How do different problem-solving styles affect gender inclusion in Computer Science courses?

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(with major contributions from Catarina Matos)
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Cognitive diversity affects how different people use the same software.
Individual characteristics in how people solve problems often cluster by gender.
In software systems, features are more supportive of problem-solving processes followed by males.
Gendermag: Evaluating usability with a focus on gender-inclusiveness

Source: https://gendermag.org/

- **Motivation for using the software**
  Why do you use a new tech, what do you want from it?

- **Information processing style**
  How do you deal with new info to solve problems with tech?

- **Computer self-efficacy**
  How much do you trust you’ll succeed with new tech?

- **Attitude towards risk**
  How willing are you to use unnecessary functionalities for the task at hand?

- **Ways of learning new technology**
  How do you interact with new technology?
<table>
<thead>
<tr>
<th><strong>Factor</strong></th>
<th><strong>Value</strong></th>
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</thead>
<tbody>
<tr>
<td>Motivation for using the software</td>
<td>To perform tasks</td>
</tr>
<tr>
<td>Information processing style</td>
<td>Comprehensive</td>
</tr>
<tr>
<td>Computer self-efficacy</td>
<td>Low</td>
</tr>
<tr>
<td>Attitude towards risk</td>
<td>Risk-averse</td>
</tr>
<tr>
<td>Ways of learning new technology</td>
<td>Process-oriented</td>
</tr>
</tbody>
</table>

**Abi (Abigail/Abishek):**
Abi's facet values are those frequently seen in women

Source: https://gendermag.org/
**Tim (Timothy/Timara):**
Tim's facet values are those frequently seen in men

<table>
<thead>
<tr>
<th>Source: <a href="https://gendermag.org/">https://gendermag.org/</a></th>
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</thead>
<tbody>
<tr>
<td><strong>Motivation for using the software</strong></td>
</tr>
<tr>
<td>Source of fun</td>
</tr>
<tr>
<td><strong>Information processing style</strong></td>
</tr>
<tr>
<td>Selective</td>
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<tr>
<td><strong>Computer self-efficacy</strong></td>
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<tr>
<td>High</td>
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<tr>
<td><strong>Attitude towards risk</strong></td>
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<tr>
<td>Risk-tolerant</td>
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<tr>
<td><strong>Ways of learning new technology</strong></td>
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<tr>
<td>Tinkering</td>
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</tbody>
</table>
Pat (Patricia/Patric): Pat’s characteristics fall somewhere in between Abi and Tim

Motivation for using the software
Learn if necessary, stick to familiar if possible

Information processing style
Towards Comprehensive, in bursts

Computer self-efficacy
Medium

Attitude towards risk
Risk-averse

Ways of learning new technology
Purposeful tinkering

Source: https://gendermag.org/
How motivated are people to explore next-generation technology?

Source: https://gendermag.org/
Are women who enroll in computer science courses different from other STEM degrees, with respect to their preferred problem-solving styles?

Considering only 1st year female students...
CS women significantly more motivated than colleagues from other STEM
CS women more adept of tinkering than colleagues from other STEM
No significant differences in self-efficacy, information processing style and attitude toward risk.
Same tendencies, smaller effect sizes, when considering all female students

Motivation

Field

Learning Style

Field

Computer Science

Other STEM

117
To what extent are these problem-solving styles correlated with academic success?
No significant differences on group project performance

Introduction to Programming for other STEM courses

78 groups of students
Better overall performance by men

Introduction to Programming: Other STEM (89 women + 97 men)
Tinkerers have a better overall performance.
Some Abis are among the top-ranked students too.
Do professors prefer similar problem-solving styles to those of students, or is there a mismatch?

Survey with 129 CS Students and 16 CS Professors
Students more motivated than professors to use new technologies
Students have a more tinkering learning style than professors
Professors have a higher self-efficacy
Professors are more selective in their information processing style.
Fairly similar attitude towards risk
Are we shaping our students to become more like us, with respect to problem-solving styles?

Survey with 16 Computer Science Professors
Professors with a lower self-efficacy seem to favor learning based on offline materials (e.g. books) and autonomous search by students.
Learning style

Professors who favor a process-oriented learning style, rather than tinkering, seem to favor solving problems with the participation from students.
Information processing style

Professors with a more comprehensive information processing style seem to favor Comprehension and Application educational objectives.
Attitude towards risk

Professors with a lower tendency for risk taking seem to favor Evaluation educational objectives.
We have only scratched the surface

More detailed data available in a MSc dissertation by Catarina Matos
Can we leverage this notion of problem-solving styles and make our teaching practices more inclusive?
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