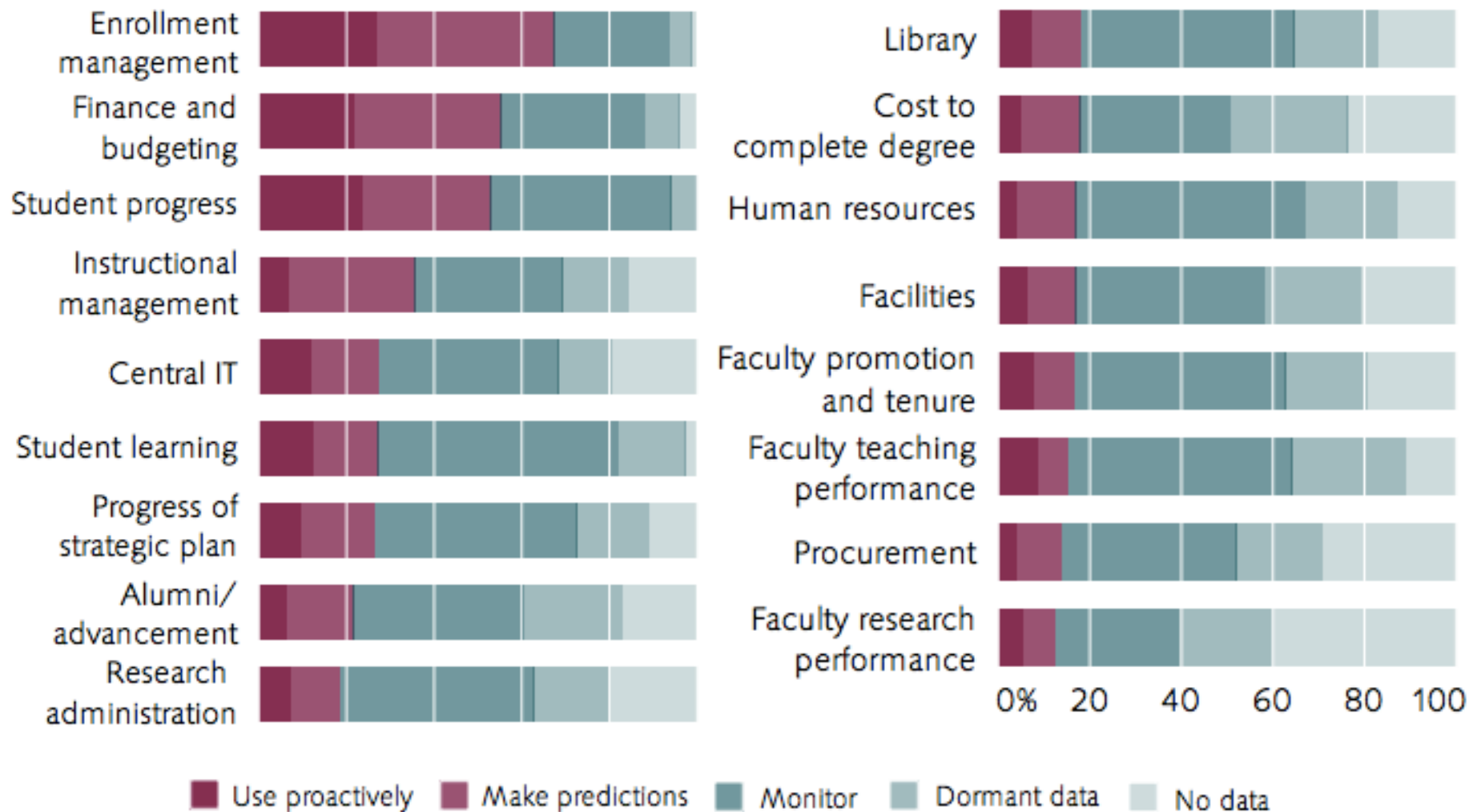


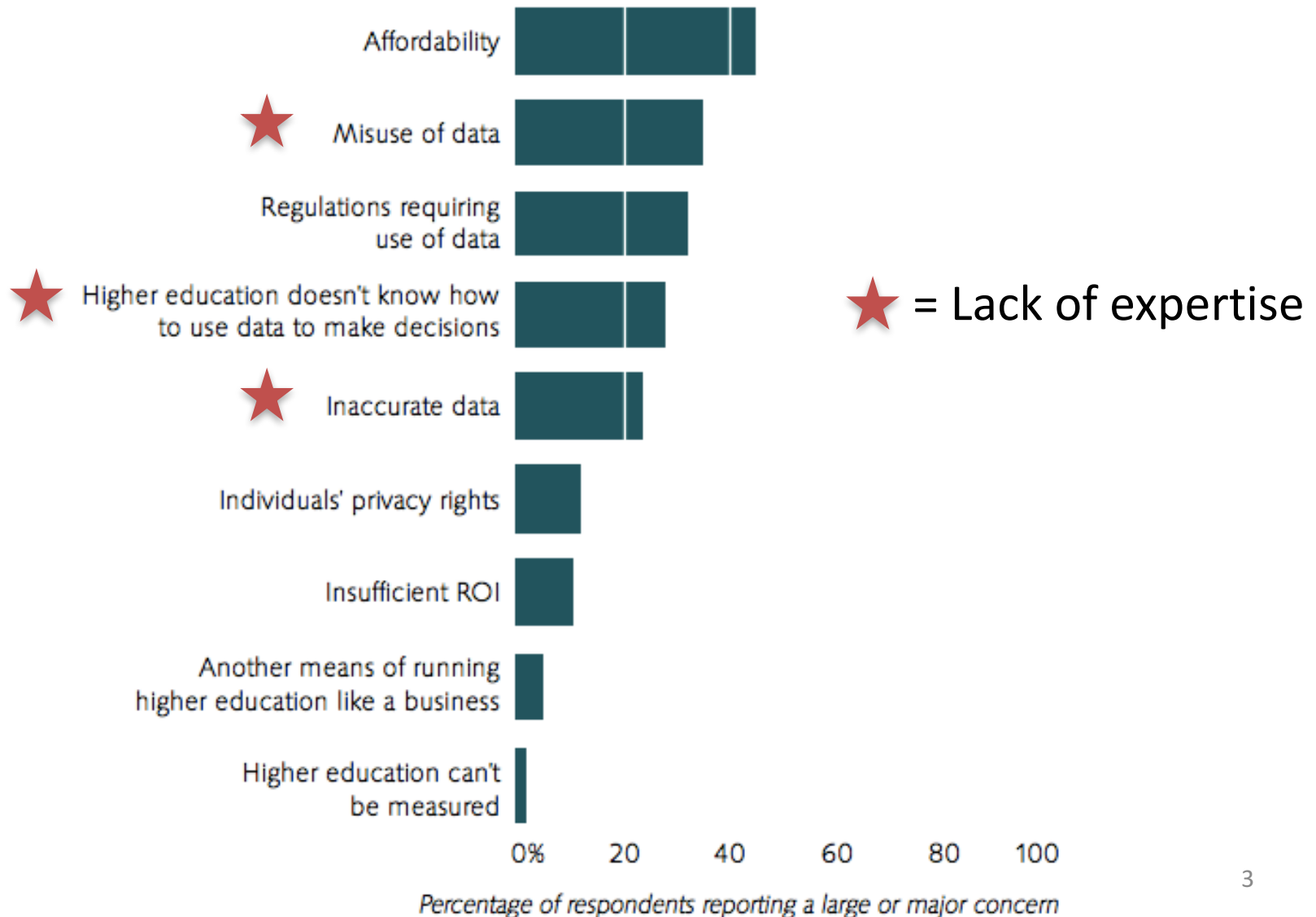
How Can Learning Analytics Improve a Course?

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Prevalence of Learning Analytics



Barriers to Adoption



Goals of this Research

- Promote evidence-based instruction
- Help make learning analytics accessible to instructors with various backgrounds
- Restrict our attention to improvements for a **course** experience
 - Two key stakeholders: instructor and student

Ways to Shape a Course

- Instructor Needs
 - Knowledge Assessment
 - Types of Errors
 - Engagement
 - Expectations
 - Experimentation
 - Course Design
- Student Needs
 - Planning
 - Monitoring
 - Improvement

Instructor Needs: Knowledge Assessment

- What are the current grades for each component?
- Which concepts are generally more difficult?
- Do I need to spend more time on this material?
- How well do students understand the material that was just presented? Or in a (pre-)reading?
- Are students following instructions correctly?
- Which students are doing well? Which are at risk of failing?
- What is the learning trajectory of the student?

Instructor Needs: Types of Errors

- What kind of mistakes do students usually make on a particular concept?
- Which are the most common compilation errors students make for specific concepts?
- Which questions incur the most mistakes?
- Which coding behaviours do successful students exhibit?

Instructor Needs: Engagement

- Are students engaged in the course?
- How much participation is there in specific activities?
- Do students attempt optional assignments?
- How engaged are the students in the optional topics?

Instructor Needs: Expectations

- With regards to the tentative schedule, are we behind or ahead of schedule?
- What are the average scores on a particular exercise, relative to previous year's scores?

Instructor Needs: Experimentation

- By changing a specific aspect of the course, what is the impact on:
 - Individual performance within the course?
 - Retention in comparison to a previous course offering?
 - Student engagement in the class?
 - Interest in the field of computer science?

Instructor Needs: Course Design

- Is the lab/assignment too long or difficult?
- Are there any questions on the exam that is too easy or too hard?
- Does this assessment help students be better prepared for the final exam?

Student Needs: Planning

- What and when is my next deadline?
- What are my upcoming deadlines?
- What are all the deadlines in this course?
- What do I need to get on my final exam in order to get a certain grade for this course?

Student Needs: Monitoring

- How am I doing in the course?
- How am I doing in comparison to others in the class?
- Am I spending too long or not enough time on this question or assignment?
- Am I following the right steps in completing this exercise?

Student Needs: Improvement

- What can I do to improve my grade?
- What kind of mistakes do I usually make?
- Where do I usually lose marks on exams?
- What kinds of programming strategies work best for other successful students?
- Which study habits are more effective for exams?
- What kind of study habits do successful students have?

Simple LMS: Course Canvas

COSC 111

Discussion Forum

Slides

Quizzes

Submissions

Labs ▾

Surveys

Assignments ▾

Admin

Bowen Hui ▾

Welcome to COSC 111

Introduction to Computer Programming I

Administration

Download the course [syllabus](#).

Evaluation Criteria: Total 100%

- 10% In-class activities
- 5% Online Quizzes
- 10% Labs
- 15% Assignments
- 10% Midterm 1
- 20% Midterm 2
- 30% Final Exam

Tentative Schedule

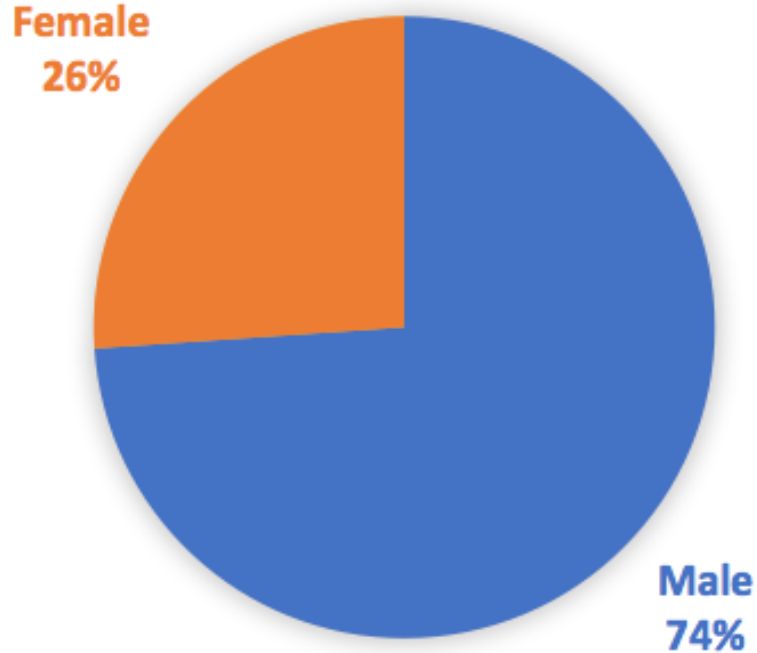
Week	Topics	Readings	Assignments and Tests	Labs
1 (Jan 04)	Introduction	Ch 1		No labs

Study Details

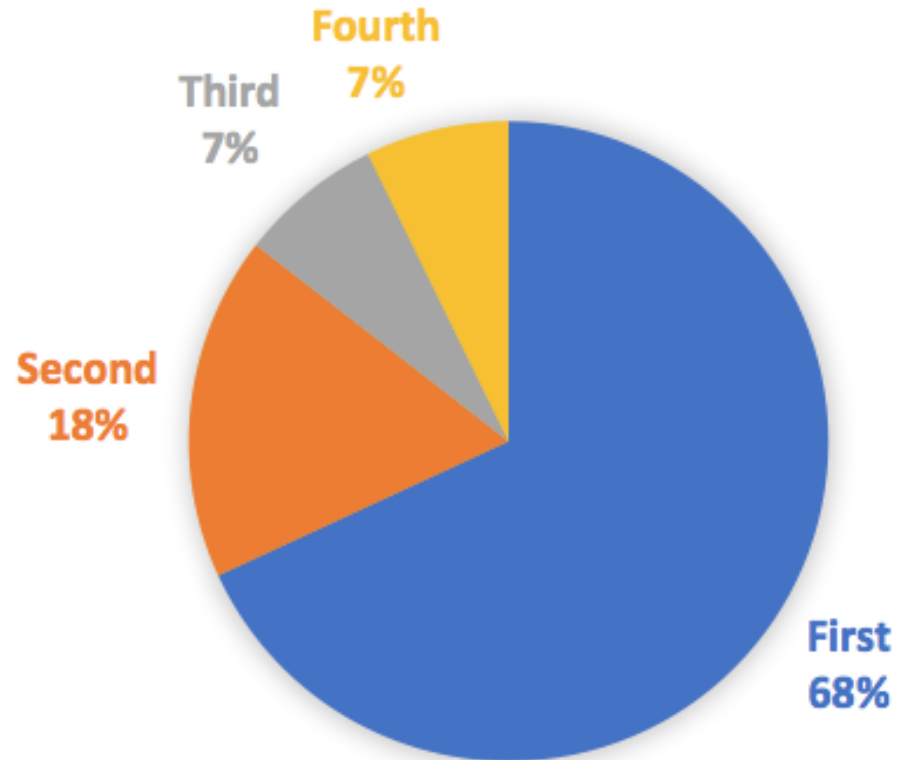
- Course: Computer Programming I (Jan 2016)
- Setup:
 - Participants
 - Materials
 - Procedure
 - Measures

Participants

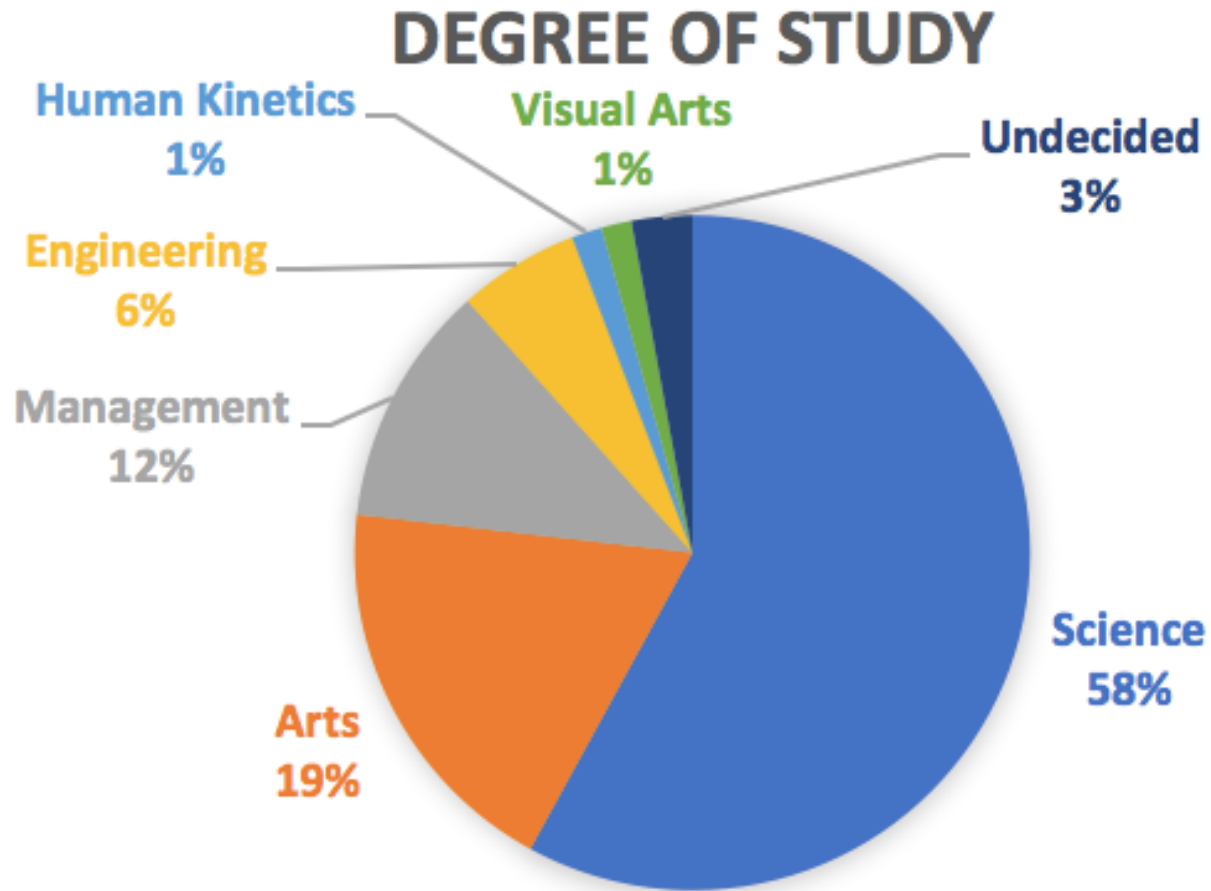
GENDER



YEAR OF STUDY



Participants



Materials

- Gradually released throughout semester:
 - Course syllabus
 - Week-by-week schedule
 - 13 weeks of lecture slides
 - 9 multiple choice quizzes
 - 9 programming labs
 - 3 programming assignments
 - 3 surveys

Procedure

- Brief intro to the site usage
- Surveys completed with bonus marks
(total worth about 0.3% of the course grade)
- Course as usual

Measures

- Survey responses
 - E.g. number of hours spent studying for midterm
- Activity in online discussion forum
 - E.g. number of thread creations or responses
- Performance on various class activities
 - E.g. percent grades on quizzes, assignments, labs, in-class exercises, exams
- LMS usage
 - E.g. pageviews, number of sessions, time spent in seconds

Results

- Many can be addressed using simple statistics:
 - Knowledge Assessment
 - Types of Errors
 - Engagement

Results

Instructor Needs: Course Design

- Which course component predicts final exam performance?
 - Stepwise multiple linear regression
 - Predictors ($F(4,64)=73.827$, $p=2.87E-23$, R^2 of 0.811):
 - Assignments
 - In-class activities
 - Midterm 1
 - Midterm 2

Not labs or quizzes

Results

Student Needs: Improvement

- How should a student study for Midterm 1?
 - Stepwise multiple linear regression
 - Predictors ($F(1,52)=4.999$, $p=0.03$, R^2 of 0.070):
 - Amount of sleep the night before

Not how much they study, or
what materials they used to study, or
what technique they used to study

Results

Student Needs: Improvement

- How should a student study for Midterm 2?
 - Stepwise multiple linear regression
 - Predictors ($F(1,31)=6.506$, $p=0.01$, R^2 of 0.147):
 - Number of hours spent studying

Not how much they slept, or
what materials they used to study, or
what technique they used to study

Conclusions

- Proposed a framework of pedagogical questions
- Help individuals decide how learning analytics can improve their courses
- Showcased a course LMS
- Provided examples to illustrate data use to answer pedagogical questions

Future Work

- Conduct focus groups to broaden the applicability of our proposed framework
- Explore additional case studies to populate the framework
- Suggestions and feedback on framework much welcomed