Incorporating data science into undergraduate microbiology

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reproducible
research
education
practice
data science
open
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community
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incorporate
undergraduate
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publishing
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increasingly
analyzing
educators
non-classroom
developing
linking

$>$ 90% of researchers in the biological sciences work with or plan to work with big data.

Williams & Teal 2017

Poll

When in your career did you *start* acquiring data science skills?

a. K12
b. Undergraduate
c. Graduate
d. Postdoc
e. PI / Scientist / Researcher
f. I do not use data science

$>$ 60% of researchers in the biological sciences report a need for more training in data science.

Meta-analysis 2013 - 2016
Attwood *et al* 2017


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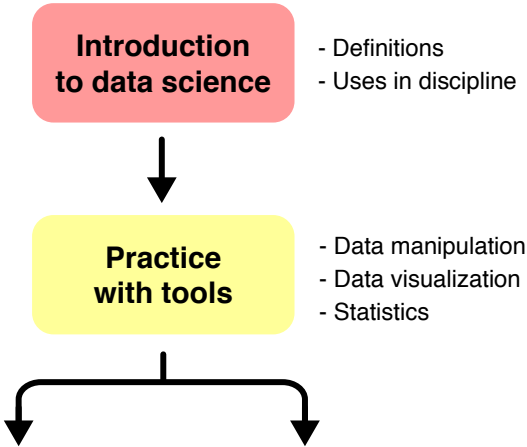
Experiential
Data science for
Undergraduate
Cross-disciplinary
Education

Our goal:

Modular integration of data science curriculum
into existing microbiology courses

Content overview



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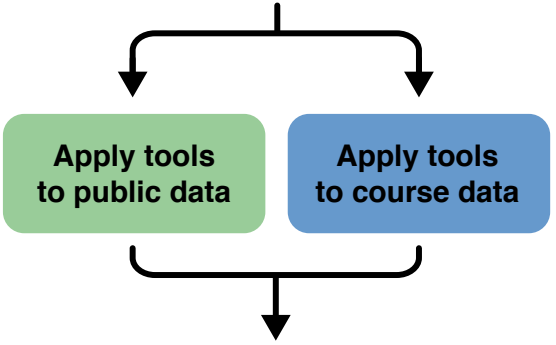
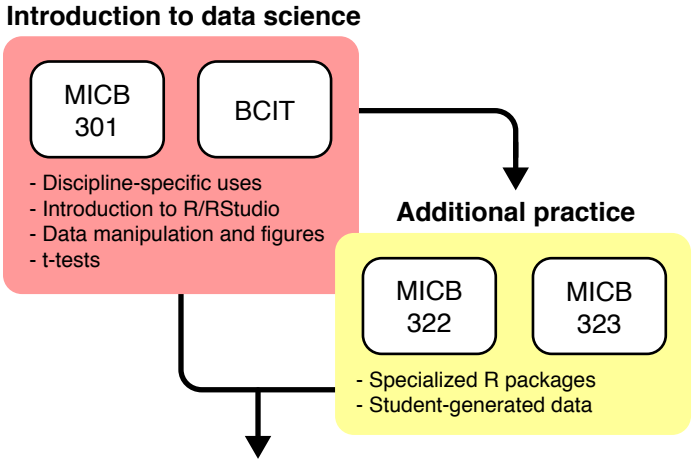


Course overview



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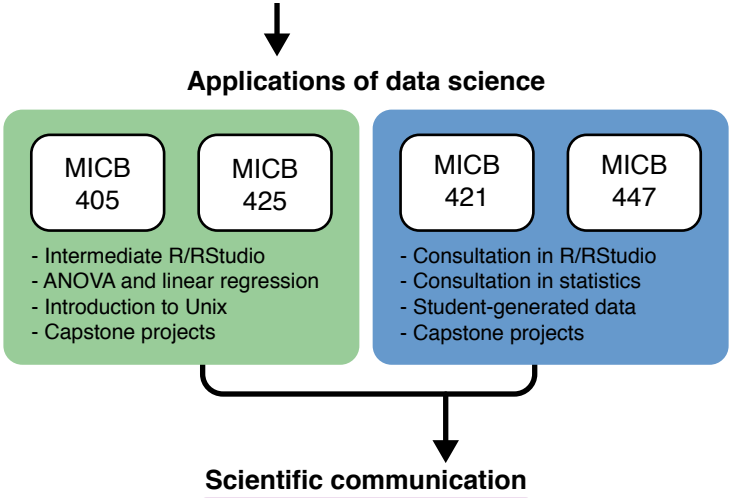
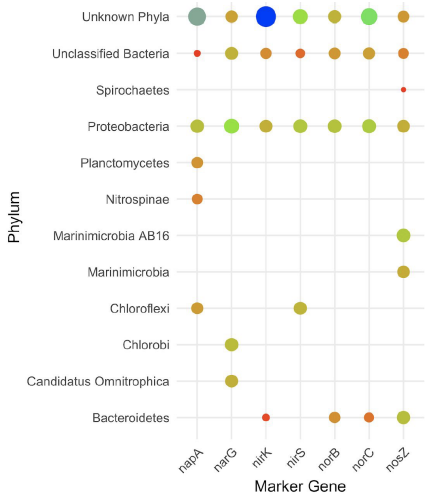


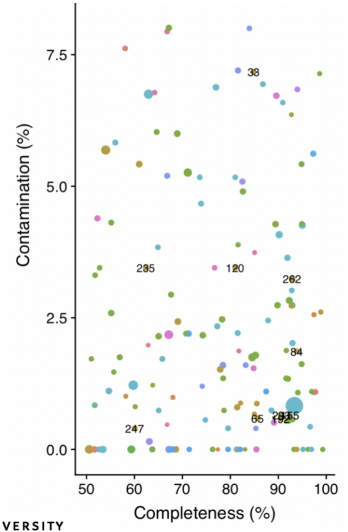
Examples



Genomic and transcriptomic analysis of denitrification processes at 120m in Saanich Inlet

Kevin Chan, Dionzie Ong, Adam Mesa, Gurkiran Parmar, Raaghul Anand

Examples



A Shallow Dive into Saanich Inlet: Metagenomics Analysis at 10m Depth

Virginia Pichler, Jessica Ha, Vivian Li (Greg Morgan, William Zeng)

Does EDUCE effectively teach
data science skills
to microbiology students?

Poll

What aspect of 'data science' do you think undergraduate students find most difficult?

a. Programming / scripting
b. Statistics
c. Installing software
d. Interpretation within the context of microbiology
e. Other (Provide your response in our open GitHub issue!)

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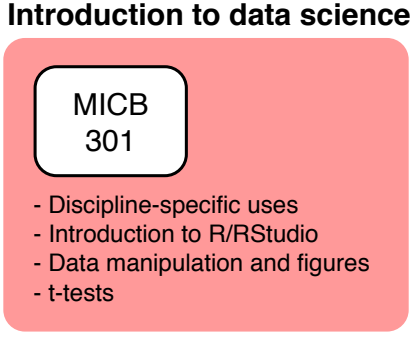
MICB 301 as a case study

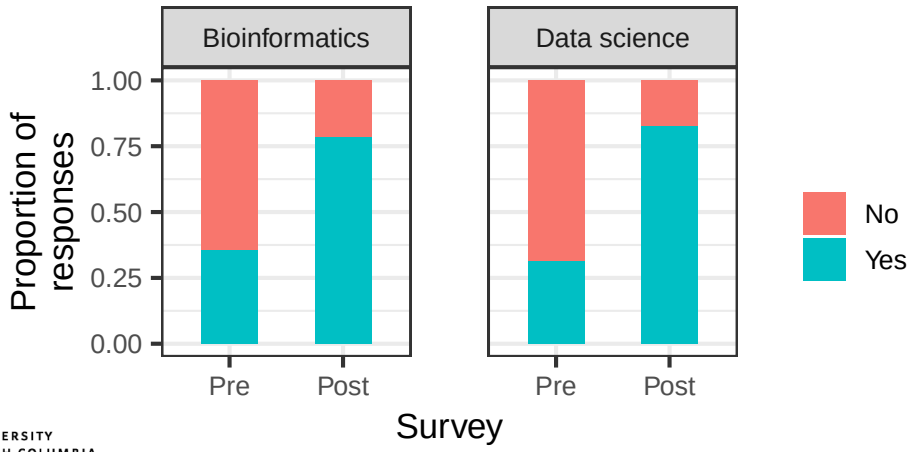
EDUCE in MICB 301



- Required for MICB majors
- ~120 students / yr
- 5 x 50 min class sessions across 5 weeks

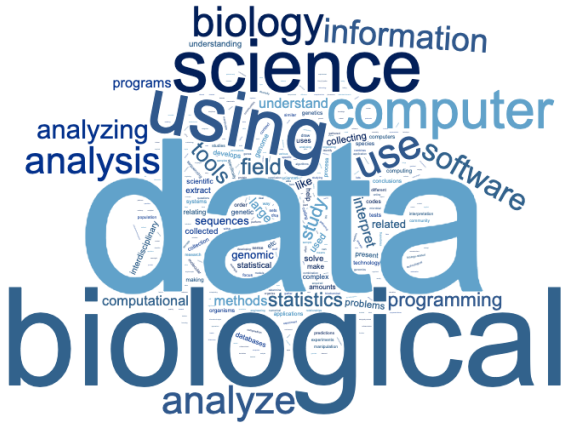
Increased awareness of data science

Have you heard the term _____?



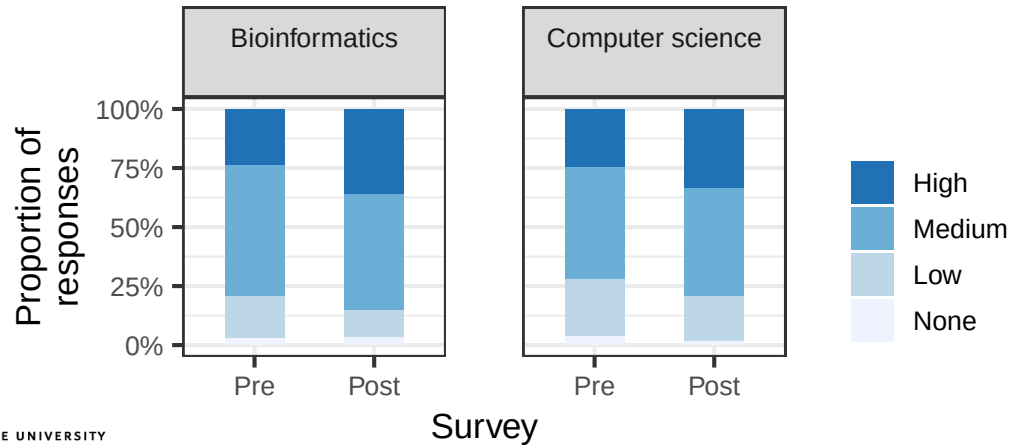
Definitions of data science

Definitions of bioinformatics



Increased interest in data science

How would you rate your interest in...



Increased interest in data science

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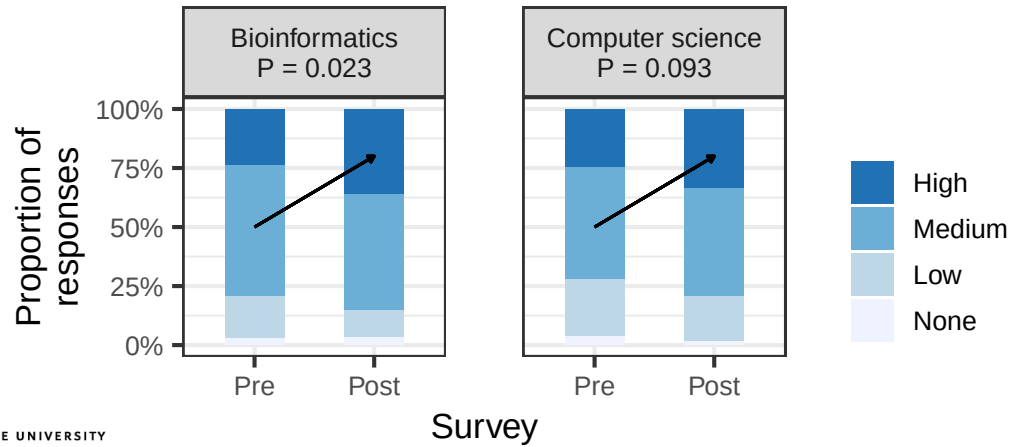
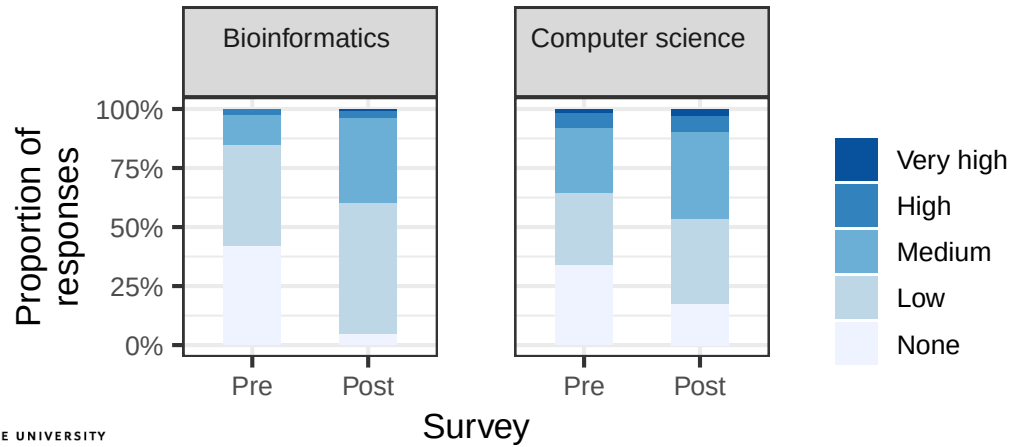


Increased experience in data science

What level of experience do you have in ...



Increased experience in data science

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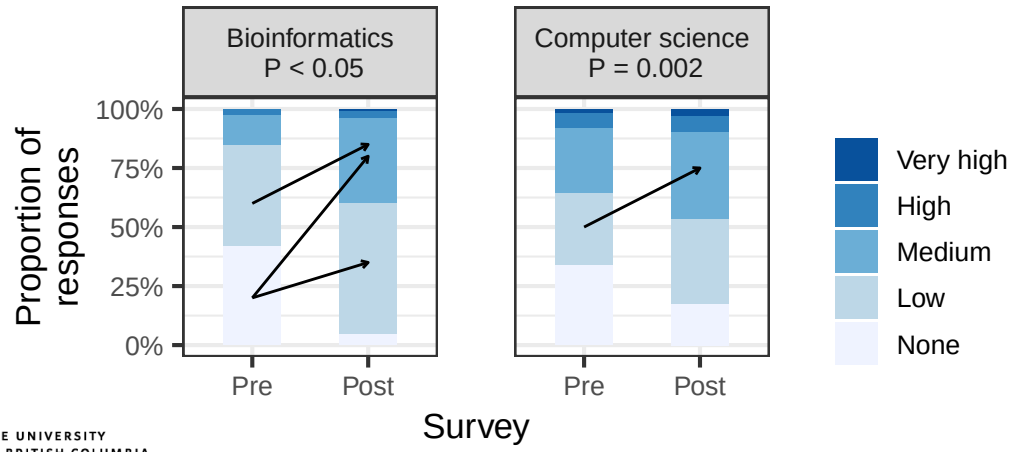

No changes in interest or experience
in “microbiology” or “statistics”

Conclusions

- Data science literacy is needed in the life sciences

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- EDUCE provides a flexible, modular approach for integrating data science into undergraduate curriculum

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- Data science literacy is needed in the life sciences
- EDUCE provides a flexible, modular approach for integrating data science into undergraduate curriculum
- Even minimal exposure (5 hours) can increase student self-reported knowledge, interest, and experience in data science areas

The future

- A wealth of survey data
- More courses? Other departments?
- Faculty of Science Data Science Curriculum Committee
- Independent learning tools: https://ubc-educe.shinyapps.io/course_knitter/

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Want to learn more?

EDUCE GitHub: https://github.com/EDUCE-UBC

EDUCE website: https://educe-ubc.github.io/

EDUCE email: info.educe@ubc.ca

Undergraduate Journal of Experimental Microbiology and Immunology (uJEMI): https://jemi.microbiology.ubc.ca/

References

Attwood TK *et al* 2017. *A global perspective on evolving bioinformatics and data science training needs.* Brief Bioinform. 20(2):398-404. doi: 10.1093/bib/bbx100

Williams JJ & Teal TK. 2017. *A vision for collaborative training infrastructure for bioinformatics.* Ann N Y Acad Sci. 1387(1):54-60_ doi: 10.1111/nyas.13207

Students impacted per year