INCREASING STUDENT ENGAGEMENT WITH FORMATIVE ASSESSMENT THROUGH THE APPLICATION OF SCREEN CAST VIDEO FEEDBACK - A CASE STUDY IN ENGINEERING

Joel Ross, Sean Lancastle
University of Bristol (UNITED KINGDOM)

Abstract
The generation of useful feedback for students is a significant academic investment. However, engagement with the feedback can often be poor. Over the last 4 years, the authors have monitored the impact and the change in student perception of feedback as a result of a shift to using recorded instructor audio dialog with Video Screen Cast (VSC). The initial investigation invited students to select a feedback method, from ‘traditional’ online marking, audio comments or synchronised screen cast and audio, and a strong preference for the latter was apparent.

The initial study investigated the impact of this new feedback medium on two summative reports within a third-year engineering unit, where the feedback on the first report should aid the student on the second. Students appeared to consider the feedback as a significantly more personal investment in their work and appreciate the time devoted into the feedback process. Over this period the marking criteria and nature of the coursework set remained constant. However, an increase in attainment of 7% was noted when the screen cast feedback was introduced.

In the most recent extension of this study, the first assignment was changed to formative only, attracting no summative contribution to the student’s grade. Whilst lecturing colleagues were apprehensive regarding the impact on student participation in the activity, student engagement with the formative opportunity remained high with over 80% of the cohort opting in. Students that opted to participate achieved on average a grade 12% higher than those that did not, highlighting the potential learning benefit and engagement with the feedback achieved through this medium. Finally, students suggested that they gave the feedback significantly more attention when the assignment was formative than they would if it had been a traditional summative assessment. Students reported that the only barrier to engagement with formative work was perceived workload.

This impact of these combined interventions was a 30% improvement in the students’ surveyed responses to the opportunity to receive feedback and its usefulness from that of the traditional feedback system.

Keywords: Assessment, feedback, video cast, audio, formative, summative.

1 INTRODUCTION
Students regularly report dissatisfaction with written feedback on assessments, citing helpfulness, timeliness, frequency and consistency as key issues [1]. Students can find written feedback ambiguous and may not always fully understand their tutors’ intentions. Markers often assert that their comments are ignored [2] and that students don’t see beyond the grade [3]. Effective feedback requires students to make sense of information about their current performance and to use that information effectively in the future, and this feedback is best supported when the comments are detailed, supportive and personal [4]. However, providing this increased dialogue between tutor and student is challenging with increasing class sizes and limited resource [5].

In their recent study, Mahoney et al. argue that video feedback provides students with more feedback information in greater detail than traditional written forms [6]. Video feedback has also been shown to change the relationship between marker and student, encouraging students to view feedback more as coaching than judgement [7] and to make the interaction feel more like a meeting in person [8].

Screencast feedback is a specific form of video feedback, usually described as a recording of a tutor’s computer screen which captures mouse/stylus movements, typing and scrolling, together with a synchronous audio narration [3].

The use of screencast feedback has a number of affordances: the speed of talking is generally higher than that of writing, leading to the possibility of more detailed feedback; communication includes voice
tone and intonation, providing feedback that has more richness of meaning; and the feedback is more obviously bespoke and personal leading to a stronger connection between student and marker [3]. It can even lead to the claim that “it gives the student an impression of being present during the marking process” [9].

Jones et al [9] also posit that the previous experiences of the current generation of students make them predisposed to video-delivered information and that screen capture helps students whose first language is not English by giving them repeated opportunities for review. Knauf [10] recognises the contribution of the personal nature of the audio component of feedback to accessibility and comprehensibility for students from a wide range of backgrounds.

It has been suggested that screencast feedback is particularly suitable for some specific disciplines, such as engineering, technology and design [11].

Several studies have reported that the time tutors spend on producing video feedback is comparable to or less than that spent on traditional written comments, and that the process is less tedious (for example Henderson and Phillips, [12]).

Whilst a number of studies have shown students positive experiences with screencast feedback, most of these have centred around student self-evaluations. Improved student perceptions may result from changes in feedback format, but these don’t necessarily result in improved student performance [13]. Relatively few studies have considered the impact upon student learning and performance [6], an objective of this study it to examine the impact of VSC on these criteria.

1.1 Case study

The module being examined was a compulsory 10 credit Finite Element Analysis (FEA) unit on the 3rd year (UK FHEQ level 6) of a BEng/Meng Mechanical Engineering degree course at the University of Bristol. Over the course of the 4 year investigation, the average cohort sitting the unit was 165 students. This is in line with the larger units running within the School of Civil, Aerospace and Mechanical Engineering (CAME), an important consideration if any new approaches developed were to be adopted more widely.

1.1.1 Assessment structure

The original assessment structure for the years of data reported within this study (from 2014 to present) was as follows:

- 50% Exam – Assessing the underpinning science and mathematics associated with FEA.
- 25% Coursework 1 (CW1) – Assessing the practical application of commercial FEA to a simple problem.
- 25% Coursework 2 (CW2) – Once again assessing the practical application but, to a more complex problem with an additional focus on engineering judgement and problem definition

Note that the focus of this study is on the feedback cycles and learning journey through CW1 and CW2 and does not evaluate the impact on the examinable material. This core structure remained the same over the course of this investigation, but the weighting of CW1 and CW2 were altered to reduce student perception of workload whilst ensuring the same development of learning. This structure was developed to help ensure students are working in a Zone of Proximal Development (ZPD) [14] through a scaffolded development model of the learner’s knowledge via a feedback cycle between the two pieces of work, illustrated in Fig. 1.

The first exercise requires students to apply the new method, FEA, to problems which can also be solved through well-established analytical theory that the students have been utilising throughout the first 2 years of the programme. This maintains the ZPD between their prior learning and the new content, see Fig. 1. The aim of this initial stage is simply to ensure students are familiar with the tool. This is extended within CW1 to a problem with the same boundary conditions but to a model that does not have an analytical solution to provide a simple but non-trivial problem to develop their grasp of what the FEA tool can achieve. The aim of this stage of the activity is to encourage students to analyse the results of the FEA and to present key information from their models to confirm the validity and convergence of their results through a conventional technical report. Feedback was provided on CW1 with the aim of informing student’s development for the following CW2.
The second exercise presents a problem which has no exact analytical solution, although approximations are available. It is rooted in a fictional design problem, with real engineering considerations and poorly considered model input definition. Learners must utilise the same tools developed in CW1 to this new problem which does not have a transparent conventional solution as before. The coursework once again requires a technical report following broadly the same format albeit with a larger focus on the evaluation of application of FEA to a real problem and pointing out any shortcomings / potential pitfalls the analyst could encounter.

An important consideration in the design of these activities is that the FEA process is capable of producing inappropriate results. Careful analysis of output data is required to ensure validity. This is unlike the analytical processes applied by students to problems previously, where a correct calculation and application of given theory will always produce a valid result. Whilst some students may be able to make this step independently, for many it is so far beyond their previous experience that it falls outside of their ZPD. So, CW1 is designed specifically to bridge that gap (see Fig. 1).

1.1.2 Problem definition

When the authors took over the coursework element of the unit in the academic year 2015-16, the starting position was to maintain the status quo and provide continuity in the course. Thus, the feedback was provided in the same format as previously delivered, a traditional, text-based ‘drag and drop’ comments system with the additional provision of free form text where necessary through the institution’s Virtual Learning Environment (VLE). However, upon completion of the unit, students gave relatively poor feedback scores of 3.6/5 and 3.4/5 for questions on the ‘opportunities to obtain feedback’ and whether the feedback was ‘prompt and useful’ respectively. The grade outcomes of the students had also shown no average improvement from CW1 to CW2 and it was noted that in the previous year, where feedback had been provided by inexperienced markers, the average grade outcome fell by 3% between the two exercises. This alerted the authors to a potential failure in the current feedback cycle which did not appear to be supporting students as required. This provided the motivation for the current intervention. It should be noted that whilst the feedback may have been ineffective, it still took around 35 hours to deliver, providing further motivation for improvement.

2 METHODOLOGY

As previously illustrated, the interventions in this study were in response to previous poor feedback scores from end of unit surveys, despite a large academic time investment. Thus, the study took the form of action research aimed at creating positive change in the student perception of feedback and their engagement with it through the VSC approach.

Firstly, the authors examined what different options for feedback generation where available through the current VLE, assessed what was logistically possible and then engaged the students in an opportunity to decide what feedback method they most wished to receive. The concept was to provide the students with the opportunity to take ownership of the way they received their feedback. This opinion was collected through polling software during a ‘feed forwards’ lecture. The methods that were found to be easily delivered with no capital investment in equipment were: the current system of
Turn-It-In drag and drop quick marks and written comments; short voice recordings; or desktop screen capture and voice via the institution’s lecture capture software. The results of this poll are shown in Fig. 2 and illustrate a strong preference toward receiving a recorded screen cast and voice approach, with a score greater than double that of the traditional written feedback.

With this information an initial trial was conducted with this year group, which was then further extended to investigate the interaction of formative and summative assessment on engagement with feedback and learning.

2.1 Phase 1 trial – Implementation of video screen cast feedback

2.1.1 Delivery of feedback

As a result of the number of students on the cohort, minimising the logistical overhead of the new feedback mechanism was important. This was achieved by using existing tools. The institution’s lecture capture system was used for recording the screen and voice and automatically uploading to the VLE. The generated link was then copied into the work being marked into the general comments section for students to access. The meant that there was minimal overhead with regard to delivering video files to individual students.

In year 2015/16, the video was recorded with a basic laptop which provided for interaction via a mouse, keyboard and microphone. From 2016/17, the authors also invested in a touch sensitive device and stylus which provided for richer communication via on screen sketches. Whilst some colleagues were concerned that the overhead from video editing might be too burdensome, for the cohort sizes of 165 and greater, the authors approach was simply not to edit at all. On occasion background noises occurred during recording, such as people knocking on the author’s door. This was simply apologised for live, recording paused and the interruption addressed, then the recording resumed. Whilst the videos did not have a polished appearance in places, students did not appear concerned with this, thus any additional time invested in polishing the final video was considered to be a waste in academic investment, adding nothing meaningful to the learning content.

2.1.2 Evaluation of feedback

To evaluate the impact of the intervention, two anonymised systems were utilised. Firstly, the Engineering Faculty’s unit feedback system, based on the student data store which not only held student attainment but also the end of unit surveys. These surveys held freeform text and a score out of 5 for the following questions: Unit Rating?; Unit objectives are clear?; Unit well organised and run smoothly?; Unit content relevant and useful?; Unit material was good enough for needs?; Opportunities to obtain feedback on progress?; and Feedback prompt and useful? Whilst this survey was not focused on the needs of this study, the last two questions were relevant, and the freeform text also contained useful data. Running this survey was also standard faculty practice and thus did not add any additional workload to what students expected.

Secondly, a bespoke survey was created to ascertain more detailed feedback regarding the impact the change had made upon the students. Concentrating on this single topic meant that students were aware of the focus on coursework feedback as opposed to taking the whole unit into account. This survey was given out with the video cast feedback link. Again, this survey collected both quantitative and qualitative data through a scaler rating, yes/no and freeform questions. The 3 questions common
across all 3 years after the intervention were: Written to VSC preference (a scale from 1-5 where 1 was written and 5 was video); do you think the feedback received would be useful for other work outside of the FEA unit? and any other comments (for freeform text). It had been noted that feedback on technical writing was limited elsewhere in the course. Thus, the authors were interested to gauge whether students felt the feedback given would empower them in this regard outside of the FEA unit. The data collected from this survey was primarily used to gauge student perception of the feedback whilst the impact on learning was to be evaluated through the change in average cohort attainment.

2.2 Phase 2 trial – Altering CW1 to a formative assessment

From staff-student liaison committees, it had been clear that across all engineering disciplines, students felt over-assessed and as a result over-worked. This reduced the time for reflective learning cycles, students simply moving from one assessment to the next. Whilst, CW1 was required to complete the learning journey, having a reasonably high stakes summative assessment added stress to the students which was not conducive to the learning that the authors were trying to promote. It was also clear that summatively assessing work which was intended to be part of the learning journey disadvantaged students’ final outcomes by attaching a grade to their understanding only halfway through the learning itself. Therefore, the report was made optional, reduced in length from 4 pages to 3, and more emphasis was placed on developing the required learning for the final summative report, CW2. This change was met openly by the faculty with regard to the reduction in summative assessment for the unit, although some staff questioned whether students would engage with formative work bearing no credit and hence leave students disadvantaged overall. To mitigate against this, the benefits to the students of participating were clarified during a ‘feed forwards’ lecture, demonstrating the link between the two pieces and the likely summative benefit on the final piece.

As the video screen cast feedback system was being taken forwards into this change the same surveys used in section 2.1.2 above were utilised to measure the student perception of this feedback method. To assess the impact of this change to a 50% exam, 0% formative CW1 and 50% CW2 weighting, a new survey was created with a focus on examining the students’ perception of doing the formative assessment. This was given out after both the formative and summative pieces of work had been completed such that students could reflect on the interaction between the two pieces. The questions asked were the following:

- How much did the learning experience with an ungraded formative assessment aid your concept development? (answered on a Likert scale from 1, no aid, to 5, substantial aid)
- How useful did you find the feedback on your ungraded formative assessment? (answered on a Likert scale from Extremely useful to not useful at all)
  - Why did you give the above answer? (Freeform text)
- How much attention did you give to the feedback provided from the ungraded assessment when compared with that from traditional graded assessments? (answered on a Likert scale from much more to much less)
- How likely are you to attempt more ungraded exercises that are specifically aimed at preparing you for summative assessments? (answered on a Likert scale from extremely likely to not likely at all)
- What might stop you from undertaking these exercises? (Freeform text)

3 RESULTS

3.1 Effect of video screen casting on the student experinece of feedback

A primary measure of the student experience of feedback was extracted from the end of unit questionnaire as it provided a comparison with data from before the start of the study. The questions were graded on a 0-5 scale where 5 represents a positive outcome. Fig. 3(a) shows the student perception on opportunities to obtain feedback. It can be seen that there is a significant 22% increase score at the point of introduction of video screen cast feedback. This highlights an unexpected result of the use of video screen casting - whilst no additional feedback opportunities where provided, students reported an increased satisfaction with the ‘opportunities to obtain feedback’. At the point when richer video communication was provided through the use real time sketching via a touch sensitive stylus a total increase from the datum year 2015/16 of 28% is observed. This was
maintained into the subsequent year. This also suggests that although sketched communication appears to offer some benefit, the primary source of improvement can be attributed to the video screen casting process as opposed to specific technology. In addition, results from a question asking if students found the feedback “prompt and useful” can be seen in Fig. 3(b). Whilst these results show a less significant initial improvement of 12% from the datum at the introduction of video screen casting, further improvement appeared to be gained when a richer communication experience was introduced in 2017/18 with a total improvement in score of 26% which, the authors suggest, is aligned with providing feedback of greater use to students. Of course, it is not possible to separate the terms prompt and useful from the response, the change in feedback form did not influence the timeliness of the feedback. From these data there appears to be a strong correlation between the introduction of video screen casting and an improvement in the student evaluation of feedback.

![Figure 3. Student score of (a) “opportunities to obtain feedback on progress”, (b) “whether feedback was prompt and useful”](image)

Although the increase in satisfaction provides evidence of success, the authors were keen to quantitively measure the impact on student understanding and the potential interaction with their ZPD. Fig. 4, shows the % change in mean student attainment between CW1 and CW2. Initially, in 2014/15, there was a decrease in attainment between the two pieces when feedback was provided by inexperienced assessors. When the authors took over the assessments this negative trend was eliminated, but there was no gross increase in attainment between the two pieces. This suggested the feedback cycle was not achieving the intended goal of holding student in a productive ZPD. When the VSC feedback was introduced a significant attainment change was observed between the two coursework pieces. A 6% and 7% positive change was generated when the VSC feedback was introduced in years 16/17 and 17/18 respectively. This begins to demonstrate the positive influence that the change in feedback method can have on ensuring students are maintained within their ZPD and the potential for this VSC feedback to provide higher levels of learning and attainment. The impact on the student learning journey is shown in Fig. 5 where it is proposed that the richer feedback form stretches the ZPD leading to higher attainment and engagement with the learning.

![Figure 4. Impact of feedback cycle on change in attainment between CW1 and CW2](image)
Results from surveys directly enquiring of the student’s personal preference on feedback method between VSC and the status-quo written feedback can be seen in Fig. 6. In all three years, a strong positive skew towards the new VSC form of feedback is evident, providing further evidence that the increase in feedback satisfaction shown in Fig. 3 can be directly attributed to the VSC method. Finally, in the same surveys participants were asked to select a binary response to whether they felt the feedback received would be useful for other report writing outside the current context. In all years students agreed that this was the case, starting at 93% responding ‘yes’ and rising to 100% in the final year of this study, shown in Fig. 7. The authors noted that the VSC provided a unique opportunity to instruct the student’s regarding their approach to report writing. This was punctuated with by the ability to bring up examples of professional practice from published journal papers and displaying it in the context of their own reports which is most likely the reason for this strong response.
Finally, the authors would like to make a personal reflection on giving the VSC. Whilst, there was neither a significant advantage or disadvantage in the total time spent to record and deliver the feedback over that of more traditional means, it was a considerably more enjoyable process which also improved student outcomes and satisfaction.

### 3.2 Effect of zero weighted formative assessment

At the start of the study, each coursework element contributed 25% to the summative assessment of the unit. To allow students to progress through their learning journey at their own pace and only assess students on the intended learning outcomes once the learning had been completed, it was decided that CW1 should be zero weighted (i.e. formative) and the remaining 5 credits should be allocated to CW2 (i.e. now 50% of the unit). The direct impact on student engagement with the zero weighted CW1 was measured through the VLE, this showed that the engagement was higher than 80%. A survey specific to formative assessment was implemented to capture data on the student perception of this new approach. Fig. 8(a) shows the response to the questions asking about the impact on learning experience with regard to concept development, with over 90% of respondents suggesting it was either a 4 or 5 on a scale of 1-5, where 5 is a substantial aid. This demonstrates that students found the formative assessment process had a significant positive impact on their understanding of the problem. Further to this, Fig. 8(b) shows that 74% of participants suggested that the feedback was either very or extremely useful which again validates the data directly associated with the VSC formative feedback mechanism.

![Figure 8. Students response to (a) “How much did the learning experience with an ungraded formative assessment aid your concept development?” (b) “How useful did you find the feedback on your ungraded formative assessment?”](image)

To further understand the relationship between the students' perception of learning and the influence of making the assessment formative, students were asked on a Likert scale how much attention they gave the feedback when compared to a summative approach, see Fig. 9(a). This provided an insight into a potential change in the psychological approach that students take to engagement with the feedback, with 69% of respondents suggesting they would pay more or much more attention to the feedback on a formative piece of work. This highlights a key outcome of this study, that students are more likely to critically engage with feedback on a task that is formative which refocuses the coursework on learning rather than ‘gaming’ the assessment. Finally, respondents were asked if they
were likely to attempt this type of formative work again if the aim was to prepare them for a future summative assessment. The results shown in Fig. 9(b), illustrate an exceptional motivation for participating in this type of formative work with over 88% of students suggesting they were either very or extremely likely to attempt this type of activity in the future.

Whilst a strong positive student response for formative work has been demonstrated, there have been other additional benefits to this approach. In coursework like that demonstrated here, where there are learning stage gates to provide a structured learning journey, removing the summative component of CW1 means students are only being summatively assessed on their final understanding of the concepts, not their mean performance. The author’s suggest this is a significantly more satisfactory approach to assigning summative performance grades as it is indicative of the students’ attainment at the end of their learning journey. Another significant advantage is that the formative nature of the work removes the student perception of risk associated with the task, thus allowing the learner to explore different approaches and receive feedback that could further enhance their approach in the future. The author’s however, did notice that to fully take advantage of this opportunity, learners would need further training on how to approach these formative opportunities as they have a lack of experience of such in the programme’s current assessment structure. An outcome of this was that learners often took a status quo approach to the assessment rather than exploring the full potential that it offered.

Further to data from surveys, the impact on attainment was also investigated. Analysis of the grades showed a 10% increase in average grade (equivalent to a difference of one degree classification) for CW2 in those students that had conducted the formative CW1 work. This shows a significant improvement in the learning outcomes of students through the participation in the formative exercise supported through VSC feedback. Whilst it is not possible to uncouple the VSC from the change to formative assessment, it can be suggested that the overall approach has positive outcomes for students. Whilst learning appears to have been enhanced, the perceived workload for students has fallen by removing the additional pressure that summative assessment inherently incorporates.

![Figure 9. Students response to (a) “How much attention did you give to the feedback provided from the ungraded assessment when compared with that from traditional graded assessments?”, (b) “How likely are you to attempt more ungraded exercises that are specifically aimed at preparing you for summative assessments?”](image)

### 4 CONCLUSIONS

This paper has demonstrated the positive impact that the change in feedback mechanism to video screen capture has generated. Through surveys of students, it was shown that on end of unit evaluations, students’ scores for the opportunities to receive feedback and the feedback being prompt and useful had risen by 28% and 26% respectively. Through additional surveys, students also showed a significant preference for the new video feedback approach over that of the status-quo typed entries into boxes and drag and drop comments. The study also showed a positive change in student attainment, with 6% and 7% improvements, between successive assignments, when this approach was utilised over that of status-quo approach.

In the second stage of the trial, the first of two coursework activities was offered as a formative learning exercise as opposed to a summative assessment. This demonstrated extremely positive engagement with over 80% of students opting in to receive the video screen capture feedback. A survey conducted after the exercise showed a strong positive response from students. A result of
particular note from this phase of the study was that 69% of students reported that they would give more or much more attention to the feedback provided here as opposed to that in a summative alternative. Finally, a degree class difference (12%) in attainment was observed between those engaging in the opportunity and those that only participated in the summative assessment. The authors highlight the importance of ensuring students work within a zone of proximal development to ensure the learning journey is effective, and the formative opportunity was an important part of that process in this case.

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