

Modularisation of APSC180 Statics

for delivery during terms of different durations (winter 1, regular summer, Vantage summer) and to suit students with diverse prior knowledge

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Introduction

Currently APSC180 Statics is offered in three different terms: Winter 1, Vantage and regular Summers. The durations are 13, 8 and 6 weeks respectively. This project aims to modularise the course into a number lessons that collectively cover the syllabus.

The students in these three terms have a diverse background. By modularising the course, both students and instructors can decide which parts of the course to spend more time on. However, to cater to those whose learning needs are different from their classmates including those in PHYS112 Introduction to Physics for the Life Sciences I with no prior physics background, this project also aims to develop media and teaching materials for automated delivery and self-learning.

Pedagogical Foundation

A meta-analysis of 225 studies [1] comparing active learning with traditional lecturing showed that active learning produces higher average grades and lower failure rates. Moreover, STEM (science, technology, engineering and mathematics) classes, by incorporating research-based active learning strategies, have seen significant improvements in students' academic involvement [2], and metacognition [3]. Thus, each module is designed to provide ample opportunity for active learning. The structure of each module has been drawn up following the recommendations of

a paper on flipped classrooms [4]. The recommendations are: 1) length of media should be approximately 10 minutes, 2) students are given time in class to work on problems, 3) bringing in real-life applications during class time, 4) having regular online assessments.

Pre-Implementation Study

A study was carried out to compare the effectiveness of two of these modules against conventional lectures. A Statics class was

randomly divided into two groups, called 1st half and 2nd half.

On week 5, 1st half learned lecture 9 using a media module and 2nd half learned it during a live lecture. On week 6, the two groups swapped the method of learning for lecture 10. Average marks of the questions testing the content of the two lectures of both groups were compared.

Results and Discussion

Superficially, it appears that the results are mixed. The figures in the table are calculated using data from the 28% of the class who gave consent for their results to be used in the study. If the results of all students are included, then the

Topic	Average Mark	
	Learned with media	Live lecture
9	53.28%	41.55%
10	72.50%	78.86%
Including students who did not give consent		
9	Higher	Lower
10	Higher	Lower

the conclusion is that students who learned with media modules scored higher than those who attended live lecture. Without their consent, we only state the qualitative summary in the table.

References

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The Structure of a Typical Module

This is the suggested method of teaching a module. However, it is not intended to be overly rigid, and variations are possible at the discretion of the instructor

Step	Whole Class	Individual Student	Instructor	Reference Duration
1	N.A.	Watch media, (introductory content). Answer poll/survey	N.A.	Prior to class
2	N.A.	Receive poll results, reflect on his/her perceptions compared to the rest of the class.	Comment on pre-lesson poll/survey result	10 – 20 min
3	Continue to watch media explaining the more complex details of the theory, followed by a worked example.	Answer conceptual questions	Pause at critical points in the media for conceptual questions. Comment on result and clarify misconceptions.	
4	N.A.	Solve computerised question which is the same/ substantially similar to worked example. Media of step 3 can be replayed on individual computers for reference.	Walk around to answer questions. Post questions and answers on discussion board.	30 – 40 min
5	N.A.	N.A.	Announce the activity in step 7 and time for everyone to be at the same point.	
6	Optional: Watch media explaining more advanced knowledge	Optional: Questions at higher level of difficulty for the faster students	Walk around to answer questions. Post questions and answers on discussion board.	Optional
7	Watch the solving of problem. Take notes, copy or solve along if desired.	N.A.	Solve a more complex problem on document camera. Emphasise strategy, breakdown into manageable steps, etc.	20 – 30 min
8	Reflect on topic objectives, summarise knowledge/ formulae/steps, etc.			