Thinking Small: Using Micro-Lectures to Enhance Online Learning in Construction Management Courses

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Abstract

The pandemic caused a shift in the way university courses are delivered in the United States. This forced many instructors and students into the online environment for the first time. This shift has to teachers looking for ways to enhance student learning using novel teaching methods. One approach uses a form of micro-learning, the micro-lecture, that shortens lectures into specific concentrated topics. This paper summarizes the results of a project in which micro-lectures were used to enhance three required online courses with two sections each. The outcomes yielded several interesting results regarding students' opinions on the effectiveness of micro-lectures.

Keywords

Micro-Learning, Construction Education, Micro-Lectures

Introduction

The motivating factors for initiated this project will be addressed in this section along with a literature review that outlines the definition, origins and how micro-lectures are a promising novel teaching method for teaching in the online environment. Learners in an online environment are faced with unique set of challenges that differ from those found in a traditional face-to-face classroom (Zhang, J., Zhao, J., and Li M., 2021). Many students in online programs and courses work full-time have families and are already used to learning using already available technologies such as YouTube. Many times these non-traditional students do not have much time to watch an hour long lecture in a single session. This can cause some issues in retaining information from one viewing to the next, one solution is to divide the lectures into smaller concentrated parts called micro-lectures (Park, Y., and Kim Y., 2018).

The purpose of this project was to develop and apply micro-lectures to three online construction management courses with two sections each (taught by three different faculty) with the school of Construction and Design. The courses used for this included a sophomore course estimating 1 and two junior level courses estimating 2 and surveying. All three course were offered fully online asynchronously. The course were developed and continued to use two hour long standard

length recorded lectures a week. The instructors of courses observed which topics the students were struggling with and developed micro-lectures to cover those topics.

Literature Review

The idea of micro-learning and presenting the content in micro-units was first introduced in 1980 as "micro-teaching" (Hug, T., 2005). Research conducted by (Shail, M. S., 2019) indicates that micro-learning prevents learners from being overloaded with information and can improve their retention capacity. Due to the limitation of the working memory of learners, micro-learning requires minimal effort from individuals to master the content, and it provides dense and yet focused topics in fun and engaging fashion (Jomah, et al, 2016). In this regard, micro-learning has been known as a portable, focused, interactive and flexible way of delivering content to learners (Hug, T., 2005). Compared to traditional face-to-face classroom setups, micro-learning paves the way for on-demand training and just-in-time learning at anytime and anywhere (Brandenburg and Ellinger, 2003).

With the rise of online-based training, micro-learning has been a promising method to adapt on E-learning platforms. Considering the expansion in the number of Transistors and microcomputers with Moore's Law and the convenience of high-speed internet access at the global scale, there has been a substantial increase in the adaptation of E-learning in the early 2000s (Shail, M. S., 2019). In this regard, E-learning contents are usually divided into several chunks (e.g., micro-units, or micro-content) to be fitted into the micro-learning standards (Polasek & Javorcik, 2019). E-learning is usually delivered in the form of mobile learning or web-based learning. Several resources, such as video lectures, audio lectures, simulations, infographics, and even GIFs are leveraged to deliver micro-units to learners (Ghasia and Rutatola, 2021). In addition, social media platforms such as YouTube (Palmon et al., 2021), Twitter (Aitchanov et al., 2013), Instagram (Osaigbovo and Iwegim, 2018), TikTok (Khlaif and Salha, 2021) and Facebook (Kovacs, 2015) have widely been used to provide and distribute miro-units to the online users (Ghasia and Rutatola, 2021). The adaptation of social media enables collaborative learning, designing creative content, openness, and socialization among online learners (Khlaif and Salha, 2021).

Numerous studies have studied the application of micro-learning in different disciplines, including health education (De Gagne et al., 2019), language learning (Edge et al., 2011) (Brebera, 2017), physical education (Zhang and Zhang, 2017), and engineering (Said and Cavus, 2018). In the context of language learning, (Brebera, 2017) investigates the strength and weaknesses of popular learning platforms, such as Kahoot, Duolingo, and Hot Potatoes. More than 80% of students indicated Kahoot as a very encouraging platform to learn a foreign language. Emerson and Berge (2018) study the adaptation of micro-learning in the workplace. Due to the nature of micro-learning in providing a convenient way to access information, managers and supervisors prefer on-demand training, given their tight working schedules (Overton, 2011). In addition, a survey developed by (Mazareanu, 2019) indicates that 80% of employees learning prefer on-demand training. Despite the benefit of adopting micro-learning, research conducted by (Kadhem, 2017) suggests that constant and immediate feedback from the micro-learners is crucial to improve the course design and how the micro-units are delivered to

the learners. Such consistent and on-the-spot improvements in the course design have the potential to enhance the progress and productivity of learners.

Methodology

This section provides detailed information on how the micro-lectures were implemented in each of the three courses. Which will highlight the commonalities in each instructor's approach as well as the differences to applying micro-learning in the form of micro-lectures to their respective courses.

Pre-implementation Assessment

Micro learning is an effective teaching strategy that can take on several different forms. For this research the perceived effectiveness of micro lectures in an online construction program was evaluated in a case study involving three different professors and their respective courses. Prior to implementing micro-lectures in the courses, the three instructors presented a brief presentation in the form if micro-lecture explaining the definition and purpose of using micro-lectures in their courses. All three instructors used the same PowerPoint but created their own unique recorded lectures. Following the introductory lecture, the instructors used a questionnaire to assess the students' opinions regarding the use of micro-lectures and how it might impact their learning. The following shows a representative sample of the student comments taken directly from the questionnaire.

1. *Are there any advantages using micro-lectures in the course?*
- I feel that an advantage of this, especially from an online student standpoint, is there wouldn't be a lot of fluff or side conversation when presenting lessons.
- People learn better when information is provided in small chunks, easier to focus on the entire lesson and the short format makes it more convenient to review the material when time is an issue.
- I believe there are many advantages when using micro-lectures in courses. Since it shortens the lecture time, students can leave the class feeling like they learned more than if they had sat through a standard-length lecture. Most students can also leave feeling less stressed and more prepared to accomplish assignments.
- I feel like micro-lectures are a way to work with a student's attention span
- The lectures are a big help especially with the homework. Sometimes the book does a terrible job providing examples.

2. *Are there any disadvantages using micro-lectures in the course?*
- Yes, since the lectures are short and to the point, they may tend to leave out details
- Everyone learns differently. What is considered helpful to the instructor may not be helpful for the student.
- The lack the back and forth of a class recording
- What are your opinions regarding the student's role in the "micro learning" approach? I think it helps because it is more to the point and not as time consuming.
- For the "micro-learning" sessions to work, the student must watch them and actively participate. If the student does not, then the professor is wasting his or her time.
- It caters to the student that is just looking for the facts of a lesson but could pose an issue to interactive students who like to see more examples of lessons in practice.

3. *What are your opinions regarding the teacher's role in the "micro learning" approach?*
- Micro lessons when done well can help a teacher convey the lesson to students to help with teaching online.
- The teacher would be responsible for posting the micro learning lectures in a timely matter.

- The teacher would have to explain information in a way that is easy to comprehend.

4. *Do you have any concerns regarding the teachers' use of micro learning approach for this course?*
- The only concern is that it would take a lot of videos to explain a difficult concept if they are short form.
- Thus far, I do not have any concerns; I am excited to see how this approach may help me in the course.
- I am concerned that lessons cannot be taught in small lectures

5. *What motivation is there to watch the micro lecture videos?*
- They would be easier to understand and not as overwhelming as a long lecture.
- To learn valuable information without having to spend a lot of time.
- There is very little distraction and the ability to focus is greater.
6. *Do you anticipate watching the micro lecture videos?*
- Yes, I anticipate in watching the micro lecture videos this semester.
- I will watch all the micro lecture videos as I think it is a great way to hold people's attention and deliver complex info in doses they can handle
- I will try to watch all the lectures provided in this class.

Course: Estimating 1

The Estimating 1 course is mainly focused on performing quantity take-off for wooden, concrete, and steel structures as well as the earthwork on pre-construction. Students are required to do detailed mathematical calculations to be able to accurately estimate the quantities needed. Every Fall semester, there are two online and one face-to-face sections offered by the school. The efficacy of micro-learning is studied among online students for two sections consisting of 24 and 14 students. For Estimating I, there are two sessions each week, and each session is 75 minutes. The video for each session is divided into 30 to 45 mins micro-lessons. The topic that was covered during the micro lecture are the following:

- Micro-lesson 1: Introduction to wooden structures (e.g., studs, sills rafter plates, wall plates.)
- Micro-lesson 2: Introduction to quantity take-off for building roof (e.g., calculating the number of rafters, rafter length, roof area)
- Micro-lesson 3: Example of roof quantity take-off
- Micro-lesson 4: Introduction to quantity take-off for building walls and flooring (e.g., calculating the number of framing studs and length of sill plates)
- Micro-lesson 5: Example of wall and flooring quantity take-off

Course: Surveying

Surveying is a required course in the Construction Management curriculum and is usually taken during the first semester of the junior year. There are two sections of the online course, and one section of the live course offered every fall semester.
For this study, the instructor chose to offer the micro-lessons for only the two online sections. This was done for two reasons. enrollment for the online sections (30 and 20 students) is considerably much larger than that of the live section (13 students), and because the instructor felt that the micro-lessons would have a larger impact on online students since they have less opportunities to interact with the instructor. Over the seven-week period in which the study was conducted, the instructor integrated five micro-lessons within the existing curriculum. The topics of these micro-lessons were:

- Micro-lesson 1: chain corrections
- Micro-lesson 2: profile leveling using Excel
- Micro-lesson 3: bearing computations

- Micro-lesson 4: balancing latitudes and departures
- Micro-lesson 5: measuring angles using the double angle approach

These topics were identified using a combination of student requests (emails requesting assistance with certain topics) and "muddiest point" activities (exercises in which students were asked to write down the most confusing/difficult part of a lesson)

Course: Estimating 2

The Estimating 2 course is focused on performing cost analysis for rough order magnitude, conceptual and detailed estimates. Students are required to do detailed mathematical calculations to be able to accurately estimate the costs of pre-construction activities . Every Fall semester, there are two online and one face-to-face sections offered by the school. The efficacy of micro-learning is studied among online students for two sections consisting of 30 and 26 students. For Estimating 2, there are two sessions each week, and each session is 75 minutes. The video for each session is divided into 10 to 20 mins micro-lessons. The topic that was covered during the micro lecture are the following:

- Micro-lesson 1: Sitework for feasibility estimate compare the profitability for a small parking lot vs a custom-built shopping center
- Micro-lesson 2: Building for feasibility estimate compare the profitability for a small parking lot vs a custom-built shopping center •
- Micro-lesson 3: Calculate average rate return for both parking lot and custom-built shopping center.
- Micro-lesson 4: Calculate concrete for detailed foundation estimate

Results

This section presents the qualitative results collected through the end-of-semester questionnaire regarding the students' experiences and perspectives of micro learning.
At the conclusion of each course, students completed a questionnaire containing eight short answer questions addressing their views on the use of the micro-lectures in their course. The following provides a representative sample of the comments received from the questionnaire:

1. Were there any advantages using micro-lectures in the course?
- Broke down some of the harder to understand topics into smaller amounts that made it easier to understand.
- They provide extra information to students who may be struggling with a particular subject.
- They were fast paced with more detail. Easy to understand.
- They provide valuable insight on a specific topic without having to view the normal lessons which can be time consuming.
- Well suited to online learners that struggle with time management.
- I felt more engaged because the video lengths are much shorter.
- The visuals from the micro-lectures are helpful since regular class doesn't have much view of the board or our professor.

2. Were there any disadvantages using micro-lectures in the course?
- Watching micro-lectures is useful for learning how to solve problems, but they lack the detail of a full lesson.
- Some of it just seemed like extra videos that needed to be watched along with the normal class videos.

- Since they were fast paced, I really had to focus.
- Some students are likely to watch only these lessons (since they're focused on problem solving) and not view the full lectures. So, they will miss the definitions, derivations, and full explanations provided.
- I could see some people struggling with tracking a larger number of shorter lessons, compared to having to look for a single lesson.

3. How have your opinions regarding the student's role in the "micro-learning" approach changed since micro-lectures have been implemented in the course?
- I thought it would be nice to have a short and to the point video showing how to do the work, but I feel like the videos needs to have more detail and explain how and why we are doing what we are doing.
- My opinions haven't changed. I like them and believe they are a valuable tool. We use them in the military as well to facilitate learning.
- I think students can focus more on short topics more than an hour-long lectures.
- The videos can only help so much. You still need to review the full-length lectures, read the textbook, and do the assignments.

4. How have your opinions regarding the teacher's role in the "micro-learning" approach changed since micro-lectures have been implemented in the course?
- It's a great thing for teachers to take the time to do in order to give students that extra help if they need it
- It's extra work for the teacher, but worth it
- My opinion of the teacher's role has increased
- I was unsure as to how the instructor would include the micro-lectures within the class, I now see that he/she has to incorporate these somewhat strategically.

5. In what ways were you motivated to watch the micro-lecture videos?
- I was motivated to watch the video because they were short in length, straight to the point, and explained clearly.
- They were useful for dealing with a difficult topic or difficult calculations.
- They allowed me to get a better understanding of the lesson without having to contact the professor with questions
- The computations where easier to see since they were shown on the screen (unlike the regular videos where online students cannot see the board)
- The videos were long enough for me to understand the calculations, without having to commit to an entire hour-long video

6. Were there any positive aspects of having micro-lectures added to the course?
- Yes, any extra information aside from the normal lesson is positive.
- Yes, I think the micro-lectures added to the course had a positive impact on my motivation to watch the lectures.
- I found that the main positive aspects were less stress, free time, and more time for assignments.
- Yes. The micro-lectures helped students in understanding the math problems more. It also cleared up parts of the lessons that the student does not understand.
- It allowed me to manage my time better since I could find the information needed in 5-10 minutes versus watching an entire lecture
- Yes, I use of micro-lectures to the course had a positive impact on my motivation level.
- Micro-lectures are very fitting for this course

7. Were there any negative aspects of having micro-lectures added to the course?
- I saw the micro-lectures as just extra work where I didn't really learn anything more than what was taught in the lectures.
- Sometimes the micro lectures were too brief and didn't provide an adequate explanation of the topic.
- There are numerous topics in a course that cannot be addressed in a micro-lecture.
- Not every topic discussed can be covered or they wouldn't be micro-lessons.

- I could see certain students relying solely on the micro-lectures (since they are less time consuming) and not viewing the full lessons, etc.

8. How could the micro-lectures in the course be improved going forward?
- Some of the micro-lectures need more detail regarding calculations. Professors often skip this assuming we remember everything from our previous math courses
- The only trouble I had was that I didn't feel like the content in the book was addressed as much as it could be.
- The classes using micro-learning should be picked better. Some courses (surveying) require more detailed information.
- Use micro-lectures for all modules in our course. We only used it for half the semester.

Discussion

Advantages of using micro-lectures for the students

- Students benefit from having exposure to lesson in the form of a micro-lecture: many students benefit from having lesson taught in smaller portions based on the qualitative survey students appreciated having lessons in the form of micro-lectures
- The micro-lectures allowed students to review material at their own pace in the online environment.
- The students were able to ask questions or request specific topics in addition to the normal lectures for the course.
- Student feedback from end the semester questionnaires and direct conversations with the instructors clearly indicate students enjoy and value the content presented in the micro-lectures,

Advantages of using micro lectures for the instructors

- The ability to receive student feedback and tailor specific materials to help students that identified specific topics to help them complete specific assignments or projects as identified by the instructor
- The instructors were able to create videos that were free of extra information.
- All three instructors saw increase in the contact and communication from students enrolled in online courses.
- Although it created an increased workload on the front end it decreased the amount of confusion and questions asked on the back end.

Future Research

In the Future, we plan to establish a baseline using the traditional approach and investigate how well students comprehend the lecture by implementing the micro-learning technique. Three modules, including pre-test, knowledge transfer, and post-test, will be implemented to study the efficacy of micro-lectures in an online learning platform. For each lecture, an initial pre-test is implemented to identify the existing skillset of students about the topic. As some students might be familiar with the topic, it is essential to quantify their knowledge before and after the lecture to properly assess the efficacy of micro-learning among students. Students are then divided into

two equal groups: Groups I and II. The knowledge transfer module will be performed with and without the micro-learning strategy. For Group I, the micro-learning strategy will be implemented by splitting the lecture into subtopics, and for Group II, the traditional lecture delivery method will be considered. Finally, questions that were asked during the pre-test will be asked after two different knowledge transfer methods. By comparing the pre- and post-test outcomes for Groups I and II, we will assess how students' knowledge about the topic is improved among the two groups. These topics are currently being explored as part of our ongoing and future research.

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