# Investigation of learning resource requirements to improve student engagement and satisfaction

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## STRUCTURED ABSTRACT

### CONTEXT
Student attrition is a significant concern, especially for regional universities. In analysing attrition rates, data indicates that distance students particularly have the highest levels of attrition. Some researchers have identified that student satisfaction and engagement are two key elements for retention (Tinto 1997; Carini *et al* 2006). The causes of attrition can be broadly categorised into two main influencing factors: individual reasons and factors contributed by the university. This paper will explore the suitability of learning materials in an engineering unit of study in order to identify whether the new learning resources are required to better suit the different learning styles of that student cohort and, in turn, assist with improved retention.

### PURPOSE
The purpose of this project is to evaluate a suite of learning resources in order to identify student requirements and address those need to improve student satisfaction and contributes to deeper learning of the engineering concepts being taught and increased retention. This paper primarily focus on identifying student learning resource requirements.

### APPROACH
The main focus is the improvement and enhancement of learning materials to create a more interactive and stimulating environment for online students to engage and participate in learning. Learning resources improvement need will be identified to create interactive materials to improve the quality of learning resources in order to support multimodal learning and promote self-paced learning. The new learning resources will augment past learning materials. Students have been invited to participate in a pre-term survey that will identify the types of learning resources they prefer as the learner. At the end of the term, students will participate voluntarily in an online survey and a semi-structured interview to express their views on how the learning resources supported their learning.

### RESULTS
The analysis of student learning resource needs and addressing them will enhance student learning and contribute to higher levels of engagement with the unit content. Furthermore, we are optimistic that student satisfaction will be higher thus leading to improved pass rates and higher levels of retention in the unit.

### CONCLUSIONS
Proper understanding of learning resource requirements and embracing student's diverse learning needs, it is anticipated that not only will student satisfaction and their learning experiences be improved, but longer term effects such as retention and deeper knowledge acquisition will result in quality professionals entering the field of engineering.

### KEYWORDS
Multimodal learner, self-paced independent learning, engagement,

# Introduction

At present, Central Queensland University (CQUniversity) is deemed as Australia's most inclusive and engaged university due to the vast offering of online education in addition to having many campuses in regional areas and metropolitan cities throughout Australia. Although CQUniversity is a leader in the field of teaching resources and well known for introducing the latest state of the art technologies to students, there is always room for improvement due to advancement in technology. These emerging technologies provide ample opportunities for instructors, as well as students, to improve their learning and teaching experiences. The School of Engineering and Technology (SET) at CQUniversity has a unique student cohort which differs vastly to G8 universities. CQUniversity has a high percentage of mature age students who present with a vast range of needs and skillsets. Within the student cohort in SET, there is a diversity of age, motivation, confidence, skill levels and capabilities which educators need to be aware of in order to consider the student needs at each stage of their learning journey. In addition to this, around 27% of the enrolled CQUniversity engineering students undertake units in online mode (Mandal, 2015).

Student attrition is a significant concern, especially for regional universities. In analysing attrition rates of CQUniversity during the period 2010 to 2014, internal data indicates that the SET had very high attrition ranging from 23% to 38%. The data also shows that online students in particular have the highest levels of attrition (CQUniversity Radar, 2018). The causes of attrition can be broadly categorised under two contributing factors. Firstly, those relating to more personal issues such as personal difficulties, financial challenges, health problems, work or family commitments, and the second factor relates more to academia which can more easily be influenced by the university (Ariandurai, 2008; Mayer, 2010). Therefore, if retention is an aspect that requires addressing, then current approaches to learning and teaching need to be evaluated and new ways considered. What is evident in research is that student satisfaction and engagement are two key elements that improve retention (Tinto, 1997; Carini, et al. 2006).

Due to the unique nature of CQUniversity's SET student cohort and inherent complexities associated with engineering subjects, there is a critical need to improve student learning experiences. Electrical engineering subjects are often highly technical, and rely heavily on rigorous mathematical and theoretical concepts. Sometimes, it is challenging to connect the concepts being taught to physical intuition and practical insight. This may impede student engagement and satisfaction with the unit if they are not gaining understanding of the content. Previous offerings of the electrical units received negative student evaluations stating that the subject matter was boring, hard to understand, and difficult to apply concepts in problem solving. Therefore, building student confidence, promoting engagement, improving skills, challenging time constraints, and inculcating deep and independent learning habits are the key aspects that demanded a pragmatic approach to improve student success and reduce student attrition. Alongside that, consideration of more engaging learning materials that encourage self-directed learning and the ability to apply content to real life experiences would assist with creating a more engaging learning experience. Promotion of self-directed learning, providing guidance, and facilitation of self-paced learning has been found to enhance student's intrinsic motivation, in turn promoting student ownership of their learning. Kransow (2013) emphasises the importance of building linkages among peers, and more open interaction with lecturer/facilitator (Sher, 2009) in order to improve student satisfaction and learning.

Online education at CQUniversity has large numbers of enrolments due to the diversity of the student cohort. When online education was first offered at universities, the first generation of learning materials were primarily based on printed learning resources (Nipper, 1989). The second generation saw broadcasting added to further support the learning materials (Peters, 2002). Currently, the third generation of online education heavily relies on IT based tools which include, but are not limited to, web-based tools, videos and video conferencing. However, some educators simply try and create internal materials into online resources with limited success. In particular, student learning analytics demonstrate that lengthy lecture videos are not well accepted by students, especially if they include difficult concepts being taught in a non-engaging format. Therefore, it is important that emerging technologies and teaching and learning strategies are tailored to suit the needs of the student cohort in order to improve student learning experiences.

Electrical Components and Circuit Analysis unit (ENAE12013) is a second year unit which is only offered as an online unit of study within the Engineering Associate Degree course at CQUniversity. From Term 2, 2018, analysis of learning resource requirements was carried out and based on the findings, a new set of learning resources was introduced to students enrolled in this unit. When developing these new

learning material, additional scaffolding was introduced to help students to understand the difficult concepts. In addition, a new technology, pen casting, was utilised in order to create highly interactive resources to assist students in better understanding the concepts and applying them to real world situations. It is anticipate that these resources will allow students to learn difficult concepts off-line at their own-pace which facilitates independent learning and increases the students' sense of ownership towards their learning.

## Methodology

This research project was conducted over a one term period beginning in June 2018 and finishing in October 2018. The project proposal was formulated leading to the submission and approval of an ethics application to Central Queensland University's Human Research Ethics Committee. This project was conducted with second year students enrolled in ENAE12013 unit. This paper will report on the findings from the initial online survey where students were asked to voice their preferences on teaching resources that best assist them in learning engineering concepts. In addition, it will share some details around the development and creation of the new resources using pen-casting technology.

A mixed methods approach involving a combination of quantitative and qualitative data analysis was used to analyse the data (McKenney & Reeves, 2012). The mixed method approach enhances the capability to more broadly expand on the results compared to using only qualitative or quantitative study designs (Cronholm, 2011). Students were invited to participate in this research project via email. Participation requirements included completing a pre-term survey, a post-term survey and a final interview. Although it is preferable for the same students to participate in all activities, due to this being anonymous and voluntary, students may opt in or out of the project without penalty. In order to ensure students are not coerced into participating, an external researcher, not involved with SET, carried out the individual interviews.

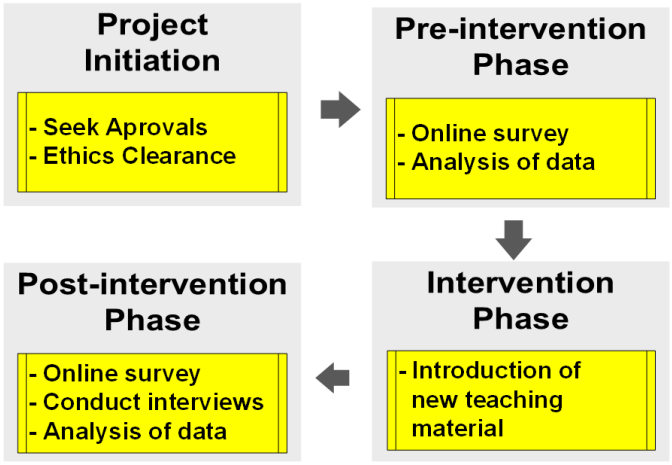


**Figure 1: Methodology**

The proposed research study includes the four key stages as shown in Figure 1. Within the Project Initiation phase, approvals were sought from the Dean of SET and the Deputy Dean of Learning and Teaching to conduct this research. An ethical clearance application was presented and approved through Central Queensland University's Human Research Ethics Committee. All aspects of recruitment of participants (students), research project design finalisation, development of qualitative and quantitative research instruments, collection of data from EASI CONNECT, echoCenter, unit evaluation dash board data bases all follow the process approved through the ethics application.

The Pre-intervention phase tasks involve conducting the online survey, analysing the data, and reviewing and compiling the findings from the dataset. *Survey Monkey* was used to conduct the online survey. Open-ended questions were presented to collect the student voice to inform the intervention requirements.

The Project Intervention phase includes the introduction of the newly developed pen-casting enabled study material for the unit. During this phase, the learning materials will be modified to respond to the needs of the students based on the evidence provided by the analysis of pre-intervention. In doing this, the main focus will be to ensure that the material is easy to use and students' understand the concepts being taught. Learning materials will be modified to promote self-paced learning and to improve peer-engagement. All enrolled students will have unrestricted access to modified and un-modified learning materials regardless of project participation.

The Post Intervention phase includes a post-term online survey, semi-structured interviews, analysis and comparison of datasets, and interpretation and presentation of results. In addition, to further expand on the student voice, the educator will present a self-evaluation around the successful elements and the aspects that require further enhancement.

However, this paper will report solely on the findings of the pre-intervention phase. The results from the remaining phases will be reported in a subsequent publication.

### Data Analysis

The project will use both quantitative and qualitative data analysis through the collection, collation and interpretation of data derived from internal data repositories, survey questions and semi-structured interviews. Quantitative data collected from internal data bases and likert scale rating questions will be analysed using statistical data analysis technique. Semi-structured interviews will be analysed using thematic analysis (Braun & Clark, 2006). This interpretative/qualitative data analysis will integrate a thematic approach to classify, analyse and report on arising themes and any interconnectedness between these themes. Implicit and explicit ideas with in the text will be extracted from data. Formative assessment of the project will be carried out regularly by investigating the acceptance of the new approach, and outcomes will lead to further refinement of the methodology in an iterative fashion based on evidence (McKenney & Reeves, 2012).

## Findings and Discussion

### Student evaluation and unit performance

Teaching and learning is greatly influenced by student evaluation and feedback process (Sayem, et al. 2017). Through analysing and reviewing end of term student evaluations and addressing their feedback will enhance the unit and make the learning process more attractive to students. CQUniversity uses a one to five scale rating system to measure unit performance. The university expects each unit to achieve an average satisfaction rating of 4.0 out of 5.0. In addition, they expect at least 50% or more of the student cohort to respond to the student evaluation survey.

| Year | Response Rate | Overall Satisfaction | Moodle Navigation | Learning Resources | Assessment Tasks | Assessment Return / Feedback |
|---|---|---|---|---|---|---|
| 2017 | 100% | 4.9 | 4.9 | 4.1 | 4.6 | 5 / 4.6 |
| 2016 | 70% | 4.4 | 4.4 | 4.0 | 4.1 | 4.8 / 4.3 |
| 2015 | 74% | 3.9 | 4.1 | 3.4 | 3.9 | 3.7 / 3.9 |

**Table 1: Student evaluation** (source: https://radar.cqu.edu.au)

Table 1 represents the results of the student evaluations that measure the performance of Electrical Components and Circuit Analysis (ENAE12013) unit. It can be seen that the overall unit performance has improved since 2015. However, learning resources scored the lowest evaluation and same pattern can be observed in all three years. Although ENAE12013's unit performance meets CQUniversity's performance standards, these findings indicate that there is an opportunity to improve student satisfaction by providing appropriate state of the art learning resources.

## Pre-intervention phase online survey findings

It is noted that the number of responses to the online survey was equal to the number of students enrolled for ENAE12013 unit during Term 2, 2018. It was found that more than 57% of students are over 31 years of age and only 28% of students are less than 20 years old. This shows that the majority of students enrolled are in the 31- 45 year old age bracket. These findings indicate that the majority of students in this cohort are mature age and completed their high school studies quite a while ago.

According to the online survey responses, it was found that a majority of the students were confident with the basic concepts within the electrical circuit unit. In general, most of the mature age students have had hands on industry experience. This may be an indication as to why they claim confidence in the concepts.

Around 43% of students have indicated that they prefer to have written instructions compared to videos in order to understand the learning tasks. More than 86% of students liked to access online resources to further their learning.

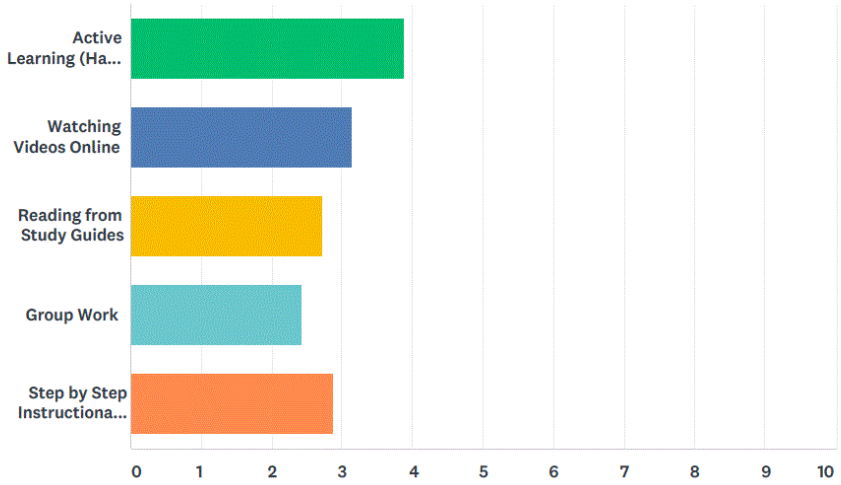


**Figure 2: Preferred learning method**

Students were asked to rank the preferred method of learning and Figure 2 demonstrates the summary of students' responses. It is observed that active learning (hands on approach) was found to be the most preferred method of learning. This may be due to many of these students having worked within the field as tradesmen so they are used to hands on experiences. Therefore, they are more comfortable with learning while doing compared to learning theoretical concepts first and then applying them to practical exercises. Online videos and step-by-step instructions were found to be the next preferred method of learning. Quality internet connection with sufficient bandwidth was the main problem associated with videos. Although it is possible to select the content to view by fast forwarding the video, step by step instruction based methods may be more valuable and help prompt more independent learning. Utilising the pen-casting system allows for a more step-by-step approach using audio visuals, without the need for a high quality internet connection as students can access these resources off-line.

Students were asked to rate the learning resources considering the usefulness using the Likert scale of 1 being the most beneficial and 10 being the least beneficial. Figure 3 displays students' responses against each learning resource. For this particular student cohort, group experiments were regarded as the most beneficial learning resource. Moodle forums, lecture videos, instructional videos, and design tasks were also found to be beneficial as effective learning resources. Students rated written instructions as the least beneficial resource for learning.

Although written material has been the primary source of knowledge transfer for most universities, these results indicate that audio-visual based learning resources are gradually overtaking the main role in knowledge transferability. However, it is a well-known fact that online lecture videos demand good internet connection and high bandwidth to facilitate a quality video based learning environment. For some distance students who live in regional and rural areas in Australia, this may be challenging.

Therefore, the authors suggest that it is necessary to develop a set of learning resources which have audio-visual effects similar to videos but demands less bandwidth requirements and this is the gap that pen-casting may fill.

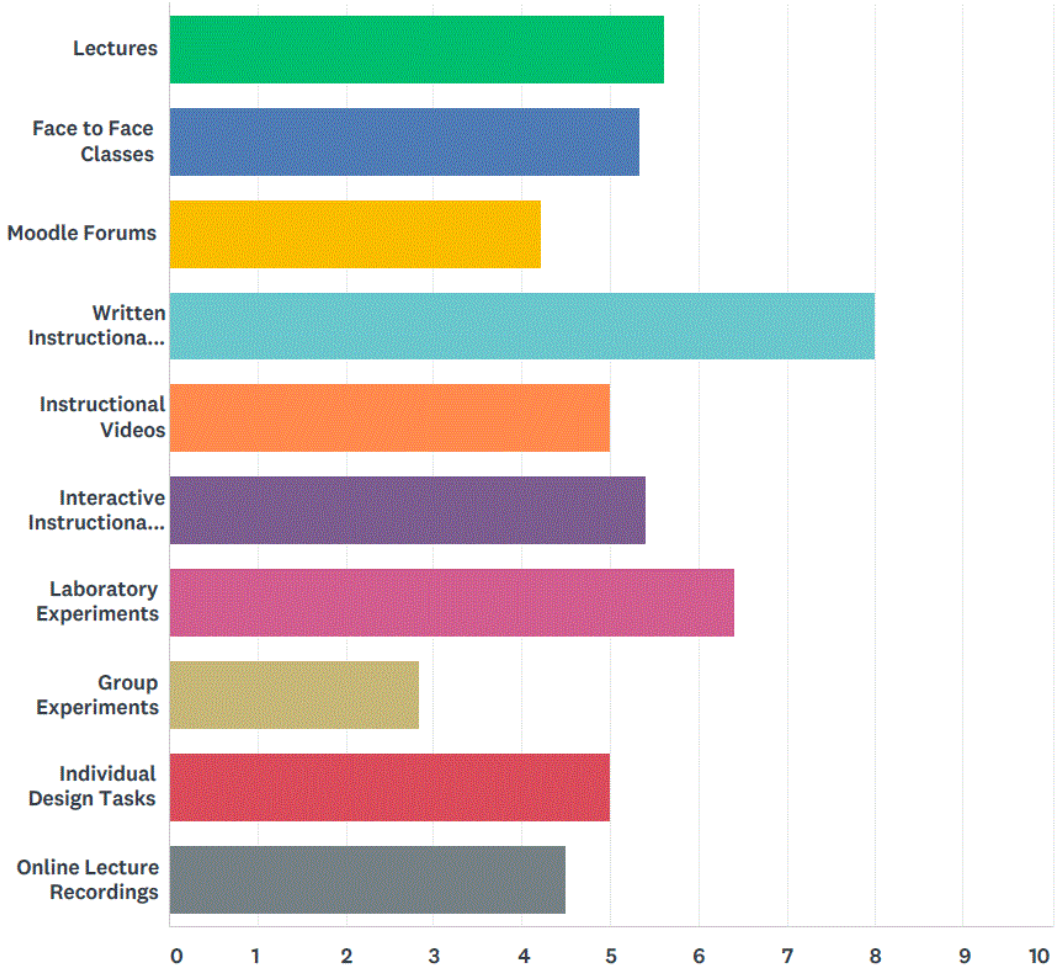


**Figure 3: Ranking of learning resources**

## Conclusions

This paper has reviewed the preliminary findings from a project analysing the quality of learning resources within the Electrical Components and Circuit Analysis unit. Data were derived from students' responses to online surveys and from the CQUniversity data repositories.

Unit evaluations indicated that the suite of learning resources within this unit required improvement. The findings from the pre-intervention online survey indicated that students preferred audio-visual based learning resources over document based learning resources. It also highlighted the fact that to have a video based learning environment, it is necessary that students have good internet connection and a high quality bandwidth. Considering all these aspects, the authors have found that a pen-casting based technique is beneficial when developing learning resources.

It is anticipated that the pen-casting enabled learning resources will improve student satisfaction and student engagement thus lowering student attrition. The results from the remaining phases of this project will be reported in a subsequent publication and it is hoped that through examining the impact of the introduction of the new pen-casting learning resources, it will identify whether they enhanced the unit and made the learning process more engaging for students. It is anticipated that that this innovative approach will improve student learning outcomes as well as encourage students to continue in higher education.

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