

# Translating a Successful Lecture into Online Course Content – Experiences of a Control Engineering Lecturer

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**Abstract:** Online lectures are a tool that finds increasing application within traditional academic institutions. There are many reasons why a lecturer decides to provide an online version of the course in addition to the traditional lecturing. However, most lecturers are subject matter experts and not experts in producing YouTube channels with high ratings. This contribution details the experiences of the author who has translated her lecture into an online course format. Ironically, the content is concerned with automation and robotics and the lecturer has – somewhat – automated herself by producing videos. The aim is to summarize the experience, investigate why a lecture is successful and how the material can be translated into an online format.

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## 1. INTRODUCTION

In recent years, the term MOOC, which stands for massive open online courses, has attracted attention amongst universities. From a financial perspective, these online courses designed for large audiences may be very attractive for universities (Deming et al., 2015). Simultaneously, MOOCs provide access to quality education to a larger group of people. On the whole, the area of online resources, courses and degrees are evolving at a high speed, some argue that the education landscape will change dramatically in the near future (Anderson, 2008).

On a smaller scale, online MBAs have received significant attention (Kim et al., 2005). The reason is that MBA courses are often offered as part-time degrees as people work simultaneously and therefore lend themselves to an online environment where the student can participate in classes from home and in the evenings or on the weekend while still attending an accredited program (Bocchi et al., 2004).

Online courses have the possibility to reach different audiences and provide flexible participation options but questions remain whether the learning experience is as effective and as satisfactory. While studies suggest that students acquire the same knowledge, the experience is often less fulfilling and does not meet expectations (Kauffman, 2015).

There also appears to be a gap between the universities that aim at making course content available online for a larger audience and for better learning experiences and the experience of the lecturer who is an expert in the subject matter but not necessarily on teaching technology (Siemens et al., 2015).

When developing the material, training was provided by the university on how to develop online material. But at the end of the day, the lecturer cannot become an expert in instructional design models and does not have the time to

read and research the literature extensively. It is therefore necessary to get the essentials right. This article aims at reviewing the process of taking a successful lecture and translating it into online content. The focus is on control engineers with similar backgrounds and knowledge base but the experience will most likely translate to other engineering lectures as well.

This article is structured as follows. The next section argues what can constitute a successful lecture. The following section looks at the preparation required to translate the online material while Section 4 discusses the course design by looking at online programs, online videos and online assignments.

## 2. WHAT MAKES A LECTURE SUCCESSFUL?

Many lectures are still delivered by educators in the classroom and in lecture theatres. So in most cases there is an existing lecture that will form the basis for the online content. For mathematical intense lectures such as control engineering many educators still prefer the blackboard to convey ideas while others find that slide presentations works with their presentation style. The most commonly cited advantage of the blackboard is that it forces the lecturer to pace herself to the speed of her own handwriting, developing complex concepts slowly. Slides allow for the presentation of images that are too intricate to be drawn by hand. The means of presentation is not important, as long as it suits the presenter and makes her comfortable.

### 2.1 From Knowledge to Understanding

Unsurprisingly, knowledge leads to more knowledge (Willingham, 2009). If a student is interested in the construction and control of cars, she will already know a significant amount about it. New knowledge will be eagerly absorbed and put into context to existing knowledge. Another

student who has no prior knowledge of cars will find it more difficult to fill in the gaps.

Within a lecture, this means that it is important to understand the vocabulary of the subject. For every lecture there will be new vocabulary and it is the lecturers responsibility to clearly identify this as new and add it to the existing body of knowledge. This is relatively easy for specific terms such as ‘Nyquist plot’. Trickier are compound terms such as ‘plant asset management’. The students will know what a plant is (as in production plant), what an asset is and what management involves. Conveying the concept behind the term requires extensive knowledge about the operation and maintenance of a production plant.

In this sense, it is key to teach the student what they don’t understand or in other words, to recognize a new terminology and concept as such and find out what background knowledge is required to make sense of the term. The lecturer has the responsibility to guide the student through this journey. Most students learn best when solving problems. In a good lecture, one problem leads to another with enough time given to the students to attempt it by themselves.

There may be only two motivations for student to learn: The first is to pass the exam. While some simply want to pass, the ambition of others is to get the highest mark possible. Every lecturer has experienced the effect that the following sentence has on students’ slumber in the time slot after the lunch break: ‘The following will be asked in the exam:...’. Secondly, students recognize that the degree is only the first step in a life-long career path. Providing knowledge that will be useful in the student’s profession is another incentive to learn. It is important that the lecturer, if not from industry herself, makes herself knowledgeable in the profession that students will choose. It is in fact very easy – invite former students who are now working, former classmates or other industry contacts to contribute to the classroom.

Qualities expected of a lecturer are (i) to be organized and competent and (ii) to be sympathetic to the students. Every lecturer has her own teaching style and there is no style that is regarded as superior to the other as long as these two principles are fulfilled.

### 2.2 The Story of Control

It is important to note is that every successful lecture tells a story. Physicists such as Newton and Einstein used narrative to analyse and communicate scientific principles (Sheehan and Rode, 1999). Clearly, telling a story is easier done in the social sciences than in engineering lectures. However, with some experience every method can be told as a story and possibly easier in control engineering than in other engineering disciplines. There are several lists of C’s that define good story telling. Arguably the ones most relevant when lecturing control systems are: Causality, character, conflict and complications (Nathanson, 2006).

Causality comes natural to most engineers: Once definition leads to another. However, sometimes connections slip the mind of the lecturer and are omitted. After designing a lecturer, it is well worth going through the material and checking if all conclusions build on each other.

The introduction of a character is not as easily done. One way of incorporating character is to put the lecturer or the student in the shoes of the main character. For example, the student may be taking a shower in the morning, adjusting the temperature. Because there is a pipe from the geyser to the showerhead, some time passes before the hot water reaches the student in the shower. This leads to the introduction of dead-time in a dynamic system.

Conflict and complications are the essence of any good story. Without them there would be no story. Conflict can be translated into problems though care must be taken to space out problems throughout the lecture. At the beginning of a lecture all students pay attention, it is towards the middle of the lecture that the story has to come to its climax. Examples could be conflicting control objectives or requiring an important sensor measurement but not having access to it (which then leads to the necessity of soft sensors).

### 2.3 Teaching evaluations

Teaching evaluations are widely perceived as the best way to determine whether a lecture is successful. Unfortunately, teaching evaluations are largely flawed for a number of reasons. Studies found that male students gave better evaluations for male teachers while female students did the opposite. Difficult subjects, such as statistics, receive bad evaluations and better-looking lecturers get significantly better ratings (Gray and Bergmann, 2003). It is also possible, as Neath (1996) demonstrates, to improve teaching evaluations without improving teaching. On the upside, conducting teaching evaluations in the classroom and online does not affect the outcome of the evaluation (Dommeyer et al., 2004).

To determine whether a lecture is successful thus requires more than evaluations. However, in the absence of other more objective measures teaching evaluations remain the most widely used assessment tool.

## 3. PREPARATION FOR ONLINE COURSE DEVELOPMENT

The first pitfall is to assume that the material can be taken as it is and recorded in a video and made available online. Although this is clearly the easiest way – just ask a colleague or student to place a camera at the back of the lecture venue – it is not necessarily the best way of translating an existing lecture into an online format. However, the existing content and structure can be used, just not in long videos. Instead, it needs chopping and changing as much as careful evaluation of all material to be included. Because less time should be spent watching online lectures, the value of every aspect of the material should be re-evaluated.

Good advice is to watch as many online videos and enrol in online courses as possible and to take note what works and what doesn’t. There are many free online courses available, perhaps most notably from Stanford University, where pioneers of online course development reside (<https://online.stanford.edu/courses>).

A good starting point is to critically assess the existing lecture and preparing answers to the following questions:

- Are all the presentation slides clear and can they be understood without voicing anything over them?
- How can the lecture be subdivided into smaller chunks?
- Does each chunk follow a story?
- Do the chunks build on to each other?
- What additional reading material exists for the individual chunks?

Once the existing lecture has been dissected and improved it is time to start the online course design.

#### 4 COURSE DESIGN

This paper describes the experience of the author in translating a lecture into an online course. The lecture is titled ‘robotics in business’ and is part of the MBA offerings at Wits Business School (WBS, [www.wbs.ac.za](http://www.wbs.ac.za)). Other WBS faculty members selected the lecture because it was deemed ‘successful’ in a number of teaching evaluations (though the shortcomings of evaluations has been discussed in Sec. 2). Robotics in business at WBS is a half-day module or a four-hour lecture and part of the course Digital Technology Fundamentals (DTF). DTF looks at latest technologies that promote and change digital businesses, underpinning the ‘digital revolution’. Other modules within DTF are cyber security, artificial intelligence, block chain technology and robotic process automation. This section examines the online program and methodology used for it, looks particularly into video lectures, which form an essential part of the course, and finally describes the options for online assignments.

##### 4.1 Online program

There are guidelines for successful Online Programmes that have shown to be successful for online courses offered by universities. To give a competitive edge for the online version of a course, multiple starts should be enabled, about four to eight times per year. Thus, students can start immediately and do not have to wait six months or longer for enrolment and the start of the next semester. Generally, online courses are shorter than traditional lectures. This is for a number of reasons: (i) online courses can be more effective and (ii) the students are more impatient to get through the course and see results (i.e. a completed module) and (iii) only one to two courses should be done at the same time. On the whole, studying in a complete online environment is a very different experience to studying in the classroom.

A key aspect when designing the course is the choice of the platform. Today, unlike a decade ago when online teaching was more novel and universities developed their own software tools, there are many good providers for online platforms, also referred to as Learning Management Systems (LMS). The ‘big four’ of LMS systems are depicted in Fig. 1, acting as a communication platform between the instructor and on the right and the learners on the left.

What needs to be carefully mapped out is the course sequence and workload for the students. Tab. 1 gives an example of the course sequence for the first and second day of the lecture for the course ‘robotics in business’. It clearly states what needs to be done (watch, read, discuss, write) and

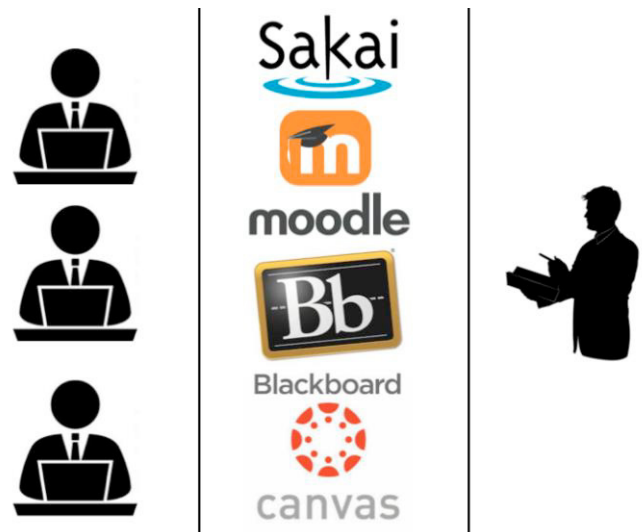


Figure 1. Learning Management Systems (LMS) act as the communication platform between learners (left) and instructors (right).

**Table 1. Example of the content on the webpage presented to the students, specifically detailing what needs to be done and when.**

Watch	The Robotics online lecture welcome video. Robotics Online Lecture Video 1.	Day 1
Read	G. Nichols, Robotics in business - everything humans need to know. ZDNet 2018. D. Pogue, Robots rising. Scientific American 2015 <a href="http://www.oharas.com/ET/scientificamerican1015-32.pdf">http://www.oharas.com/ET/scientificamerican1015-32.pdf</a>	Day 1
Watch	Video of Sophia the robot e.g. <a href="https://www.youtube.com/watch?v=S5t6K9iwcdw">https://www.youtube.com/watch?v=S5t6K9iwcdw</a>	Day 1
Discuss	Think of recent technology: where would you place it on the Classification of Robots matrix? What about a drone? What about chess playing robots? A coffee machine?	Day 1
Write	Short essay. Submit your completed written assignment by Day 4 of this topic. For detailed instructions on completing this assignment, see the associated course page.	Day 1-4
Watch	Watch Online Lecture 2 – Robotics Evolution	Day 2
Read	International Federation of Robotics <a href="https://ifr.org/downloads/press2018/Executive_Summary_WR_2018_Industrial_Robots.pdf">https://ifr.org/downloads/press2018/Executive_Summary_WR_2018_Industrial_Robots.pdf</a>	Day 2

in what order. Appropriate hyperlinks will lead to the material and the tasks at hand. It is necessary for a well-designed course to employ colleagues and professionals to

work through the program as guinea pigs, giving detailed feedback. It is not possible for one person to compile the material and check the flow, content and user experience. It is important to recognise that each person will have a different experience.

An important part of the learning experience is the interaction with the instructor. Discussions are facilitated on all LMS, often in discussion boards where students and instructor meet online at a specified time. A discussion forum facilitates exchange amongst students but should always be moderated by an instructor. In addition, the instructor needs to be present for queries throughout the course.

There are two different options how the module can be executed by the student, either self-paced or by ‘drum-beat’, meaning that the student follows prescribed tasks on a daily basis. Studies on student satisfaction have shown that the latter is more successful for student retention and pass rates alike. Loosing focus is the most cited reason why students abort an online course and this is less likely if tasks are ordered according to a schedule. The student will feel ‘less lost’ as a result. Tab. 1 contains the example of the ‘drum-beat’ where all students are required to do the same work on the same day.

However, this does not mean that content should be locked away. Instead, all content, assignments and material should be accessible throughout the course. The reasons for this are that (i) the student can work ahead of time if she knows her schedule will not allow study at a later stage and (ii) that the student has a good overview what is still to come and can pace herself accordingly.

#### 4.2 Video lectures

Important aspects of online learning are video lectures. It has to be pointed out, however, that video lectures on their own are not sufficient to constitute an online course. Videos are only one aspect of the experience.

One of the reasons why online learning has increased dramatically is that it is today very easy to produce videos at home by oneself. The online video platform YouTube is also a treasure trove of online learning. Many lecturers or their students have posted videos of their lectures on this platform. Today every cell phone, every laptop has a built in camera and microphone, which is all that is needed to produce a lecture video.

However, there are several techniques and pitfalls when it comes to producing videos as part of an online course. There are different options in producing videos, largely three categories of videos: (i) lecturer’s speaking, showing her face and upper body; (ii) PowerPoint or similar presentation program slides; (iii) writing text in a paint program. Of course, there can and will be any combination of these three categories in a well-produced lecture video. Fig. 2 shows a screenshot of a video recording of the lecturer (i) and embedded in the online course for the lecture at hand. Fig. 3 is a screenshot of a presentation with voice-over (ii) recorded in Screencast-O-Matic.

The best advice for any type of video is probably to invest in a good quality microphone. Most laptops come with size-constraint microphones and the while the resolution of the video may not be reflected so well in an online video, the r voice will always sound much better when recorded with a decent microphone. Another good practice is to write down in detail the text that will be presented and spoken in the recorded video, word-for-word.

The screenshot displays the Canvas LMS interface. The browser address bar shows the URL: [witsstudyonline.instructure.com/courses/33/pages/topic-5-r-online-lecture-2-robotics-evolution?module\\_item\\_id=2101](https://witsstudyonline.instructure.com/courses/33/pages/topic-5-r-online-lecture-2-robotics-evolution?module_item_id=2101). The left sidebar contains navigation options: Announcements, Grades, Syllabus, Modules, Discussions, Assignments, Quizzes, People, Conferences, Collaborations, Outcomes, Files, Pages (highlighted), Google Drive, and Settings. The main content area is titled 'Topic 5 (R) - Online Lecture 2: Robotics Evolution'. Below the title is a video player with a play button. The video player shows a woman with glasses speaking. Above the video player, there is a text prompt: 'Click the video below to watch the online lecture 2 - Robotics Evolution'. Below the video player, there is a text prompt: 'In the second lecture video you get to identify what the main industrial applications are and get to understand who the key players are in robotics.'

Figure 2. Example of the online platform tool ‘Canvas’.



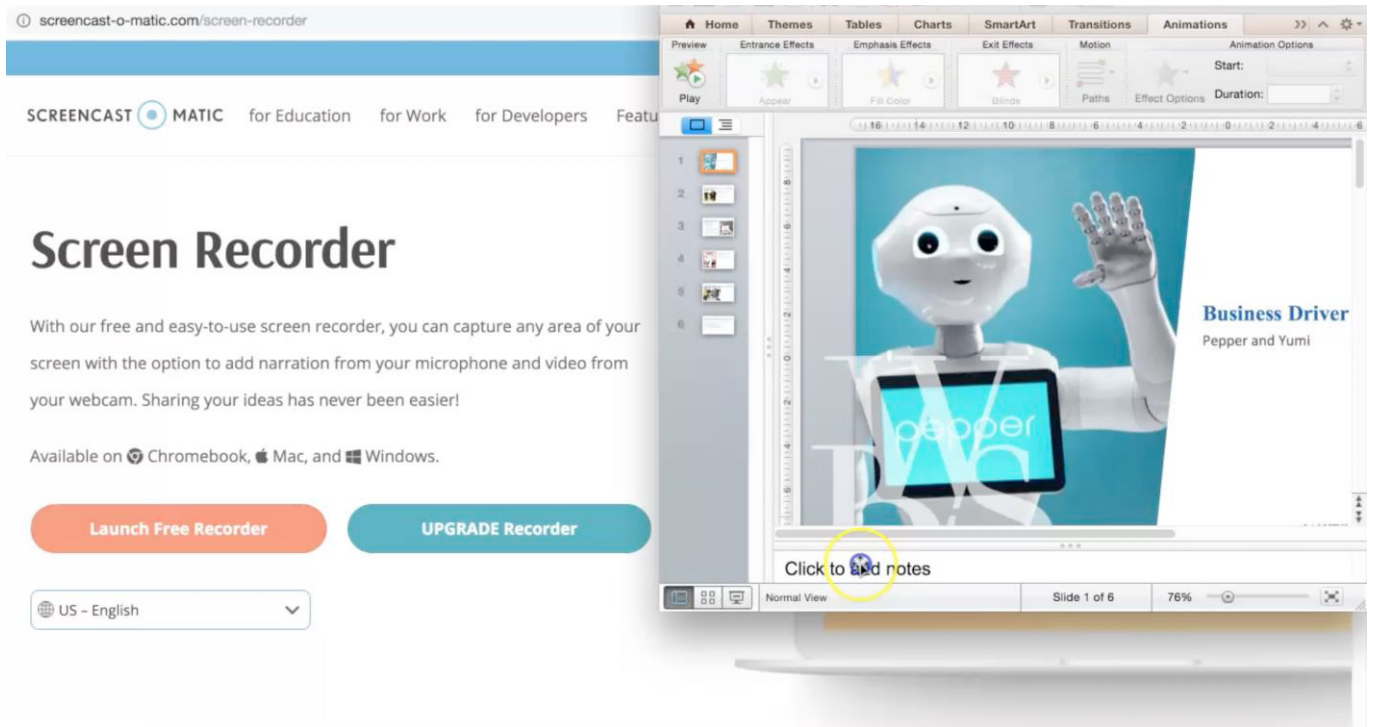


Figure 3. Example of screen-capture of slides with SCREENCAST-O-MATIC and PowerPoint.

#### 4.3 Assessment

Arguably the most important quality of an assessment is to ‘Design assignments so that the students will unavoidably think of meaning.’ (Willingham, 2009). In other words, an assessment needs to be formulated so that the student thinks of the consequences and effects.

Assessments can have different forms and the benefit of an online course is that the marking can be largely automated. The most commonly used assessment types are written assignments, exams, case studies, group work, presentations and projects. As in face-to-face lectures, it is important to spend time during the videos to relate information to the assessment. Assignments can be handed in via tools such as Dropbox, in a discussion forum (contribute) or in quiz tools for multiple choice and true/false questions.

#### 5. CONCLUSIONS

This contribution has summarised the experience of producing an online lecture from an existing lecture material. In summary, the following lessons were learnt in the experience.

1. Online lectures the potential to reach a wider audience and can improve learning because the students can watch videos, read material at their own pace.
2. Knowledge leads to more knowledge. Provide relevant reading material, keep essentials to a limit but give as much extra as possible.

3. Develop a story line for each part of the lecture and for the connected lecture.
4. A regular drum-beat keeps the students on their toes.
5. Don’t lock away any material. Instead, present the students with all the material so they can get an idea how much work is involved.
6. Everyone’s learning experience is different. The online material has to cater for different learning styles.
7. To the non-narcissistic, unfamiliar user of technology, watching videos of oneself is a very painful experience.
8. This pain has to be overcome – it is vital to watch oneself (again and again) in order to improve.
9. Get as many colleagues, peers etc. to watch your videos, do your course and comment on them (kindly but critically).
10. Design assignments so that the students will unavoidably think of meaning (Willingham, 2009).

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