

Combining videos and quizzes to provide additional support and enhance learning in Mathematics

Faculty of Science | Department of Mathematical Sciences

Modules: Mathematics (Bio) 124, Mathematics 176 & Mathematics 171

Lecturer: Ms Bessie Burger ejburger@sun.ac.za

Blended Learning Coordinator: Dr Ilse Rootman-Le Grange ilser@sun.ac.za

Learning activity:
Out-of-class learning

Learning technology:
Videos & quizzes

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Context

Background

At Stellenbosch University, numerous Mathematics programmes are offered to first-year students, prospective students and provisionally accepted students.

The Department of Mathematical Sciences offers various mainstream first-year Mathematics modules, including Mathematics (Bio) 124, which has 800 to 900 students. The BSc Extended Degree Programme (EDP) also offers Mathematics 176 to about 70 students who did not meet the minimum requirements for admission to their preferred programme in the Faculty of Science. (The purpose of the EDP is to broaden access to students from disadvantaged educational backgrounds, the additional year preceding the standard mainstream programme.) Finally, SciMathUS offers a year-long bridging programme to about 100 students to improve their Grade 12 marks to enable them to reapply for tertiary studies.

During 2015, Ms Bessie Burger lectured in Mathematics (Bio) 124 and Mathematics 176. She also presented a two-week course to 30 SciMathUS students (Mathematics 171) to assist them with their preparation for Mathematics 124 the following year.

Intended learning outcome and established practice

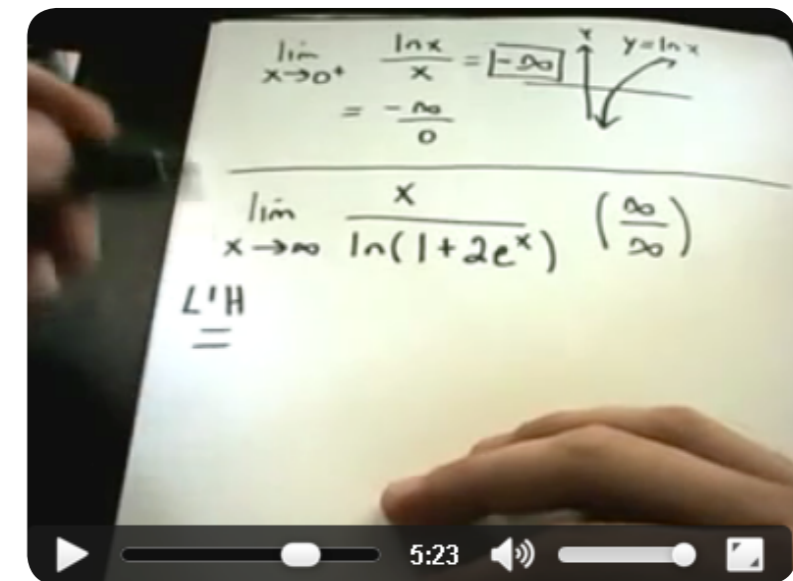
The lecturer's objective for all three modules was to support students to develop a greater understanding and ability to apply relevant mathematical concepts. She used a blended learning approach in support of this. Online activities included video material and quizzes and classroom activities consisted mainly of problem solving opportunities and group discussions.

In 2015, she explored different ways of using videos to teach mathematics, using existing video material from various sources, which she made available to her students via the specific modules' SUNLearn pages. It is important to mention that the online material was integrated with the face-to-face sessions and not designed only as supplementary content to the modules.


The challenge

The reason for the intervention was to provide the Mathematics (Bio)

124 students with additional support. These students have a very full curriculum, however, and using a blended learning approach with videos linked to quizzes provided a way to give them this extra support with more regular formative feedback outside of formal contact time. Since some of the concepts covered in Mathematics (Bio) 124 are also covered in Mathematics 176, the lecturer used the material in that module as well. The 176 module, however, has a far lighter curriculum, which allowed the lecturer to include the videos during the contact sessions.



 A3:L'Hopital's Rule

 Video: L'Hopital's Rule

 Quiz on Video L Hopital

Not available unless: The activity **Video: L'Hopital's Rule** is marked complete

Figure 1: Example of a video with accompanying notes in PDF format and a quiz on L'Hopital's Rule



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Learning and assessment activities

Learning and assessment activities

Videos were used in two different ways: they were uploaded on SUNLearn, accompanied by quizzes specifically for formative assessment, and they were used during face-to-face sessions.

The videos that the students accessed through SUNLearn outside of class were used for four different purposes:

- To provide an introduction to a new topic. A quiz consisting of three or four questions on the video content was also available to help the students assess their comprehension of the content before the contact session.
- To provide confirmation of content covered in face-to-face lectures, with additional examples and an accompanying quiz consisting of 10 to 12 questions on the content.
- To provide more difficult and complicated examples, followed by group discussions during face-to-face sessions.
- To provide immediate formative feedback. Students completed a quiz on SUNLearn as self-assessment and, once the quiz was closed, they could view a video explaining the correct solutions.

The videos that were used during face-to-face sessions were used in three different ways:

- At the end of a lecture to introduce a new topic for the next day.
- To introduce a specific mathematical challenge, followed by group discussions to analyse the approach.
- To share real-life mathematical applications with the students, followed by group discussions.

Feedback practices

The SUNLearn quizzes were made available for one to two weeks,

depending on the topic and the time spent on the topic in the lectures. The students were allowed two attempts per quiz and there was no time limit on their individual attempts.

Immediately after completion of an attempt, the students were able to see their grades and which questions they had answered correctly and which incorrectly. Only after the quizzes officially closed were the students able to see the correct answers to all the questions. At this stage, no specific detailed feedback was included in the quizzes.

Student self-regulation

The lecturer did not use any conditional availability settings for the quizzes and there were thus no prerequisites that the students had to adhere to before they were able to attempt a specific quiz. This may be considered for the future to enable the creation of a more adaptive learning environment where students have more control over the pace of their learning. This would have to be managed very carefully, especially with first-year students, who depend very strongly on their lecturers to set the pace for their learning.

Learning environment

Learning setting

Learning took place both inside and outside of the classroom. All the learning activities (the videos and the quizzes) were loaded onto SUNLearn.

Technology resources

Since the lecturer used existing video material from online sources, no additional technology resources were required.

Support challenges

No issues were experienced with student access or support. The only obstacle was for those students who wanted to access videos off campus, as some of the videos were very slow to download and they were unhappy with the amount of data that the videos used. It is thus crucial for lecturers to ensure that the videos that they require their students to watch are not too long and that they give the students enough time to watch the videos on campus where they have access to the computer user areas and Maties Wi-Fi.



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STUDENT EXPERIENCE

Student feedback on the learning experience

At the end of each module, the students were asked to complete an electronic survey to give their feedback on how they experienced the use of the videos and quizzes in the modules. For Mathematics 124, there were 193 respondents and, for Mathematics 176, there were 42 respondents. From the SciMathUS students, 29 responses were received.

The students were asked to indicate on a given scale to what extent the videos and quizzes improved their understanding of the mathematical concepts. The majority of the respondents experienced the intervention as positive. The results are summarised in Tables 1 and 2 below.

Table 1: Summary of the Mathematics 176 and 171 students' perceptions of the extent to which the videos and quizzes improved their understanding of mathematical concepts

	Not at all	Little	Quite a lot	To a great extent
Mathematics 176	1	1	17	25
Mathematics 171	0	2	13	14

Table 2: Summary of the Mathematics (Bio) 124 students' perceptions of the extent to which the videos and quizzes, separately, improved their understanding of mathematical concepts

	Not at all	Little	Quite a lot	To a great extent
Videos	5	21	106	21
Quizzes	21	51	77	44

Feedback from an open-ended question in the survey supported this feedback, the students from all the groups being overwhelmingly positive. The students were asked for their opinions on the use of the videos and quizzes in the modules. From the feedback, four themes were identified. The first theme was around understanding concepts better. The students referred to how the videos and quizzes gave them the opportunity to revisit concepts that they had not grasped during the lectures.

"Dit help om weer deur die werk te gaan indien jy dit nogsteeds na klas nie verstaan nie." ["It helps to go through the work again if you still don't

understand it after class."] (p. 17)

The second theme, which is linked to the first, is how the videos and quizzes helped the students to keep up to date with work and to prepare for lectures in advance. This was stressed more by the Mathematics 124 respondents than the 176 respondents, although both groups referred to this aspect.

"Dit het ook baie gehelp omdat die module baie inhoud het wat in net 6 maande gedek moet word en dit het effektiewe hulp gebied buite klastyd." ["It also helped because there is a lot of content in the module that has to be done in only 6 months and it provided effective help outside of class time."] (p. 37)

"The videos helped me prepare for a lecture for the following day . . ." (p. 225)

The third theme that the students referred to was around problem solving approaches. The videos introduced them to different approaches that could be used to solve the same problem, which the lecturer did not necessarily have time to explore during contact time. Also, when they struggled to solve a particular problem out of class time, they could watch a video on that concept and get an idea of how to approach the problem.

"It is extremely helpful as it gives you another person's take on how to approach the concepts." (p. 66)

"Dit help baie as 'n mens hersiening doen en nie seker is hoe om die som te doen nie en dan weer stapsgewys te sien wat om te doen." ["It helps a lot when you're doing revision and aren't sure how to do the calculation and then to see again what to do step by step."] (p. 69)

The final theme that the students identified was around test and exam preparation. They said that the videos, but especially the quizzes, were a valuable revision tool that supplemented their class notes very effectively and gave them valuable feedback.

"The quizzes are by far the best help that can be offered, because the



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mistakes can be viewed afterwards. Notes can then be made further by the student. I also think that the quizzes and the videos go hand in hand." (p. 4)

"It gives a view of how questions could be asked." (p. 20)

"Die videos help ongelooflik baie as jy dit reg gebruik . . . ek sou graag na ek geleer het vir 'n toets my boek vat en deur videos gaan wat oor alle werk handel [daarmee saam]" ["The videos help a tremendous amount if used correctly . . . after studying for a test I would like to take my book and go through videos that deal with all work"] (p. 88)

General

Other concluding thoughts

Finding appropriate videos and creating videos that give students hints on how to approach problems rather than comprehensive solutions proved challenging. With regard to optimising contact time with the students, the videos proved very beneficial for introducing new content before class, providing the students with additional examples and material for the revision of concepts that were already covered in the contact sessions. Combining this with the quizzes allowed the students to evaluate their own understanding and get immediate formative feedback. In conclusion, both from a student and a lecturer perspective, the use of videos in combination with quizzes was a positive experience that enriched the teaching and learning environment in these modules.

