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PROVIDING STUDENT FEEDBACK THROUGH ELECTRONIC ASSESSMENT FOR LINEAR ALGEBRA AT MASENO UNIVERSITY, KENYA

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ABSTRACT

In this poster, we present our work to set up, use and evaluate electronic assessment for mathematics courses at Maseno University, Kenya. This was introduced as an attempt to address the problem of providing high quality student feedback in large classes with limited support resources

We report on a first year introductory course Linear Algebra course offered in the Spring of 2019 for 700 students using weekly quizzes developed with STACK (**S**ystem for **T**eaching and **A**ssessment using a **C**omputer algebra **K**ernel), a computer aided assessment system for mathematics.

Results on students' use of the system and feedback from an evaluation indicate it was effective in providing better feedback to support student learning.

The approach is now being adopted by other universities across Africa

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INTRODUCTION

One of the problems affecting teaching and learning of mathematics in Kenyan public universities is high student to lecturer ratios, particularly for introductory courses. In the Spring of 2019, Dr. Oyengo was assigned a Linear Algebra class of 700 first-year students without any support in the form of teaching assistants. In addition, he was teaching a fourth-year course to 500 students. This heavy workload meant preparation time and resources for teaching were limited. In addition, it is impossible to provide any form of detailed feedback to students during the semester, due the amount of marking that would be required. As a result, students do not do regular assignments from which useful feedback that enhances learning is provided.

CONTEXT ON PUBLIC UNIVERSITIES

- They are government funded.
- Have large student enrollments.
- Are under-staffed: Lecturers do not have teaching assistants to support in teaching.
- Inadequate feedback to support learning by students
- Students have little interaction with content outside classroom
- Inadequate teaching and learning resources (Teaching halls, stationary, reference books, computers and/or tablets, internet access)
- Most students have smartphones and can access internet through mobile phone providers
- Lecturers lack time for quality research

Overview and Features of STACK

- Has very flexible input mechanisms based around algebraic input: students can freely enter an equation or a polynomial.
- Supports "reasoning by equivalence", where students present an argument line-by-line.
- Can generate questions with random variables, ensuring different students see different variants of a question.
- Uses computer algebra to assess answers, and teachers can give partial marks and tailored feedback depending on the different mathematical properties of the students' answers.
- Uses established mathematical properties hence allowing infinite correct solutions.
- Works in Moodle (course management system)
- STACK is the most advanced open source assessment system for mathematics (https://github.com/maths/moodle-qtype_stack)

IMPLEMENTATION OF STACK AT MASENO

Dr. Oyengo was introduction to STACK by Prof. Chris Sangwin the founder of STACK. He was given a quick tour and a short training on authoring STACK questions.

The School of Mathematics at Maseno University expressed willingness to pilot the us of STACK in formative evaluation of their students.

The pilot project was to be done on the University of Edinburgh LMS servers. This was facilitated by Prof. Sangwin.

Authoring of questions was done by Dr. Oyengo and supported by Danny Parsons. Dr. Oyengo being the course lecturer, would identify the most appropriate questions, and he would receive support from Danny parsons in the authoring. Accuracy of authored questions would then be verified before setting up of quizzes.

QUIZ FORMAT

	Mastery Quizzes	Test Quizzes
Attempts allowed	Infinite	1
Deadline	End of Semester	End of each week
Feedback	Immediate	End of each week
Restriction	None	>70% on Mastery Quiz
Percentage of grade	45%	45%

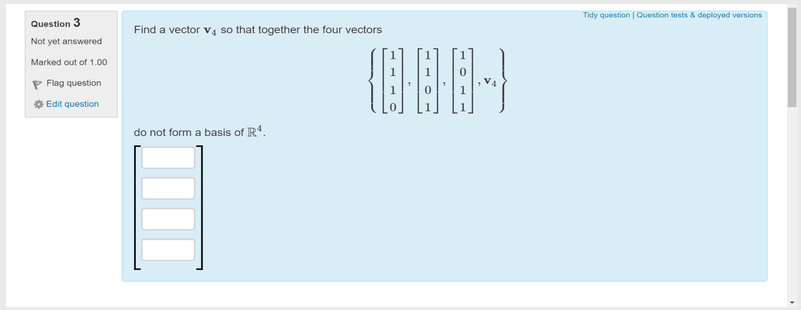

Figure 2. Sample question

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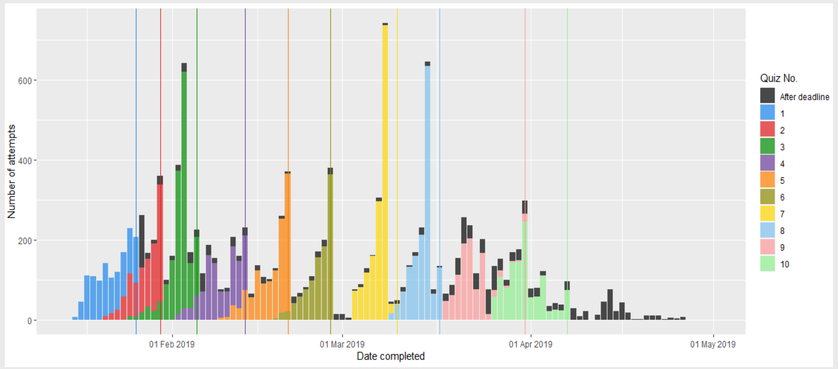

Figure 1: Number of attempts and completion times on the ten mastery quizzes

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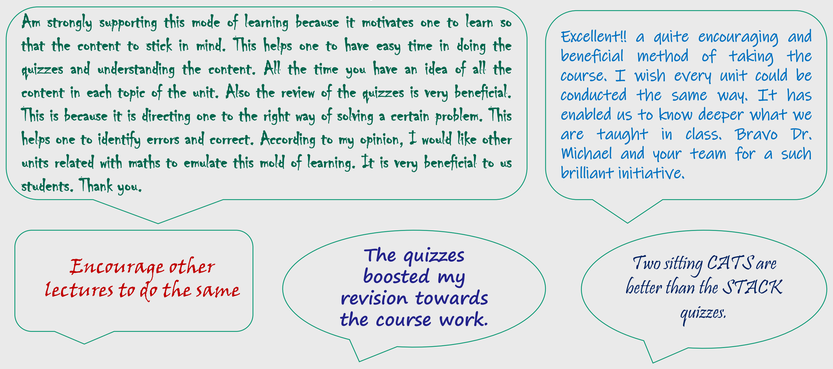

RESULTS AND DISCUSSION

Figure 1, showing number of mastery quiz attempts, shows there was continued engagement with these quizzes. Sharp spikes occurred just before the deadline of the test quizzes, shown with vertical lines.

There were also consistent attempts at the mastery quizzes after the due date of the test quizzes, shown in black in figure 1. This indicates that the mastery quizzes were used by students to genuinely master the content not just to access the test quiz, as well as prepare for the final exam, as shown by the attempts made after the final test quiz and before the final exam.

CONCLUSIONS

Electronic assessment enabled students to continuously interact with problems which helped improve the mastery of content. STACK features made it possible to provide detailed feedback to quiz questions from which students could identify their mistakes and reattempt the quizzes.

With the support provided, implementing this was achievable for the lecturer, and will save time for future lecturers. STACK could help improve teaching and learning, particularly in low resource environments where providing feedback to individual students in big classes is almost impossible

FUTURE PLANS AND EXPANSION

- Open access to courses already developed at Maseno
- Continue course development at Maseno (Descriptive statistics, Linear Algebra II, Calculus II)
- Adapt courses for other Kenyan (and African) countries
- Organize workshop in Kenya (Africa) to share with other universities and to conduct trainings
- Electronic textbooks with STACK for schools in Kenya

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