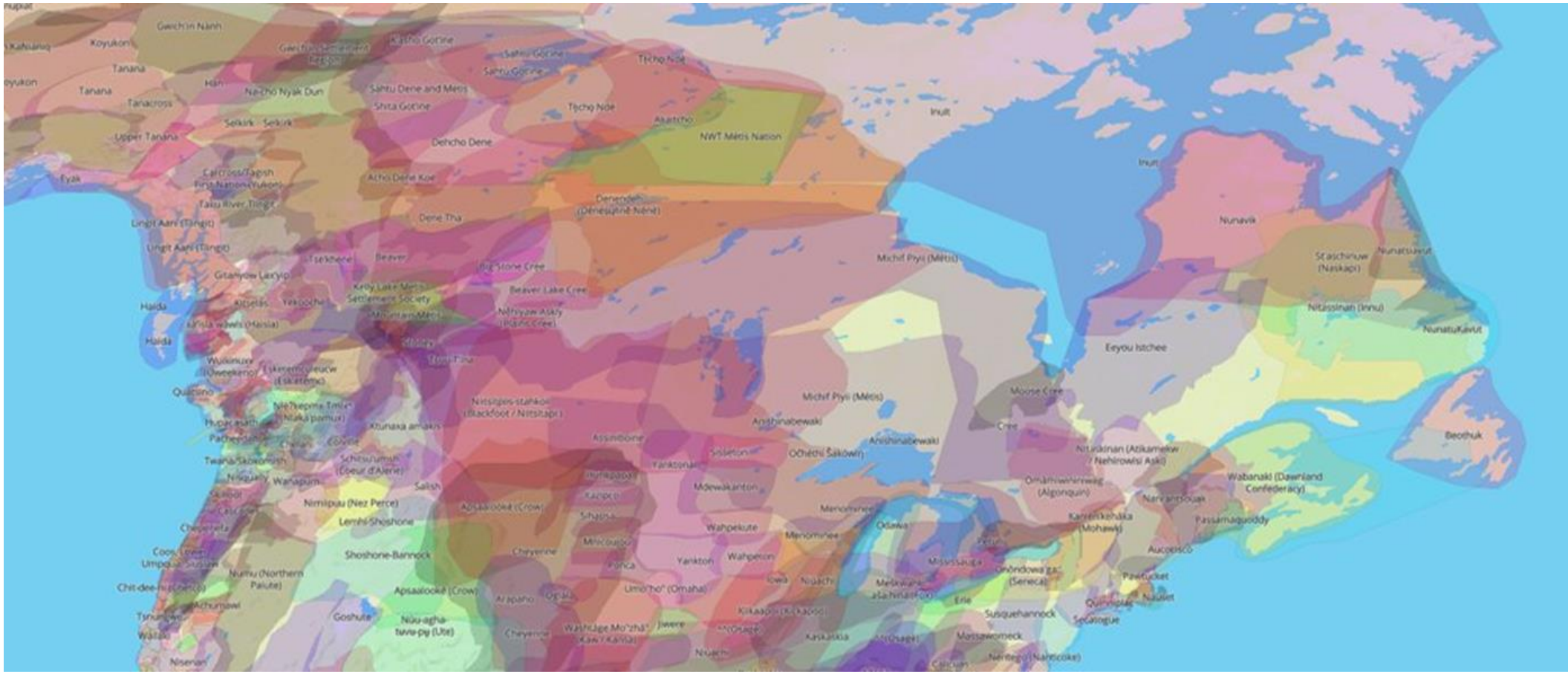
SHOWCASE EVENT

Data-Driven Design: Quercus Analytics (D3:QA) 2021-22

Land Acknowledgement



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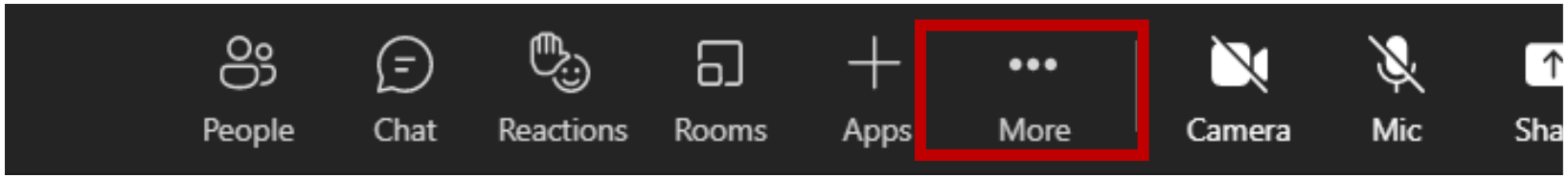
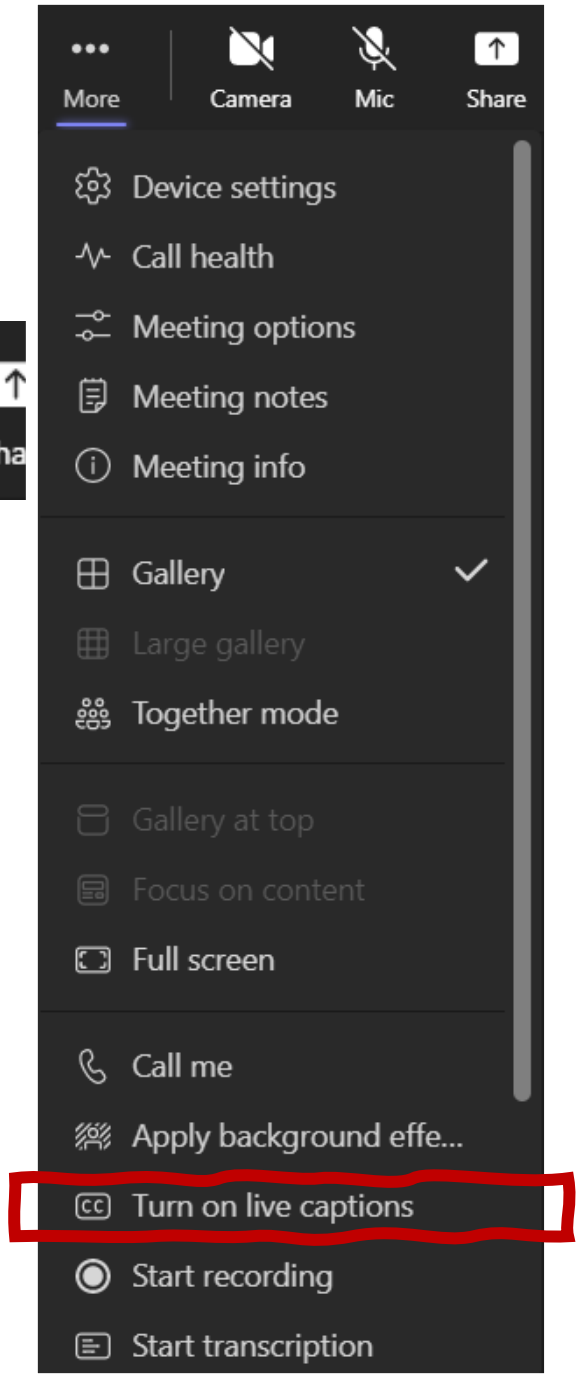
Accessibility





Agenda

- ✓ Welcome and Introductions
- ✓ Overview of D3:QA goals and outcomes
- ✓ Participant Showcase

D3:QA Project Team

- **Laurie Harrison** (Director, Digital Learning Innovation, ITS)
- **Will Heikoop** (Coordinator, Digital Learning Innovation, ITS)

Learning Data Analysts

- **Qin Liu** (Senior Research Associate, Institute for Studies in Transdisciplinary Engineering Education & Practice (ISTEP))
- **Alan da Silveira Fleck** (Data Analyst, Learning Analytics, OVP:IUE)

D3:QA Instructor Cohort

- **Naomi Steenhof** (Pharmacy)
- **Tingting Zhu** (UTM – Geographic Information Systems and Computer Science)
- **Stavroula Andreopoulos** (Medicine)
- **Naomi Levy-Strumpf** (Faculty of Arts and Science – Human Biology)
- **Chirag Variawa** (Faculty of Applied Science and Engineering)
- **Pooja Vashisth** (UTM – Computer Science)

Overview of D3:QA 2021-22

D3:QA Initiative for 2021-22

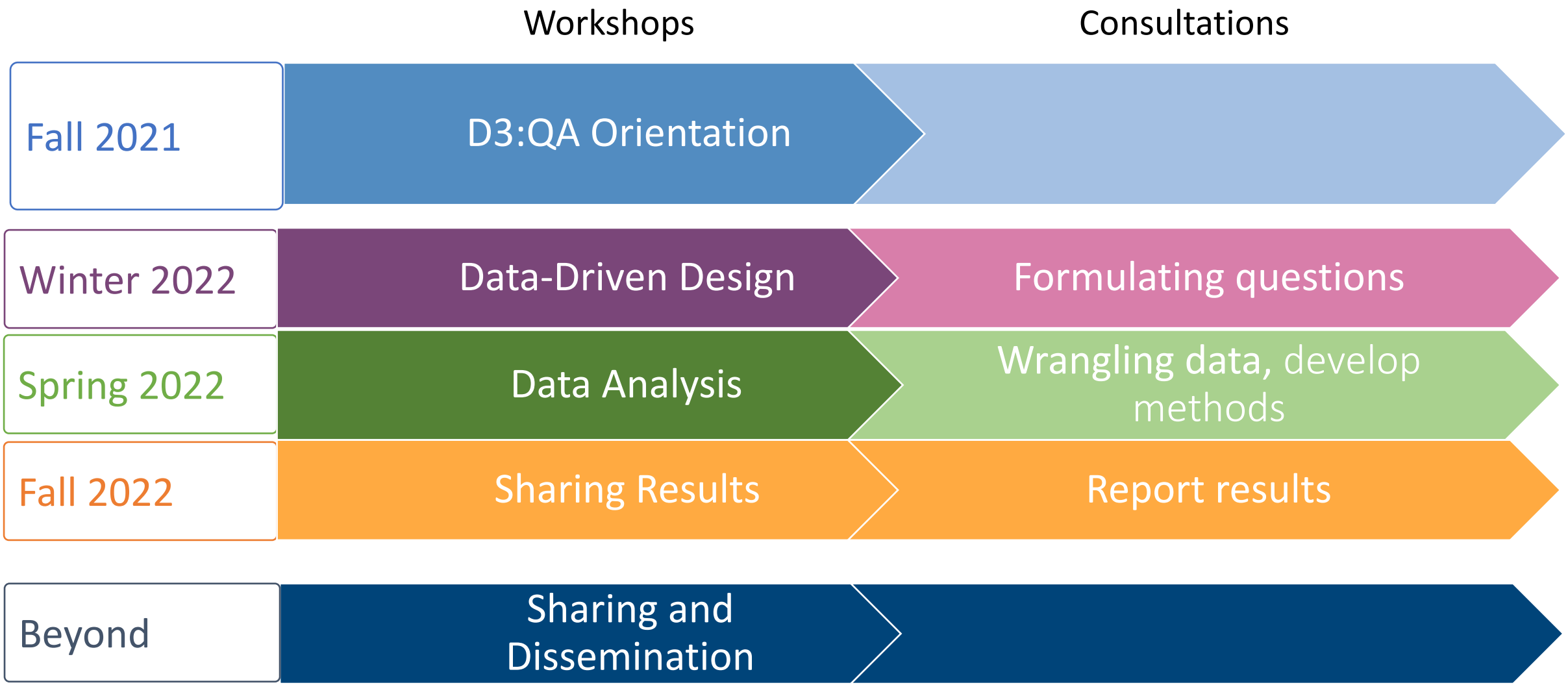
Overarching Goal: Explore use Quercus student data to make course [re]design decisions

Peer network participants will build capacity:

- extracting and making meaning of Quercus analytic data
- generating example reports
- applying to course design plans

Undertaken as QA-QI project to inform course design and faculty development.

Program Components



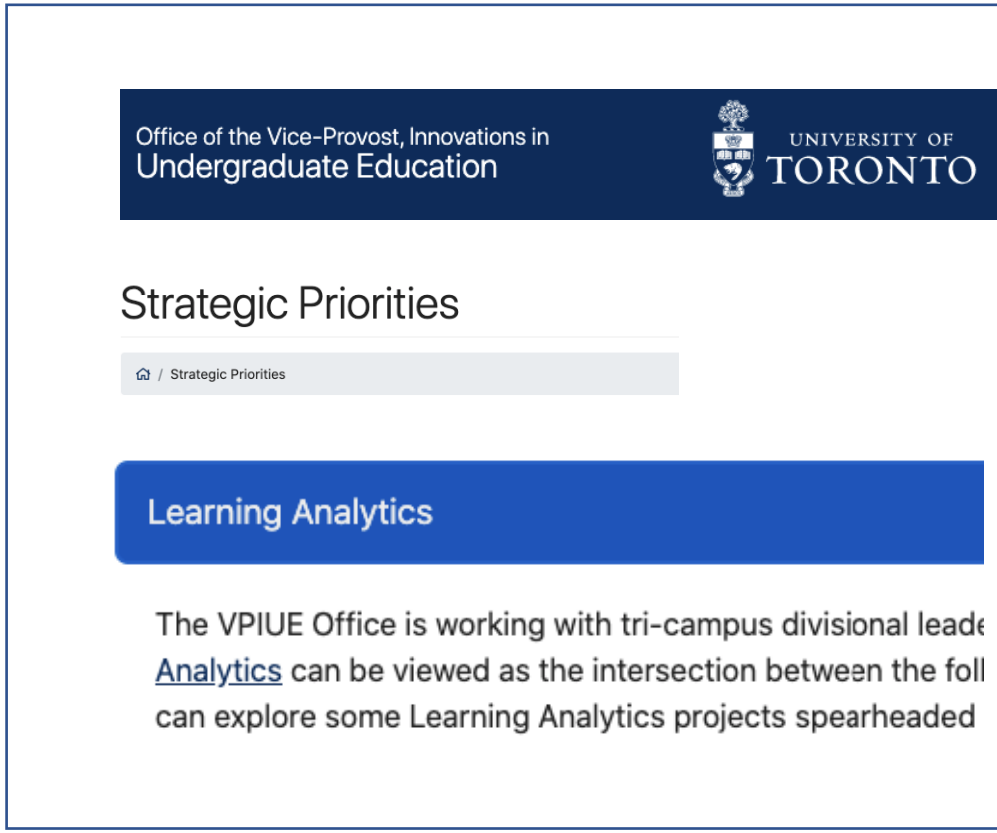
University of Toronto Strategy and Principles

→ Outcome of year-long consultation to establish a strategic direction

Principles:

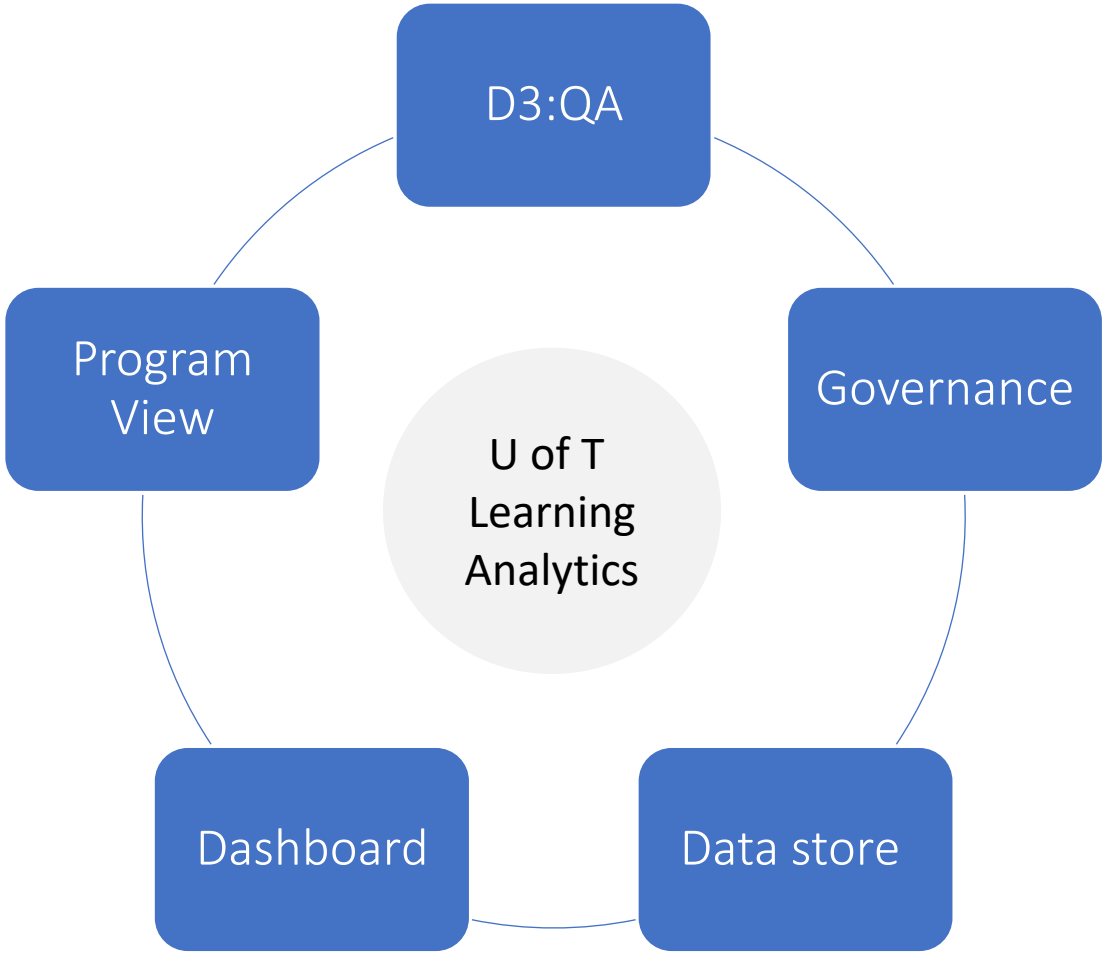
- Beneficence and Non-Maleficence
- Equity
- Privacy, Confidentiality, and Security
- Transparency
- Community Engagement

[Read the full strategy paper]



New LA Initiative Program at U of T

- D3:QA is part of the broader program of activities championed by VP-IUE
- Crossing dimensions of people, processes and technology
- Instructor input and experiences within this program will inform planning



SHOWCASE

PRE-MODULE TESTING: INFORMING DESIGN OF A SIMULATION COURSE

NAOMI STEENHOF, ASSISTANT PROFESSOR – TEACHING STREAM

PHARM D

PHM305H1: Medication Therapy Management 4
This course focuses on developing and enhancing skills needed to optimize the pharmacist's scope of practice in providing effective patient care in Ontario.

Course/Design Context

Assessing whether a pre-testing intervention can improve the performance of struggling students through closer look at outcomes.

This will potentially help the teaching team design an **adaptive learning module** in subsequent years.

Instructional Challenge

The overarching goal is improvement of student performance during simulations.

Learners are currently provided with customized resources and learning activities prior to the simulation to scaffold and direct students towards studying strategies/content areas.

Learning Analytic Strategy

Introduce Design Intervention: Provide pre-module quizzes designed to prime students for the post-module quizzes and simulations.

Confirm whether students who perform poorly on a pre-test (prior to the lecture and simulation) show improvement on post-tests and simulations.

Use of Data to Inform Design/Instruction

Questions	Data Sources
Can the pre-module and post-module quiz scores be used to identify students who are at risk of failing the simulation?	Pre-module quiz scores Post-module quiz scores Simulation scores
Is there a correlation between a student's performance on a pre-test and their performance on a post-test and final simulation?	Pre-module quiz scores Post-module quiz scores Simulation scores
Identify gaps in student's content knowledge	Pre-module quiz scores Post-module quiz scores

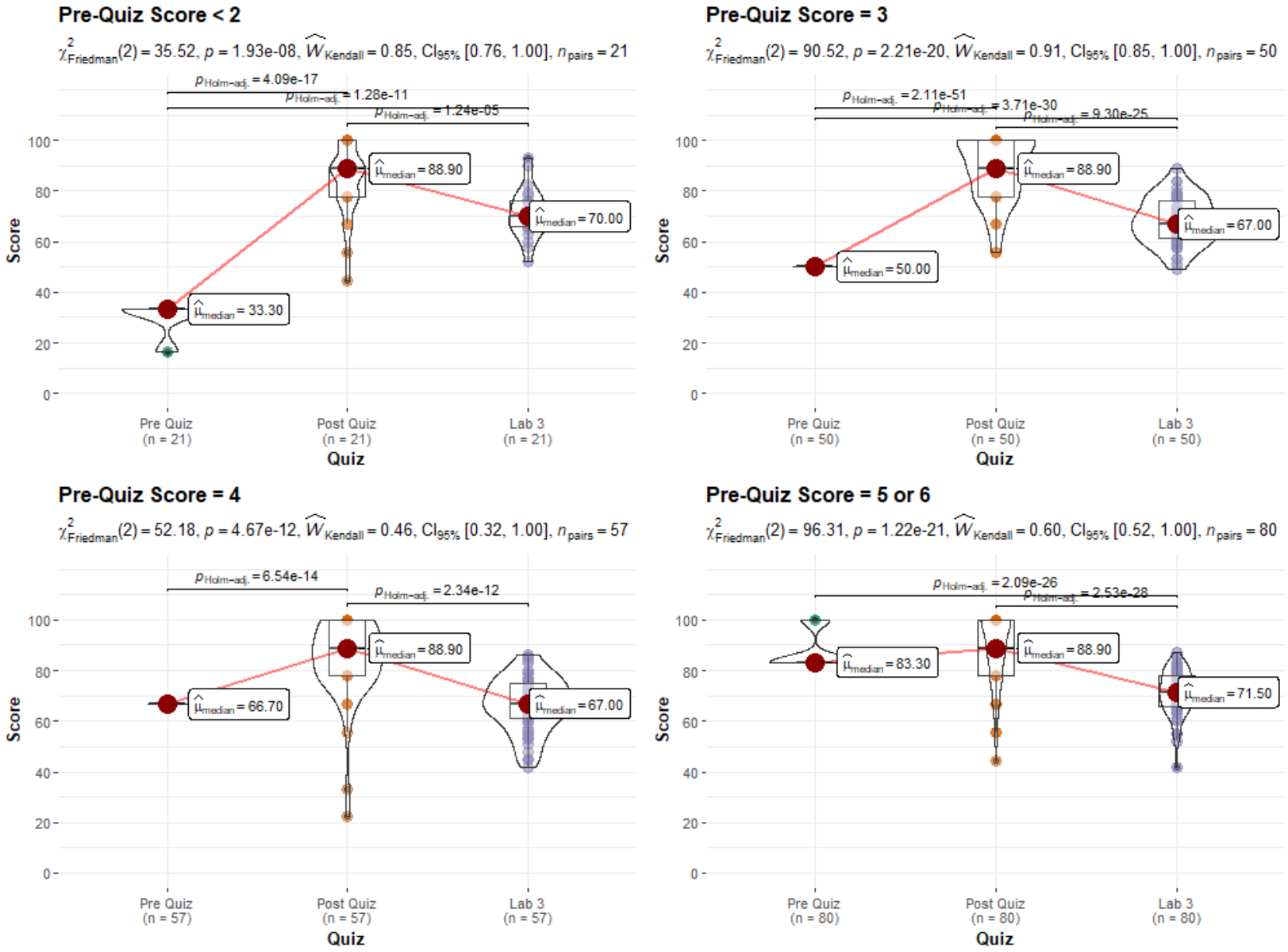


Figure 1: Violin Plots with Comparisons of the Scores by Quiz and According to the Pre-quiz Score Categories

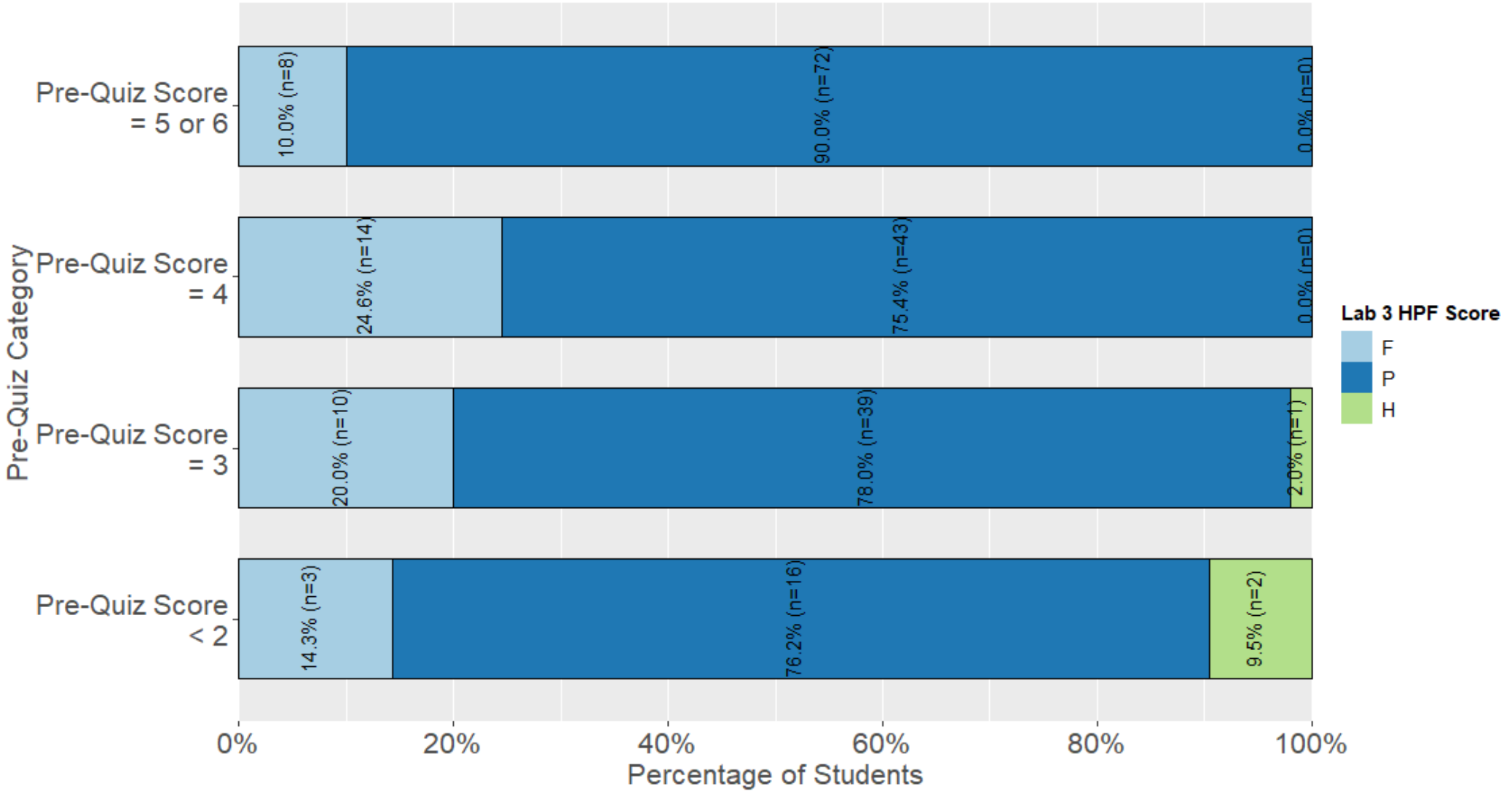


Figure 2: Distribution of Lab 3 H/P/F grades according to the pre-quiz categories

Next Steps

What question(s) do you still have?

- Can prior experience working in a pharmacy be used instead of using the pre-quiz as a proxy for prior knowledge?
- What is the reason for the increase in the performance of students in the lowest pre-quiz categories?

What will you do next?

- Build in adaptive learning components to the pre-quiz

IMPACT OF EMBEDDED LEARNING STRATEGY ACTIVITES: STUDENT ENGAGEMENT AND PERFORMANCE

TINGTING ZHU, ASSISTANT PROFESSOR – TEACHING STREAM

Geography, Geomatics and Environment

GGR278 Geographical Information Systems
Introduction to models of representation and management of geographical data for scientific analysis. Basic quantitative methods and techniques for geographic data analysis, including collection, manipulation, description and interpretation. Practical exercises using GIS and statistical software packages with examples drawn from both physical and human geography.

Course/Design Context

Exploring provision of student opportunities to exercise learning strategies in discussion boards to enhance student engagement and performance.

Instructional Challenge

The overarching goal is to help students be more effective learners by exercising study skills such as drawing concept maps, designing questions according to Bloom's taxonomy, and reflecting on academic goals.

These topics were included in alternating biweekly quizzes and biweekly discussion boards for students.

Learning Analytic Strategy

We collected the frequency of student views and participations in each discussion board and correlated them with student performance in the following week's quiz. Including:

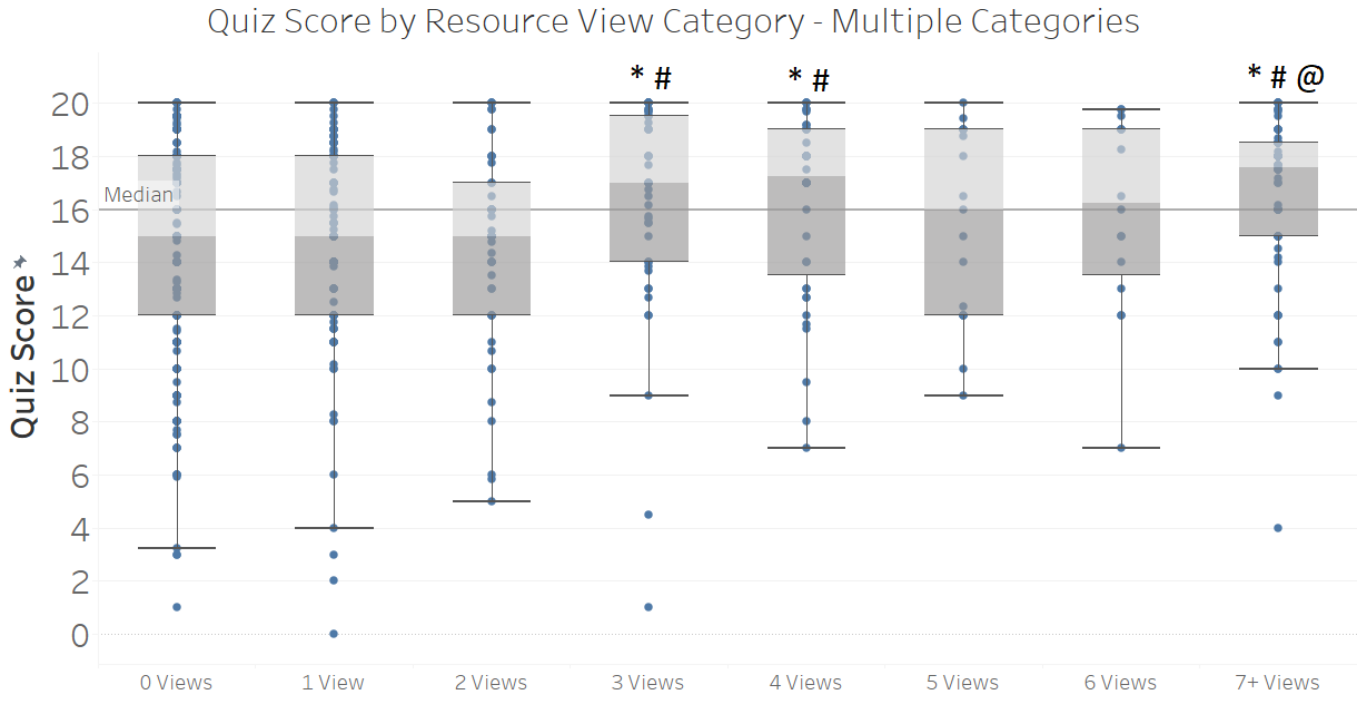
- Analysis of binary groups (e.g., students viewed versus not-viewed; students participated versus not-participated)
- Compared the effects of multiple views and participations (e.g., viewed 0, 1, 2, 3, 4, 5, 6, 7+; participated 0, 1, 2, 3, 4+)

Use of Data to Inform Design/Instruction

- Positive and significant correlations between the frequency of views of the discussion board and quiz score for 3 out of 5 quizzes.
- Positive and significant correlation between the frequency of participations in the discussion board and quiz scores for 3 out of 5 quizzes.
- Students who accessed the discussion board before each quiz had a statistically higher quiz score compared to the ones that did not access this resource.

Use of Data

The higher number of views (>= 3) are associated with higher median quiz scores compared to fewer total views (<3); whereas participations at all levels are associated with a same level of improvement compared to 0 participations.



* P <0.05 compared to "0 Views"; # P <0.05 compared "1 View"; @ P <0.05 compared to "2 Views".
Kruskal-Wallis Test

Next Steps

What question(s) do you still have?

What factors contributed to some study skills (implemented in #2) that did not positively correlate with student performance?

What will you do next?

Explore the factors that contributed to better performance, whether it is the adoption of the study skills in the discussion board, or the student engagement, or simply because students who perform better are generally more engaged.

ACTIVE LEARNING: EFFECTIVENESS OF SCIENTIFIC LITERACY AND COMMUNICATION MODULES IN A STEM COURSE

STAVROULA ANDREOPOULOS, PROFESSOR – TEACHING STREAM

Biochemistry

BCH311H (Biochemistry I: Nucleic Acids and Biological Information Flow)

This 12-week course (currently online) covers the basics of nucleic acids and flow of information in biological systems.

Course/Design Context

Explore the extent of student engagement (via collected Quercus data) with four e-modules we created and to assess how this engagement relates to their academic performance.

Instructional Challenge

Improve student engagement/use (time accessed/# of views) of 4 e-modules to increase student success (average grade of each assignment, overall course grade).

Explore if individual completion of the e-modules is the best approach, or if future students should complete the e-modules (and possibly assignments) in small groups, promoting active learning.

Learning Analytic Method

Explored e-module viewing count data that was generated by linking the weekly data exported from Quercus and analyzed it with respect to post-module submission scores and assignment/quiz scores for each of the four e-modules, along with final overall grade obtained from the Quercus Gradebook center.

Use of Data to Inform Design/Instruction

- The total view counts for e-module 2 was lower than the other three e-modules (may be due to assignment structure i.e. quiz versus written/oral assignment).
- There was a weak but statistically significant correlation between the viewing counts and academic performance indicators (post submission score, assignment score, final grade) for e-modules 1, 3 and 4.
- Analysis of student views (based on frequency) revealed that the more often students viewed the e-modules, the better their performance on both the post submission score and assignment score.

Use of Data

Student engagement (as measured by e-module viewing counts) is associated with academic performance indicators. This also complemented qualitative data associated with the e-modules (Fig.1).

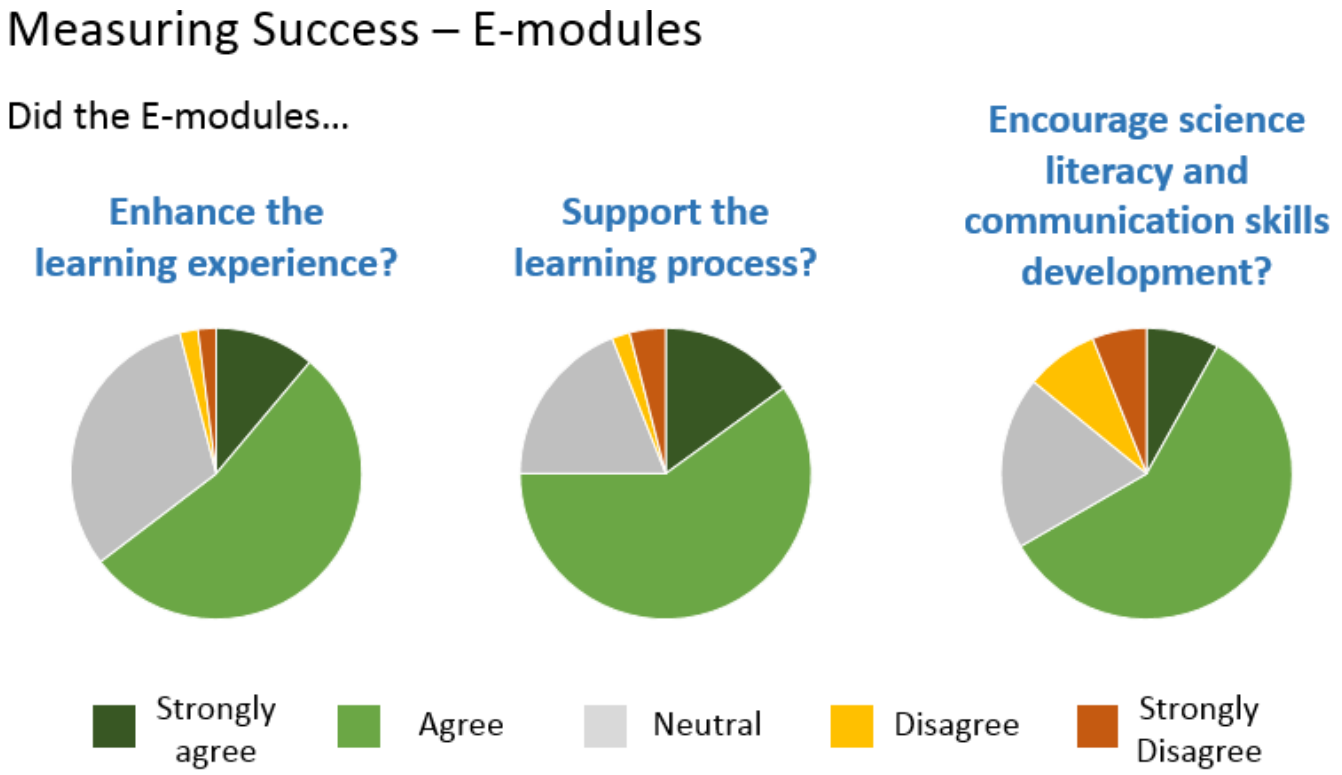


Figure 1: Majority of students felt that the e-modules contributed to their learning

Next Steps

What question(s) do you still have?

- Can we address student e-module interaction (e.g. note-taking, rewinding for content) by creating short surveys to accompany the e-modules?

What will you do next?

- Make the e-modules available throughout the duration of the course rather than being released at specific time points.
- Offer a longer time period for completion of this assignment and/or incorporating this component into one of in-person assessments during the January 2023 course offering.

STRATEGIC DESIGN: IMPACT OF SCAFFOLDED SUPPLEMENTARY CONTENT RESOURCES ON MASTERY OF KEY CONCEPTS

NAOMI LEVY-STRUMPF, ASSISTANT PROFESSOR

Human Biology Program

Introduction to Fundamental Genetics & it's applications

This course provides a comprehensive introduction to a variety of therapeutic approaches including gene therapy, CRISPR-based gene editing, epigenetic manipulations & regenerative medicine.

Course/Design Context

Redesign the course around students, enhance resources that students are naturally drawn to and find most helpful, and leverage analytical insights to design effective interventions that will positively impact student learning.

Instructional Challenge

I wished to:

Identify the most effective & impactful resources: what do students interact with & how, can we correlate it with success in the course?

Identify frequently used resources: aiming to curate supplementary materials according to what students are naturally drawn to.

Glean useful data to enable student-centered strategic interventions: taking an informed approach to help students achieve greater mastery of foundational concept.

Explore the impact of strategic interventions on the mastery of key concepts.

Learning Analytic Strategy

- Tracked student engagement, measured by the number of views and timing of access to the different resources and how it correlates with mastery of concepts as measured by performance on weekly quizzes.

- Gleaned data from weekly quizzes and designed strategic interventions to address gaps and misconceptions leading to deeper comprehension & greater mastery at the completion of the course.

Use of Data to Inform Design/Instruction

The data clearly identified the study guides as a valuable resource, demonstrated that “cramming” or reviewing the material shortly before the assessment, is not as effective as paced-learning and demonstrated the value of peer-to-peer learning.

These evidence-based insights will be shared with students to emphasize the benefit of paced-learning and group work. This will enable students to make informed decisions on their own learning practices.

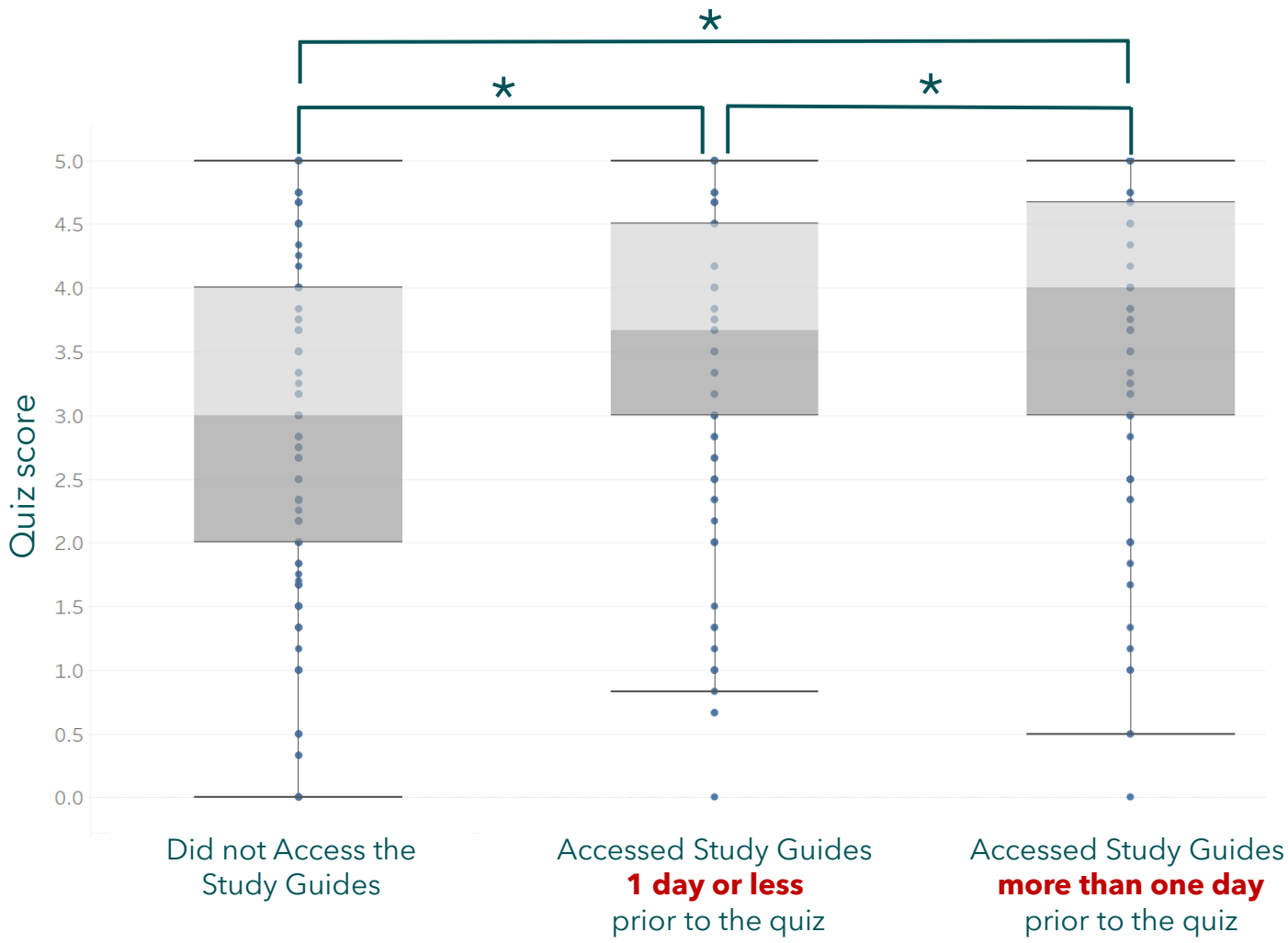
Lastly, the data demonstrated that data driven strategic interventions can have a measurable impact on student success. Students performed significantly better post intervention as was demonstrated in five of the seven concepts tested.

Use of Data

Impact of Paced-Learning:

Advance Access to Study Guides Significantly Improve Performance on Weekly Tutorial Quizzes

Quiz Score Correlated with the Timing of Access to a Learning Resource (Study Guide)

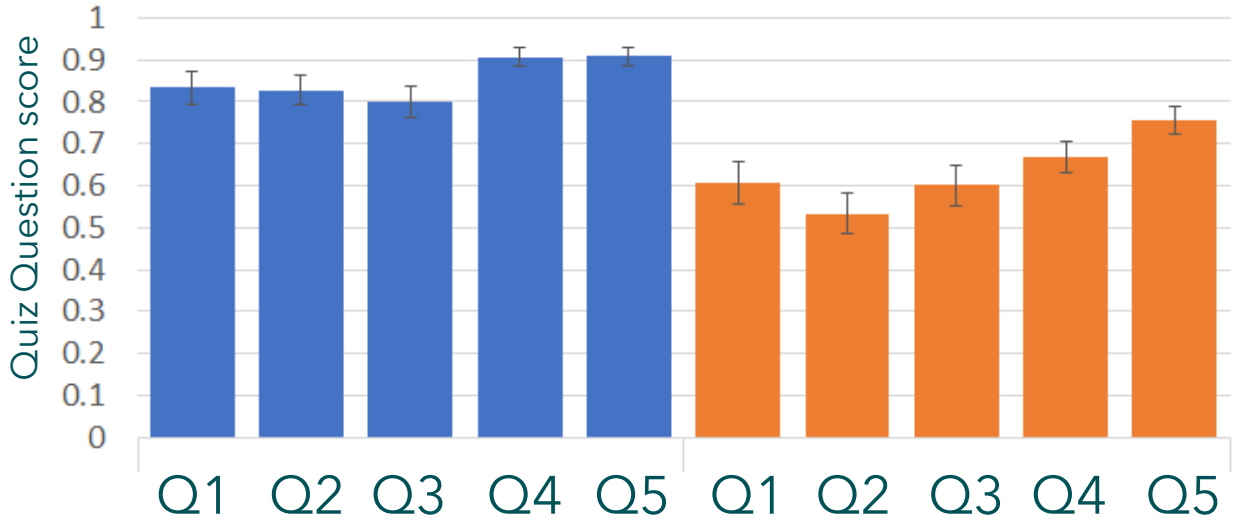


*P-Value <0.001Kruskal-Wallas Test

Use of Data

Peer-to-Peer Learning

Quiz #1 Average score per question



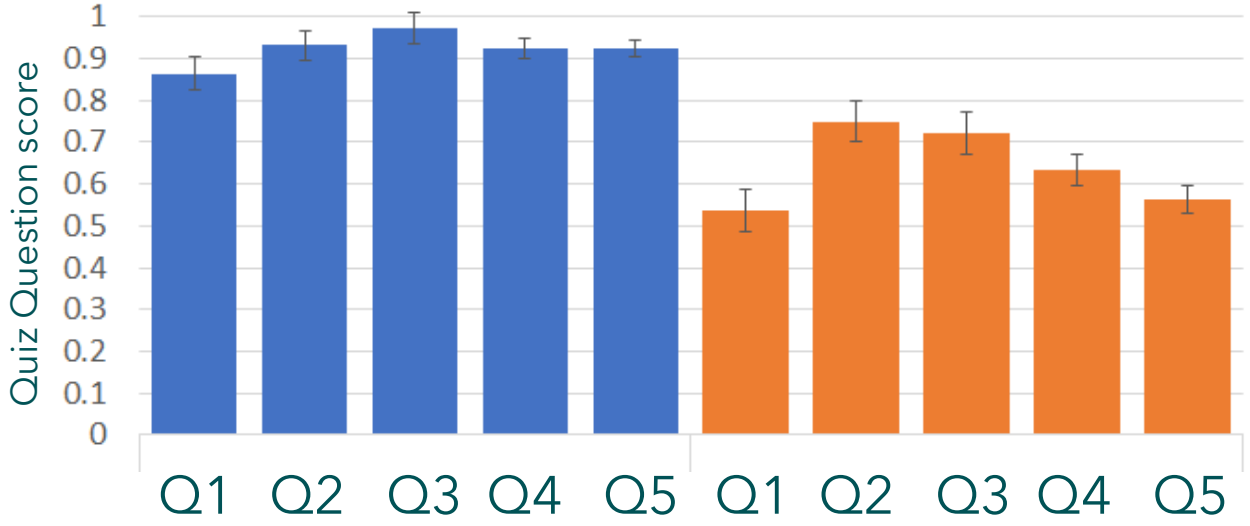
Group Quiz #1
Combined Average:
85%

Individual Quiz #1
Combined Average:
63%

*

*P<0.001; T-test

Quiz #8 Average score per question



Group Quiz #8
Combined Average:
92%

Individual Quiz #8
Combined Average:
64%

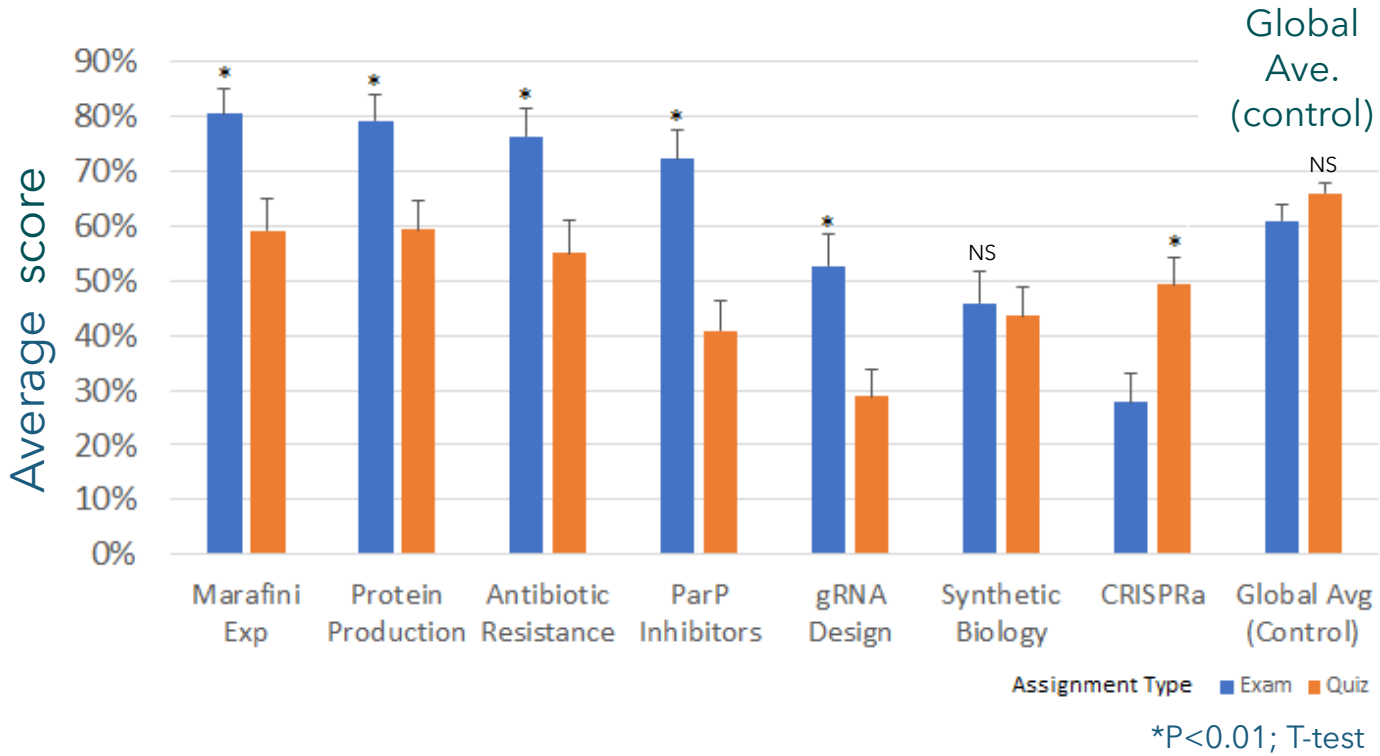
*

Use of Data

Impact of data driven interventions:

On average students performed similarly on the weekly tutorial quizzes compared to the final exam (right side bars); information-based strategic intervention changed the trajectory of student success within the time frame of a single semester. Furthermore, it identified topics that require a different approach in the next iteration of the course.

Average Scores on Final Exam **(Post Intervention)** Versus Average Scores on Tutorial Quizzes **(Pre-Intervention)**



*P<0.01; T-test

Next Steps

Implementation:

- Implement in future iterations of this course as well as in other courses.
- Share with students to advocate for effective study skills and provide evidence-informed guidance.

Further Exploration:

- Continue exploring adaptive design and the outcomes of strategic interventions.
- Conduct a comprehensive overview of resource effectiveness.

CHOOSING A PATH OF STUDY: INSIGHTS FOR TAILORING CONTENT

CHIRAG VARIAWA, ASSISTANT PROFESSOR – TEACHING STREAM

Applied Science and Engineering

APS191 – TrackOne Seminars

This is a seminar series that will preview the core fields in Engineering. Each seminar will highlight one of the major areas of Engineering. The format will vary and may include application examples, challenges, case studies, career opportunities, etc. The purpose of the seminar series is to provide first year students with some understanding of the various options within the Faculty to enable them to make educated choices for second year. This course will be offered on a credit/no credit basis.

Course/Design Context

The APS191 Instructional Team wished to understand how this course helps undecided first-year undergraduate engineering students make an informed decision regarding their field of engineering study and glean insights that can be used to tailor content to student needs, while improving future iterations.

Instructional Challenge

Our overarching goal was to identify “common questions” that students have when deciding on a program of study.

→ Tremendous impact on recruitment to various programs within our Faculty and will inform the development of resources for students who may be undecided (prior to application, or during secondary-postsecondary transition).

Learning Analytic Strategy

We asked the following:

- Did undeclared engineering students change their mind about their discipline of choice as they progressed through the course APS191? If so, to what degree?
- What factors did undeclared engineering students consider while making their decision about their engineering discipline for their second year of engineering studies?

Use of Data to Inform Design/Instruction

Weekly quiz data were collected throughout APS191 in the Winter Term 2022:

Q1: After attending today's seminar, are you:

- Most likely to select this engineering program?
- Just as likely to select this engineering program?
- Less likely to select this engineering program?

Q2: Why? (please use between 50-100 words in your response).

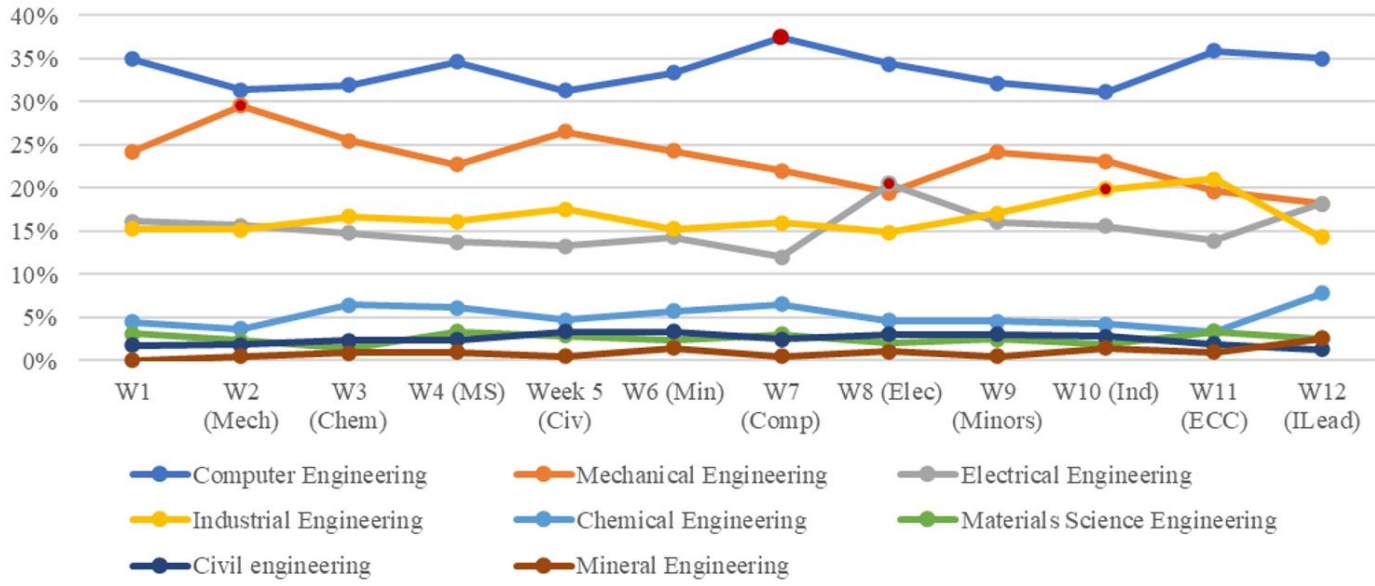
Q3: Given what you have learned in this course to date, rank the following Engineering disciplines in order of decreasing interest according to your current interest for each as a program of study in Year 2. Students were asked to rank each discipline only once

Use of Data

The top four influencing factors for the undeclared students' decision making:

- Presentation during the class session of the week
- Expected career paths if choosing a particular discipline
- Expectations about the curriculum
- Interest in certain subject areas

Figure 1. Students' Top Choice



Next Steps

Stage 2:

- Interview Prof. Variawa and reach out to other UofT professors teaching first year engineering courses
- Research methods to objectively evaluate proposed key metrics

Stage 3:

- Finish manually labelling one of the APS100 datasets for SA comparisons
- Help sister project finish manually coding the APS191 dataset to use in TA comparisons

More Information

D3:QA Showcase Website (full details and reports)

https://ocw.utoronto.ca/d3qa-2022-showcase/

Questions about D3:QA: <digital.learning@utoronto.ca>

Chair of Learning Analytics Project Team: <alison.gibbs@utoronto.ca>

Coming soon

https://learninganalytics.utoronto.ca/