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Dr. Matías Salibián-Barrera
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Dear Dr. Salibián-Barrera,

This document contains the formal analytical report, "Maximizing Effectiveness of Lecture Capture Systems in the Statistics Department at UBC." The research conducted for this report has produced some interesting results and valuable insights into the best practices for structuring Statistics courses.

Although most students indicate that they would benefit from the implementation of Lecture Capture Systems, Statistics students are not as convinced -- traditional approaches to lectures seem to be sufficient. However, traditional approaches complemented with this modern technology could yield better student satisfaction, performance, and participation under certain circumstances. This report gives recommendations for exactly these cases, to best benefit Statistics students.

I would like to thank you for your initial support and interest into this topic. Producing this report has been very insightful for myself and I hope the results will be for you. I am really glad to be a part of the Statistics community at UBC.

If you have any questions, comments, or you would like to discuss this further, please feel free to contact me at my email, yury.zhuk@alumni.ubc.ca. I can also be reached at (778) 714 1056.

Best Regards,

Yury Zhuk

Maximizing Effectiveness of Lecture Capture Systems in the Statistics Department at UBC

For:

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Dec. 19, 2019

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Abstract

Lecture Capture Systems are audio and video-recording setups designed to enhance lecture experiences. They can function as a method to deliver course content without physical presence requirements, or more commonly, supplement physical lectures [1][4]. They are already used in many UBC departments, including for Computer Science courses in the Science faculty [3]. As lectures for Statistics courses are enhanced with modern technology, such as I-clickers and Jupyter Notebooks, there is a possibility that Lecture capture systems will be implemented as well. In order to maximize the benefit to students enrolled in these courses, it is useful to study the differences between student sentiments towards these technologies, between departments.

This study provides recommendations, based on gathered survey data, on how to maximize three metrics: student performance, student participation, and student satisfaction by making changes to the way Statistics lectures are conducted. The specific recommendations provided are that: portions of the final marks of courses should be awarded for participation, such as through I-clickers or hints revealed about the content of exams. Physical lectures should focus on challenging concepts, with explanations of complex derivations to best-promote student understanding. If possible, a textbook with material closely tied to the content of the course should be accessible. Written notes and explanations should be provided to supplement in-person and video lectures for upper-year students especially. Based on the survey results and supplementary research, following these practices will have the best outcomes for students by the aforementioned metrics.

Introduction

Lecture Capture Systems

Lecture Capture Systems are designed to make lecture content available online via audio and/or video-recordings distributed online (e.g. posted on a course website). According to UBC Information Technology, these systems are being actively integrated across campus [1]. As of June 24th, 2019, there were 40 such systems across different faculties, introduced over the past 10 years, according to The Ubyssey's interview with Shaun Filwok, the senior manager at Audio Visual Services UBC [2].

Case Study and UBC Statistics department

The Computer Science department at UBC has taken lecture capture even further by introducing the "reverse classroom" model to certain undergraduate courses, such as CPSC 110. Under this model, video content is viewed online by students ahead of lecture sessions. [4] The online content is focussed on teaching concepts for the first time, whereas physical lectures are for disseminating examples, problem solving, and question-answering [3]. This example and other uses of lecture capture systems will be particularly useful for analysis, because many students are enrolled in both Computer Science and Statistics courses.

Purpose of Report

The Statistics Department at UBC is continuously modernizing lectures provided to students with the introduction of a variety of technologies. For example, mixed-content Jupyter notebooks, I-clicker systems, and online discussion forums are now being used in courses. With the installation of audio and video-recording technology in more classrooms, this report aims to provide recommendations to the Faculty of Statistics at UBC on the best use of these systems. These recommendations will target student performance, satisfaction, and participation as the primary metrics for evaluating successful implementation of these systems.

Data Collection Methods

To collect data for this report, a short survey was created and distributed via class discussion groups for statistics and computer science courses. A secondary survey was posted online to the UBC Reddit subcommunity, with the same questions to obtain responses from a wider range of students.

Scope of Inquiry

This project investigates how the implementation of lecture capture systems impacts student learning in other Faculties at UBC, then provides recommendations based on existing evidence and survey responses.

The following factors are considered in delivering the most effective ways of using Lecture Capture systems:

- Ways of delivering lectures that have been tested at UBC (e.g. reverse classroom model at the department of Computer Science);
- How varying methods of lecture delivery impact student participation, student performance, and student satisfaction
- How a course's structure impacts the effectiveness of the systems, and which types of courses benefit from the system the most
    - Classified by year level
    - Specific to Statistics courses
- What changes can be made to courses to best-utilize the systems

Data

Targeted factors

The aim of this study is to provide recommendations which will maximize the following three performance measures.

- *Student Participation* is simply defined as lecture attendance and attentiveness during those lectures.
- *Student Performance* is defined as the average student GPA at the end of the course
- *Student Satisfaction* is not trivial to quantify. Student satisfaction can be measured through end-of-term feedback surveys, comments on in-class discussion forums, and students' willingness to recommend the course to their peers.

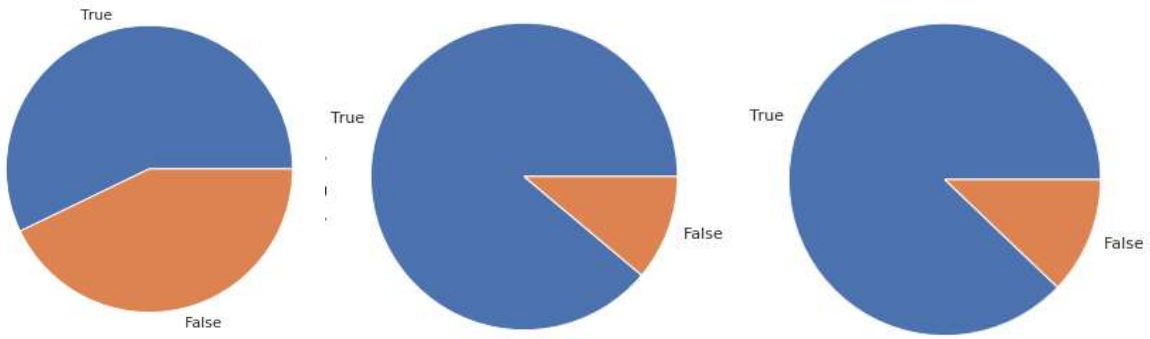
Survey

To gain insights into the possible effects of Lecture Capture Systems on students, a survey was conducted. 23 survey responses were collected through Piazza and the Canvas discussion board from students enrolled in STAT 404, STAT 406, and CPSC 422 in the first winter term of 2019. 26 further responses were collected from a wider set of students via the UBC subcommunity of Reddit (reddit.com). The full list of questions can be found in the appendix at the end of this document.

Responses

Although the results from the two surveys are very similar, there are notable differences between lower-year (1-2) and upper-year (3+) students, as well as Statistics, and non-statistics-major students. 7 total Statistics-majoring students, and 9 total Computer Science majors responded.

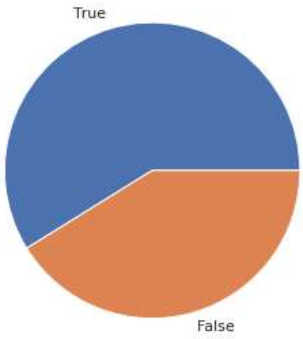
Figure 1: Students, which indicated "The availability of recorded lectures online **is helpful for reviewing course content**":



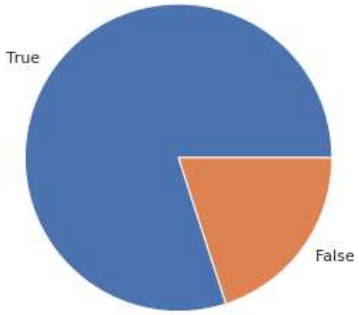
Statistics Students Computer Science Students All Other Students

Although most of the Statistics-majoring students state that recorded lectures are helpful for review, as seen in Fig. 1, the ratio is much lower compared to other students and even that of computer science students. This difference is not noticed when comparing upper and lower-year students. Students in years 1 and 2 seem to benefit more from recorded lectures in terms of their understanding of the material, as is apparent in Fig. 2.

Figure 2: Students, which indicated "The availability of recorded lectures online **helps in understanding a course's material**"



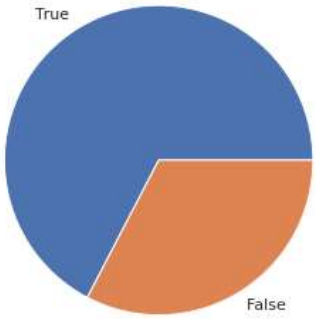
Students in years 3+ (including Graduate Students)



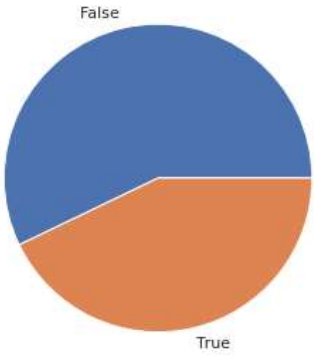
Students in years 1 and 2

Figure 3: Additional Responses

All student responses to "The availability of recorded lectures online **is unnecessary,**" **(blue is False)**



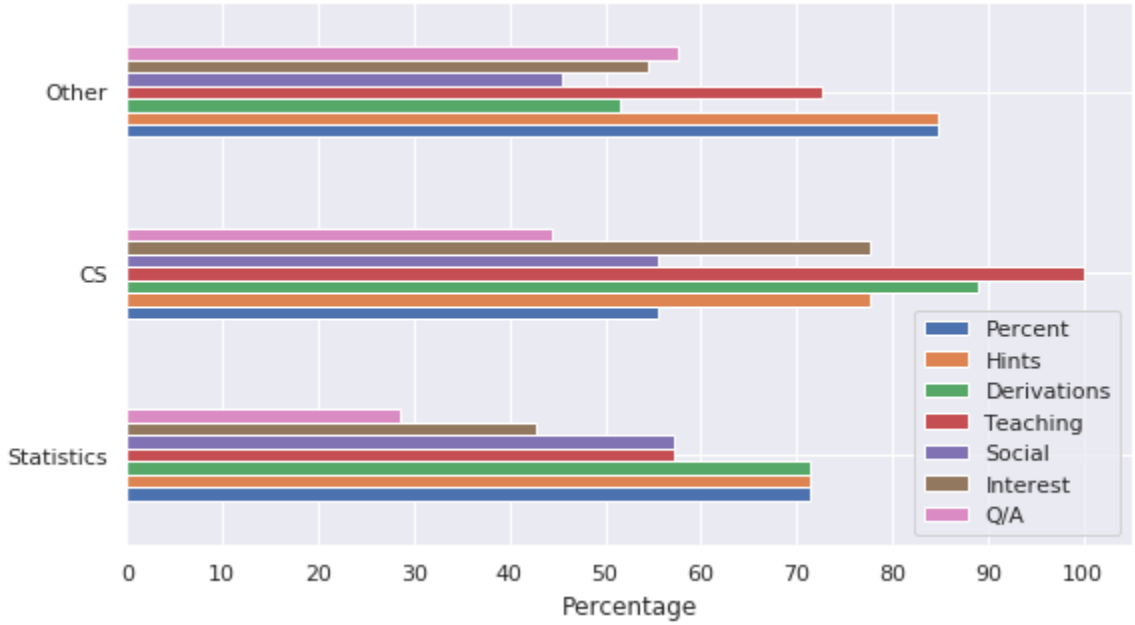
All student responses to "The availability of recorded lectures online **makes studying easier**"



All student responses to "The availability of recorded lectures online **discourages lecture attendance**"

The responses indicate a minor difference between the motivators of Statistics-majoring students, Computer Science-majoring students, and other students, towards lecture attendance (Fig 4). “A percentage of a class' grade associated with lecture participation (e.g. clickers),” “Hints about material that could appear on exams,” and “Derivations of complex equations or explanations of complex concepts” are among the top motivators for Statistics students’ attendance. Based on these data, Computer Science students are most motivated by “Quality of teaching,” but this is not as important to Statistics students.

Figure 4: The percentage of students that believe certain exam aids encourages attendance, grouped by major



Conclusion

Summary

Most students believe that online video-recorded lecture material could be beneficial to their learning, based on the survey results. Students in years 1 and 2 may benefit more from these systems in comparison to other types of supplementary lecture aides. Statistics students specifically indicate that professors explaining complicated derivations of mathematical and statistical concepts motivate their presence in physical lectures, as well as grades associated with participation and potential hints about their exams.

Although most students state that these systems do not discourage attendance, it is not by a large margin, and the empirical results may differ from sentiments that students express. There is evidence to support that student satisfaction and student performance could be increased with a carefully-planned introduction of these systems.

Opportunities in the Statistics Department and Proposed Modifications to Courses

The favourable attitudes that most students express towards lecture capture systems could help achieve favourable results under the student satisfaction and performance metrics. Students could be enabled to customize their learning experience and employ their own learning strategies from a variety of media. However, these systems may need to be supplemented with additional lecture material in upper-year statistics classes for their full benefits to be seen.

To counteract decreases in attendance, the use of I-clickers and other methods of assessing participation in lectures may be implemented. Participation has been shown to be positively correlated to attendance in undergraduate courses related to Statistics, Mathematics, and Computer Science [5], and should thus be taken into consideration.

Recommendations

The following are ideal conditions that should be adhered to in order to best accommodate Statistics students, in situations where lectures are recorded and posted online:

- Physical lecture attendance should be incentivized, especially in upper-year Statistics courses, through one or more of the following:
    - A portion of the final mark awarded for participation, such as I-Clicker marks
    - Hints revealed about content of the exam
- Physical lectures should focus on challenging concepts, with explanations of complex derivations to best-promote student understanding
- If possible, a textbook with material closely tied to the content of the course should be accessible
- Written notes and explanations should be provided to supplement in-person and video lectures for upper-year students especially

The findings from the surveys indicate that students in every major will benefit from Lecture Capture systems. The above advice is particularly applicable to Statistics students, with minor differences for students in years 1-2 and students in years 3-4 of their undergraduate degree. If Lecture Capture systems are to become a core part of the lecture, these recommendations will ensure the most positive outcomes for students with regards to performance, satisfaction, and participation.

Bibliography

[1] “Lecture Capture.” *Lecture Capture | UBC Information Technology*, https://it.ubc.ca/services/audio-visual-creative-services/lecture-capture.

[2] Alden, Charlotte. “The Right to a 'Bad Hair Day': Will Lecture Recordings Catch on at UBC?” *The Ubyssey*, 24 June 2019, www.ubyssey.ca/news/should-ubc-install-lecture-capture/.

[3] “UBC: CPSC110 Systematic Program Design.” *EdX*, https://edge.edx.org/courses/course-v1:UBC CPSC110 2019W1/course/.

[4] “Flipped Classroom.” *Flipped Classroom | Flexible Learning*, flexible.learning.ubc.ca/research-evidence/research-articles-2/flipped-classroom/#evidence-of-impact-2.

[5] Nagowah, Leckraj & Pudaruth, Sameerchand & Sungkur, Roopesh & Chiniah, Aatish. (2013). The Effect of Class Attendance on the Performance of Computer Science Students.

Appendix (Survey)

Use of Lecture Capture Systems at UBC

I am an undergraduate student in UBC Statistics, taking part in a technical writing project. The purpose of this survey is to gather primary data on the use of digital lecture material, specifically video and audio-recordings, and their impact on your learning. This data will be used to compile a report addressed to the UBC Department of Statistics, with the purpose of providing recommendations on improving the learning experience of Statistics students. There are 6 questions which will take about 3 minutes to complete. Thank you for your participation! All responses are optional and anonymous.

What is your year standing at UBC?

- ○ First year
- ○ Second year
- ○ Third year
- ○ Fourth year +
- ○ Graduate/Other

Which faculty are you in?

- ○ Statistics
- ○ Other...

Please rank the following by desirability:

	Not desirable at all	Somewhat desirable	More desirable	Very desirable
Video recordings of le...	○	○	○	○
A textbook with sectio...	○	○	○	○
Summary notes of the...	○	○	○	○
TAs available during la...	○	○	○	○

Which of the following are motivators for physical lecture attendance? (please check all that apply)

- [ ] A percentage of a class' grade associated with lecture participation (e.g. clickers):
- [ ] Hints about material that could appear on exams
- [ ] Derivations of complex equations or explanations of complex concepts
- [ ] Socializing with peers
- [ ] Interest in subject
- [ ] Ability to ask questions during lecture
- [ ] Quality of teaching
- [ ] Other...

For most of my classes, I attend lectures:

- ○ Regularly
- ○ Roughly half of the time
- ○ Less than half of the time

The availability of recorded lectures online: (please check all that apply)

- [ ] Is unnecessary
- [ ] Is helpful for reviewing course content
- [ ] Helps in understanding a course's material
- [ ] Discourages lecture attendance
- [ ] Makes studying easier