Video Vignettes for Organic Chemistry: Morphing of assignments over three years

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Abstract

When we, as faculty, decide to incorporate a new learning activity or assignment into our courses, we should be prepared to engage in an iterative process of modifications. Ideally, each iteration brings us closer to a design that will have the greatest impact on student learning, or at least helps us identify design elements that should be avoided. In this paper, I describe a series of modifications extending over a three-year timeframe, from idea generation to refined implementation as I explored implementation of student authored video vignettes in undergraduate second-year organic chemistry courses.

Generation of an Idea

In August of 2014, I was following a Twitter discussion with Dr. Simon Lancaster from East Anglia University in England (@S_J_Lancaster). The topic was about how to have students give presentations through recording videos to explain chemistry topics rather than using in-class presentations. I followed up by emailing Dr. Lancaster to get more information relating to how the assignment was designed and assessed. With iPad devices as a required component of my organic chemistry courses, I recognized the existing capacity to incorporate this style of active learning assignment.

Background

Video has been having a profound impact on education in general as well as chemical education specifically. Many faculty members have found the ability to post lecture material for students via video a valuable tool in building more interactive and dynamic learning during face-to-face time (Read and Lancaster, 2012) or to improve student laboratory techniques (DeMeo, 2001).

Recently there has been interest in engaging students in the video creation process. Student authored video assignments have been reported in a variety of chemistry coursework. In general chemistry students have been asked to explain electron shielding via video (McCollum, 2017) and improve lab skills by creating a video to explain performance of a standard laboratory technique (Erdmann and March, 2014). Biochemistry students have been challenged to develop videos in groups to explain a biochemical area of interest (Ryan, 2013). Video vignettes have been used in a summary fashion integrating material from a series of courses in a Master's level program (Lancaster, 2014; The Chemistry Vignettes Website).

Based on these successful implementations, I decided that student-authored videos presented an opportunity for enhanced learning in the organic chemistry lecture courses at the University of Illinois Springfield (UIS). The combination of verbal and symbolic explanations of organic chemistry concepts had never been incorporated in any other assignments for the organic sequence. A modified version of the model from Dr. Lancaster was used as the basis for this assignment since this was the use-case that first inspired the idea to incorporate student-authored videos.

iPad Modifications

Though I was already familiar with video recording and editing, having created over 130 videos to convert my organic chemistry courses to a flipped learning format, I recognized that the video editing software that I had been using has a significant learning curve to feel competent in its use (Camtasia Studio and iMovie). Since my students all had iPad devices for the 2 semester organic chemistry sequence, I began to explore software that students could use to generate video vignettes completely on the iPad.

Examples of video vignettes created by UIS undergraduate students can be found on the YouTube Channel – Video Vignettes for Organic Chemistry
https://www.youtube.com/playlist?list=PLZxW9yeYihslHPYF6UHhaR3T75cnZ_Q3i

Three apps were eventually selected to record and edit the videos.

- Adobe Spark Video (originally called Adobe Voice)
- Explain Everything
- iMovie

Each app has its own advantages, depending on the video content being created. Adobe Spark Video is the simplest to use. It allows importing of images (which could be created with ChemDraw or other chemical structure drawing software) into each “slide”. Then one can record their voice narrating the information relating to that picture. By repeating this procedure, a movie is generated with a series of images and explanations. There is also a pre-defined set of musical backgrounds that can be added to the presentation for aesthetic effect. The entire set of narrated slides with music can be exported as a video once complete. The limitation of Adobe Spark Video is that it does not allow for real-time recording of drawing or showing of motion, which is often required to explain organic chemistry topics (such as mechanisms or resonance).

Figure 1. Sample Adobe Spark Video vignette
https://www.youtube.com/watch?v=OC11FsVQYwk&list=PLZxW9yeYihslHPYF6UHhaR3T75cnZ_Q3i&index=9

Explain Everything is a much more versatile app that allows for recording drawing and narration simultaneously. It also allows for importing of images, however now the image can be arranged on a page and then drawn upon during the video recording. Similar to Adobe Spark Video, each "slide" allows recording of audio relating to that slide and upon completion of the project, the entire set of slides can be exported as a video. Due to the broad capability of this app and the improved drawing capability that appeared with the release of the iPad Pro and Apple Pencil, I replaced my previous Camtasia Studio setup with Explain Everything on an iPad Pro for my own lecture videos.

Figure 2. Sample Explain Everything vignette
https://www.youtube.com/watch?v=nJnHGyM1S9c&index=8&list=PLZxW9yeYihslHPYF6UHhaR3T75cnZ_Q3i&t=1s

iMovie was introduced to help students that wanted to incorporate both the Adobe Spark Video and Explain Everything apps into a single video (however it was later determined that this same type of merging of videos could be accomplished within Explain Everything without use of a third app). Within iMovie a project could be started and each of the previously exported videos from other apps could be imported, arranged, edited and then exported as a single video.

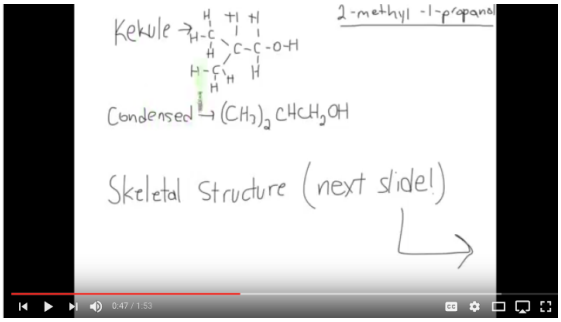

Figure 3. Sample vignette using iMovie to integrate Adobe Spark Video and Explain Everything
https://www.youtube.com/watch?v=Gf5Y80uGe9M&index=7&list=PLZxW9yeYihslHPYF6UHhaR3T75cnZ_Q3i

Morphing of an Assignment

The video vignettes assignment was introduced in organic chemistry 1 classes (fall and summer) and organic chemistry 2 classes (spring) at UIS. The class sizes range from 18-24 in the summer to 60-65 in the fall. The students are a mixture of biology, chemistry, and clinical lab science majors with a few that are planning post graduate study in the health sciences but have a non-science major.

Fall 2014

#Videos assigned: 1
Video length: 5-10 minutes
Points for videos/points in class: 25/630

The first student authored video vignette assignment was given in my organic chemistry 1 course during Fall semester 2014. A list of all course topics was given to the class. Each student was asked to work in a group of 3 students to create a video on one topic chosen from the list. The groups were randomly selected and assigned. Attempting to get a wide variety of content videos, each subject was only allowed to be chosen by one group, with the first group selecting the topic given priority. The videos were expected to be between 5-10 minutes long, including examples of how the concept can be applied to problem solving. Following completion of a first draft of the video, each group peer reviewed 2 other group videos and gave feedback to the authors. Then the groups were allowed to edit their original video to make a final draft video for grading by the instructor. A rubric was included that explained all the required criteria that the projects would be graded on. As grading of the final drafts was undertaken, a glaring omission in the required criteria appeared. There were points for whether the material was easy to follow, well structured, thoroughly explained and at the appropriate level. However, there were no points assigned for the chemistry actually being accurate.

CHE 267 Video Vignette Project Grade Student_____
Fall 2014

Instructor Evaluation:

Criteria	Points Possible	Points
Initial Draft – complete and on time	5	
Review -1	2.5	
Review -2	2.5	
Description of changes after review	2	
Audio was clear and understandable	1	
Images/graphics were clear	1	
Images/graphics enhanced understanding of material	1	
The material was easy to follow	2	
The presentation was well structured	2	
The material was thoroughly explained	2	
The level was appropriate for CHE 267 students	1	
The examples were helpful and related to main point	2	
Spelling and grammar correct	1	
Total	**25**	

Figure 4. First video vignette rubric

What Worked Well: The students adapted to the technology easily. The students were able to make presentations about chemistry without using class time.

What Needed Improvement: The students mostly focused on the simplest material. The videos were too long. The rubric did not reward students for having accurate chemical information.

Spring 2015

#Videos assigned: 3
Video length: 5-10 minutes
Points for videos/points in class: 70/670

Once again groups of students were assigned. They were given the task to create 2 videos, as a group and a third video would be completed individually. This time, the topics were limited to topics that were covered on each of the 3 exams during the course (not including the final exam). The video was due before the corresponding exam so that creating the video could serve to aid students in studying for the exam. Again there was a rough draft and final draft with student reviews of the videos designed to give feedback for the groups to improve their final drafts. The content accuracy was now included as half the points for the final draft. This replaced criteria including “material was easy to follow”, “graphics enhanced understanding of material”, and “spelling and grammar correct”. While grading the Fall 2014 videos there were not significant issues relating to these concepts. Student surveys were given at the completion of the assignment.

Based on student responses and the videos submitted I reflected further on the nature and value of the video assignment. Many students complained that the groups didn’t function well and some partners were not contributing to the assignment. While this was partially addressed with reduced grades for the non-contributing partners, it did not encourage all students to take advantage of this assignment to improve their understanding of relevant

chemical principles. It was also evident that most groups tried to choose the simplest possible concepts for which to create a video. This thwarted the idea that having to explain difficult concepts will help students improve their understanding of organic chemistry. The students responded when surveyed that they didn't feel that they learned very much from watching and reviewing the peer videos. The learning objectives of the assignment were also reflected on and the creation of a final draft video seemed to be more about video production skills than about learning chemistry content and using verbal and symbolic language to explain it to others.

What Worked Well: Points focused on accurate chemical information.

What Needed Improvement: Multiple drafts focused on non-chemistry learning. Reviewing other students' videos was not a time effective learning tool. Groups were not effective to encourage all students to learn from authoring the videos. The simplest concepts were often selected for the videos.

Summer 2015

#Videos assigned: 3
Video length: 2-3 minutes
Points for videos/points in class: 30/470

Based on lessons learned through the first 2 semesters of employing video vignettes, this semester each student was asked to create 3 individual videos. During summer the course includes 2 exams and a final exam. Each video topic was required to be selected from a list of course concepts that would be covered on the corresponding class exam. The video was due before the corresponding exam so that creating the video could aid students in preparing for the exam. Final drafts were eliminated based on the previous analysis of learning objectives and each video was only graded by the instructor without student reviews. Since students had more videos to create, the time for each video was reduced from 5-10 minutes to 2-3 minutes per video. Students were given additional instruction on choosing a topic:

> "Most important!! – Choose a topic that you don't understand well. Working on these videos will require you to learn more about the topics you choose."

It was explained to students that selecting a topic that is already well understood will be a waste of their time. The value in the assignment comes in having to learn an unfamiliar topic well enough to explain it to others. This was the most successful assignment yet as far as student responses regarding the value of creating videos to aid in their learning. A new idea began to dawn in my mind of the potential increased learning that could happen if students had to explain more ideas from the course.

What Worked Well: Individual videos, single drafts, eliminating peer review and shorter videos were all successfully implemented.

What Needed Improvement: There were only 3 videos while the course covered 13 chapters.

Fall 2015

#Videos assigned: 13
Video length: 1-2 minutes
Points for videos/points in class: 50/600

My experience from this semester should serve as a warning: do not get carried away with a good idea. As I prepared for the Fall semester, I reflected that if learning 3 concepts from organic chemistry really well, as I believe happened in the summer class when the students were required to author 3 videos, wouldn't it be great if each student learned one concept really well from each of the 13 chapters covered in the course. The assignment this semester was to create one video per student per chapter or 13 videos each. As this would result in ~780 student-authored videos during the semester, I came up with a grading scheme based on discussions with several K-12 teacher-colleagues. I graded the first video from each student to make sure all students had feedback to let them know if they were successfully meeting the requirements. Then I randomly selected 3 of the remaining 12 videos authored by each student to be graded. iTunes U was used to deliver the course materials and assignments and I was assured by Apple education specialists that the amount of storage this class would require would be acceptable. Even before the end of the term I was aware of the difficulties this assignment was causing the students. Before registration for organic chemistry 2 opened, I promised them that I would never try to have students create one video per chapter again. Not only was it causing the students to spend too much time with the technology, it was a logistical nightmare for me as the instructor.

What Worked Well: Clear rubric (Figure 5) and short videos.

What Needed Improvement: The number of videos was unmanageable, both for student authoring and faculty grading.

Assignment: Video Vignettes using Explain Everything

Scoring:

Criteria	Points
Chemistry content is accurate	5
Audio/Images clear and understandable	1
Introduction	1
Conclusion	1
The video fit into 1-2 minutes	1
Presentation is clear and focused	1
Total	**10**

Figure 5. Updated rubric for video vignettes assignment.

Spring 2016

#Videos assigned: 4
Video length: 1-2 minutes
Points for videos/points in class: 40/640

This semester began by returning to the Summer 2015 version of the assignment, since that had been the most successful version of this video vignettes experiment so far. The only difference from summer is inclusion of an extra exam, so there were 4 videos opposed to 3. However, about half way through the term another idea was sparked. While at the American Chemical Society National Meeting in San Diego, Dr. Brian Goess was discussing how his class had been creating crowd-sourced materials for Bioorganic chemistry (Tartaro, A., et. al., 2015). At the same time, I was struggling with my students desire to have more problems to work on outside of class. Since I had been using the LibreText for the last few years, my students didn't have any publisher provided homework system that I forced them to purchase. They only had the few problems per section that were integrated into the LibreText at that time. Many students had requested more problems to work on at home (for no points I must add). I had begun to create some problems with video solutions to post for them but I didn't have time to do that for every chapter. The solution was to begin using the video vignettes assignment as a crowd-sourced homework problem generator with video solutions. The pedagogical advantage of having the students create these problem-based videos was that the videos were now forcing them to engage with the material in the same way they would on the exam for the symbolic aspect of drawing out solutions, with the added feature of requiring them to understand concepts well enough to explain them verbally as well.

What Worked Well: Beginning to shift video assignment to exam type problems with video solutions.

What Needed Improvement: Consistency of the assignment. The focus was changed for the last 2 videos to the new problem-based idea.

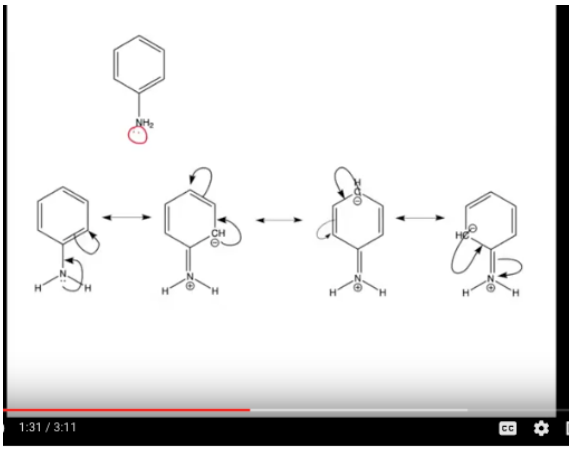

Figure 6. Sample vignette with a solution to a problem: https://www.youtube.com/watch?v=Rqu8u8Lo5uw&index=23&list=PLZxW9yeYihslHPYF6UHhaR3T75cnZ_Q3i

Summer 2016

#Videos assigned: 3
Video length: 1-2 minutes
Points for videos/points in class: 30/470

During Summer 2016 the system of one video per exam was continued. The spring modification of having one video per exam where the video was a solution to a problem type that would be found on the exam was carried through the summer organic chemistry I course. The previous type of video vignette that merely explained a topic was discontinued.

What Worked Well: The solutions to relevant organic chemistry problems, similar to exam questions.

What Needed Improvement: There were some complicated problems students were attempting to answer that required videos longer than 2 minutes.

Assignment: Video Vignettes using Explain Everything
Scoring:

Criteria	Points
Chemistry content is accurate	7
Question submitted as image or pdf	1
The concept selected was narrow enough to be explained well	1
The video was focused on solving the problem stated	1
Total	**10**

Figure 7. Rubric for problem-based video vignettes.

Fall 2016

There was no video vignette assignment during organic chemistry lecture for Fall 2016 due to introduction of a new technology based assignment where students were required to solve problems collaboratively with students from Mount Royal University (MRU) in Calgary, Alberta, Canada and I didn't want them to have technology overload which could limit the time spent learning organic chemistry concepts. Due to scheduling plans between UIS and MRU, this collaborative assignment was only offered during the Fall semester.

Spring 2017

#Videos assigned: 4
Video length: under 3 minutes
Points for videos/points in class: 40/640

Spring 2017 was an opportunity to return to the video vignette assignments. I decided to repeat the design used during Summer 2016, with students submitting problems with video solutions. They again are submitting one video per exam, which means 4 videos for a non-summer course. After considering all the previous iterations of the assignment, I

decided this version offered the best exam preparation for students as they are being asked to practice explaining exam-type problems before taking an exam on the related material.

Conclusions

Incorporating video vignettes into organic chemistry has allowed practice of student presentation skills to be included in the course assignments without requiring large amounts of class time. Students were able to adapt quickly to the technology-based assignments, especially when working on them individually rather than in groups. The majority of students surveyed reported performing better on exam questions based on their chosen video vignette topics. They also reported learning more from creating their own videos than from peer review of other student videos.

The rubric for the assignment was modified as the assignment changed. I think that each of the final 2 rubrics seen in Figure 5 and Figure 7 worked well based on the assignment type. The rubric in Figure 5 focused on important features when explaining a topic, including appropriate introduction and conclusion. The problem based rubric in Figure 7 focuses primarily on correct chemistry in explaining the solution to an organic chemistry problem.

Several of the assignments were effective in meeting the goal of incorporating presentations into organic chemistry where students are required to explain chemistry using words and symbolic representations. Ultimately having students solve exam style questions while showing they understand the chemistry behind the solution well enough to verbally explain their reasoning seems the most valuable use of the video vignette assignment.

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