

Full Paper

Introduction

New technologies offer tremendous power to assist with design and change in higher education curricula. Online educational resources have become increasingly common in recent years, as evidenced by their use in distance education and blended learning courses. In particular, one of the latest trends to appear online is the mass creation of online expository videos, including how-to, tutorial, and lecture videos (Carter, Cooper, Adcock, & Branham, 2014). As a result, a large number of free educational videos have become available on the internet.

Several previous studies (Ajumobi, Malakouti, Bullen, Ahaneku, & Lunsford, 2015; Majid, Khine, Oo, & Lwin, 2012; Rittberg, Dissanayake, & Katz, 2015) together with our own observations have shown that without necessary skills to search, locate, process, evaluate and use information, students often experience various information related problems, such as information overload, inability to find the needed information and to extract the important points. Also it has been demonstrated that only a minority of YouTube videos are useful for teaching due to misleading content and poor quality (Fischer, Geurts, Valderrabano, & Hügler, 2013; Raikos & Waidyasekara, 2014; Yaylaci et al., 2014).

But the demand for multi-mode learning continues to rise among today's students where the development and integration of video lessons to the course curricula could be the option. With new technologies it has now become possible for educators to self-create high quality video materials (Bae & Lee, 2015) which can be further integrated to the course and serve as a self-study, revision tool or an alternative option for students studying by distance.

The aim of this study was to increase UWSCollege student's engagement and learning performance in Electrical Fundamentals which has been identified as one of the most difficult units for students during their first year of study. This would be done by creating educational video content which would be shared with a variety of stakeholders via a YouTube channel. The following goals were set for the study:

1. To analyse the current YouTube videos related to the course Electrical Fundamentals at UWSCollege and to collect general information about reliability and accuracy of the information and its potential use for teaching.
2. To develop short video tutorials/working examples for the Electrical Fundamentals unit to help students have greater study flexibility, engage them through a familiar medium and to encourage them to work outside of the usual lecture and tutorial times.
3. To evaluate the effectiveness of the created video tutorials to UWSCollege students and world community by collecting feedback from students and YouTube users.

Methods

This study was conducted in three stages: (1) literature review and analysis of recent YouTube videos, (2) design and development of video tutorials; and (3) analysis of the student's responses and evaluations.

The participants included students studying the Diploma of Engineering at UWSCollege. This course is equivalent to the first year Bachelor of Engineering degree at UWS. A total of 68 students studying the unit Electrical Fundamentals in Term 2, 2014 participated in this study.

1st stage – analyses of YouTube videos.

A literature search was conducted to identify the best practice in the development of educational video resources. We were looking for easy software to create “white board style” tutorials similar to in-class activities.

You Tube videos were queried using four search terms which are also the names of topics in the Electrical Fundamentals unit: “Mesh Analysis”, “Nodal Analysis”, “Thevening’s Theorem” and “Principle of Superposition”. Videos not related to Electrical Fundamentals, funny videos and duplicated videos have been excluded.. The first three searched YouTube pages were evaluated and were characterized by the following parameters: the relevance of the content to the Electrical Fundamentals unit and the explanation of the working procedure according to the theory concept.

2nd stage - design and development of video tutorials

To create video tutorials we selected the software Explain Everything. This is a free application which is very popular with educators and widely used to develop video content. The following steps were taken during the design and development stage:

- Script writing and collection of images being used in videos
- Recording videos in the form of white board tutorials with instructor voice over
- Uploading videos to the YouTube channel

A total of seven videos 10-13 minutes long were created and uploaded on YouTube channel (<https://www.youtube.com/channel/UCMBAI3O8EDKdXwpUDU3mMBw>) and UWSCollege’s own vUWS site (UWS Blackboard site).

3rd stage - analysis of the student’s responses.

The students were asked to complete the survey about their experience with using online video tutorials. Also the data from students’ surveys on the unit and unit assessment results have been evaluated. Data from the YouTube channel was used to evaluate the public’s response to the videos and was compared with UWSCollege student’s own responses.

Results and Discussion

Analysis of YouTube videos

A total of 190 videos related to the four topics identified for the Electrical Fundamentals unit were analysed with the purpose of identifying videos suitable for student’s self-study. Similar to previous studies (Camm, Sunderland, & Camm, 2013; Fischer et al., 2013) we found only a small amount of videos were suitable for students as self-study or revision options. Each video was categorized as follows:

- (1) Videos used the same concept/problem solving strategy as used in the Electrical Fundamentals unit at UWSCollege and the theoretical background explained;
- (2) Videos used the same concept/problem solving strategy as used in the Electrical Fundamentals unit but without explanation of the theory;
- (3) Videos used a different concept/problem solving strategy, but were well explained;
- (4) Videos used a different concept/problem solving strategy without explanation;
- (5) Videos related to the Electrical Fundamentals but were of a very poor quality.

Videos which fell into the first category were considered as suitable for UWSCollege students. A summary of the number of videos searched and categorized for each topic is listed in Table 1. An example of the break down of the first 20 searched videos into the categories for the topic “Nodal Analysis’s is shown in Figure 1.

Table 1

The summary of the videos searched for Electrical Fundamentals topics.

<i>Topic</i>	<i>Total number of videos in first three search pages</i>	<i>The number of videos suitable for UWS College students</i>	<i>Percentage of total videos suitable for UWS College students</i>
Nodal Analysis	57	2	3.5%
Mesh Analysis	58	8	13.8%
Thevenin's Theorem	61	8	13.1%
Principle of Superposition	14	4	28.6%

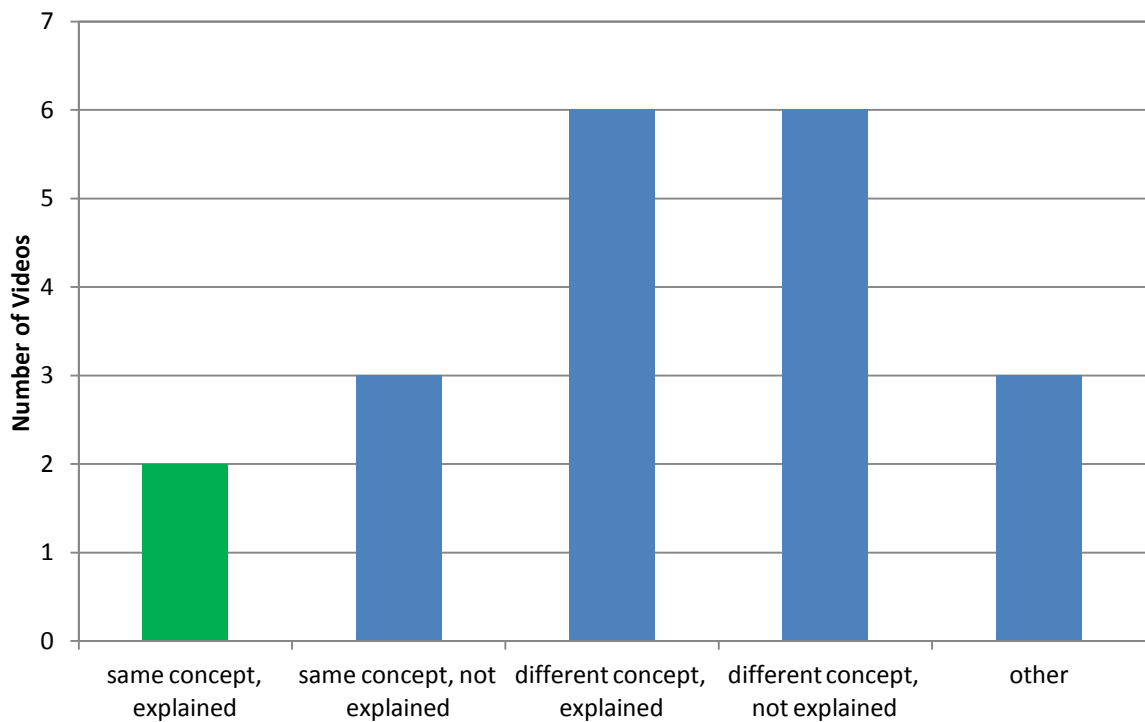


Figure 1. The analysis of 20 YouTube videos for 1 topic – “Nodal Analysis” from Electrical Fundamentals unit

An average of 11.6% of videos searched for across the four topics indicated were found suitable for students' self-study and teaching purposes. The topic "Nodal Analysis" had the smallest number of videos suitable for UWS College students (Table 1). For this topic only two (3.5%) were found to follow the same problem solving procedure as used in Electrical Fundamentals while 8 videos (14.0%) were well explained and of a good quality..

Thus, the overall analysis of YouTube videos indicates that student's conducting their own search of educational videos related to the Electrical Fundamentals unit are likely to be confused after watching videos not recommended for the unit. Therefore we decided to develop our own materials to tightly integrate video tutorials into the unit.

Design and development of video tutorials

Video tutorial with the “white board look” were created by using screencasts; direct captures of screen activity and images with audio recorded simultaneously (Sugar, Brown, & Luterbach, 2010). It is known that the presentation of information in both visual and verbal forms support dual coding and cognitive load theory for student multimedia learning (Mayer, Heiser, & Lonn, 2001).

The series of Electrical Fundamentals video tutorials were created using a hand writing tool and an instructor voice over. The videos were uploaded to both the Electrical Fundamentals UWSCollege website (vUWS) in August 2014 and YouTube page (https://www.youtube.com/channel/UCMBAI3O8EDKdXwpUDU3mMBw) as shown in Figure2.

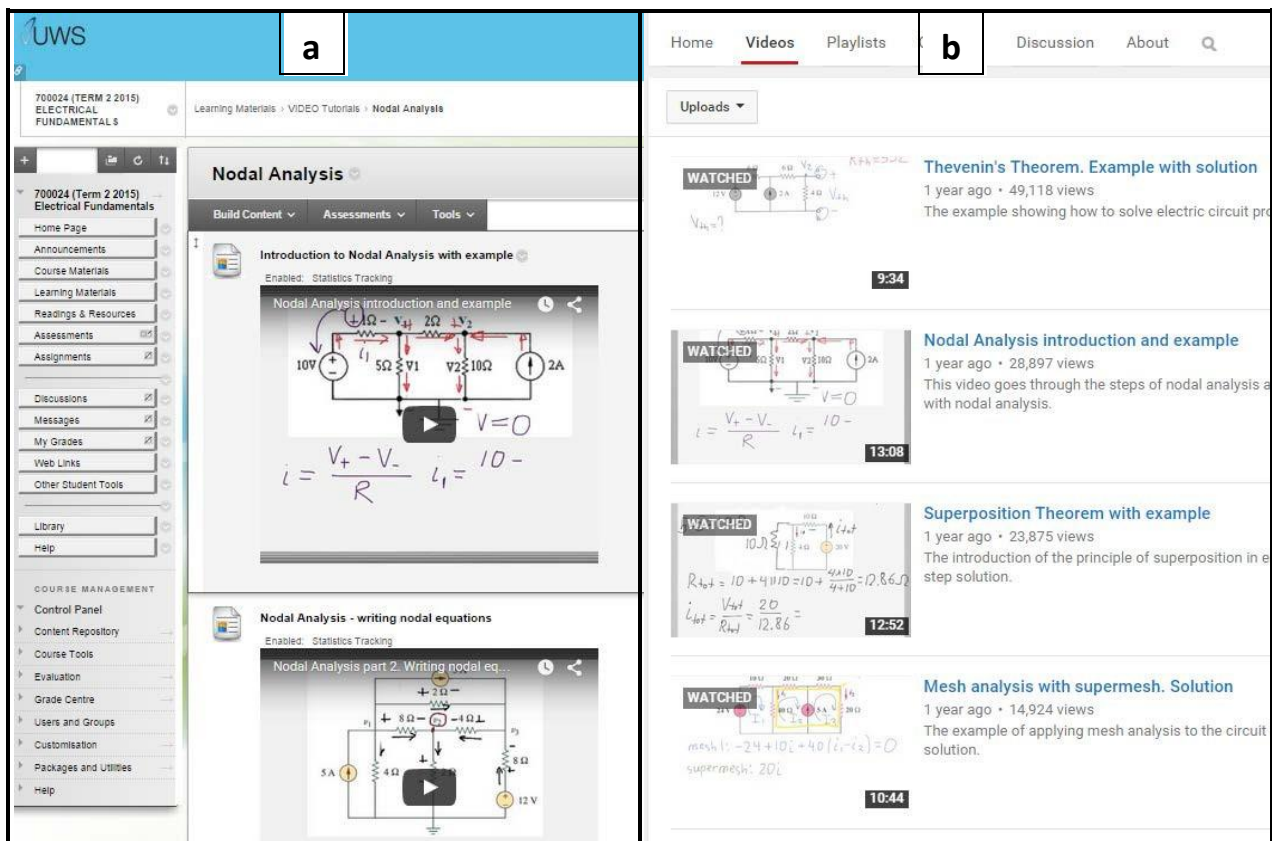


Figure 2. Unit website (a) and YouTube page (b).

Analysis of initial YouTube viewing data shows that since the videos were uploaded to the YouTube (UWSCollege students were notified via email when this happened), the students used videos heavily before exams as shown by the large increase in views prior to the mid semester and final exams (Figure 3).

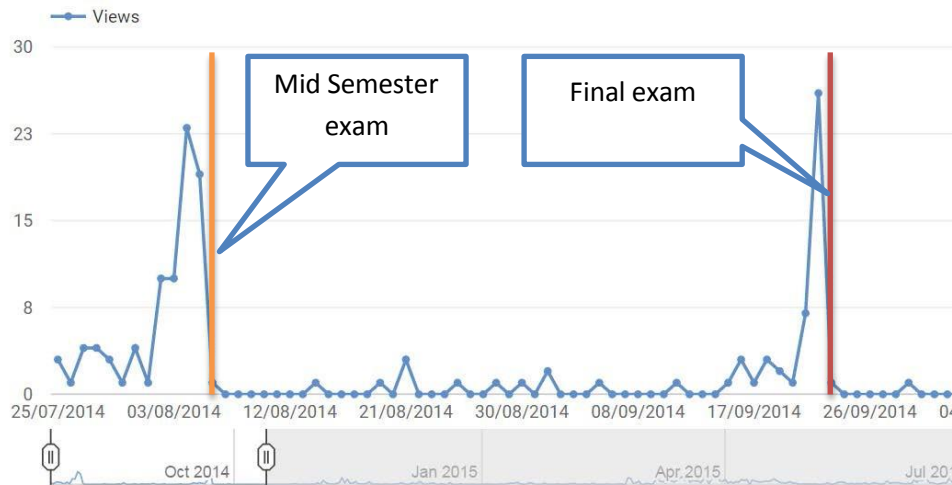


Figure 3. The YouTube views report for UWSCollege students during Term 2 (August-October) 2014.

When the public view on YouTube was enabled, a large number of positive comments were submitted to the channel. The viewing report demonstrates stable audience retention during the video's 8-10 minute running time, suggesting the selection of the video's length was reasonable (Figure 4). The initial views drop of approximately 20% can be explained by the video occasionally being accessed by mistake. For the period of one year on YouTube, the videos attracted over 110,000 views, showing that the project videos developed may have been of interest or use to other external users not directly connected with UWSCollege.

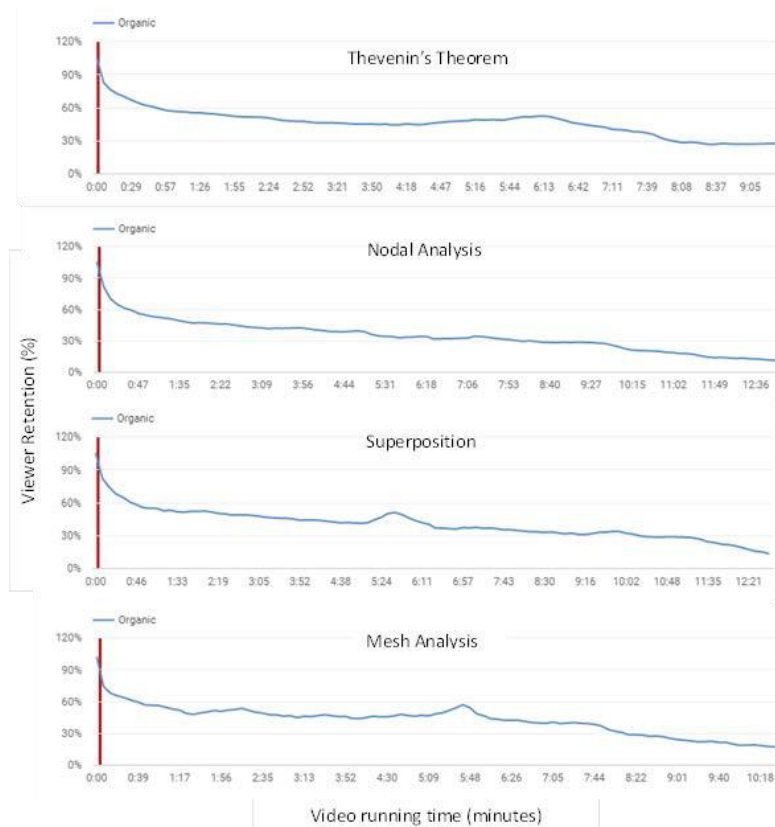


Figure 4. Audience retention report on the 22/08/15.

At the end of Term 2 in 2014, students were asked to give feedback about their learning experience with the video tutorials. Student's comments from the questionnaires and surveys, as well as public comments from the YouTube channel indicated that new video tutorials had been well received. Some examples of comments include the following:

'Thank you so much, it helps a lot, I wish if you can solve many problems'

'Video tutorial were useful in my study, especially when I was studying for a test at home. It did help me understand topics and it would be better if I could have video tutorials in all my subjects, especially physics and maths'

'The videos helped me to understand the topic and basically I passed the midsemester exam be referring to the video tutorials'

'I used videos as a guide to do extra questions and revisions'

Analysis of UWSCollege student's surveys on the unit showed a significant increase in the unit's 2014 score when compared to those from 2012 and 2013 (Figure 5). Also, when video tutorials were introduced for the first time in 2014, student's average learning experiences in the unit were above average compared to UWSCollege's other units on offer campus-wide.

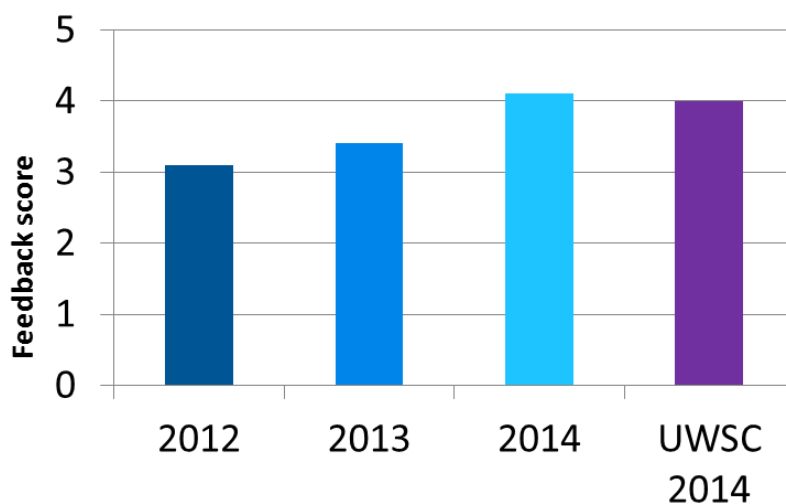


Figure 5. Feedback on student's learning experience for the Electrical Fundamentals unit from 2012 to 2014 (blue) compared to UWSCollege's average feedback on all units offered campus-wide in 2014 (purple).

Student's exam results for each topic (Figure 6b), were compared to the overall report of YouTube views by UWSCollege students for each topic (Figure 6b) The video "Thevenin's Theorem" attracted the largest number of video views. This topic however, was also identified as the topic student's performed the worst in exams on as shown in Figure 6 (b).

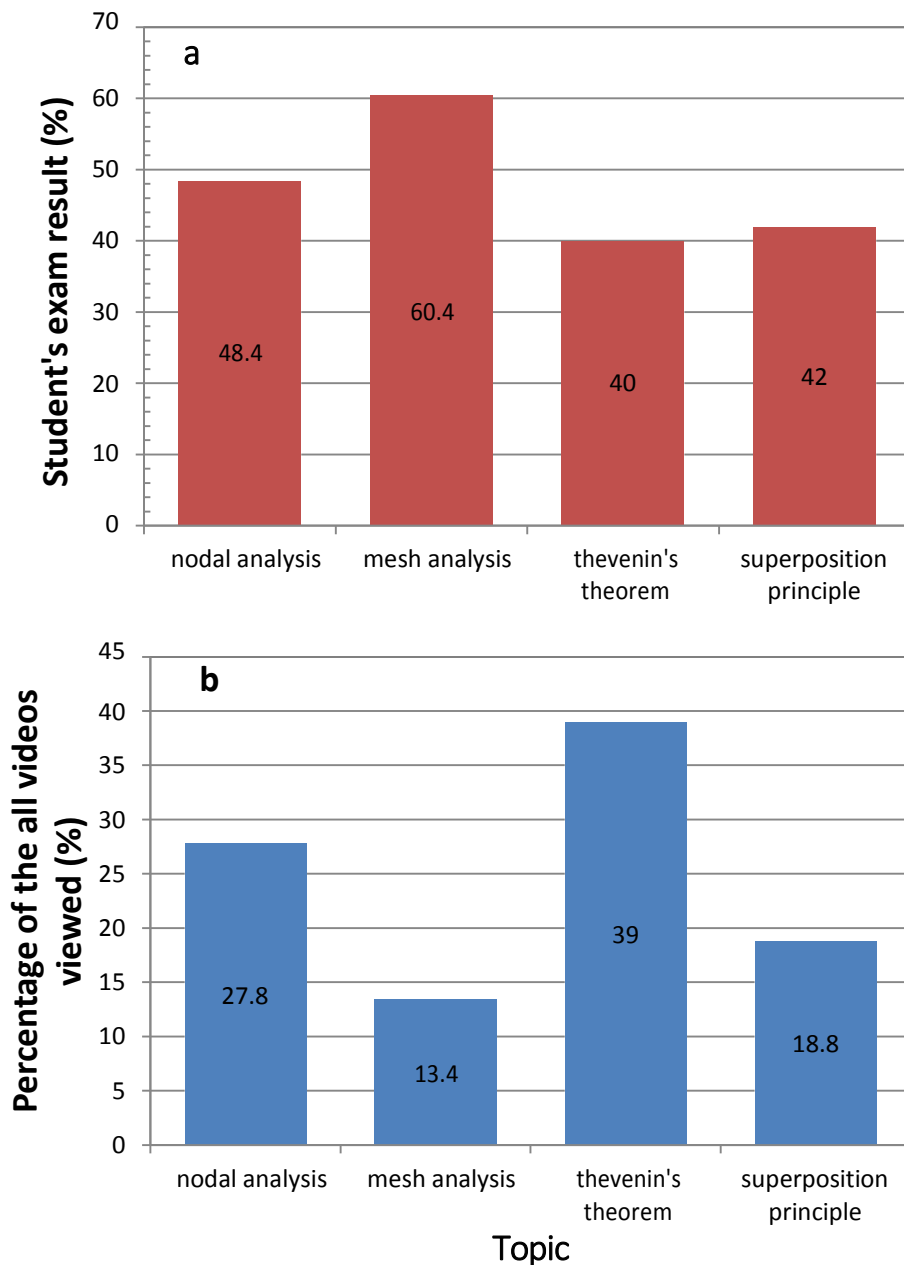


Figure 6. Student's exam results by topic as a percentage of maximum marks (a) compared to the percentage of videos views by topic (b).

The second most popular video on YouTube was on “Nodal Analysis”. The average student exam mark for this topic was found to be around 48%. This was followed by the video on “Superposition Principle” which totaled 18.8% of YouTube views and corresponded to an average student exam mark of 42%. The lower number of views for “Superposition Principle” compared to the topics “Thevenin’s Theorem” and “Nodal Analysis”, can be explained by the fact that the Superposition question was only included in the mid semester exam and not included in the final exam. The highest student achievement was found for “Mesh Analysis”, which also corresponded to the lowest number of views, 13.4%.

These results indicate that student’s prefer to watch videos about “difficult” topics, as the most viewed subject had the lowest average student mark, while the least viewed had the highest average student mark. This trend can be clearly seen in Figure 7. Again, the topic on “Superposition Principle” may not fit the trend as it was only included in the mid-semester exam, and not the final.

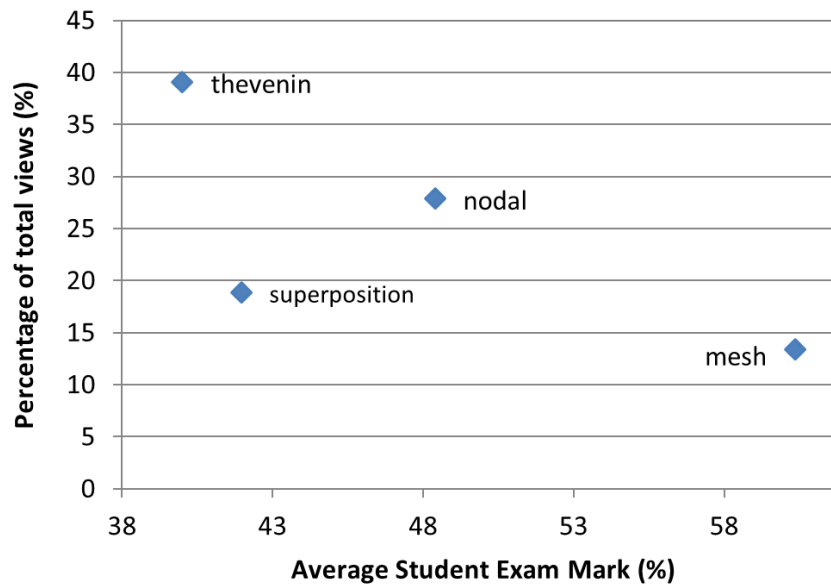


Figure 7. Average student exam results versus the percentage of views for each topic

The popularity of videos on the harder topics where students are underperforming indicates that students may benefit from the development of more video tutorials on these areas. This may include breaking up a single topic into separate more detailed videos.

Conclusion

This paper presents a preliminary project in searching, developing and implementing video tutorials for the unit Electrical Fundamentals taught at UWSCollege. Analysis of current videos already available on YouTube showed that only a small portion was suitable for teaching this unit. Therefore student's learning experience can be enhanced by the creation of educator's own videos tailored to the unit they are teaching.

The videos created were uploaded to a YouTube page as well as the UWSCollege's unit website. The development of video tutorials based on the student's needs to improve their understanding of the unit's content, helped them to learn and revise materials in their own time and to engage them in the study. From the analysis of students' feedback and YouTube data and final student's grades it can be concluded that the integration of video tutorials into the curriculum was effective in improving the learning process, especially on issues related to understanding of the concepts studied in class. Throughout this study, the positive global perception and satisfaction of the participants after the implementation of the videos is noticed.

Short video tutorials created by academics can therefore be used as effective learning tool in engineering subjects. It is proposed that created materials should be systemised by subjects and learning outcomes and shared between universities.

References

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