QuizCram: A Question-Directed Video Studying Interface

1st Author Name
Affiliation
Address
e-mail address
Optional phone number

2nd Author Name
Affiliation
Address
e-mail address
Optional phone number

3rd Author Name
Affiliation
Address
e-mail address
Optional phone number

ABSTRACT
TODO less than 150 words

Author Keywords
Guides; instructions; author's kit; conference publications; keywords should be separated by a semi-colon.
Optional section to be included in your final version, but strongly encouraged.

ACM Classification Keywords
H.5.m. Information Interfaces and Presentation (e.g. HCI): Miscellaneous

See: `http://www.acm.org/about/class/1998/` for more information and the full list of ACM classifiers and descriptors. Optional section to be included in your final version, but strongly encouraged. On the submission page only the classifiers letter-number combination will need to be entered.

INTRODUCTION

Online courses on platforms such as Coursera and EdX focus heavily on viewing video content. However, a phenomenon known as the testing effect shows that actively engaging with the material and quizzing yourself on it is more effective for retention than simply passively watching the content. Platforms such as Coursera have in-video quizzes which attempt to bring the benefits of testing into the video context by asking the user a multiple-choice question at key points in the video about the content that they have just watched.

Our system, Quiz-driven Video Cramming (QuizCram), makes the quiz the focus of the review and doing the following:

Quizzes are shown before and alongside the associated video content, instead of after A timeline of previously answered quizzes, along with associated videos, is shown Quizzes can depend on video segments other than just the immediately preceding one.

However, there are some weaknesses with the standard in-video quiz format, which the system presented in our paper attempts to address:

In-video quizzes are shown only after the viewer has viewed the video: The in-video quiz serves simply as an after-the-fact indication to the user of whether they understood the preceding section or not. It does not actually help the user with the task of deciding whether he needs to watch this section, or identifying the key parts of the video that they should pay attention to while watching.

No call-to-action if the user doesn't know the answer: The user is freely able to skip over the quiz, and if they answer the question incorrectly then they are simply told they are incorrect (with no other feedback), or if they answer incorrectly 3 times the answer is shown and the video advances onwards. This does not encourage the

Limited flexibility in writing questions: In-video quizzes imply that their answer is located

Limited density of questions:

We present a system which attempts to improve on these weakness of in-video quizzes in the following ways:

Show the quiz beforehand: Our interface encourages users to look at the associated question before watching the video, so that it serves as an advance organizer to prime them towards the key concepts they should focus on while watching the video.

Provide helpful feedback

However, because the in-video quiz tests the key concepts in the section, it can also serve as a summary of the video. It is useful to look at it prior to viewing, both to show the user whether or not they need to view the video. Our interface encourages users to look at the in-video quiz before watching the video, so that it serves as an advance organizer to prime them towards the key concepts they should focus on while watching the video.

No call-to-action if the user doesn't know the answer: The user is freely able to skip over the quiz, and if they answer the question incorrectly then they are simply told they are incorrect (with no other feedback), or if they answer incorrectly 3 times the answer is shown and the video advances onwards. Instead, our system more useful feedback in response to an incorrect answer, encourages the user to review the relevant portion of the video, and enforces that users can answer the question on their own before advancing them to the next portion of the video.

Users are not encouraged to review the portions of the video they do not understand: Our own independent analysis of

viewing logs on Coursera shows that among users who finish watching a video, less than a sixth will ever re-open it. To encourage people to review videos, our system keeps track of which video portions users need to review (using a score based on question scores on associated segments, percentage of the segment reviewed, and recency of reviewing), and gives them suggestions of portions to review once they have watched all the video segments.

RELATED WORK

We designed our system features around a set of phenomenon from the education literature, which are also exploited by many other systems.

Testing Effect: Traditional Quizzes and In-video Quizzes

The testing effect finds that repeated testing combined with fast, informative feedback helps students remember material [8]. . Traditional courses already employ testing in the form of exams, but these are infrequent, are not repeated, and . Although in-video quizzes are more frequent, help resolve the delayed feedback issue by putting the quiz immediately after the relevant section of the video. However,

Our system attempts to make this more granular, making testing and quizzing at the video-clip level rather than the .

Pre-Testing Effect

Lindsey E. Richland: The Pretesting Effect: Do Unsuccessful Retrieval Attempts Enhance Learning?

Advance organizers: Video Transcript Summaries

Amy Pavel: Video Digests: A Browsable, Skimmable Format for Informational Lecture Videos

Visualizing progresss within videos

Robert Mertens: Social navigation in web lectures

Juho Kim: Data-Driven Interaction Techniques for Improving Navigation of Educational Videos

Abir Al-Hajri: Video Navigation with a Personal Viewing History

Spaced repetition: Flashcards

Spaced repetition is a technique designed to help learners retain information by having them review items at regular intervals. A class of applications that exploit this are flashcards, where information is split into independent chunks that are scheduled for review based on factors such as mastery and recency of review. Flashcards can also have associated multimedia, such as video clips.

Similar to flashcards, our system also schedules items (questions and associated video clips) for review according to mastery and recency of review. One key difference is that lecture videos build on each other, so this is an additional constraint for scheduling: the user needs to have covered the previous videos. Another key difference is the cost of review: a user memorizing vocabulary using flashcards only needs to spend a few seconds on each flashcard, while answering a question or reviewing a video clip takes an order of magnitude more time. Hence, the user will make fewer review passes through the video content than they would with vocabulary flashcards.

Integration and assessment of streaming video content and API development into a spaced repetition service

The relevant portion of the video is not indicated by the quiz: the portion being tested is obviously

Density of In-video Quiz Questions

Is there any related work for this?

SYSTEM DESIGN

QuizCram's interface shows users a question to review, with an associated video segment, as shown in Figure 1. It also shows a scrollable timeline of previously answered questions and associated video segments below the current question. Questions are first scheduled in order, then once the user has made an initial pass, questions are selected for review algorithmically, based on historic correctness of responses, percentage of associated video that has been watched, and the recency of review. We also use the video progressbar to indicate the section of the video that is relevant to the current question, and portions of the video that the user has previously seen.

An existing course with in-video quizzes, such as MOOCs on Coursera, can be automatically transformed into the QuizCram format. This results in each video segment having one associated question. However, unlike in-video quizzes, the QuizCram format is also suitable for having multiple questions associated with a single video segment.

Question-Focused Video Viewing

For each section of the video in the course, we have one or more associated questions. We can get these question-video pairs automatically from existing videos with in-video quizzes, by associating the in-video quiz section with the immediately preceding video segment. For video segments that did not have an associated in-video quiz, we either automatically insert a generic "How well did you understand this video" question, (the format tested in our first study), or write a new question (the format tested in our second study).

Whenever the user advances to a new section, we show the question and video concurrently, with the question to the left of the video, as shown in Figure 1. The video does not autoplay, so that the user has time to read the question before they start watching the video. If the user already knows the answer, they can answer the question and move on to the next section. Even if the user does not already know the answer, reading the question before they watch the video serves as an advance organizer which summarizes the key points they should pay attention to when watching the video.

Unlike in-video quizzes, which users are freely able to skip over, in QuizCram the user must correctly answer the question before they can move on to the next question and associated video segment. This is designed to ensure that users learn the material before advancing onwards, as opposed to simply passively watching the videos without testing themselves.

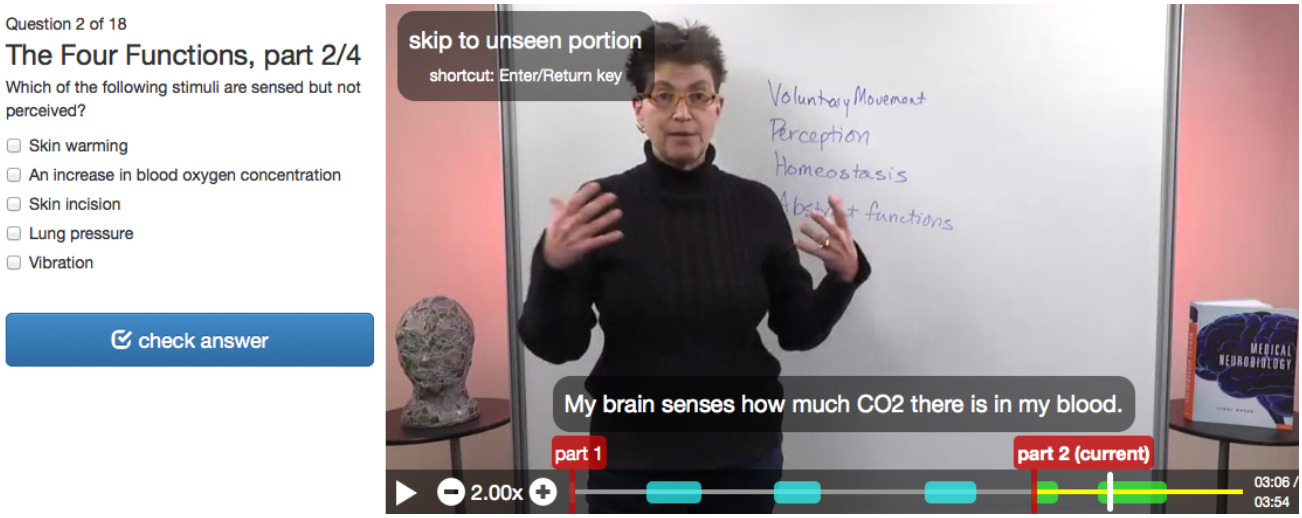

Figure 1. The QuizCram interface, showing the current video. The focus question is on left, and the associated video is on the right. The progressbar highlights the relevant portion of the video in yellow. Already-watched segments of previous sections is in blue, already-watched segments of the current part are in green. Because we are currently watching a section we have already viewed, an option to skip to the unseen portion is shown.

Forcing users to answer the question may lead to frustration if the user is unable to determine the correct answer even after watching the video. Hence, whenever the user answers the question incorrectly, we provide them with immediate, informative feedback by showing the answers and providing an explanation, as opposed to the model used by Coursera where it states that the answer is incorrect, and only shows the explanation and correct answer after 3 tries. We made this design choice based on literature that finds that specific feedback that explains the correct answer to learners is more helpful and motivates them more than simply stating that their answer is incorrect [10].

Of course, immediately showing the answer in response to an incorrect answer leads to the risk that learners may choose to immediately reveal the answer without attempting to answer the question themselves. To discourage such behavior, even though we show the user the answer and explanation in response to an incorrect response, we do not advance them automatically. Rather, we shuffle the answer options and require them to view an additional 10% of the video, which is roughly 20 seconds, before attempting to answer it again, as shown in Figure 2. We do not enforce the 10% viewing requirement if the user has already watched over 75% of the video. This viewing task encourages users to view unseen portions of the video, incentivizes users to answer questions correctly, and ensures they aren't simply storing the answers in short-term memory and reproducing them. Requiring users to view the video and then retesting them after an incorrect response creates an additional retrieval opportunity, which should improve retention of the material [8].

While shuffling the answers and requiring video watching in response to an incorrect response discourages users from simply submitting the incorrect response and memorizing the answers, it does not entirely eliminate the risk. We can further discourage memorization of answers by having multiple questions for each video segment, which we alternate between. For example, in a algebra context we could simply ask the question again with different variable values whenever the user responds incorrectly. However, we did not use this option in our user studies since it would require us to write additional questions.

Scheduling Questions and Video Sections for Review

We want users to spend their study time focusing on material that they have not yet mastered. Hence, we assign each question a *mastery score*, which represents how well the user currently knows the material, and show users the questions for which they have low mastery score. The question's mastery score is based on the following 3 factors:

- *Past performance on question*: This element of the score encourages users to review questions they answered incorrectly. Each time a user tries answering the question, we give them a score between 0 to 1 based on the percent of checkboxes they correctly checked (the questions used in our study were all multiple-check questions). We then do a weighted-mean of all historic scores, with each newer score assigned 2 times more weight than the previous score (so more recent performance is weighted more heavily). For those video segments that have no associated question, we obtain this score by asking users to rate "How well did you understand this video?". If the user has never answered the question before, this has a default score of 0.

- *Fraction of associated video segment watched*: This element of the score encourages users to view video segments they have not seen. For each section of video, we keep track of whether the user has ever watched it. This score is the number of seconds watched in the question's video segment, divided by the total length of that video segment.

- *Recency of review*: This element of the score encourages spaced repetition for the questions. It also ensures that users are not shown the same questions repeatedly, which

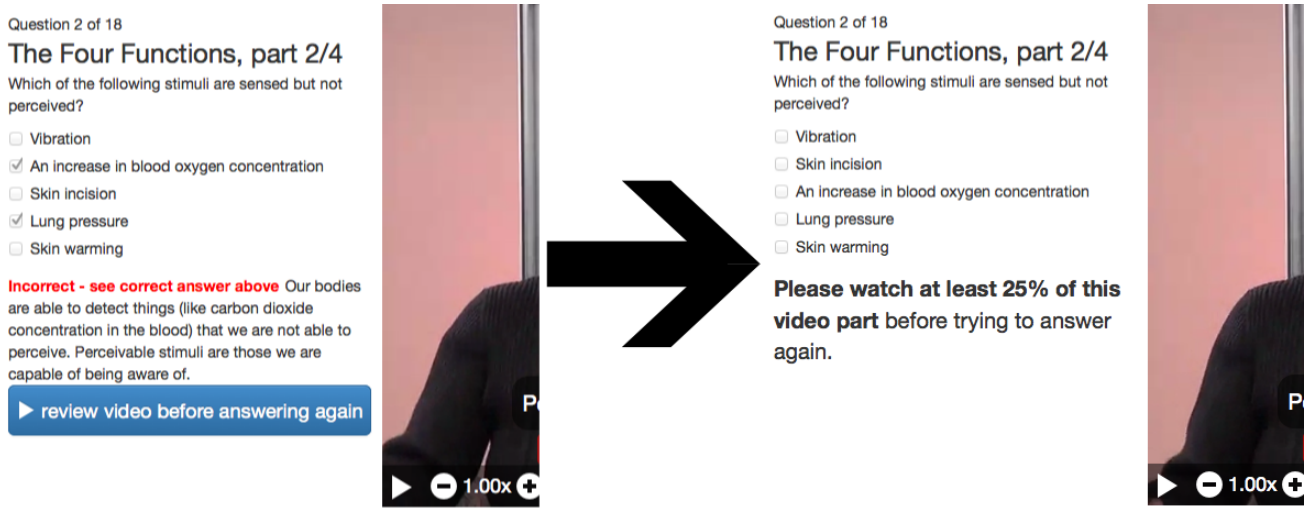

Figure 2. In response to an incorrect response, the user is asked to view an additional 10% of the video, the answer options are shuffled, and the user needs to re-answer the question correctly before moving on.

would make users bored. It is equal to 1 / number of questions elapsed since this question was last seen by the user. If the question has never been seen, this has a default score of 0.

The mastery score is a weighted sum of these factors, where question correctness is 4/7 of the score, fraction of the video watched is 2/7 of the score, and recency of review is 1/7 of the score. We assign question correctness the highest priority because users should all be able to answer the questions correctly, but some users may choose to not watch portions of video they consider irrelevant or already know.

Sorting by the mastery score alone does not enforce that users have met the prerequisites for understanding the video and answering the question, before we show them the video and question. Unlike flashcards, lecture videos are meant to be watched in order and build on each other, so each video segment has a set of prerequisite videos which need to be watched before students can understand them. In our implementation, we enforce prerequisites by requiring that the user has correctly answered the questions for preceding video segments, before we show them the next video segment and associated question.

Sorting questions by mastery score and enforcing the prerequisites effectively results in users first being shown questions that work them through the videos in the order the course covers them, then asking them to review the questions they got low scores for and videos did not finish watching.

Timeline of Previous Questions and Videos

Although QuizCram focuses the user's attention towards the current question and associated video segment, we also wish to make it easy to refer back to the previously answered questions and video segments. Whenever a question is correctly answered, we insert the next question and associated video segment at the top of the interface, and push the existing questions down. This results in a scrollable visual history of the previously answered questions and videos which we call the *timeline*, shown in Figure 3. The timeline displays the question and its answer and a miniaturized version of the video which can be clicked to enlarge it to full size and play it. The miniaturized video displays the frame the user left off at, so it serves both as a visual summary, and also allows users to easily resume viewing progress of previous videos. We also show the historic correctness of the user's answers to that question, and percentage of the video they have watched, to help users identify questions they had trouble with and videos they did not fully watch.

The timeline gives users the option to use a more traditional, self-directed reviewing strategy, in contrast to the flashcard-style reviewing that our question scheduling algorithm encourages. By organizing the list of previous video segments according to the associated question that users answered, this allows users to scan video segments with a more salient summary than just the title. Question-based video navigation also allows users to search at a higher granularity, as questions refer to a specific subsection of the video, while the title refers only to the entire video contents. Furthermore, re-reading the previously answered questions helps trigger the users' memory of the associated clip, giving learners another retrieval opportunity to solidify their memory of the video contents.

Directing Attention to Parts of Video Relevant to Question

Standard in-video quiz viewers show the entire video at once. However, QuizCram shows only the part of the video relevant to answering the question, specifically, the start of the video up until the point where the question would be located (in an in-video context). We additionally highlight in yellow the section of the progressbar where question answer is located. This is designed to focus the user's attention to the portion of the video that will help them answer the question.

For questions generated from in-video quizzes, we highlight the segment of the video that immediately precededs the in-video quiz to indicate that it is where the answer is found, as shown in Figure 1. However, because we can highlight any

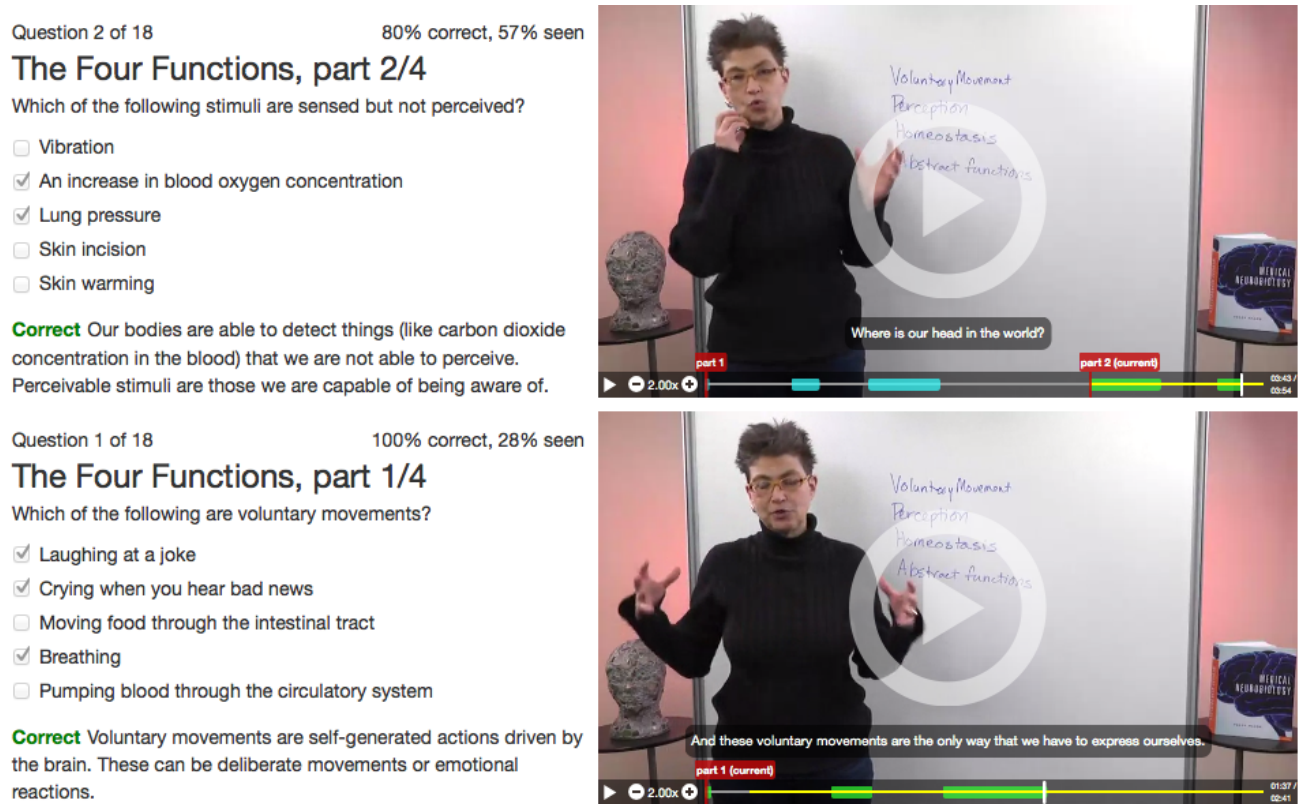

Figure 3. The scrollable timeline, shown immediately below the current question, displays the past set of questions the user has answered. We list the correctness score and video progress scores to help users locate the questions they had difficulty with, and videos they have not yet fully watched.

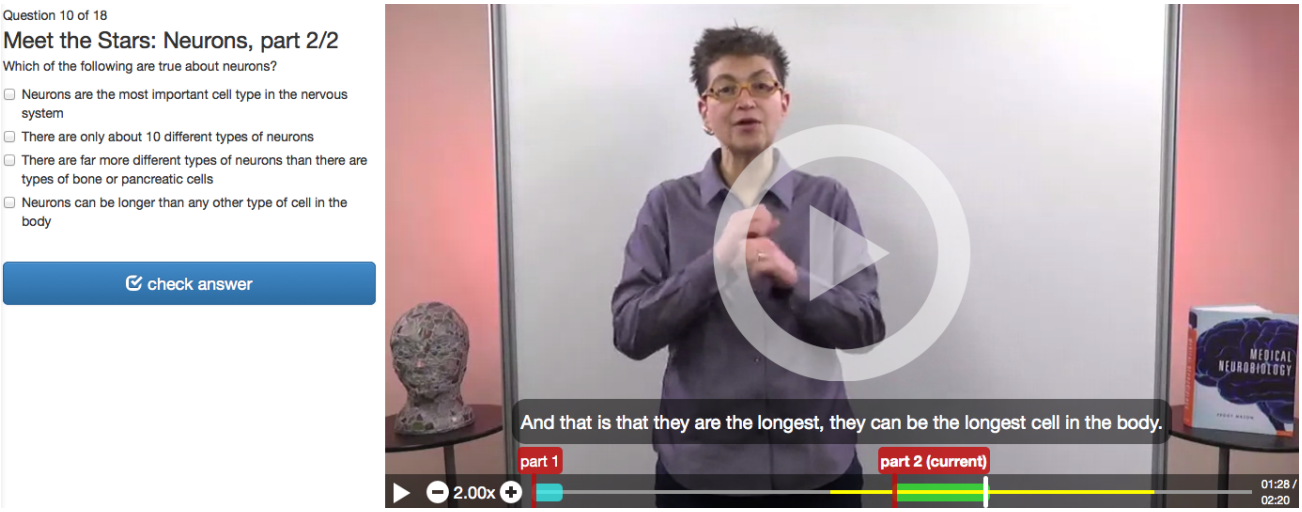

Figure 4. We highlight portions of the video that are relevant to the current question. This gives additional flexibility in question writing and placement: if the question depends on a portion of the video from a previous part, as in this example, we can highlight that section in the video progressbar to indicate that it is relevant to the current question

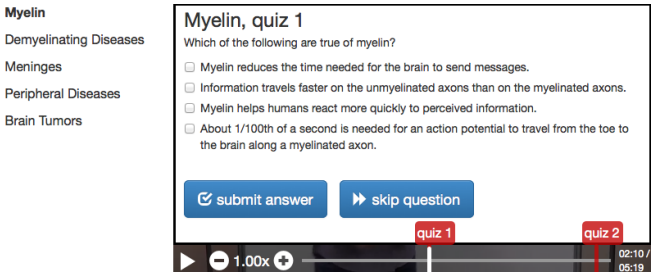

Figure 5. The in-video quiz format that served as our baseline. Left side lists videos, right side is a video viewer that shows the in-video quiz when reached. Locations of quizzes are indicated in red on the progressbar.

preceding portion of the video to indicate that it is relevant to the current question, this also allows us to have more flexibility in question writing and placement: we can place questions where they would fit most naturally, rather than immediately following the section where the answer is covered, as shown in Figure 5. This also enables us to have multiple questions that cover a single segment of video, without confusing users about where the answers to the questions are located.

Directing Attention to Unseen Parts of Videos

In addition, because QuizCram encourages reviewing videos, we wish to make it easy for users to keep track of what parts they have already watched. Hence, we highlight on the progressbar the already-seen parts in green (if it is from the current part of the video), or blue (if it is from a previous part of the video). If the user is viewing a section that has already been watched, we show a button at the top-left of the video that allows them to skip to the unseen portion. Similar techniques for visualizing the user's video viewing history have been presented in the literature [7] [4], though our system adds the novel feature of allowing users to skip to the next unseen portion.

EVALUATION

We conducted a pair of within-subject user studies that compared students' learning behavior using the QuizCram interface, compared to an in-video quiz format that imitates Coursera. The course materials – videos, in-video quizzes, and unit exams — were Units 1 and 2 of an existing Neurobiology course on Coursera.

The first study tested the QuizCram format which results from a direct, algorithmic transformation from the original materials from Coursera. In the second study, we started with the results of this direct transformation, but then also inserted additional questions to see what the effects of doubling the question-to-video-content ratio would be with the QuizCram format.

The questions we aimed to answer with these studies were:

- Do students prefer QuizCram or the in-video quiz format?
- Do students remember the questions presented along with videos better when using QuizCram?

User Study 1

Our first study was an within-subjects study that compared the automatically-generated QuizCram format to an in-video quiz interface that imitates Coursera. We wished to answer the questions:

- Do users remember the questions better

Study Design

User Study 2

Our second study was an within-subjects study that compared the QuizCram format with double the number of original questions (resulting from inserting additional questions into the video), to an in-video quiz interface with the original questions from Coursera.

Study Design

The study was a within-subjects design, where each learner used QuizCram and an in-video quiz viewer interface to study a set of videos. They were asked to provide qualitative feedback immediately after viewing, and were tested on the material they studied a day later.

Participants

We recruited FILLIN university students by posting on mailing lists and job boards. We asked specifically that they have no experience with neuroscience, to ensure that they did not know the material beforehand. As an additional measure, we also asked them to define neuron and myelin sheath, and excluded participants who were able to correctly define both of them. FILLIN participants reported having previous experience with MOOCs. Participants received $60 for their time.

Materials

We doubled the number of questions shown in the QuizCram condition by adding additional questions in the same style and format as the original multiple-checkbox in-video questions. We chose our questions carefully such that the answers were clearly stated in the video, but they would not ask the same facts that were tested on the unit exam or original in-video questions.

We also wrote a set of free-response questions, one corresponding to each of our extra multiple-checkbox questions. For example, the question "Which of the following are true of astrocytes?" followed by 3 true options and 2 false options would be transformed into the free-response question "List 3 facts about astrocytes". We used these free-response questions to test whether users had actually learned the material tested by our new questions well enough to recall it, as opposed to simply learning to recognize the answers when presented in multiple-checkbox format.

Procedure

The study was conducted online over 2 days, with a 90-minute study section on the first day, and a 30-minute test section on the second day. Before users started the study, we informed them that they would be given 2 sets of videos, they should study them for 40 minutes apiece, and they would be given an exam on their contents in 24 hours. We did not tell them about the content of the exams.

On the first day, users used one tool to watch the first half of Unit 1 (5 videos of length 23 minutes total). They were told after 40 minutes to fill out a survey about the tool. Then, they used the other tool to watch the second half of Unit 1 (5 videos of length 25 minutes total), and filled out the survey after 40 minutes of watching.

On the second day, users filled out a set of exams in the order listed below:

1. Extra free-response questions (as described in the Materials section), both halves
2. Original in-video questions from Coursera, both halves
3. Original unit exam from Coursera, both halves
4. Extra multiple-checkbox questions (as described in the Materials section), both halves

Parts 2-4 of the exam were automatically graded, giving each question a score equal to the fraction of checkboxes correctly checked. The free-response questions, which were of the general form "List N examples of X" or "State N facts about X", were graded by marking each fact stated by students as correct or incorrect, then giving them a score of:

$$\frac{\#correct\ examples\ given}{Maximum(\#examples\ requested,\ \#examples\ given)}$$

Thus, if a question requests 2 examples, giving 1 correct example gets a score of 1/2, giving 2 correct examples and 1 incorrect example gets a score of 2/3, etc.

We chose this design of having users watch both sets of videos before taking any exams, as opposed to having them take an exam after they finished studying each section, because this way the user does not know that the exam includes the in-video questions, so this does not influence their study behavior. In pilot studies we had observed that if users know they will be tested on in-video questions, either by taking the exam or if we told them explicitly, they will devote time to explicitly study them and score extremely high on those parts of the exam, but not the rest of the exam. We instead chose our current study design so that we can observe the tool's effect on in-video question retention in natural study contexts where the user knows nothing about the exam.

Test Results

DISCUSSION

This format is to be used for submissions that are published in the conference proceedings. We wish to give this volume a consistent, high-quality appearance. We therefore ask that authors follow some simple guidelines. In essence, you should format your paper exactly like this document. The easiest way to do this is simply to download a template from the conference web site, and replace the content with your own material.

PAGE SIZE AND COLUMNS

On each page your material (not including the page number) should fit within a rectangle of 18 x 23.5 cm (7 x 9.25 in.), centered on a US letter page, beginning 1.9 cm (.75 in.) from the top of the page, with a .85 cm (.33 in.) space between two 8.4 cm (3.3 in.) columns. Right margins should be justified, not ragged. Beware, especially when using this template on a Macintosh, Word can change these dimensions in unexpected ways. Please be sure that your PDF is US letter and not A4. If your PDF or paper are formatted for A4, the submission will be returned to you to fix.

TYPESET TEXT

Prepare your submissions on a word processor or typesetter. Please note that page layout may change slightly depending upon the printer you have specified. LaTeX sometimes will create overfull lines that extend into columns. To attempt to combat this, the .cls file has a command, \sloppy, that essentially asks LaTeX to prefer underfull lines with extra whitespace. For more details on this, and info on how to control it more finely, check out **http://www.economics.utoronto.ca/osborne/latex/PMAKEUP.HTM**.

Title and Authors

Your paper's title, authors and affiliations should run across the full width of the page in a single column 17.8 cm (7 in.) wide. The title should be in Helvetica 18-point bold; use Arial if Helvetica is not available. Authors' names should be in Times Roman 12-point bold, and affiliations in Times Roman 12-point. For more than three authors, you may have to place some address information in a footnote, or in a named section at the end of your paper. Please use full international addresses and telephone dialing prefixes. Leave one 10-pt line of white space below the last line of affiliations.

Abstract and Keywords

Every submission should begin with an abstract of about 150 words, followed by a set of keywords. The abstract and keywords should be placed in the left column of the first page under the left half of the title. The abstract should be a concise statement of the problem, approach and conclusions of the work described. It should clearly state the paper's contribution to the field of HCI.

The first set of keywords will be used to index the paper in the proceedings. The second set are used to catalogue the paper in the ACM Digital Library. The latter are entries from the ACM Classification System [3]. In general, it should only be necessary to pick one or more of the H5 subcategories, see **http://www.acm.org/class/1998/ccs98.html**

Normal or Body Text

Please use a 10-point Times Roman font or, if this is unavailable, another proportional font with serifs, as close as possible in appearance to Times Roman 10-point. The Press 10-point font available to users of Script is a good substitute for Times Roman. If Times Roman is not available, try the font named Computer Modern Roman. On a Macintosh, use the font named Times and not Times New Roman. Please use sans-serif or non-proportional fonts only for special purposes, such as headings or source code text.

First Page Copyright Notice

Objects	Caption — pre-2002	Caption — 2003 and afterwards
Tables	Above	Below
Figures	Below	Below

Table 1. Table captions should be placed below the table.

Leave 3 cm (1.25 in.) of blank space for the copyright notice at the bottom of the left column of the first page. In this template a floating text box will automatically generate the required space. Note however that the text box is anchored to the **ABSTRACT** heading, so if that heading is deleted the text box will disappear as well. You can replace the default copyright notice by uncommenting the \toappear block at the beginning of the document and inserting your own text, for example, for versions under review.

Subsequent Pages

On pages beyond the first, start at the top of the page and continue in double-column format. The two columns on the last page should be of equal length.

References and Citations

Use a numbered list of references at the end of the article, ordered alphabetically by first author, and referenced by numbers in brackets [2, 5, 6, 11]. For papers from conference proceedings, include the title of the paper and an abbreviated name of the conference (e.g., for Interact 2003 proceedings, use *Proc. Interact 2003*). Do not include the location of the conference or the exact date; do include the page numbers if available. See the examples of citations at the end of this document. Within this template file, use the `References` style for the text of your citation.

Your references should be published materials accessible to the public. Internal technical reports may be cited only if they are easily accessible (i.e., you provide the address for obtaining the report within your citation) and may be obtained by any reader for a nominal fee. Proprietary information may not be cited. Private communications should be acknowledged in the main text, not referenced (e.g., "[Robertson, personal communication]").

SECTIONS

The heading of a section should be in Helvetica 9-point bold, all in capitals. Use Arial if Helvetica is not available. Sections should not be numbered.

Subsections

Headings of subsections should be in Helvetica 9-point bold with initial letters capitalized. For sub-sections and sub-subsections, a word like *the* or *of* is not capitalized unless it is the first word of the heading.)

Sub-subsections

Headings for sub-subsections should be in Helvetica 9-point italic with initial letters capitalized. Standard \section, \subsection, and \subsubsection commands will work fine.

FIGURES/CAPTIONS

Place figures and tables at the top or bottom of the appropriate column or columns, on the same page as the relevant text

Papers and notes may use color figures, which are included in the page limit; the figures must be usable when printed in black and white in the proceedings. The paper may be accompanied by a short video figure up to five minutes in length. However, the paper should stand on its own without the video figure, as the video may not be available to everyone who reads the paper.

LANGUAGE, STYLE AND CONTENT

The written and spoken language of SIGCHI is English. Spelling and punctuation may use any dialect of English (e.g., British, Canadian, US, etc.) provided this is done consistently. Hyphenation is optional. To ensure suitability for an international audience, please pay attention to the following:

- Write in a straightforward style.
- Try to avoid long or complex sentence structures.
- Briefly define or explain all technical terms that may be unfamiliar to readers.
- Explain all acronyms the first time they are used in your text—e.g., "Digital Signal Processing (DSP)".
- Explain local references (e.g., not everyone knows all city names in a particular country).
- Explain "insider" comments. Ensure that your whole audience understands any reference whose meaning you do not describe (e.g., do not assume that everyone has used a Macintosh or a particular application).
- Explain colloquial language and puns. Understanding phrases like "red herring" may require a local knowledge of English. Humor and irony are difficult to translate.
- Use unambiguous forms for culturally localized concepts, such as times, dates, currencies and numbers (e.g., "1-5-97" or "5/1/97" may mean 5 January or 1 May, and "seven o'clock" may mean 7:00 am or 19:00). For currencies, indicate equivalences—e.g., "Participants were paid 10,000 lire, or roughly $5."
- Be careful with the use of gender-specific pronouns (he, she) and other gendered words (chairman, manpower, man-months). Use inclusive language that is gender-neutral (e.g., she or he, they, s/he, chair, staff, staff-hours, person-years). See [9] for further advice and examples regarding gender and other personal attributes.
- If possible, use the full (extended) alphabetic character set for names of persons, institutions, and places (e.g., Grønbæk, Lafreniére, Sánchez, Universität, Weißenbach, Züllighoven, Århus, etc.). These characters are already included in most versions of Times, Helvetica, and Arial fonts.

ACCESSIBILITY

The Executive Council of SIGCHI has committed to making SIGCHI conferences more inclusive for researchers, practitioners, and educators with disabilities. As a part of this goal, the all authors are asked to work on improving the accessibility of their submissions. Specifically, we encourage authors to carry out the following five steps:

1. Add alternative text to all figures
2. Mark table headings
3. Add tags to the PDF
4. Verify the default language
5. Set the tab order to "Use Document Structure"

Unfortunately good tools do not yet exist to create tagged PDF files from Latex. LaTeX users will need to carry out all of the above steps in the PDF directly using Adobe Acrobat, after the PDF has been generated.

For more information and links to instructions and resources, please see: **http://chi2014.acm.org/authors/guide-to-an-accessible-submission**.

PAGE NUMBERING, HEADERS AND FOOTERS

Your final submission SHOULD NOT contain any footer or header string information at the top or bottom of each page. The submissions will be paginated in a determined order by the chairs and page numbers added to the pdf during the compiling, indexing, and pagination processes.

PRODUCING AND TESTING PDF FILES

We recommend that you produce a PDF version of your submission well before the final deadline. Your PDF file must be ACM DL Compliant. The requirements for an ACM Compliant PDF are available at: **http://www.sheridanprinting.com/typedept/ACM-distilling-settings.htm**.

Test your PDF file by viewing or printing it with the same software we will use when we receive it, Adobe Acrobat Reader Version 7. This is widely available at no cost from [1]. Note that most reviewers will use a North American/European version of Acrobat reader, which cannot handle documents containing non-North American or non-European fonts (e.g. Asian fonts). Please therefore do not use Asian fonts, and verify this by testing with a North American/European Acrobat reader (obtainable as above). Something as minor as including a space or punctuation character in a two-byte font can render a file unreadable.

BLIND REVIEW

For archival submissions, CHI requires a "blind review." To prepare your submission for blind review, remove author and institutional identities in the title and header areas of the paper. You may also need to remove part or all of the Acknowledgments text. Further suppression of identity in the body of the paper and references is left to the authors' discretion. For more details, see the submission guidelines and checklist for your submission category.

CONCLUSION

It is important that you write for the SIGCHI audience. Please read previous years' Proceedings to understand the writing style and conventions that successful authors have used. It is particularly important that you state clearly what you have done, not merely what you plan to do, and explain how your work is different from previously published work, i.e., what is the unique contribution that your work makes to the field? Please consider what the reader will learn from your submission, and how they will find your work useful. If you write with these questions in mind, your work is more likely to be successful, both in being accepted into the Conference, and in influencing the work of our field.

ACKNOWLEDGMENTS

We thank CHI, PDC and CSCW volunteers, and all publications support and staff, who wrote and provided helpful comments on previous versions of this document. Some of the references cited in this paper are included for illustrative purposes only. **Don't forget to acknowledge funding sources as well**, so you don't wind up having to correct it later.

REFERENCES FORMAT

References must be the same font size as other body text.

REFERENCES

1. Adobe Acrobat Reader 7. **http://www.adobe.com/products/acrobat/**.
2. Anderson, R. E. Social Impacts of Computing: Codes of Professional Ethics. *Social Science Computer Review December 10*, 4 (1992), 453–469.
3. How to Classify Works Using ACM's Computing Classification System. **http://www.acm.org/class/how_to_use.html**.
4. Kim, J., Guo, P. J., Cai, C. J., Li, S.-W. D., Gajos, K. Z., and Miller, R. C. Data-driven interaction techniques for improving navigation of educational videos. In *Proceedings of the 27th annual ACM symposium on User interface software and technology*, ACM (2014).
5. Klemmer, S. R., Thomsen, M., Phelps-Goodman, E., Lee, R., and Landay, J. A. Where do web sites come from?: capturing and interacting with design history. In *Proc. CHI 2002*, ACM Press (2002), 1–8.
6. Mather, B. D. Making up titles for conference papers. In *Ext. Abstracts CHI 2000*, ACM Press (2000), 1–2.
7. Mertens, R., Farzan, R., and Brusilovsky, P. Social navigation in web lectures. In *Proceedings of the seventeenth conference on Hypertext and hypermedia*, ACM (2006), 41–44.
8. Roediger III, H. L., and Butler, A. C. The critical role of retrieval practice in long-term retention. *Trends in cognitive sciences 15*, 1 (2011), 20–27.
9. Schwartz, M. *Guidelines for Bias-Free Writing*. Indiana University Press, 1995.
10. Shute, V. J. Focus on formative feedback. *Review of educational research 78*, 1 (2008), 153–189.

11. Zellweger, P. T., Bouvin, N. O., Jehøj, H., and Mackinlay, J. D. Fluid annotations in an open world. In *Proc. Hypertext 2001*, ACM Press (2001), 9–18.