The Flipped Classroom

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Overview

The basic idea of the Flipped Classroom is simple: students watch online video tutorials outside of class so that class time can be devoted to learning activities that are active and peer-based. Flipping your classroom results in a more engaging learning experience for your students. They learn the material more deeply, and they learn how to apply their knowledge to real problems. It also leverages the power of peer instruction. All of these factors, as studies have shown, lead to improved learning outcomes.

However, the Flipped Classroom also presents some challenges. For example, it can initially take significant time to create or locate the video tutorials that your students will watch outside of class. Additionally, if you are going to flip your classroom, you need to implement strategies to ensure that your students actually watch the video tutorials before coming to class.

An instructor can flip all of the classes in his course, or just certain ones. Generally speaking, if you are going to flip your classroom, you should do so with at least 25% of your classes, so that students understand that it is an integral part of your teaching practice.

Note: The content resources that are usually associated with the Flipped Classroom are video tutorials. However, it is also possible to create a flipped classroom with more traditional content resources, such as paper-based readings or online readings. This document will use video tutorials as the typical content resource.

What is the Flipped Classroom?

The first universities were established in Europe almost one thousand years ago. Because those universities came into existence before the invention of the printing press, the main tool for sharing knowledge was the human voice: a scholar stood at the front of a room and either spoke his thoughts or read out loud from rare handwritten manuscripts. The students would listen and try to remember as much as they could. Paper was so rare that they weren't even able to take notes.

Five hundred years after the first universities were established, the printing press was invented, which made it possible to create a new kind of content resource – namely, books. However, even though knowledge could now be recorded in books, lectures continued to be the main method of teaching. The tradition of the expert lecturer – also known as the "sage on the stage" – persisted. It continued through the centuries, perhaps because knowledge was seen as a product that a scholar essentially "poured into" the heads of his students. Students were seen as passive recipients of knowledge. This approach to teaching is known as "transmission" pedagogy. For the most part, it didn't work very well.

Around 2007, a new approach to teaching began to gain support. It was pioneered by two high school teachers in Colorado named Jonathan Bergmann and Aaron Sams. They discovered a software tool that allowed them to narrate and record PowerPoint presentations. Using this tool, they recorded their lectures and then posted them online as video tutorials so that students who missed classes could catch up. Before long, they realized that their video tutorials were being used not only by students who missed class, but by other students who wanted to review the lectures that they had already attended.

Around the same time, a financial analyst named Salman Khan began creating short video tutorials in mathematics for his nephew, which he posted on YouTube. These video tutorials soon developed a larger following of other students who needed tutoring in math. Khan quit his job to establish the Khan Academy, whose mission was to create numerous video tutorials in all kinds of disciplines.

Thanks to these and similar initiatives, the idea of delivering content to students via short online videos began to spread, including into higher education. Educators also realized that by delivering content via online videos outside of class, they could free up valuable class time for more productive and effective learning activities. This change in teaching practice came to be known as the Flipped Classroom.

What are the benefits of the Flipped Classroom?

- Studies have shown that the attention of most students begins to diminish after about 15 minutes of a lecture. Flipping the classroom can keep them engaged and focused for the entire class time. (Medina, 2008)

- Deep learning occurs when students have time to process and reflect on new concepts and information. The Flipped Classroom gives them time to do this before coming to class to apply their learning.

- With the Flipped Classroom, course content is delivered online, which means that students can control when they watch it, where they watch it, the pace at which they watch it, and how many times they watch it. Students who are having difficulty with the material can view it several times. The online video tutorials are also useful for students whose first language is not the language of instruction. Students can also review the video tutorials when preparing for final exams.

- In a Flipped Classroom, strong students can choose to work through the video tutorials more quickly, which prevents them from becoming bored with the slower pace of their less gifted peers. (Hattie, 2013)

- Flipping the classroom frees up class time that can be used for learning activities such as peer instruction. Studies have shown that peer instruction is a very effective teaching strategy for several reasons:

    - Peer instruction leverages a learning theory called Social Constructivism. According to this widely accepted theory, learning occurs best when it

happens in a social context (that is, through interactions with others), and when students build upon their preexisting knowledge.

- Peer instruction gets students emotionally engaged in the learning process.

- With peer instruction, students learn through one another and from one another.

- Because they are experts, instructors can sometimes find it hard to understand why a student is having trouble with the content. In contrast, during a peer instruction session, a student can often identify what is preventing a peer from understanding.

- The online videos that are created for the Flipped Classroom can be reused by the instructor for several years.

- During the in-class components of the Flipped Classroom, the instructor can observe and interact with students as they are working on their in-class activities; as a result, he can sense what problems or misunderstandings the students are having, and can address them immediately. This opportunity for "just-in-time" intervention is important because providing students with immediate feedback has a positive impact on student learning. Beesley and Apthorp (2010) found that in-class instructor feedback was nearly four times as effective as homework on learning outcomes.

- During the in-class components of the Flipped Classroom, the instructor can physically circulate among the students and interact with them. Studies have shown that this kind of interpersonal interaction helps students achieve better learning outcomes. (Hamre and Pianta, 2005)

- Flipping the classroom takes advantage of technologies that are becoming widespread and familiar. For example, in 2007, only 15% of Internet users had watched an online educational video; this percentage increased to 30% by 2010. Moreover, the growth of sites such as the Khan Academy is notable: it now features over 6000 video tutorials in mathematics, history, healthcare, medicine, finance, physics, chemistry, biology, astronomy, cosmology, art history, economics, and computer science. These video tutorials are viewed by 10 million students every month. Students are coming to expect instructors to make use of video tutorials in their courses.

Evidence of Effectiveness

- In 2010, Clintondale High School was identified as one of the least successful schools in the state of Michigan. Flipping their classrooms, however, resulted in huge academic improvement. In one year, the failure rate in English dropped from 52% to 19%; in math, it dropped from 44% to 13%; in science, from 41% to 19%; and in social studies, from 28% to 9%. The percentage of students who went to university after graduation rose from 63% to 80%. (Rosenberg, 2013)

- A survey of 453 instructors found that 67% reported that flipping the classroom resulted in their students improving their test scores; 80% reported that their students' attitudes toward learning improved. Additionally, 99% of the instructors said they planned on flipping their classrooms again the following year. (Flipped Learning Network, 2012)
- A study conducted at the University of North Carolina's School of Pharmacy showed that flipping the classroom led to an increase of 5% in student performance. Additionally, 90% of students reported that they preferred the Flipped Classroom teaching model over the traditional lecture-based teaching model. (McLaughlin, 2014)
- A 2011 study of a large-enrollment Physics course at the University of British Columbia showed that students in a Flipped Classroom section scored an average of 74% whereas their peers in a traditional section scored an average of 41%. Additionally, student engagement increased from 45% to 85%. According to the study author, this result is the biggest performance boost ever documented in educational research. (Deslauriers, 2011; Applying science to the science of teaching, 2011)
- A 2013 study at San Jose State University found that students in a flipped section of an engineering course received a midterm grade that was 11% higher than students in a traditional section. (San Jose State U. says replacing live lectures with videos increased test scores, 2012)

What are the potential challenges of the Flipped Classroom?

- The instructor must create or locate video tutorials for students to watch outside of class. The instructor must also develop in-class learning activities. These preparations will take a significant amount of time the first time the course is taught. However, the instructor will likely be able to reuse these materials the next time he teaches the course. In short, there will initially be a significant investment of time but it will probably be recovered through subsequent offerings of the course.

- An instructor may find that in a Flipped Classroom he can't get through the same amount of content as in a traditional course. However, there is a trade-off: while less content is covered, the content that is covered is learned more deeply and more thoroughly by the students. Generally speaking, it's better for students to have a deep knowledge of less material than a shallow knowledge of more material. At a later date, their solid understanding of the course content will probably help them independently learn the material that was not covered.

- Instructors of large classes are more limited than instructors of small classes with regard to the in-class learning activities that they can implement in the Flipped Classroom. Nonetheless, there are still many ways that instructors of large classes can get students to apply concepts and to engage in peer instruction. Clickers can be an especially helpful tool to facilitate peer instruction in large flipped classes.

- Initially, some students will not watch the video tutorials prior to coming to class. When this happens, the instructor should not spend class time re-teaching the material; once these students start to feel left behind, most of them will realize that they need to come to class prepared. Additionally, instructors should begin each class with a brief quiz on the content of the relevant video tutorial. Clickers can make it fast and easy to conduct such quizzes; for more information, see the booklet prepared by the Deanship of Skills Development entitled "Increasing Student Engagement with Clickers."

- Some students will initially resist the Flipped Classroom model. For them, passively listening to a lecture is easier and less intimidating than being actively involved in a class. However, studies have shown that most students, after they experienced the Flipped Classroom, prefer it to traditional lecture-based classes.

A Typical Flipped Classroom Sequence

As mentioned above, a Flipped Classroom has two key components: the video tutorials that the students watch outside of class; and the learning activities that they do during class. However, two other things are also needed to make those components work. First, the video tutorial has to be introduced to the students; and second, the students need to be assessed based on their understanding of the content resource. The sequence of these four steps looks like this:
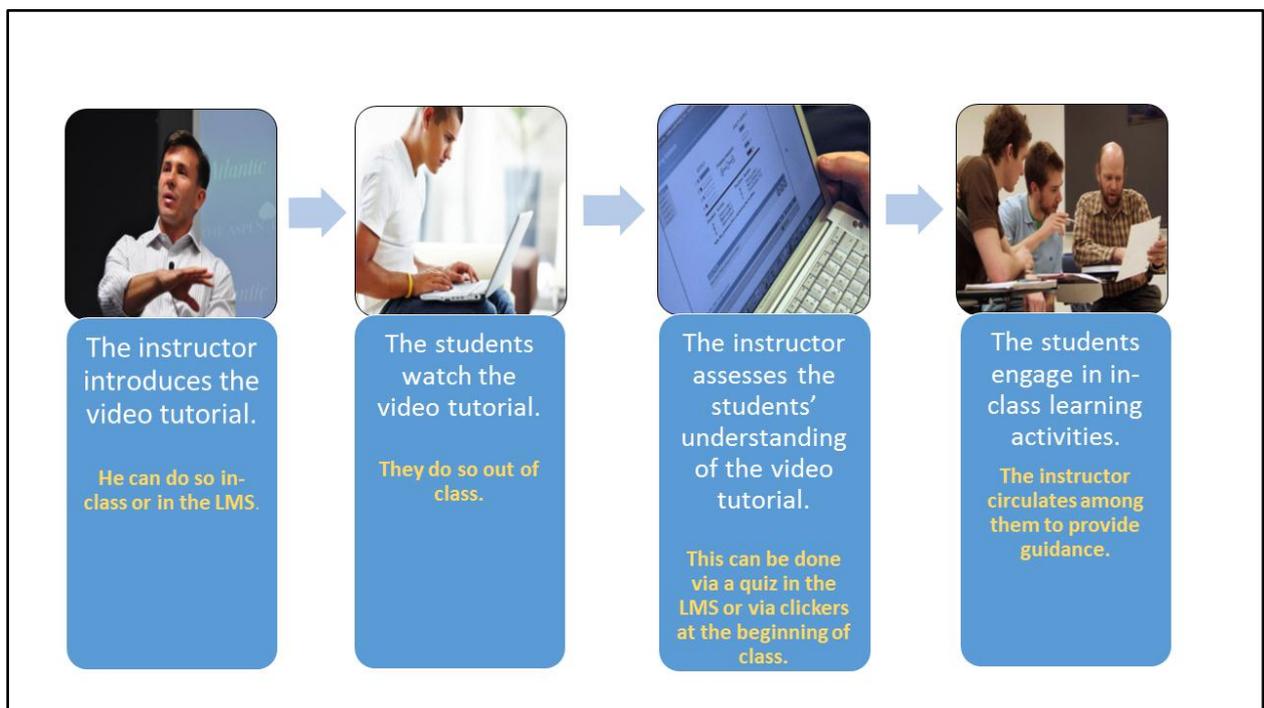
Each of these four steps will now be explained in more detail.

Step 1. The instructor introduces the video tutorial

If you just tell your students to "go watch the video," they might not learn much from it. Instead, you need to provide them with some introductory information and guidance so that they can maximize their learning:

- **What is it?** Is the video tutorial one that you developed or one that you located? Is it available in the university's learning management system or on YouTube? Is it part of a series or a stand-alone piece? How long is it? Will it continue to be available till the end of the course?
- **How should your students watch the video tutorial?** Should they simply watch it or should they take notes? Should they watch it once or twice? Are there particular things you want them to identify or think about as they watch? If they have questions after watching the video tutorial, should they ask them in class, should they email them to you, or should they post them in an online discussion group in the learning management system?

Step 2. The students watch the video tutorial

In the second stage of a Flipped Classroom sequence, your students watch the video tutorial. The video can be one that has been created by a third-party and which the instructor has simply located. Alternatively, the video tutorial can be one created by the instructor. Video tutorials should be no more than 15 minutes in length. Ideally, the students should watch the video tutorial a day or so before class, so that they have time to reflect on it.

Step 3. The instructor assesses the students' understanding of the video tutorial

Before the in-class learning activities take place, it can benefit both the instructor and the students to know how well the students have understood the content in the video tutorial. With that knowledge, the instructor can adjust the in-class learning activities if required. This assessment can take several forms:

- The assessment can be a multiple-choice quiz that students do in the LMS immediately after watching the video tutorial. Such quizzes are automatically graded by the LMS. The instructor can choose to have no marks attached to the quizzes (to make them purely diagnostic) or a small percentage attached to them (to help motivate the students). The quiz can be set up so that students are automatically given feedback, depending on whether they answer correctly or incorrectly.
- The assessment can be a contribution that students make in an online discussion forum immediately after watching the video tutorial. The contribution might be a question they have about the content of the video tutorial, a comment on how the content of the video tutorial relates to a previous class, or their summary of the main ideas in the video tutorial. With regard to the last option, the online discussion group can be configured so that a student cannot see the contributions of his classmates until he has first posted a contribution.

- The assessment can be a multiple-choice quiz that students do via clickers at the very beginning of the class – that is, before beginning the in-class learning activities. If these in-class quizzes are worth a small percentage of the final grade, it will help ensure that students watch the video tutorials before coming to class. For more information, see the booklet prepared by the Deanship of Skills Development entitled "Increasing Student Engagement with Clickers."

Step 4. The students engage in in-class learning activities

In-class learning activities that foster deep learning are ones that involve peer instruction, collaboration, and interactions between the students and the instructor. The best learning activities are also ones that students find challenging but achievable, and which they see as relevant to the learning outcomes of the course and to their future career. Whatever learning activities the students engage in, the instructor's role during these in-class session is always the same: to guide the students as they encounter and solve problems. Approached this way, class time becomes an opportunity for students to be creative, take risks, and makes mistakes – all under the guidance of the instructor.

Note: Regarding stages 2 and 3 of the Flipped Classroom sequence that are described above, an instructor might have students go through one, two, or even three cycles in preparation for the next day's in-class learning activities. In practice, it might look something like this:

Monday evening (at home)	1. Students watch video tutorial #1
	2. Students do a quiz in the LMS that is based on video tutorial #1
	3. Students watch video tutorial #2
	4. Students contribute a posting to a discussion group in the LMS, based on video #2
	5. Students read an online document
	6. Students do a quiz in the LMS that is based on the online document
Tuesday afternoon (in class)	1. Students do an in-class learning activity based on video tutorial #1
	2. Students do an in-class learning activity based on video tutorial #2
	3. Students to an in-class learning activity that draws on the video tutorials and document

Summary

In any course, students need to be given course content, but delivering it to them during class time as lectures is not always the most effective teaching strategy. Recent advances in technologies have made it possible and easy to deliver content to students outside of class time by means of video tutorials. This teaching strategy – known as flipping the classroom – frees up class time so that the students, under the instructor's guidance, can engage in more productive and effective learning activities. Moreover, these in-class learning activities can leverage peer instruction, which has been proven to be highly effective.

Flipping a classroom requires an investment of the instructor's time, at least initially. This investment, however, is repaid later on, as the instructor is able to re-use in subsequent courses the video tutorials that he has developed. More important, the instructor's investment in time results in improved learning outcomes for students.

Appendix 1: Examples of in-class learning activities for the Flipped Classroom

Think-Pair-Share (Time on task: 5 to 15 minutes. Group size: 2)

Students take a key concept, or a controversial question or issue, and think about it individually and then discuss it in pairs. This activity works well with any class size.

1. Think phase: students work on their own to develop (and write down) their ideas.
2. Pair phase: students discuss their ideas with a nearby partner.
3. Share phase: the instructor asks several pairs of students to share their ideas with the class, and then moves into a discussion involving the whole class.

Round Robin (Time on task: 5 to 15 minutes. Group size: 4 to 6)

Small groups of students engage in methodical brainstorming:

1. One student begins the Round Robin by saying a word or phrase that relates to a central concept or topic. All the students in the group write it down.
2. The next student in the group is then asked to add an additional word or phrase to the list. This continues till all the group members have contributed.
3. The group then summarizes or synthesizes the words or ideas they wrote down.

Team Matrix (Time on task: 10 to 20 minutes. Group size: 2)

This learning activity helps students distinguish similar concepts or items from one another.

1. Pairs of students are given a list of characteristics that relate to two or more concepts.
2. Students determine which characteristics belong to each concept and/or which characteristics are shared by two or more of the concepts.
3. After the students have completed their work in pairs, the answers are discussed with the class as a whole to identify any misunderstandings.

Fishbowl discussion (Time on task: 15 to 20 minutes. Group size: 3 to 5 inside, remaining class outside of circle)

This learning activity helps students become more aware of how to solve content-related problems and team-related problems more effectively.

1. A small group of students sit in a circle at the front of the class, or stand at a blackboard. They engage in a discussion of a topic or problem that is facilitated by a peer.
2. The rest of the students in the class watch and listen as the small group has its discussion. They take notes and critique the content, logic, and process of the discussion.
3. After the small group has finished its discussion, the rest of the class discusses the interaction and provides feedback and additional insight into the topic.

This learning activity works because most students are more comfortable critiquing the work of their peers than of their instructor.

Three-Step Interview (Time on task: 15 to 30 minutes. Group size: 2, then 4)

This learning activity can help students prepare for a midterm test or final exam.

1. Students interview each other in pairs about a concept related to the course content, using questions that they themselves have developed.
2. After the pairs of students have finished interviewing each other, they summarize their questions and responses, and then share them with another pair of students.

Role Play (Time on task: 15 to 45 minutes. Group size: 2 to 5)

Role play can be used to demonstrate or reveal diverse perspectives on a topic, such as a controversial topic in the media or different ways of solving a problem.

1. Students take different roles in small groups and then represent or defend those roles in a discussion or dramatic interaction.
2. After the small groups finish the role play, the class as a whole discusses the different approaches that the groups or individual students took.

Reaction Sheets (Time on task: 30 to 45 minutes. Group size: 4 to 6)

This learning activity can solidify the understanding of a topic or a threshold concept that the entire class needs to understand before they can move forward.

1. The instructor divides the class into groups containing about five students each. The instructor then gives each group a different question pertaining to course content.
2. Each group spends about ten minutes writing down ideas pertaining to the question. Ideally they do this on a blackboard or large poster paper.
3. Each group then moves to the blackboard that belonged to another group. They look at the ideas that were recorded, and add their own additional comments.
4. After each group has added comments to the blackboards of all the other groups, they return to their original blackboard, review the additional comments, and summarize all the comments for the rest of the class.

Think-Aloud Pair Problem Solving (Time on task: 30 to 45 minutes. Group size: 2)

1. In pairs, students are given several complex problems that require multiple steps to solve.
2. One student begins to solve a problem, explaining the process step by step to the other student.
3. The other student listens to the process and offers suggestions if there are difficulties, or indicates his confusion if the explanation is not clear.
4. After the first problem has been solved, the students switch roles and solve another problem.

Affinity Grouping (Time on task: 30 to 45 minutes. Group size: 3 to 5)

This activity helps to ensure that students all have the same level of understanding before they move on to a more complicated in-class activity.

1. Students individually write down ideas on a sheet of paper.
2. As a group, students then attempt to classify their ideas while discussing why certain items should be categorized together.

Dyadic Essays (Time on task: 30 to 45 minutes. Group size: 2)

1. Students come to class with an essay question that they have developed (based on course content) as well as a brief response to that question.
2. In class, they share their essay question with a partner, who writes a short response to it during class.
3. Once the students are done responding to their partner's essay question, they compare their responses and discuss the differences; then, they compare their responses to an ideal response prepared by the instructor, again discussing differences.

Critical Debate (Time on task: 1 to 2 hours. Group size: 4 to 6, then 8 – 12)

1. The instructor creates student groups of about four to six, and then assigns each group a number.

2. The instructor identifies a controversial topic related to the course content; alternatively, the class identifies a topic.

3. The instructor assigns each group to one side of the topic: groups that were given an even number have to argue for this side of the topic, and groups that were given an odd number have to argue for the other side of the topic. Each group has 30 minutes or so to prepare an argument to support their side of the topic.

4. While preparing for the debate, it can be helpful for each group to assign specific roles to their members. For example, one student might be the main speaker; one might be the person who responds to counter arguments; one might be the person who finds supporting information on the Internet; and so on.

5. Each group then pairs up with another group that is defending the other side of the topic. They spend half an hour of so engaging in a debate with one another. If the debates become too heated, one of the students can be pulled out of a group and be designated as a neutral moderator for the two sides.

6. Afterwards, they summarize the various points of debate in a larger class discussion.

Case Study (Time on task: 1 to 2 hours. Group size: 3 to 4)

1. In groups of three to four, students review a case study concerning a specific, real-life problem or scenario.
2. Each group discusses the case study based on what they have learned from content resources such as video tutorials or readings. Together they come up with a solution or proposed plan of action for the case study.
3. The instructor asks several of the groups to present their solution to the rest of the class.

Clicker questions

Clickers are handheld devices that students use to respond to multiple-choice questions that the instructor displays on a screen. The clicker system collects the students' responses and displays them as a bar chart. Clickers can very effectively support in-class peer instruction in the following way:

1. The instructor displays a multiple-choice question and the students use their clickers to respond to it individually. They are given a minute or so to do this.
2. The instructor then shows the students the bar chart of their responses.
3. The instructor then tells the students to find one or two students who chose a different response to the multiple choice questions, and discuss the reasons for their responses. They are given three to five minutes to do this.
4. The instructor displays the same question again, and students again use their clickers to respond to it individually. Students can change their response from earlier if they want to.
5. The instructor then displays the new bar chart of responses. Typically, the number of correct responses increases because the students have participated in effective peer instruction.

For more information about using clickers, see the booklet prepared by the Deanship of Skills Development entitled "Increasing Student Engagement with Clickers."

Appendix 2: Making video tutorials (and screencasts)

In a Flipped Classroom, students access content resources outside of class so that class time can be spent on more productive learning activities. Although those content resources could be documents, the Flipped Classroom tends to assume that they will be video tutorials. Those video tutorials could be created by a third party, which means that the instructor simply needs to locate them. More and more, however, instructors are creating their own video tutorials, thanks to easy-to-access tools that facilitate their creation, such as the following:

- An instructor can use a video camera to record himself as he speaks or as he writes or draws on a blackboard.
- An instructor can use software to create a screencast. A screencast is a special kind of video tutorial that focuses on the instructor's computer screen rather than on the instructor himself. There are several ways to create a screencast:
  - You can turn your content into a PowerPoint presentation and then use the "Record Sound" tool in PowerPoint to add narration to it. You would then share the PowerPoint presentation, and whenever students advance to a new slide, they will hear your narration for that slide.

- You can turn your content into a PowerPoint presentation, upload it to an online platform such as MyBrainShark, and then add narration. The resulting screencast will be a video rather than a narrated PowerPoint.
- You can use an online tool such as Screencast-o-Matic to create a screencast from scratch. Such tools are easy to use, but they don't allow you to easily edit your screencast.
- You can use a program such as Camtasia to record whatever appears on your computer screen while you narrate it. It takes several hours to learn how to use Camtasia, but with it you can edit and enhance your screencasts. Camtasia can also capture full motion: that is, you are not limited to just static slides, but you can capture whatever your draw or write on the screen. You can also incorporate video from other sources.
- You can use an iPad along with an app such as Explain Everything. You load your images, slides, or PDFs into the app, and then you can draw and write on them as you narrate your comments.

With all of these methods (except the narrated PowerPoint option), you can upload your video tutorial to YouTube or to your LMS.

Note: To be effective, a video tutorial should be no longer than 15 minutes. However, you can have students watch several video tutorials in a single sitting if you have them do some sort of assessment activity in between. For example, after watching the first video tutorial, they do an online quiz; after watching the second video tutorial, they contribute a posting to an online discussion group; and so on.

More information about making screencasts is available at this web page developed by the Centre for Teaching Excellence at the University of Waterloo: https://uwaterloo.ca/cte/screencasts

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More Resources

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