

What Novice Programmers Don't Know

Gary Lewandowski
Alicia Gutschow
Robert McCartney
Kate Sanders
Dermot Shinnery-Kennedy

Which programming concepts have little or no meaning for students?

- How frequently do students indicate a concept has less meaning?
- Does “don't know” differ from “not applicable”?
- Does classification vary based upon course performance?
- Is it the concept or the vocabulary?

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Outline

- Bootstrapping
- Card Sorts and Ragbags
- Methodology
- Results
- Conclusions

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Bootstrapping

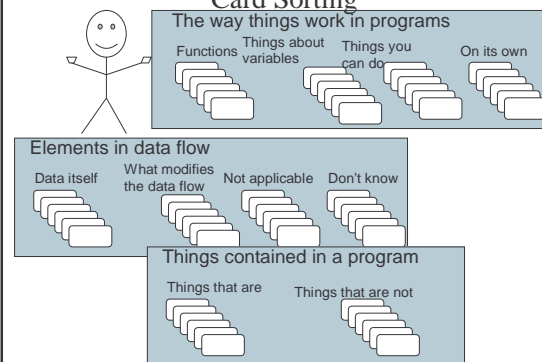
- NSF sponsored workshop: Sally, Marian and Josh
- Multi-national, multi-institutional study
- 22 researchers from four continents, six countries
- Data from 247 students
- How do first-competency students organize programming concepts?

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Card Sorting



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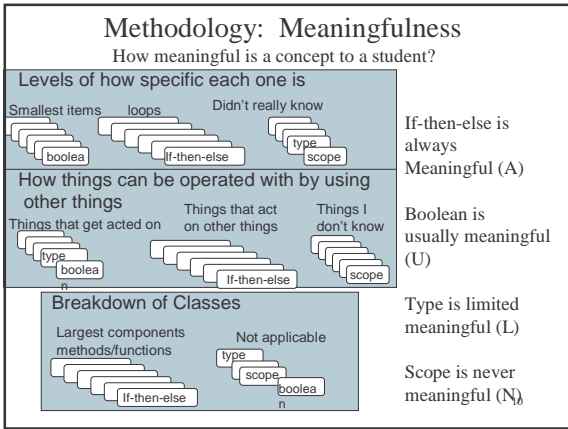
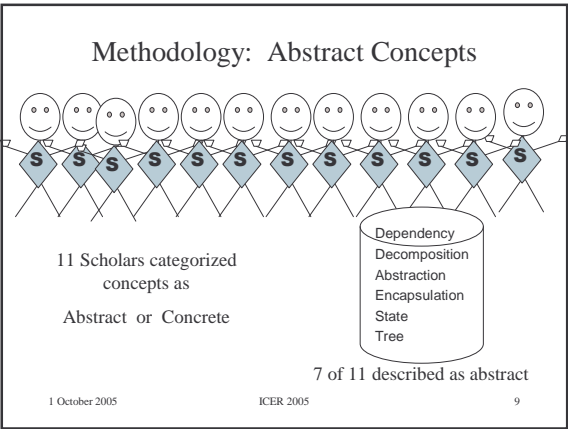
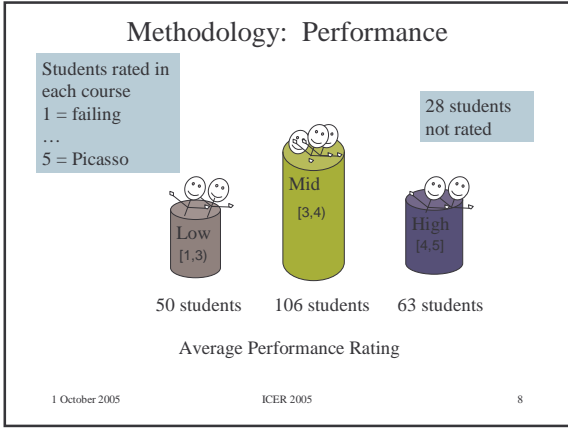
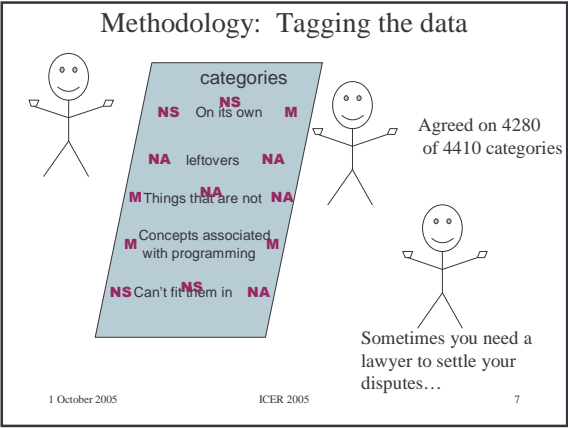
Ragbags

- Don't Know (DK): never knows it
- Not Sure (NS): doesn't know in this sort
- Not Applicable (NA): not applicable in this sort
 - Boolean sorts may or may not have an NA

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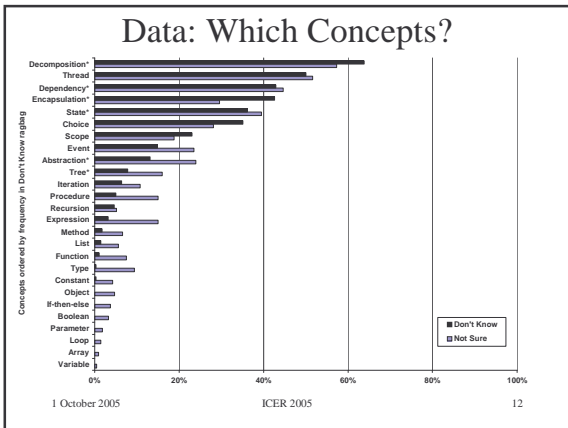
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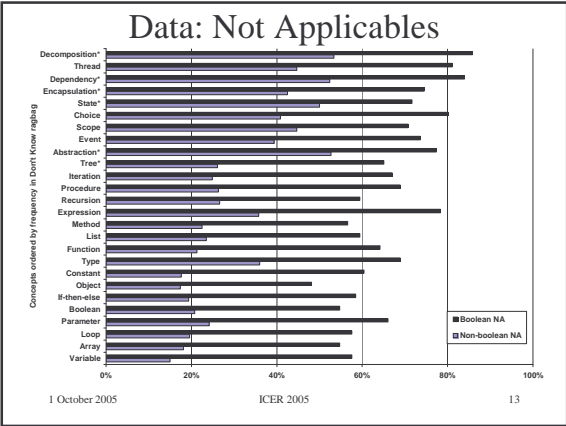


Data: Frequency of Use

#students	247 total	50 low	106 mid	63 high
At least 1 ragbag	96%	94%	92%	98%
NA	75%	68%	69%	90%
Bool/not	(20%/169%)	(24%/58%)	(15%/63%)	(25%/86%)
DK	32%	14%	37%	40%
NS	48%	64%	44%	33%

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Data: Meaningful or Familiar?

Variable is always or usually known to 238 of 247 students
 Object is always or usually known to 234 students
 State is always or usually known to 165 students.
 Recursion is always or usually known to 223 of 247 students

Iteration: 217
 Procedure: 212
 Expression: 204

Deomposition, the least well known concept, is always or usually known by 126 of the 247 students.

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- ### Life, the universe, and ragbags
- Ragbags used frequently, dominated by abstract concepts.
 - Ragbag categories are used for different purposes.
 - Low performers less likely to place concepts into don't know. (Murphy/Tenenberg, do computer science students know what they know?) How do we help them see their confusion?
 - Dichotomous pairs: a problem and opportunity?
 - Yet again, programming language and paradigm are not the issue.
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