainstream students.

The initial interviews indicated that students underestimated the importance of studying the theory in financial accounting, a problem that was then addressed on several fronts (Nagel & Oberholster, 2011). According to Frick (2008) the new National Curriculum Statement for schools (grades 10 - 12) places the emphasis on developing certain skills rather than focusing on content knowledge. Students were thus not used to studying, understanding and applying the theory, which forms the basis of accounting. It also became apparent that the students struggled to keep up to date with the work and they found the volume of work daunting. The quizzes were introduced to FRK 101 (students who did not take accounting at school) in 2011 to address these problems. The feedback from the students regarding the quizzes were overwhelmingly positive, with the exception of about 6% of the respondents, they indicated affirmatively that

- they studied the theory before the first or second quiz attempt
- they benefitted from the quizzes and the immediate feedback on each question
- quizzes and feedback helped them to learn for this subject and
- quizzes confirmed how well they understood the work
- they regarded the scope for every week's quiz as suitable (not too much or too little work), as the test covered a limited section corresponding to a topic that was completed before the next one was started. This helped students to manage the large volume of work required for semester tests.

These results showed that, except for a small group of students, practically everybody found the quizzes beneficial. The results show that the quizzes do address the two main problems that students face, namely realizing the importance of theory and learning to manage the large volume of work. In order to gauge the benefit of the quizzes to different profiles of students, we separated the responses of students who repeated the course (26) from those who were first-time first-year students (65). The repeaters was a valid "control" as they had not experienced the quizzes or any of the other learning innovations before. Dividing the data thus exposed three patterns: for some questions, there was no difference in responses between the two groups, while for some questions there were significant differences, some aspects of the quizzes reportedly being more beneficial to one group, while others benefitted the other group more.

For the question regarding the scope of the work covered by the quizzes, the responses were similar in the two groups, with about 92 % of both groups finding it suitable. This was important, as previously students only studied large chunks of work for semester tests that were spaced far apart, and the previous year's unsuccessful students indicated in the interviews that they could not master such vast amounts of work. On the question about the spacing of the tests, 70% of both groups thought that the spacing of the quizzes was suitable, while 30% would have preferred them to be further apart.

One of the core issues in the course had been their lack of studying theory, and students being unable to catch up after the first semester test when they realized the importance thereof (Nagel & Oberholster, 2011). The feedback on the quizzes indicated that both repeaters as first-time students now studied theory for the quizzes after they have been bombarded with slogans to study theory before attempting problems. There was no difference in the distribution of how diligently they studied. Of the repeaters, 46% *usually* studied the theory, while another 46% *sometimes* studied theory. The non-repeating students indicated that 48% usually and 44% sometimes studied theory. Likewise there were no significant differences in the pattern of studying theory before a second attempt at the quiz. Significantly more of the students who studied the subject for the first time

(86%), wished to have a second chance to complete each quiz, compared to the repeaters' 76%. Even though the quizzes contributed only 20% to their semester mark, this might indicate that the first-time first-years aimed at higher grades than the repeaters. The class average grade for the 17 quizzes was 61%, which was higher than any of the averages for the written tests. Considering that they had two attempts at a quiz on each subject, and they could consult any supportive documentation as they wished, the quizzes were still challenging, but provided an opportunity to perform quite well. This was less so in the written tests, as FRK101 wrote the same tests as the students who had accounting at school and were at a distinct disadvantage up to the final examination. As quizzes provided about 10% of the final mark, where students performed about 20% better than in written tests, it was not enough to account for the nearly 20% improvement in pass rate in the class who wrote the quizzes.

Highly significant was the perception of 81% of the repeaters who *generally* found the quizzes useful while only 64% of the first-time students found them *generally* useful, and 32% found them *sometimes* useful. This was an important finding, as the quizzes were aimed at students who were at risk of failing, and the repeating students could compare the quizzes' usefulness with what they experienced the previous year when they could not pass the subject. Judged by the student opinion, the quizzes as intervention were on target to support at-risk students.

Students also had divergent perceptions of the usefulness of the feedback, with 84% of the repeaters and 69% of non-repeaters finding the feedback *generally* useful, and 29% of non-repeaters only *sometimes* finding it useful. This is likewise an important finding, showing that the feedback that is aimed at the less successful students, is perceived as important by them. The two groups studied feedback with similar frequency.

When asked to rate whether the quizzes helped them to prepare for formal tests, 38% of repeaters replied affirmatively and 38% reckoned that it helped *somewhat*. Quizzes *generally* helped 50% of the non-repeaters and *somewhat* helped 33% in preparing for tests. From these findings, it seemed that the first-time students were unsure about what kind of questions to expect in tests, and the quizzes ameliorated their anxiety, whereas the repeaters who had previously written the formal tests and exams, were less reliant on quizzes to prepare them for this aspect of assessment.

Qualitative analysis of the open-ended responses to the surveys, confirmed the findings of the survey items. In addition, students requested to have more questions in the quizzes, or have them more frequently, like twice weekly. Requests from a number of students at the end of the year for more challenging questions indicated that the standard of those students had increased to a level where they were not merely concerned about passing the subject, but really wished to improve their grades further. Another request was to include more calculation-type questions. These findings were heartening, as these students already took many more class tests than the mainstream students, and nevertheless valued the online quizzes so highly, as to request more.

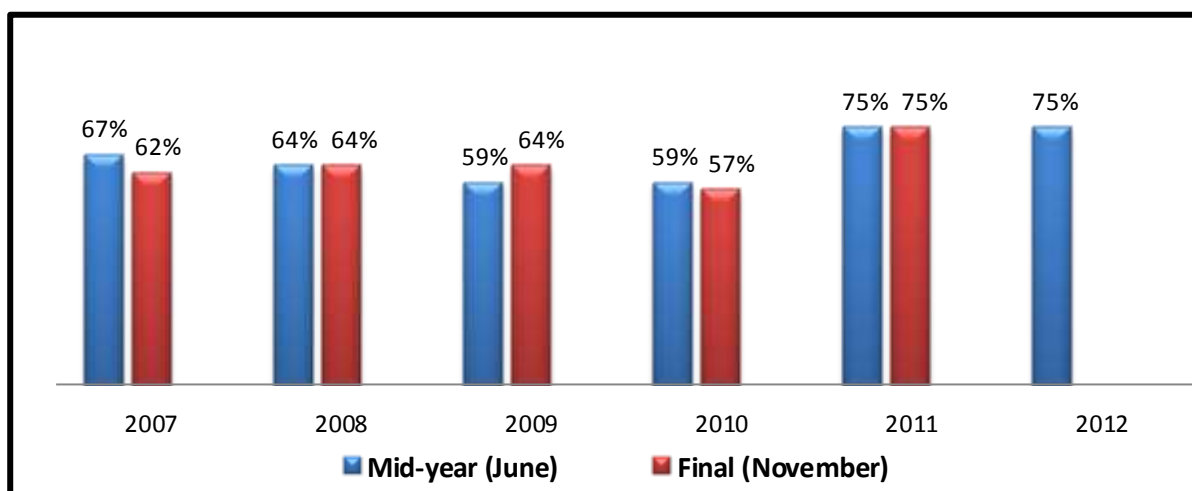


Figure 2: Pass rates of students without accounting at school

Students' self-reported opinions of the usefulness of an intervention could not be taken as only proof that the objective of improving a low pass-rate was attained. Figure 2 shows the mid-year or semester mark as well as the final mark of this class over five complete years and the first semester of 2012. It is evident that there was a highly significant improvement in pass rate after the implementation of the online quizzes in 2011. Preliminary

grades from 2012 confirmed that the present students are likewise benefitting from the interventions. From the pass rates shown in figure 2, it is evident that students who did not have accounting at school, were in a good position to pass Financial Accounting in the chartered accounting stream, and the University could expect a 75% pass rate from this course. The subject should not be classified as a high impact module after the current year.

Conclusions

This paper showed how an integrated and responsive approach utilizing simple online quizzes in an LMS can improve first-year students' engagement with the theoretical side of accounting, leading to improved outcomes. Students who did not take accounting at school were at a grave disadvantage when they enrolled for financial accounting in the chartered accounting stream. Interviews with unsuccessful students revealed that the students underestimated the importance of studying theory, in part due to outcomes-based school education that focused less on mastering content. Students also had poor study habits that consisted of cramming large amounts of work just before tests. The effect of these habits was that they could not master such huge volumes of work simultaneously. As intervention, the department instituted informal online tests that paced the students and encouraged them to study the theory before attempting to solve problems..

Feedback from the students at the end of 2011 showed that students found the quizzes appropriate in frequency (weekly) and scope (covering the current week's work). In contrast to the previous year, practically all students reported that they studied their theory before attempting the quizzes, even before a second attempt, which was also highly valued. The students who had failed the subject the previous year found the concomitant feedback that explained the concepts behind the questions in easy terms, of more benefit than the first-time students did. More of the repeaters also felt the quizzes helped them to master the work than the others. The high value the quizzes had for the repeating students, (who did not have such quizzes during their first attempt at this subject), showed that the quizzes specifically benefited students who were at risk of failing, while more than 90% of all students benefited to some extent. The first-time first-year students particularly found the quizzes beneficial to prepare them for writing formal tests. We can conclude that students across the board benefited from the quizzes, not only to pass the subject, but to increase their grades, a finding that was confirmed by open-ended responses wherein students requested greater numbers of and more challenging questions.

The benefit of the quizzes was evident in the increased pass-rate of the group who did not have accounting at school from 57% to 75%. The sustainability of the improvement is seen in the following year's half-year mark that promises a similar pass rate. It is further seen in the up-scaling of the quizzes from a class of 118 in 2011 to the whole CA stream consisting of 581 students. Increasing the database, updating of questions to reflect changing legislation and controlling quality is totally sustainable, as the tutors are a readily available resource doing an admirable task. The nature of the formative assessment that provided feedback enabled many more students who were at a great disadvantage, to catch up with a challenging subject and complete it successfully.

Based on the success of this intervention, the question database is currently being expanded and students in the mainstream accounting course are also writing weekly online quizzes. There are also plans to extend the quizzes to the (more than 2000) students in the commercial stream of Bachelor of Commerce in an attempt to increase their engagement with the subject and improve their success rate. The intervention was sustainable as it made optimal use of the limited people-power in the form of tutors, tapping into their own experience as students and facilitators. Sustained engagement prepared students also for the future as life-long learners.

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