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To critically review the use of screencasts for teaching land surveying

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TO CRITICALLY REVIEW THE USE OF SCREENCASTS FOR TEACHING LAND SURVEYING

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Abstract

Screencasting tools allow for a screen capture of the actions on a computer screen with accompanying audio. This research initially reviews through the literature how screencasting has been used pedagogically and, through this primary research, the application of an existing screencast called Screencast-O-Matic and feedback from students from both Construction Management and Geospatial Surveying Undergraduate Programmes of TU Dublin, where and how it could be deployed for the surveying classes and fieldwork during the pandemic situation. This research occurred when all Irish third-level institutions lectures and tutorials moved online, and access to survey equipment for fieldwork was severely reduced. The paper concludes with a reflection on how some of the practices put in place due to the current pandemic situation would benefit when face to face classes resume.

During surveying projects, several steps were identified during which students encountered a "bottleneck" in their learning. As screencasts provide unsupervised access to teaching materials, a series of screencasts was created as online support and incorporated into our VLE (Virtual Learning Environment); this included video tutorials on how to set up and use surveying equipment, as well as screencasts showing how to process and perform calculations of recorded survey data. Results from students being subsequently surveyed through an online questionnaire showed that the vast majority found the videos helpful or very helpful in explaining how much they knew or did not know about the material and liked the format as a complement to the weekly recorded lectures. The survey also revealed a variety of learning habits and styles within the class. Those findings are consistent with previous research, which highlight that screencasting facilitates learning for the diversity of learners.

Veedbacks, or video feedback, provided students feedback on various assignments, such as fieldwork projects and online examinations. A series of semi-structured interviews revealed that students found the veedbacks a valuable complement to the feedback process by better understanding how they could improve their subsequent assignments.

Grades for both undergraduate classes were compared with those from previous pre-Covid classes, with a significantly higher mark for students who used screencasts as an online tool. Moreover, several students surveyed suggested that screencast videos, particularly those involving calculations, should be incorporated as online support when face-to-face classes resume. Based on these findings and their own experience in creating screencasts, lecturers in this study believe that screencasting provides a means to build support material relatively quickly for feedback, tutorials and teaching material and is a helpful complement to both online and face to face classes.

Keywords: online teaching, screencast, feedback, geospatial surveying, collaborative.

1 INTRODUCTION

Following government advice and increasing patient numbers with Covid-19, third-level institutions such as TU Dublin were formally closed to students on 12th March 2020, and face-to-face teaching was suspended [1]. However, practical surveying fieldwork sessions, during which students learn to use surveying equipment, were later dimmed to be essential and were taking place under strict guidelines. A variety of online teaching methods and tools were considered at TU Dublin. This paper reviews how screencasting was implemented for surveying classes for Construction Management and Geospatial Surveying Undergraduate programmes and discussed its benefits and limitations, considering both lecturers' and students' perspectives.

Screencasting has historically been deployed mainly in the teaching context as a tool to create video tutorials that extend classroom lectures and replace or complement the formal typed documents with screen capture since 2005 [2, 3]. The benefits of using screencasting are well documented in the literature. From the teacher's perspective, the ease of creating instructional videos and adding explanations proves extremely valuable when explaining dynamic procedures and providing

asynchronous access to teaching material for distance learning and flipped classroom instructional frameworks [4]. Furthermore, the recorded material can be posted directly on the screencasting software website with the link sharable to students, uploaded onto a Virtual Learning Environment platform or to a larger audience via the Internet by uploading them onto video platforms such as YouTube [5].

Screencast is typically part of an instructional strategy, allowing sharing of material prior to online or face-to-face classes [6]. As such, screencasts have been reported as improving students' problem-solving capacity, such as solving mathematical equations [7]. Previous studies have also stated a statistically significant increase in marks in sciences after integrating videos [8]

For many years, screencast videos have been used to teach complex user interface systems such as CAD software. Videos clips are generally preferred over textual instructions, and their substantial flexibility represents another advantage. However, the importance of producing high-quality videos has been highlighted by students. [9].

There is a limited amount of literature on using screencasts for demonstrating the use of surveying equipment. Videos have been used to show surveying equipment and have been valuable supplementary material before fieldwork [10]. However, it has been suggested that it is more beneficial to students with a more visual approach to learning [11]. Interestingly, previous studies conclude that videos cannot fully replace explanations and demonstrations of the equipment by the lecturers [12].

Veedbacks, also known as video feedback, have been produced to complement students' feedback on various assignments [3]. Video feedback allows navigation through key comments in the document and provides audio support for students. Feedback should provide guidance through formative commentaries to improve students' skills in constructing an end product rather than the product itself [13]. Students find that veedbacks offer more supportive and conversational communication [14] and that it helps students' learning [15]. In addition, researchers argue that it provides more in-depth explanatory feedback [16] and greater feedback on the process itself than the final product [3].

2 METHODOLOGY

[17] state that a case study represents the most appropriate research methodology to observe a class, intending to establish a wider population within the same setting. A series of screencasts was developed as additional unsupervised learning and teaching resources for the second-year Construction Management class of 36 students and the Geospatial Surveying class of 24 students. Based on the main categories of applications identified in the literature (video tutorials, veedbacks and support to teaching materials), three series of videos were created using Screen-O-Matic software and uploaded onto the Virtual Learning Environment (VLE) available within TU Dublin, as MP4 files:

- As the access to surveying equipment was limited to specific fieldwork sessions, video tutorials were created explaining how to use survey equipment before fieldwork sessions.
- Videos were also created for unsupervised access; these videos explained how to post-process data collected during fieldwork sessions, perform related calculations, and plot data in CAD. It is worth noting that, based on previous years' experience and feedbacks from students, more screencasts were created when students have experienced a "bottleneck" in their learning.
- Finally, veedcasts were recorded "on top" of comments written on submitted reports at the end of the semester.

An online questionnaire with free-form comments' areas was later created to gauge students' perception of both classes. The questionnaire included, where relevant, a scaling bar consisting of five scales, from one (lowest/very poor) to five (highest/very good).

Marks obtained in the assignment (i.e. using screencasts) were later quantitatively compared to the marks from the same assignment from the previous year as a control sample to assess the impact of screencasts on knowledge acquisition and evaluate if differences in marks were statistically significant.

3 RESULTS

3.1 Questionnaire

The online questionnaire was aimed at evaluating students' opinions on three aspects:

- Access and quality (audio, visual, format, timing)
- Usefulness for each category of applications previously identified
- Teaching style, habit and awareness of own understanding.

A relatively high level of response, 28 out of 36 students for the Construction Management class, 18 out of 24 for the Geospatial Surveying programme), was attained, which removes potential bias issues [18].

Results are organised by the aspects below. Average scores are also calculated for questions that included a scaling bar consisting of five scales: very good, good, medium, poor, and very poor.

3.1.1 Access and quality

Most students found the sound quality and pace to be good (Q1 and Q2, Table 1); some minor sound issues were reported, and only three students stated that the pace could have been slower. The overall score is positive, as an inadequate pace can frustrate the students [19].

Table 1. Questions related to access and quality of videos (ranging from one for very good to 5 for very poor)

	5	***4***	***3***	***2***	***1***	***Score***
Q1. How did you find the pace of the videos?	27	12	4	2	1	4.348
Q2. How did you find the sound quality?	25	15	5	1	0	4.391
Q3. How easy to use did you find the videos?	29	9	4	1	3	4.304
Q4. How satisfied are you with the way the material is structured on Brightspace?	24	13	7	1	1	4.261
Q5. How difficult or easy is for you to connect to the Internet to access the teaching material?	5	26	6	4	5	3.478
Q6. How difficult or easy is for you to stay focused when using this material?	10	21	6	6	3	3.630

The majority of students were satisfied with how the material was structured on the VLE (Q4) and found the material easy to access (Q3); however, some students highlighted a difficulty with staying focused when using online teaching material (Q6). Other issues highlighted in the free-form comments areas were the difficulty to isolate from external noises such as other householders during lockdown periods due to Covid-19 and issues with their Internet connection, which is also noticeable with a lower score for the question related to the internet connection (Q5).

3.1.2 Usefulness of screencasts

With a score of 4.304, students found the video series demonstrating how to setup and use the surveying equipment beneficial (Q7, Table 2), which were first displayed before the fieldwork sessions. These videos were also available on YouTube [20]. However, some students mentioned that the process was only understood once students were using the equipment on the field.

The majority of students found videos very helpful or helpful for figuring out calculations (Q8, Table 2). Comments from students referred to various stages in surveying computations, where screencasts proved to have helped resolve issues. This is very beneficial from a teaching perspective by identifying "bottlenecks" in students' learning and adapting future teaching strategies to resolve those.

Table 2. Questions related to the usefulness of screencast (ranging from one for very good to 5 for very poor)

	5	4	3	2	1	Score
Q7. How helpful did you find the videos for demonstrating the use of the equipment?	26	12	5	2	1	4.304
Q8. How did you find the screencasts as a complement for helping you to figure out calculations?	17	17	6	3	3	3.913
Q9, How useful did you find screencasts on AutoCAD?	10	8	7	13	8	2.978
Q10. Did you find the use of video feedbacks a good complement to written feedback?	8	13	7	5	3	2.739
Q11. In general, how helpful did you find screencasts in resolving your problems (if any)?	9	16	10	6	5	3.391

On the other hand, students had contrasting opinions on the usefulness of videos in CAD (Q9). A couple of students reported that they prefer to have feedback as they go through the various stages of the drawing; an interesting comment highlighted the difficulty in viewing which tool was used in CAD and the complexity of the interface.

Not all students answered the question related to veedbacks (Q10); it later appeared that not all students listened to their recorded feedback. Although students had various feelings about this form of feedback as a complement, positive comments highlighted the possibility of rewinding and the ease of following the suggestions made for future assignments. One student also felt that it provided "more human feedback", a few found that it allows for more in-depth and detailed information, which is consistent with the literature [14].

Interestingly, many students found those videos helped them figure out issues (Q11); some commented that screencast videos should not entirely replace online lecturers and face-to-face lectures. A few students specifically highlighted the benefits of videos demonstrating calculations based on worked examples and how they would benefit the learners even when face to face classes resume.

3.1.3 Teaching habits and styles

The last questions were related to teaching habits and style and defining the variety of learners between both classes. Most students surveyed suggested screencasting is very useful in helping them understand how much they knew on the topics covered (Q12, Table 3), leaning towards developing meta-cognitive skills, recognised as critical attributes for engineering graduates [21].

Table 3. Questions 12 to 14 related to teaching habits and styles

	5	4	3	2	1	Score
Q12. Did it help you understand how much you knew/did not know about the material? *(ranging from 5 very much to 1, not at all)*	8	20	9	5	4	3.500
Q13. How difficult or easy is it to use distance learning technology? *(ranging from 5 not challenging to 1 very challenging)*	13	18	6	4	5	3.652
Q14. How confident are you in your ability to learn by distance learning? *(ranging from 5 very confident to 1 not confident)*	3	11	14	8	10	2.761

If students did not find distance learning technology challenging (Q13), there seem to be a variety of answers related to their confidence in distance learning (Q14). Some interesting comments were on the lack of contact with peer learners and the difficulty of knowing how their learning compares with those of their classmates at a given time.

When asked when students preferred to watch the videos when performing calculations and to create their drawings in CAD, results presented a wide range of answers, demonstrating a variety of learning

approaches (Fig. 1). For example, some students prefer to proceed step by step, whereas others would listen to the whole video before applying it to their data.

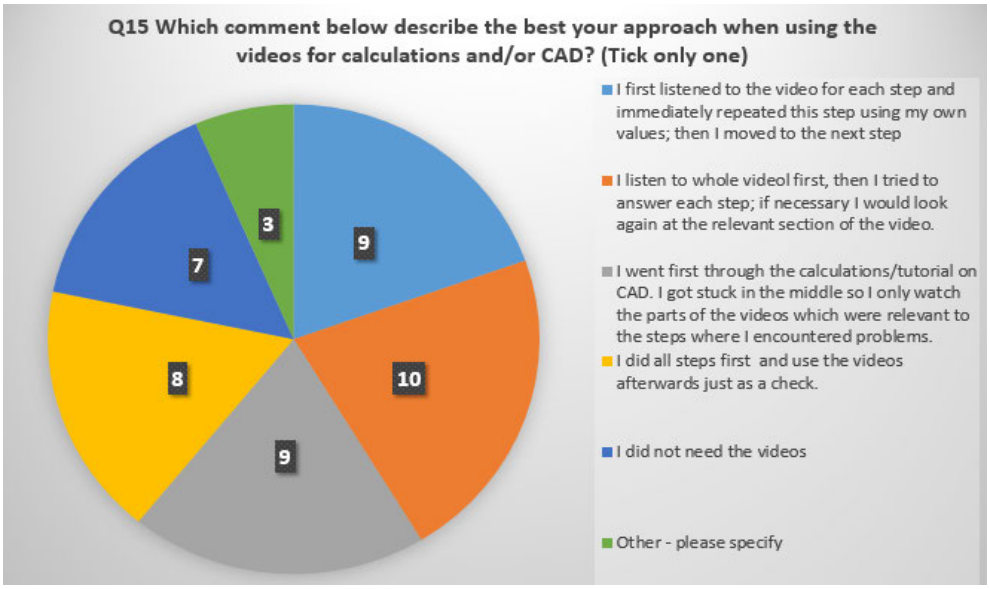

Figure 1. Learning approach when using videos.

Furthermore, some students prefer to access videos as soon as fieldwork resumes, whereas others do so before fieldwork (Fig. 2). This highlights the learners' diversity that typically makes up a class, as discussed in previous studies, e.g. [22].

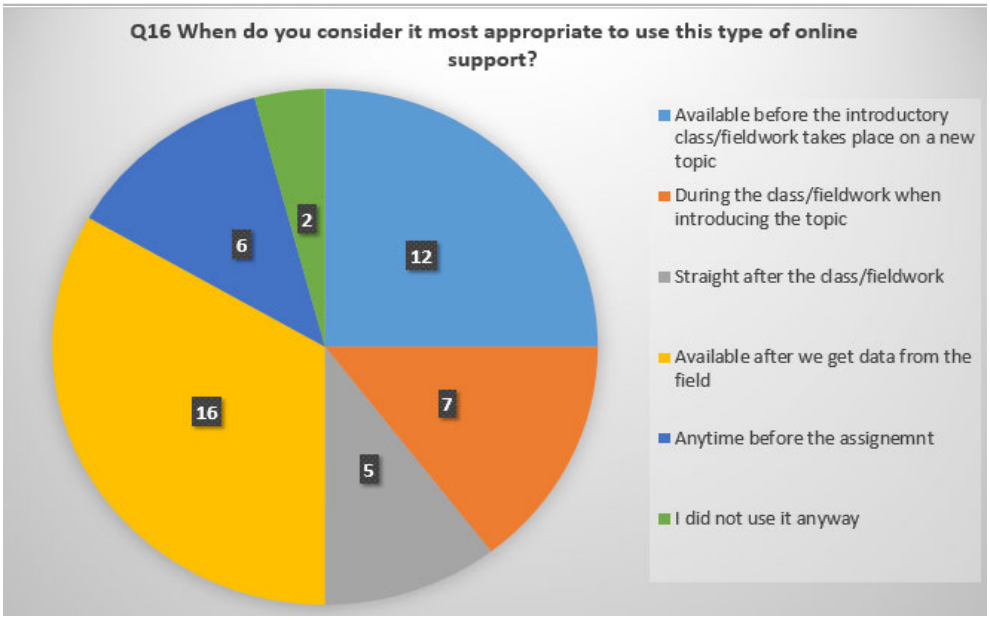

Figure 2. Most appropriate timing when using videos.

The variety of learners was further demonstrated when asked about the most appropriate video length. Some students preferred longer, others shorter videos and a few students stated that it depends on the topics (Fig. 3).

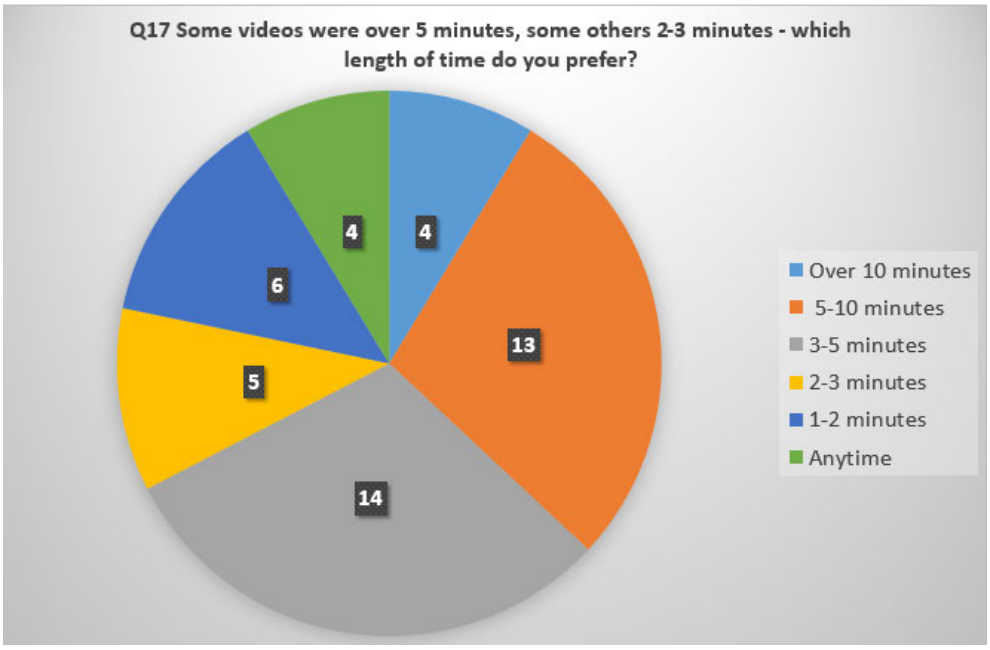

Figure 3. Preferred video length

3.2 Statistical analysis on grades

The null hypothesis (H0) researched stated: "There is no difference between students grades in 2021 (cohorts of students, whose classes and the material was online - including screencast videos) and students grades in 2020 (cohorts of students who had face-to-face classes before Covid19 pandemic)".

The alternative hypothesis (H1) stated:" There is a difference between students grades in 2021 (cohorts of students, whose classes and the material was online - including screencast videos) and students grades in 2020 (cohorts of students who had face-to-face classes before Covid19 pandemic)".

An F-Test was conducted to determine if the two populations have the same variance. The F-stat value was larger than the F Critical value. Therefore the correct t-Test to use was Two-Sample Assuming Unequal Variances.

Table 4. F-Test results

	Grades 2020	***Grades 2021***
Mean	*66.7755102*	*71.6444444*
Variance	*247.8027211*	*70.68888889*
Observations	*49*	*45*
df	*48*	*44*
F	*3.505539909*	
P(F<=f) one-tail	*2.43411E-05*	
F Critical one-tail	*1.638198396*	

The result of the t-Test (t Stat (df=75) < t Critical two-tail and p-value > α) lead to the conclusion that we cannot reject the null hypothesis and we cannot accept the alternative hypothesis (Table 5). There is not sufficient statistical evidence to determine if there is a difference between marks obtained online (2021) and marks obtained in person (2020). Analysis over a longer time will be required.

Table 5. t-Test results

	Grades 2020	*Grades 2021*
Mean	66.7755102	71.64444444
Variance	247.8027211	70.68888889
Observations	49	45
Hypothesized Mean Difference	0	
df	75	
t Stat	-1.891213715	
P(T<=t) one-tail	0.031228703	
t Critical one-tail	1.665425373	t Critical one-tail
P(T<=t) two-tail	0.062457406	P(T<=t) two-tail
t Critical two-tail	1.992102154	t Critical two-tail

4 CONCLUSIONS

This research discussed how screencasts were implemented to complement online teaching for surveying two classes on different programmes. In addition, videos were created to demonstrate how to use equipment to perform a variety of surveys, perform post-processing calculations, draw in CAD, and complement written feedback. Results from the questionnaire suggest that screencasting and videos for fieldwork particularly benefit students' understanding of a specific topic at the various surveying stages.

Previous studies suggest that screencasting promoted learning for various learning styles and habits and allowed the development of problem-solving, critical thinking and meta-cognitive skills [23]. This is consistent with this research, which recognised a variety of learners within the classes and revealed that students found screencast videos helpful as a learning tool and as a way to appreciate how much they knew on the topic.

The average marks were higher for students who used screencasts and online tools. However, there was insufficient data for statistical analysis to conclude that online classes impacted students' grades compared to in-class teaching.

Despite those positive grades, one of the survey's lowest scores was related to how much students felt confident in their ability to learn by distance. The distance learning sense of isolation and how it affects self-confidence was already mentioned a few decades before the Covid19 pandemic. The importance of developing the most helpful teaching and learning approaches and a clear structure of the teaching material was suggested to help learners overcome their difficulties [24].

From the authors' and lecturers' perspectives, the implementation of screencast videos has been a learning curve. Creating lecture videos takes a significant amount of time, as it also involves a considerable amount of editing, in contrast with veedbacks, which are in comparison quicker to create. However, in time, the easiness of developing a series of videos makes it a very attractive tool.

Results from the survey and added comments by the students suggest the integration of videos as support material once in-person classes resume, in particular the inclusion of worked examples for calculations and videos for demonstrating the use of surveying equipment. If screencasts on CAD were not considered helpful, it might reflect the variety of learners within both classes surveyed.

It could require the need for a review of the relevant videos by the teaching staff based on students' feedback. As previous studies suggested and highlighted in this study, screencasts are preferred by students as a complement rather than a substitute to classes [10, 25]. However, when redesigning the curriculum of surveying modules, these complementary materials may not only provide very beneficial support to students but also free up time for facilitating more active learning and practical activities during dedicated contact hours.

REFERENCES

[1] G. J. Longhurst, D. M. Stone, K. Dulohery, D. Scully, T. Campbell, and C. F. Smith, "Strength, weakness, opportunity, threat (SWOT) analysis of the adaptations to anatomical education in the United Kingdom and Republic of Ireland in response to the Covid-19 pandemic," *Anatomical sciences education*, vol. 13, no. 3, pp. 301-311, 2020.

[2] P. Betty, "Creation, management, and assessment of library screencasts: The Regis Libraries animated tutorials project," *Journal of Library Administration*, vol. 48, no. 3-4, pp. 295-315, 2008.

[3] R. Thompson, and M. J. Lee, "Talking with students through screencasting: Experimentations with video feedback to improve student learning," *The Journal of Interactive Technology and Pedagogy*, vol. 1, no. 1, pp. 1-22, 2012.

[4] K. Chorianopoulos, "A taxonomy of asynchronous instructional video styles," *International Review of Research in Open and Distributed Learning*, vol. 19, no. 1, pp. 294-311, 2018.

[5] S. J. Caruso, "A foundation for understanding knowledge sharing: Organisational culture, informal workplace learning, performance support, and knowledge management," *Contemporary Issues in Education Research*, vol. 10, no. 1, pp. 45-52, 2017.

[6] J. L. Jensen, E. A. Holt, J. B. Sowards, T. H. Ogden, and R. E. West, "Investigating strategies for pre-class content learning in a flipped classroom," *Journal of Science Education and Technology*, vol. 27, no. 6, pp. 523-535, 2018.

[7] M. Simbolon, E. Surya, and E. Syahputra, "The efforts to improving the mathematical critical thinking student's ability through problem solving learning strategy by using macromedia flash," *American Journal of Educational Research*, vol. 5, no. 7, pp. 725-731, 2017.

[8] C. Cormier, and B. Voisard, "Flipped classroom in Organic chemistry has significant effect on students' grades," *Frontiers in ICT,* vol. 4, p. 30, 2018.

[9] Y. Ghilay, and R. Ghilay, "Computer Courses in Higher-Education: Improving Learning by Screencast Technology," *Journal of Educational Technology*, vol. 11, no. 4, pp. 15-26, 2015.

[10] S. Rochmadi, and N. Hidayat, "Developing a learning video of the total station for building stake out," *Journal of Physics: Conference Series*, vol. 1456, no. 1, p. 012049. IOP Publishing, 2020.

[11] C. Jarvis, and J. Dickie, "Podcasts in support of experiential field learning," *Journal of Geography in Higher Education*, vol. 34, no. 2, pp. 173-186, 2010.

[12] S. Rochmadi, "Developing a learning video of the total station set up to improve the students' competencies in geomatics practicum," *IOP Conference Series: Materials Science and Engineering*, vol. 535, no. 1, IOP Publishing, 2019.

[13] P. A. Ertmer, J. C. Richardson, B. Belland, D. Camin, P. Connolly, G. Coulthard, K. Lei, and C. Mong, "Using peer feedback to enhance the quality of student online postings: An exploratory study," *Journal of Computer-Mediated Communication*, vol. 12, no. 2, pp. 412-433, 2007.

[14] J. Borup, R. E. West, and R. Thomas, "The impact of text versus video communication on instructor feedback in blended courses," *Educational Technology Research and Development*, vol. 63, no. 2, pp. 161-184, 2015.

[15] E. S. Belt, and P. R. Lowenthal, "Video use in online and blended courses: A qualitative synthesis," *Distance Education*, vol. 42, no. 3, pp. 410-440, 2021.

[16] A. L. Bultron, The use of teacher-written feedback and computer-mediated feedback to enhance Puerto Rican English as a Second Language (ESL) high school students' essay writing [Doctoral dissertation], Puerto Rico: Universidad del Turabo, 2014.

[17] L. Blaxter, C. Hughes, and M. Tight, *How to research (4th ed.)*. UK: McGraw-Hill Education, 2010.

[18] Y. Baruch, and B. C. Holtom, "Survey response rate levels and trends in organisational research," *Human relations*, vol. 61, no. 8, pp. 1139-60, 2008.

[19] T. Gonulal, "Improving Listening Skills with Extensive Listening Using Podcasts and Vodcasts," *International Journal of Contemporary Educational Research*, vol. 7 no. 1, pp. 311-320, 2020.

[20] A. Martin, "GeoLearn–Multi-Media Resources," *DIT Teaching Fellowship Report 2010-2011*, pp. 29-35, 2011.

[21] W. Sunthonkanokpong, E. Murphy, and S. Tuntrakool. "A Model of Engineering Education for Innovation." *2017 7th World Engineering Education Forum (WEEF)*. pp. 33-42, IEEE, 2017.

[22] M Beaten, F. Dochy, and K. Struyven, "The effects of different learning environment of students motivation for learning and their achievement," *British Journal of Educational Psychology*, vol. 83 no. 3, pp. 484-501, 2013.

[23] T. Pinder-Grover, K. R. Green, and J. M. Millunchick, "The efficacy of screencasts to address the diverse academic needs of students in a large lecture course," *Advances in Engineering Education*, vol. 2, no. 3, pp. 1-28, 2011.

[24] T. N. Kahl and A. J Cropley "Face-to-face versus distance learning: psychological consequences and practical implications", *Distance Education*, vol. 7, no. 1, pp. 38-48, 1996.

[25] D. F. Mullamphy, P. J. Higgins, S. R. Belward, & L. M. Ward (2010). “To screencast or not to screencast”, *Anziam Journal*, vol. 51, pp. C446-C460.