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Towards a Taxonomy of Video for HCI Education

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Abstract

This paper examines six case studies where video has been used for educational purposes, specifically on topics of Human-Computer Interaction. Through this examination, we identify the recurrent themes and propose the main dimensions upon which a taxonomy of video for HCI education can be drawn: considering who the actors in the producer-consumer dichotomy are, whether students, tutors, or external third parties. Recurrent observations made in a wide variety of contexts across our educational practice are also outlined. We propose further development of this taxonomy.

CCS Concepts: Human-centered computing → Human computer interaction (HCI); Social and professional topics → *Computing education*

2.1. Introduction

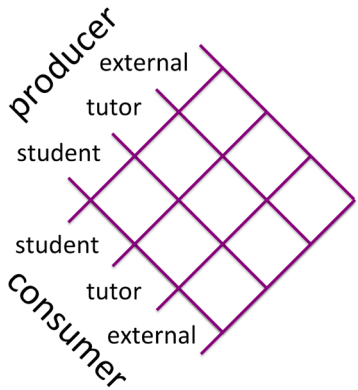

Figure 1. The roles played by producers and consumers of video for HCI Education (whether students, tutors or external stakeholders) are the main dimension to consider for an adequate classification of said videos.

The use of video in education is not new, especially for distance education. Since the early 1970s, the Open University have been broadcasting lecture-like material aired during gaps in programming on BBC's public channels (Dix, 2016). In Human-computer interaction (HCI), video has also been an integral part of both innovative systems, such as Xerox PARCs early experiments in ubiquitous office video sharing (Stults, 1998), and also methodologies in research and practice. Many of the more radical early ideas, such as the Phone Slave (Schmandt & Arons, 1985) and Wellber's DigitalDesk (Wellber, 1993) were demonstrated through "envisionment" videos, and since the 1990s video has become a normal tool of ethnography and design requirements capture.

However, in recent years there have been significant changes. On the one hand, platforms such as YouTube have changed the pattern of video consumption, widening the type and quantity of video beyond the traditional gatekeepers, and in consequence also shifting quality and accuracy judgement from producers to consumers. On the other hand, the production of video has become easier and cheaper. It is now possible to create relatively high-quality video using tools available on nearly any smartphone. This is also enabling new forms of stand-alone systems using web-cams, HTML5 video, and lower-barrier coding tools. These changes have had an impact in education broadly, sometimes making use of the generic video platforms, such as Khan Academy, and sometimes embedded within specialist platforms including plugins for generic VLEs and MOOC platforms such as FutureLearn.

This paper is based on six case studies from our educational practice, and also draws on broader input from the literature and workshops the authors have organised on HCI education [6, 8, 9]. Crucially, these case studies include not only tutor-created resources, but also various examples of student production. Reflecting on these experiences, we seek to embed the lessons learnt, problems identified, and issues raised within a nascent framework, around the producer-consumer roles of various actors (students, tutors and others), and their combinations as shown in Figure 1. Through this framework we seek to initiate steps towards articulating a taxonomy of video for HCI education. Such framework allows an increased understanding of our diverse experiences, facilitate mutual learning between them, and highlight future directions for pedagogic process and educational research. Many of the issues presented are common across similar disciplines, but others, such as the use of video within prototyping, are HCI-specific.

2.2. Case studies

Case study 1: Interactive "e-lectures" for flipped classrooms

Table 1. (Case study 1) Interactive e- lectures for flipped classrooms at UCL

Level	Course	Length weeks	Num. of students
Master-level	Persuasive Games	10	40
3rd year UG	Interaction Design	10	182

This case presents experience of two instances of using interactive e-lectures to deliver material for flipped classrooms, as detailed in Table 1. Both courses were taught at University College London (UCL), UK, and both lasted one semester (10 weeks of lectures). In the both instances the tutor designed the e-lectures to be studied by students prior to face-to-face workshops. The workshops were intended to assist learners with getting to grips with the material from the e-lectures. The effectiveness of the flipped model using e-lectures as videos was then evaluated using end-of-term online surveys. The results suggest that students prefer the flipped model offered by e-lectures compared to traditional lectures. These e-lec-

tures were not simply long videos, but they embodied interactive elements, including table of contents, which enabled students to obtain an overview of the material and also rapidly access specific parts (see Figures 2 and 3).

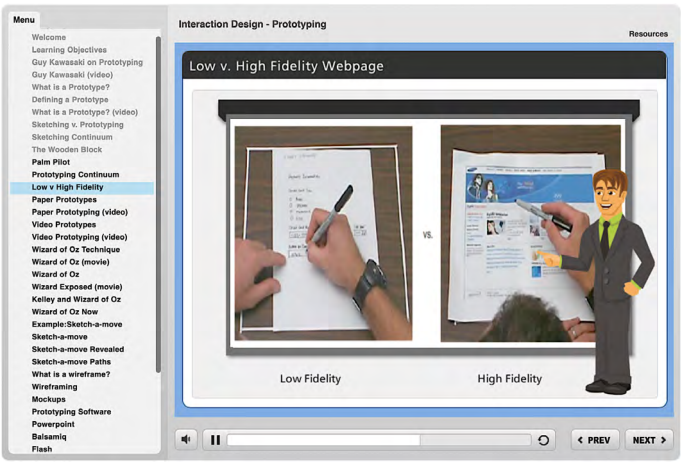

Figure 2. (Case study 1) Web layout for e-lecture delivery contrasting low- vs high-fidelity prototyping in the Interaction Design course, with a detailed table of contents (on the left), main screen with animated instructor, link to additional resources (top right corner), and navigation buttons (at the bottom).

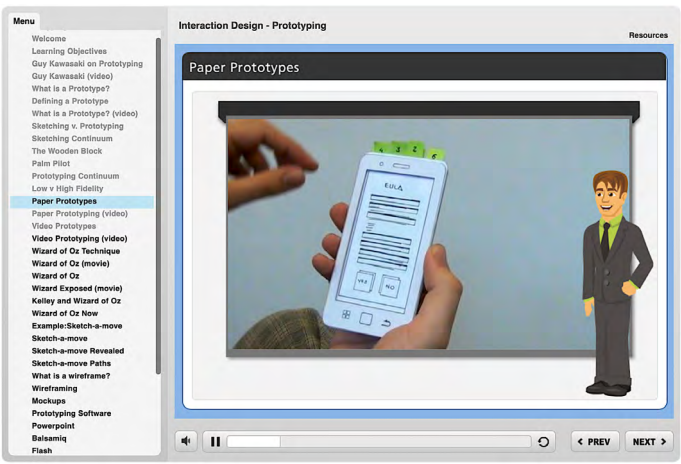

Figure 3. (Case study 1) A second view of the e-lecture shown in Figure 2, this time demonstrating paper prototypes.

Case study 2: e-lectures for the Interaction Design Foundation

In this case, video material originally created for an experimental MOOC on HCI was then reused in Interaction Design Foundation courses (interaction-design.org) and also in flipped class activities (Dix, 2016). This was in many ways 'standard' video material, but had two features of interest. First, it was deliberately low-budget compared with MOOCs that involve semi-professional studio space and editing; the aim was to emulate what an ordinary academic would produce for their own students and for sharing. This led to insights about engagement (students seemed capable of up to 10 mins length before fall-off despite widely suggested figures of less than half that); and crucial fine details of production, e.g. positioning camera so that natural eye movements to screen 'look' towards slides during simple screen-in-screen presentation, as in shown in Figure 4. Second, there was a focus on reuse of the MOOC materials, both for flip class teaching by the presenter, but also wider sharing for in-class or out-of-class use in standard face-to-face teaching. The literature on reuse is often focused on producing stand-alone units of learning (such as learning objects or Sharable Content Objects in the SCORM Reference Model); however, real instruction is highly contextual, so instead this has led to seeking methods and tools to better view small snippets from longer videos in ways that present them as units, but do not hide their extracted nature.

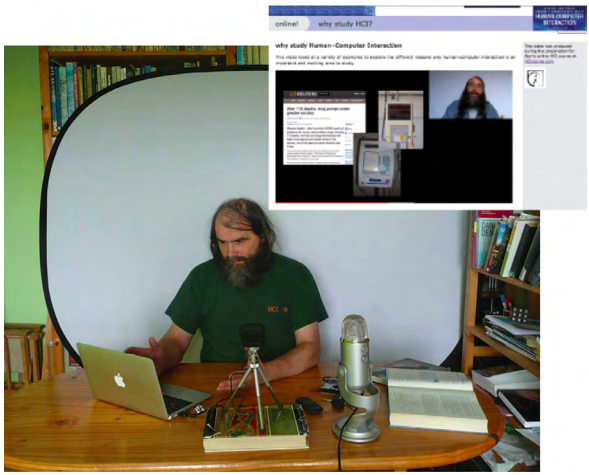

Figure 4. (Case study 2) Setup for e-lecture delivery on prototyping for an Interaction Design Foundation course, with a detailed table of contents (on the left), main screen with animated instructor, link to additional resources (top right corner), and navigation buttons (at the bottom).

Case study 3: Video coursework for Usable Security

Here, students were asked to create videos for computing courses related to *Usable Security* at the University of Glasgow (Table 2). Video presentations required the demonstration of the development of a proactive password interface for minors. The assignment was a video presentation on key challenges of the specific context, the devised interface and evaluation. The marking scheme was not tailored specifically to presentation or video challenges, but did emphasise aspects such as clarity of speech and use of visuals aids. Teams were not provided with any specific guidance on how to produce videos, suggested tools or any strict guidance as to format, but a structure was suggested.

Table 2. Coursework at Glasgow (Case study 3)

Module:	Usable Security
Number of students:	approximately 80
Course duration:	one semester
Group size:	2-3 students
Length of videos:	10 minutes
Video-production guidance provided:	minimal

Table 3. Coursework at Southampton (Case study 4)

Module:	Interaction Design
Level:	2nd year undergraduate
Number of students:	140
Course duration:	one semester
Group size:	4-5 students
Length of videos:	4 minutes
Video-production guidance provided:	lecture + past year's examples

The main observation of this case study was that 'digital native' students may submit unpolished artefacts which suggest a limited skill set in video production. This may have been

alleviated by offering guidance on video presentations issued to the students. However, the level of sophistication of the submitted artefacts may be attributed to the nature of the assignment. Very similar observations were made by one of the authors when using video coursework when teaching the module *Complex IT Systems in Large Organisations* at Uppsala University (Case study 6, see table 5).

Case study 4: Video coursework for Interaction Design projects

This case study was based on the Interaction Design module taught at the University of Southampton, UK, detailed in Table 3. The module was assessed by exam and coursework (50% each). In the coursework, students were required to conduct qualitative research and develop low-fidelity prototypes for Internet of Things devices. A student-authored video showcasing the features of the prototype was the primary assessment tool. Video production was encouraged to use a range of prototyping materials, e.g. paper, physical, computer-generated or combinations of these all. The video, part of the final submission (which included a report) required the presentation of features, functionality, fitness for purpose and justifications for design decisions of the prototype. In total, working in small groups, students authored 27 video submissions, screenshots of some of which are featured in Figure 5. The assessment criteria for the video component

Figure 5. (Case study 4) Stills from student- produced video demonstrating the functionality of a smartphone app which interacts with a smart watch in a lo-fi prototype.

were developed carefully, prioritizing prototype over production quality, so that marks were weighted towards the fitness for purpose of the developed and presented technology prototypes. In this way, students with limited video-making experience were not disadvantaged (Wilde & Snow, 2018).

Analysis of this method revealed that creation of video presentation is successful in giving students freedom to explore low-fidelity prototyping techniques, beyond simply "apps". Further, it acts as a level-playing field for materials' choice when prototyping, with the additional benefit to allow students to employ humour and ingenuity to showcase their prototypes.

Case study 5: Video coursework for Ubiquitous Computing course

This case study is the Ubiquitous computing module at Newcastle University, UK (details in Table 4). As part of the assessment (30% of the module total) students individually created three short video tutorials of their practical sessions, explaining how to program Raspberry Pi in various scenarios.

Table 4. Coursework at Newcastle (Case study 5)

Module:	Ubiquitous Computing
Level:	3rd year undergraduate
Number of students:	34
Course duration:	one semester
Group size:	1 (Individual Individual coursework, though with elements of cohort-wide collaboration)
Length of videos:	2-4 minutes
Video-production guidance provided:	lecture + shoot templates in video-production tool

A mobile video production tool was provided to aid collaborative video production. As part of the process, students used the provided tool to first create a number of short video clips to document their work with Raspberry Pi during practical sessions. Then students uploaded their clips to a dedicated server through the tool, making those clips available for their peers to see. Final-

ly, students individually combined shared clips into their own edits, which they submitted for assessment.

The used tool provided students with a "shoot template", a set of suggested shots that the tutor has chosen to help guide students on what to shoot, and aid framing and structuring their tutorials better.

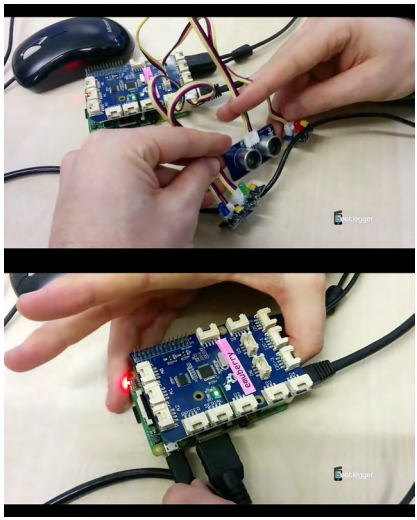

Figure 6. (Case study 5) Stills from a tutorial on Proximity Detection showing how to connect peripherals to a Raspberry Pi.

Assessment criteria for the video tutorials were developed in a similar way to the previous case study. The biggest portion of mark was given for the understanding of required concepts for working with Raspberry Pi and accuracy in explaining the steps required to achieve a certain task in the video tutorials, rather than the production quality of the video.

Feedback suggests high enthusiasm for video making, with many students expressing a preference to video over written reports and oral presentations. Further, post-analysis of the learning process (from meta-data of the video production tool) showed that collaborative video creation helps students to both demonstrate and develop media literacy skills, an unplanned by-product of the assessment.

Case study 6: Video coursework for Complex IT Systems in Large Organisations

This study took place at Uppsala University, Sweden, detailed in Table 5. The learning objectives of the course were to understand various stages in the life-cycle of complex IT systems in large organisations. The assessment comprised a group project and an individual exam. For the project, students conducted interviews with key people in various organisations to understand processes

related to a IT systems life-cycle (development, procurement, etc.) and then prepare a report accompanied by a short video. Interviewees were selected by course tutors and randomly allocated to each group. Students received interview training and discussed what makes a good educational video and what to note when creating their films.

Figure 7. (Case study 6) Stills from a video where students re-enact an interview they conducted of an expert in the field.

Table 5. Coursework at Uppsala (Case study 6)

Module:	Complex IT systems in large organisations
Level:	Master level
Duration:	one semester
Number of students:	approximately 40
Group size:	3-5 students
Video-production guidance:	Lecture + discussions of what makes a good educational video

Submissions were then shared among students and used as a base for learning goals' discussions, which were based on the learning theory of constructive controversy and the use of affinity diagrams. The individual exam at the end of the course included questions about all organisational contexts covered in the course, as presented by their peers' films and reports. The main observation from this case was similar to those of the case study 3. Many of the student groups produced videos of modest quality. This impacted the delivery of necessary information to other students who learnt from those videos. Unfortunately, since each group has been assigned to cover a specific phase of IT system development

in a specific context, the instructors had to include all of the videos and reports into class discussion and exam preparations. The course timetable restrictions allowed no time to re-do the videos. However, as reported by students in the interview the students who used the videos and reports as learning materials did not see any major issues with them and did not question the information delivered to them, despite the quality issues noted by the instructors. In other words, the learners did not think it was necessary to critically evaluate the content of peer-produced materials. This suggests, that today's students still need some scaffolding to mitigate any lack of experience in producing videos. Moreover, this case also revealed that many students lack the critical thinking skills required for peer-assessment.

2.3. Themes for video production in education

Video production in education can be classified in two themes: videos as delivery and as assessment. HCI as a discipline requires students to master design and technical skills, including film making and video production (Hewett et al., 1992). The affordances of video for communication fosters students' creativity while allowing effective demonstration of knowledge and skills. Also, in learning about prototyping, just like in industry, video is impactful for challenging prototypes. Students do not yet have mature skills to make a fully working tool or system within a course time frame, so video allows for effective Wizard of Oz demonstrations. Moreover, with video, it is possible to effectively demonstrate the prototype in context, by visualising a scenario in near-real settings with zoom-in and zoom-out options, rather than in oral in-class demos.

Production of video coursework could be supported by a specific tool or platform (like in case study 5), however, it could also successfully rely on students simply having cameras on their smart phones (like in case study 4). When designing curricula/assessment that involves student-made videos, tutors should not regard today's students "digital natives" (Prensky, 2001) as digitally proficient. As suggested by results of case studies 3 and 6, students do require sufficient motivation (make them buy the idea of how useful it is for them to produce quality videos) and scaffolding in

order to be able to produce good quality video materials and fully benefit from the making process. This could be dealt with by either investing some time in class to thoroughly explain the tasks or by having a technological support, like in case study 5, where a tool could guide the students giving them video production templates and suggesting order of steps and framing for shots.

Table 6. Use of video for delivery or assessment

Video for delivery:	**Video for assessment**:
Tutor-created video for delivery of content to students. This is not simply a recorded lecture but purposefully created content, tailored to "digital consumption" with features such as non-linear navigation, a short format and embedded interaction (e.g. quiz) to encourage viewer engagemen.	**Student**-created video that students create as part of their learning in a course. Video coursework could take various forms: presentation of research results, demonstration of a developed prototype or a working software or hardware, tutorial for acquired skills, etc.

Another technique to help students with video production is to encourage and support their collaboration. This could be done with or without a specific tool (see case studies 4 and 5). Peer learning is a powerful technique which could boost student creativity (by broadening their perspectives - e.g. seeing what others have come up with) and productivity by peer-pressure and competitiveness (thinking "I/we could do better than other students"). Technological support, however, can boost this even further and help students to acquire additional (sometimes unexpected) skills, such as media literacy, as shown in case study 5. Furthermore, collaboration where students share pre-production media material prepare them for the sharing economy. This way students also get to know basics of fair use and copyright principles as well as acquire such skills as co-production and crowd-sourcing. We found numerous educational benefits of video making across our practice. As well as promoting deep learning and being a reliable assessment technique, video production provides students an opportunity to master transferable skills, of which media literacy is a valuable one. In this process, students learn how to create a meaningful media message, whilst also acquiring or mastering video

production skills. When the process of production is collaborative and students share and see each others' pre-production material, they can engage in critical evaluation of video clips in order to make editorial choices in their own work.

2.4. Taxonomy

Drawing observation from these case studies we propose a framework that presents nine scenarios where roles of video producer and consumer are allocated in turns to tutor, student and a third party, who is external to a particular course and student cohort, as illustrated in Figure 1. In what follows we refer to pairs according to how these actors fall in the producer-consumer dichotomy, discussing their common attributes.

A **student-student** video allows sharing, encourages critical thinking, peer learning, peer assessment. At best learn critically from one another, but some consumers may tend to *overtrust* (see sidebar), given that they know the producers. A **student-tutor** video is typically used for demonstrations and assessment. FAQs could potentially be used for scaffolding and guidance. A **student-external** video is used in publications and student portfolios[1] potential to become external resource for another institution, or to allow cross-institutional peer-learning.

A **tutor-student** video can consist of e-lectures (as in case study 1), a lecture capture, or even feedback on student work. Another use could be to answer frequently asked questions (FAQs) for scaffolding and guidance. A **tutor-tutor** video can be used for coaching, professional development, or community-building in computer science education.[2] A **tutor-external** video includes MOOCs, complementary material to textbooks, and sites such as IDF (case study 2).

An **external-student** video suggests the reuse of creative-common materials and other sources. This could be either direct (requires information search and critical evaluation); or mediated by tutor (recommending tools for easy collection, editing and attri-

1. A *student-tutor* video can also be *student-external* if the institution allows the public distribution of assessed material.

2. An example of a teacher explaining how to flip a classroom: <https://youtu.be/ZRvmjjeZ9CA>.

bution). An **external-tutor** video encompasses both professional development and selection of material for teaching. Finally, an **external-external** video for educational purposes include television and broadcasts as well as online videos and vlogs in tended for information or even marketing and trend-setting, but these are not typically within the context of higher education.

2.5. Stepping back thoughts

Video as prototype builds on long-standing research on User Interfaces and HCI as well as practice, including envisionments. Not only affords numerous pedagogic advantages to students as discussed above but it is a powerful tool for all actors involved. In particular, within the proposed taxonomy, when we consider the different actors across the producer/consumer matrix presented in Figure 1, the roles of producer and consumer can be taken by student, tutor or external party, defining the purpose of the video. In the case of students, production promotes learning of video skills and domain knowledge, whilst consumption foster learning of other skills such as critical evaluation. Similarly, for tutors, both production and consumption can support their professional development and community-building, whilst for external actors the motivation is often showcasing advances in developments and services which can increase reputation and commercial rewards.

It is worth exploring further what other dimensions to the proposed taxonomy of video for HCI education can be considered, perhaps in style, tone, level of support, and other aspects which we have identified and outlined in Tables 1, 2, 3, 4 and 5.

We also observed that students may trust poor information on other students' videos. An explanation is that the videos may be perceived as endorsed by the tutor, who through the exercise is giving it some kind of approval. If videos are interviews or selection of other seemingly real or reliable original sources, the student consumer may underestimate the significance and potential bias in the process of selection, editing and collecting the material.

2.6. Conclusions

Contrasting the various case studies structured across the themes has helped to highlight potential points of mutual learning; for example, template-based approaches used to ease students sharing and editing video may also be useful for tutor produced material. It has also highlighted common challenges to practitioners, such as the need to find ways to make editing of rough videos easy. Finally, it has helped suggest potential new directions; for example, whether student questions as well as tutor feedback could be delivered through short video or audio clips. However, we feel we are at the beginning of exploring this broad and rich area, with great significance to the computer science education community at large. We welcome discussion with other HCI educators and Computer Science Educators in general, and we believe that the proposed taxonomy will offer a common vocabulary for such exchanges.

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