Python in Education

Brett Becker[1], University College Dublin

Keith Quille[2], Institute of Technology Tallaght

[1] www.brettbecker.com
[2] www.keithquille.com

About Brett

- Assistant Professor, UCD Computer Science
  - Computing Education Research
  - Secondary School Teacher Upskilling (aimed at LCCS)
- Some of my activities
  - SIGCSE (ACM Special Interest Group on Computer Science Education) sigcse.org
  - NCCA LCCS curriculum development consultation
  - External Expert, Department of Education & Skills, LCCS subgroup on teacher qualification
  - Member, CESI (Computers in Education Society of Ireland) Official teacher professional network for computer science (cesi.ie)

Why Python? Why for Education?

Tollervey, 2015:

- Why is Python so Popular?
  - Resources; Design; Community; Momentum
- "Python is the language du jour for teaching programming".
  - Why?
    - Readability; Simplicity; Extensibility; Cross-Platform Runnability; Humanity ("used by humans for humans")

Nicholas H. Tollervey. Python in Education. 2015. O'Reilly.
https://www.oreilly.com/programming/free/python-in-education.csp

Pause… Why do we care what language is used for education?

- To champion a particular language? **NO**
- Because language x is awesome? **NO**
- Isn't it obvious? **NO**
- To teach 'better'? **no, well, maybe, kind of…**
- How about:

The choice of what language to teach first influences the impressions and attitudes of computing and computer science for countless students" – Guo, 2014

AND **students -> potential graduates -> potential professionals.**

*Philip Guo. 2014. Python is Now the Most Popular Introductory Teaching Language at Top US Universities. Communications of the ACM Blog (BLOG@CACM), July (2014).
https://cacm.acm.org/blogs/blog-cacm/176450-python-is-now-the-most-popular-introductory-teaching-language-at-top-u-s-universities/fulltext

Pause… Why do we care what language is used for education?

…and we are already drowning in a sea of misconceptions, stereotypes, inequalities, imbalances and high dropout rates.

We don't need another fly in the ointment.

Pause... Why do we care what language is used for education?

Also, not enough emphasis, power, and knowledge is given to teachers.

Students generally don't pick languages.

Teachers (or institutions) do.

Who is Using Python? (2014)

- "Python Is Now the Most Popular Introductory Teaching Language at Top U.S. Universities" – Guo, 2014.

- Gotchas:
  - Top 39 US departments (US News & World Report)
  - PhD-granting
  - CS0 and CS1

Philip Guo. 2014. Python is Now the Most Popular Introductory Teaching Language at Top US Universities. Communications of the ACM Blog (BLOG@CACM), July (2014).
https://cacm.acm.org/blogs/blog-cacm/176450-python-is-now-the-most-popular-introductory-teaching-language-at-top-u-s-universities/fulltext

Who is Using Python?

- "CS1" is what computer science educators call the first, required, no-prerequisite, for-majors programming course in an undergraduate CS/Computing degree (see Hertz, 2010)

- "CS0" is a course 'before' this or falling a bit short on some requirements (e.g. not for CS majors, not required, etc.)

Matthew Hertz. 2010. What Do "CS1" and "CS2" Mean?: Investigating Differences in the Early Courses. In Proceedings of the 41st ACM Technical Symposium on Computer Science Education (SIGCSE '10). ACM, New York, NY, USA, 199–203. DOI: http://dx.doi.org/10.1145/1734263.1734335
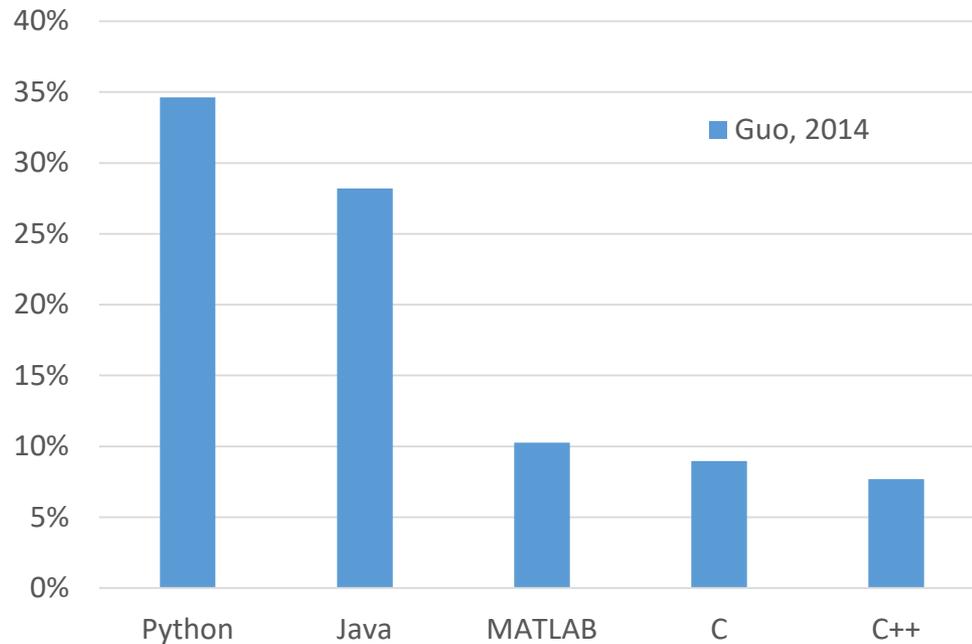
Who is Using Python? (2014)

Philip Guo. 2014. Python is Now the Most Popular Introductory Teaching Language at Top US Universities. Communications of the ACM Blog (BLOG@CACM), July (2014). https://cacm.acm.org/blogs/blog-cacm/176450-python-is-now-the-most-popular-introductory-teaching-language-at-top-u-s-universities/fulltext

Who is Using Python? (2017)

- My recent work (Becker & Fitzpatrick, 2019)
- Gotchas:
  - Top ~~39 US departments~~ 917 Global universities (QS World University Rankings)
    - 234 CS1 courses from 29 countries (USA = 50%)
  - ~~PhD granting~~
  - ~~CS0 and~~ CS1

Becker, B.A. and Fitzpatrick, T. 2019. What Do Syllabi Reveal About Our Expectations of Introductory Programming Students? Proceedings of the 49th ACM Technical Symposium on Computer Science Education (SIGCSE 2019), Minneapolis, Minnesota, USA, February 2019. ACM. *to appear*

Who is Using Python? (2017*)
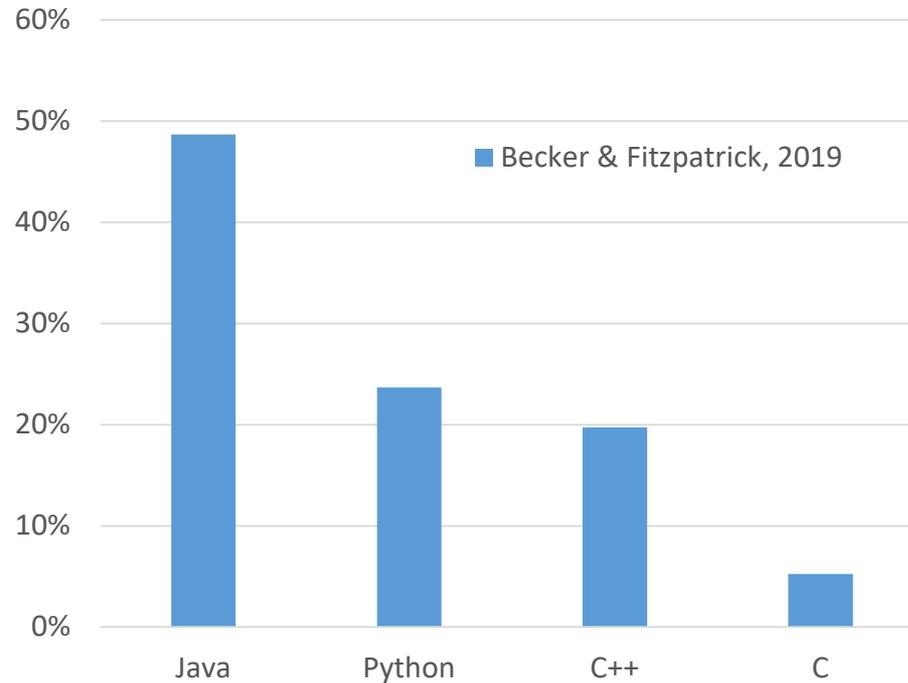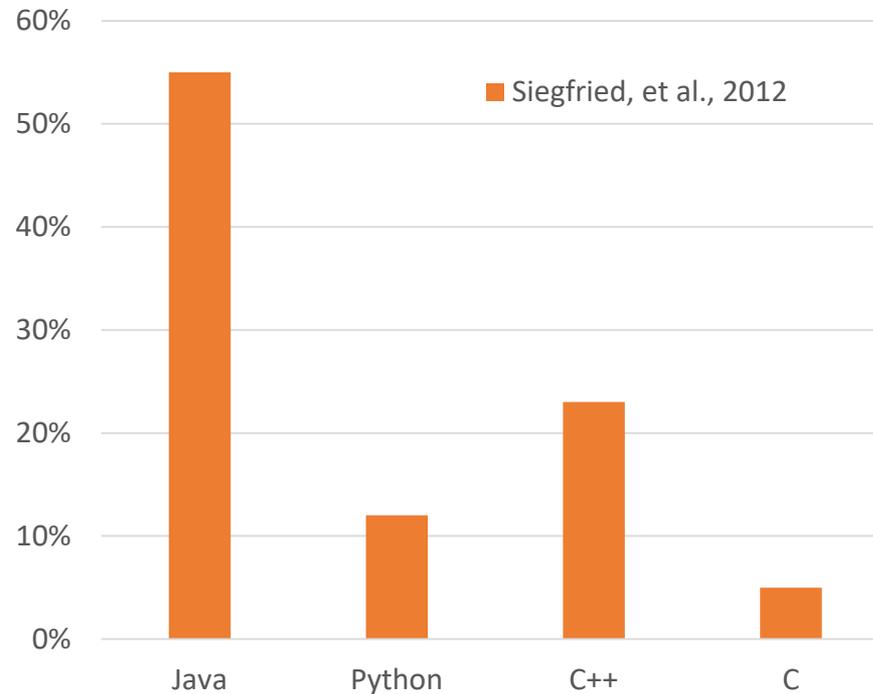

* The paper is 2019, the data is 2017.

Becker, B.A. and Fitzpatrick, T. 2019. What Do Syllabi Reveal About Our Expectations of Introductory Programming Students? Proceedings of the 49th ACM Technical Symposium on Computer Science Education (SIGCSE 2019), Minneapolis, Minnesota, USA, February 2019. ACM. *to appear*

Who is Using Python? Back to 2012

- Siegfried et al., 2012
- Gotchas:
  - 393 US departments ~~917 Global universities 39 departments~~
  - ~~PhD-granting~~
  - ~~CS0 and~~ CS1

Robert Michael Siegfried, Daniel Greco, Nicholas Miceli, and Jason Siegfried. 2012. Whatever happened to Richard Reid's list of first programming languages? Information Systems Education Journal 10, 4 (2012), 24.
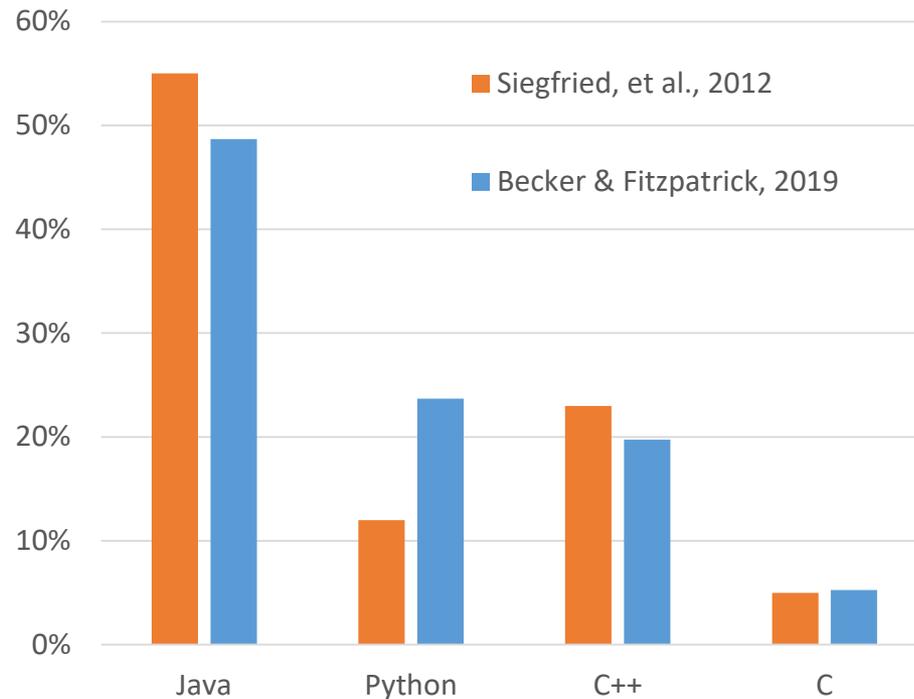
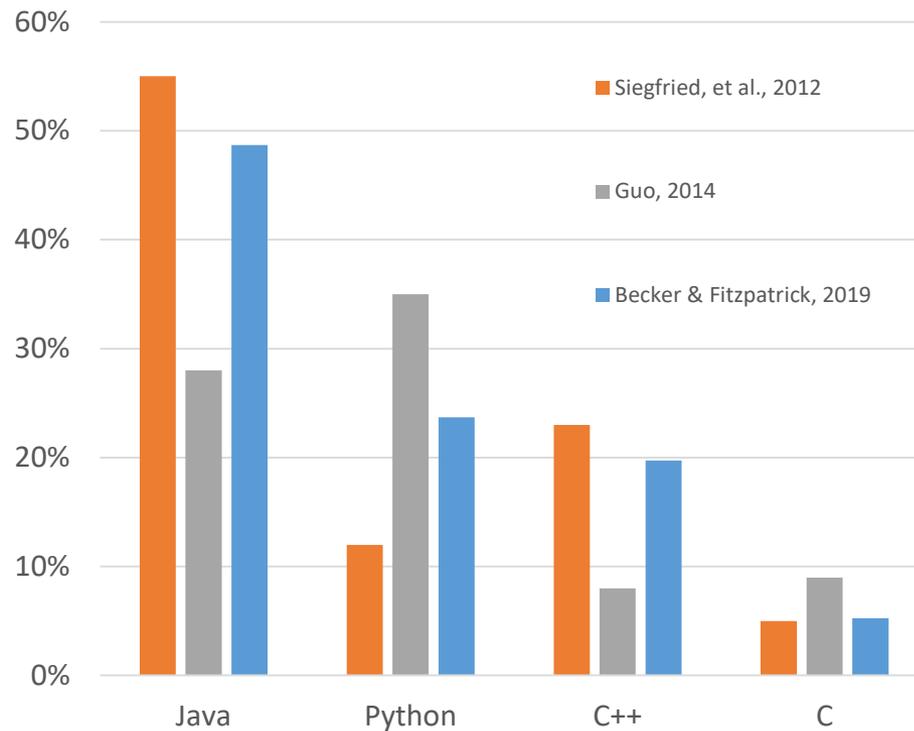# Who is Using Python? Back to 2012

Robert Michael Siegfried, Daniel Greco, Nicholas Miceli, and Jason Siegfried. 2012. Whatever happened to Richard Reid's list of first programming languages? Information Systems Education Journal 10, 4 (2012), 24.

Who is Using Python? 2012, 2017*

Legend:
- Siegfried, et al., 2012 (orange)
- Becker & Fitzpatrick, 2019 (blue)

Chart showing percentage usage for Java, Python, C++, and C.

* The paper is 2019, the data is 2017.

Who is Using Python? 2012, 2014, 2017*

* The paper is 2019, the data is 2017.

What's the difference?

- Sample size
- US vs Global
- PhD-granting or not requiring PhD-granting
- **CS0 included or not**

Who is using Python in Ireland? (Again, at University Level)

- Australasia* (Mason & Simon, 2017), n = 27 universities
  - Python: 31%, Java: 31%

- UK* (Murphy, Crick & Davenport, 2017), n = 80
  - Python: 13%, Java: 46%

- Ireland* (Becker, in preparation), 39 CS1 courses from n = 24:
  - 8/9 Universities (incl. Ulster + Queens)
  - 12/14 Institutes of Technology
  - 4 Private Colleges (HECA/QQI)
  - Python: 28%, Java: 49%

These three studies all used a similar methodology and survey instrument.

Raina Mason and Simon. 2017. Introductory Programming Courses in Australasia in 2016. In Proceedings of the Nineteenth Australasian Computing Education Conference (ACE '17). ACM, New York, NY, USA, 81-89. DOI: https://doi.org/10.1145/3013499.3013512

Murphy, Ellen, Tom Crick, and James H. Davenport. "An Analysis of Introductory Programming Courses at UK Universities." *The Art, Science, and Engineering of Programming* 1, no. 2 (2017).

So what?

"Knowing what languages are used in introductory courses is only part of the story; an exploration of the choice of languages would not be complete without asking why a particular language has been chosen" (Simon et al., 2018)

In order of importance, the reasons for language choice were:

- Australasia: Pedagogical Benefits, Industry Relevance, Availability / Cost, …
- UK: Pedagogical Benefits, Availability / Cost, Industry Relevance, …
- Ireland: Industry Relevance, Availability / Cost, Pedagogical Benefits, …

Simon, Raina Mason, Tom Crick, James H. Davenport, and Ellen Murphy. 2018. Language Choice in Introductory Programming Courses at Australasian and UK Universities. In Proceedings of The 49th ACM Technical Symposium on Computer Science Education, Baltimore, MD, USA, Feb. 21–24, 2018 (SIGCSE '18), 6 pages. https://doi.org/10.1145/3159450.3159547

Pause…

- Python is on the rise in education (2012-2017 evidence shows us that)
- There are regional differences
- It seems that it is used more, earlier (Python *seems* more prevalent in CS0 compared to CS1)
  - This could be because CS1 has to align with a four-year curriculum (which normally already exists). CS0 generally doesn't.

"There have only really been three "CS1 languages," … Pascal, C++, and Java. All three were used in a large (over 50%) percentage of CS1 [classes] …

All three were **AP CS** languages" – Guzdial, 2011

Mark Guzdial. 2011. https://computinged.wordpress.com/2011/01/24/predictions-on-future-cs1-languages/