ICED 2020 proceedings:

Can video support improve attainment? Evaluating the impact of teaching videos on student performance

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Abstract

In 2017, the Faculty of Science and Engineering at Manchester Metropolitan University began an initiative that led to the creation of over 2000 videos and screencasts to support students across all their departments. The videos cover solutions for tutorial problems, provide coursework briefing information, or support laboratory work and exam preparation. This paper reports the findings of the quantitative study to investigate the effectiveness of the initiative on unit performance. Whilst adjusting for key student characteristics, regression analysis was applied to measure the links between final unit marks of 1248 undergraduate students and their level of engagement with videos. A positive correlation was found, and a further qualitative study is now underway to elaborate on these results and to explain such impact.

1 Introduction

In recent years, there has been a dramatic increase in the possibilities for using video and other non-traditional resources in engineering higher education (Saunders & Hutt, 2014; Gillie et al., 2017). Despite the growing tendency of using rich-media to support teaching, research into the effectiveness of such resources on student performance has been limited. Furthermore, the rapidly changing technical possibilities and consuming practices of students mean previous findings rapidly become dated.

1.1 Context and previous studies

Recent studies have shown that technology can positively influence learning (Means et al., 2010; Bernard et al., 2014), and that it can be a highly efficient educational tool (Allen & Smith, 2012; Rackaway, 2012; Stockwell et al., 2015). Taslibeyaz et al. (2017) conducted several case studies to show that watching videos was beneficial for changing attitudes, encouraging cognitive learning and retaining knowledge. Similarly, Yousef et al.'s (2014) review of qualitative and quantitative papers found some evidence that use of video-based learning saw improvements in teaching methods and learning outcomes.

Video support, however, is not necessarily effective: Guo et al.'s (2014) study demonstrated that large segments of support videos are disregarded by students, while others argue that some videos contribute little to student performance (e.g. MacHardy & Pardos, 2015). Dash et al. (2016) have shown that video support may not have the same value across all disciplines, but that it might be the best suited to illuminate abstract, hard-to-visualise phenomena and conceptual frameworks that are the foundation of STEM disciplines. Furthermore, a recent review of meta-analyses concerning variables associated with achievement found that communication technology – including video support – has only a small impact on achievement

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and that it is most effective when it complements (but not replaces) classroom interaction (Schneider & Preckel, 2017). Therefore, there is no clear scientific consensus on what works for whom and in what circumstances, a question that this study begins to address.

1.2 About the initiative

Video support materials were first made available in 2017 in the Department of Engineering as a supplement to face-to-face teaching. Since then, over 2000 videos have been made across the Faculty of Science and Engineering to support student learning and assessment. Short videos were uploaded to the Virtual Learning Environment (VLE). Videos were made in each unit for core concept explanations, worked examples of seminar problems, past examination solutions and training videos. Assessment briefings and feedback videos were also added to the suite of videos across each unit (see Figure 1).

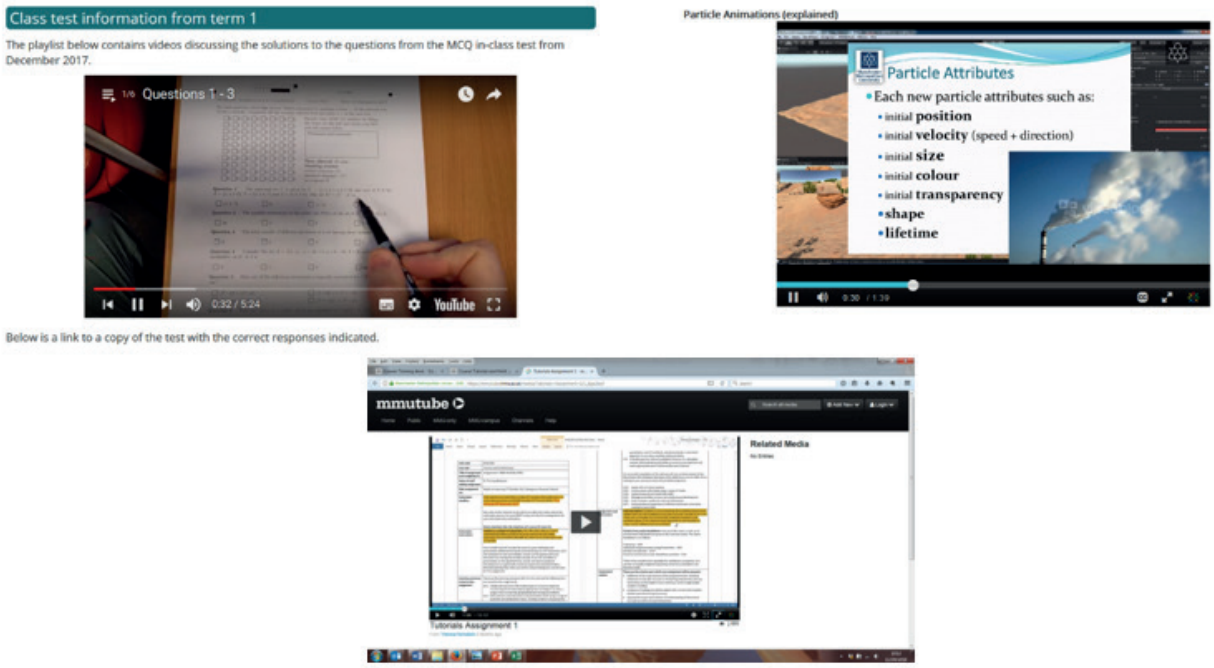

Figure 1. Example videos made in the Faculty

1.3 Aims and objectives

Student feedback on the video support materials (via staff comments and student surveys) has been consistently positive since the initiative began. However, the evidence we have had up to now for the direct impact of the videos on student performance is empirically unproven.

Our aim was, therefore, to investigate whether students' level of engagement with the videos affected their academic performance in a specific unit. To achieve this, student cohorts enrolled in different STEM units with video materials were compared to each other based on their level of engagement with videos. Regression analyses were applied that allowed us to assess the impact of video engagement when other key independent variables were accounted for.

The main objective of this quantitative inquiry was to provide empirical evidence of effectiveness, which – together with a qualitative explanatory phase – would possibly justify a comprehensive cross-disciplinary application of this teaching support strategy.

2 Methodology

The study used secondary data exclusively from 8 undergraduate units across the Faculty. Each selected unit had at least 80 students enrolled for academic year 2018/2019 and at least 5 videos uploaded to VLE. This gave us a sample size of 1442 students. Those studying part-time (30) and those who did not engage with any VLE material in general (164) were excluded. The final sample size was therefore 1248.

In our regression models, we controlled for important pre-entry characteristics (such as socio-economic status and ethnicity). The outcome variable was academic performance (final unit marks). The independent variable of interest was the level of engagement with video materials. As we only had binary information on views (e.g. someone viewed / did not view the material), and because there are varying number of videos available in each unit, a standardised video engagement index was developed that was split by subgroups (units) using z-score standardisation. The complete list of variables used in the study is shown in Table 1.

Independent variables

Variable Name	Level of measurement	Note
Level of Study	Nominal	*Level 4 (1st year undergraduate)/level 5 (2nd year undergraduate)*
Disability group (2-way)	Nominal	*Disabled/no disability*
First generaltion	Nominal	*Yes/no*
Gender	Nominal	*Male/Female*
Age	Nominal	*Young/Mature (mature students are those aged 21 or over)*
Overseas	Nominal	*Splits students based on fee status: Either Home/EU OR Overseas*
Entry Qual	Nominal	*Academic/Vocational: If students have at least one academic and no vocational qualifications (of equivalent size to an A level), they are classed as academic; if they have at least one vocational and no academic qualifications they are classed as vocational;*
Commuter	Nominal	*Commuter group is based on the students' term time postcode's distance from university (whether their travel time is more or less than 30 minutes) and their answers to the travel survey asked on enrolment*
Index of multiple Deprivation	Continuous	*POLAR4 quitile (most deprived neighbourhoods in UK)*
Ethnicity	Nominal	*White/BAME (Black and Asian Minority Ethnic)*
Above average Video views	Nominal	*above average/below average*
View / No view	Nominal	*Viewed at least one VSM (video support material)*
Video Engagement Index	Continuous	*standardised video engagement index was split by Units using z-score standardisation*

Dependent variables

Variable names	Level of measurement	Note
Final mark	Continuous	*standardised by unit*
70% or above (First Class Honours)	Nominal	*yes/no*
60% or above (Good Honours)	Nominal	*yes/no*
40% or above	Nominal	*yes/no*

Table 1: Complete list of variables used in the analysis

3 Results

After establishing initial correlations and tendencies through descriptive and bivariate analyses, regression models were developed to measure the impact of video views on performance.

3.1 Linear regression – Unit performance vs video views

Multiple linear regression was run to assess hypotheses in relation to standardised unit marks, and included the following predictors: video view, level of study, disability, first generation, age, entry qualification, clearing, commuting, multiple deprivation and ethnicity. The model produced R^2 = .186, F(11, 784) = 17.51, p < .001, suggesting that 18.6% of the variance in unit mark is explained by those predictors.

Regression coefficient results show that entry qualification (*b* = .725, p < .001) and ethnicity (*b* = .311, p < .001) act as the strongest predictors of unit mark. Video engagement also functions as a significant predictor of unit mark (*b* = .110, p < .001), whereas other factors do not predict unit performance significantly.

3.2 Logistic regression – View / no view against pass/fail, above 60 and Firsts

Logistic regression analyses were also run to see whether viewing at least 1 video changes the likelihood of either passing the unit (requiring a mark of above 40%), or gaining a good honours degree grade (>60%) or 1st class degree grade (>70%). The analysis included gender, entry qualification, ethnicity and view.

The findings suggest that watching at least one video improves the likelihood of getting a mark above 60%, and it is an even stronger predictor of getting a 1st class degree outcome. However, it does NOT predict unit failure (a mark of below 40%) significantly. In other words, video support seemed to positively impact those students who are predicted to pass the unit but does not impact those who are about to fail their units. The findings suggest that the better a student performs, the more impact viewing video support materials have on their performance. The significant predictors are highlighted in bold in Table 2.

"40% or above" - prediction							
	coeff b	*s.e.*	*Wald*	*p-value*	*exp(b)*	*lower*	*upper*
Intercept	0.922	0.350	6.917	0.009	2.514		
GENDER (M=1)	-0.103	0.216	0.227	0.634	0.902	0.591	1.378
Entry Quals (Acad=1)	**1.659**	**0.227**	**53.366**	**0.000**	**5.254**	**3.367**	**8.201**
Ethnicity 2-way (White=1)	**0.455**	**0.218**	**4.337**	**0.037**	**1.576**	**1.027**	**2.418**
Viewed?	0.383	0.324	1.404	0.236	1.467	0.778	2.766

"60% or above (Good Honours)" - prediction							
	coeff b	*s.e.*	*Wald*	*p-value*	*exp(b)*	*lower*	*upper*
Intercept	-2.191	0.279	61.800	0.000	0.112		
GENDER (M=1)	**0.287**	**0.136**	**4.446**	**0.035**	**1.333**	**1.020**	**1.740**
Entry Quals (Acad=1)	**1.326**	**0.137**	**94.331**	**0.000**	**3.767**	**2.882**	**4.923**
Ethnicity 2-way (White=1)	**0.570**	**0.132**	**18.753**	**0.000**	**1.768**	**1.366**	**2.288**
Viewed?	**1.064**	**0.242**	**19.345**	**0.000**	**2.897**	**1.803**	**4.653**

"70% or above (First Class Honours)" - prediction							
	coeff b	*s.e.*	*Wald*	*p-value*	*exp(b)*	*lower*	*upper*
Intercept	-3.251	0.348	87.341	0.000	0.039		
GENDER (M=1)	**0.522**	**0.145**	**12.927**	**0.000**	**1.685**	**1.268**	**2.239**
Entry Quals (Acad=1)	**1.086**	**0.150**	**52.098**	**0.000**	**2.963**	**2.206**	**3.980**
Ethnicity 2-way (White=1)	**0.654**	**0.137**	**22.791**	**0.000**	**1.924**	**1.471**	**2.517**
Viewed?	**1.261**	**0.305**	**17.063**	**0.000**	**3.529**	**1.940**	**6.419**

Table 2: *Key predictors of unit performance*

4 Discussion

The primary contribution of this study is that it reveals a positive correlation between viewing videos and unit performance. Given that this study measures student performance across the range of STEM disciplines, it confirms Dash et al.'s (2016) claims that videos are effective in illuminating abstract phenomena. Our findings provide new evidence to counter the view of MacHardy & Pardos (2015) that videos contribute little to student performance.

However, these findings need to be treated with caution, as correlation does not necessarily imply causation. One possible effect that we were not able to adjust for is that better students will reach better results in general, and that more motivated students are usually more motivated to watch and engage with the additional video support.

At the first (quantitative) stage of this study, we only aimed to establish an overall correlation between video engagement and achievement – regardless of video type, presentation style, the role of the instructor and other specifications that are known to moderate impact (Carmichael, et al., 2018). As a positive link between students viewing the video resources and their unit performance was detected, we now need to improve our understanding of why and how students used the videos through further qualitative investigations. Moreover, the second phase will also explore the ways by which videos act as a supplementary material to face-to-face teaching, and aims to identify the types of videos perceived as the most useful.

These findings are important for educators, particularly in STEM disciplines such as engineering where concepts and frameworks can be abstract and difficult. And, as the Covid-19 pandemic continues to run its course around the globe, it is likely that more and more students will require on-demand access to additional support resources such as the types of video described in this study, to help them progress successfully through higher education.

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