Everyday AI (EdAI) for Youth

Investigating Middle School Teacher Education, Classroom Implementation, and the Student Learning Outcomes of an Innovative AI Curriculum

Presentation for the
2022 PI ITEST Annual Meeting

Katherine Moore
Research Scientist
MIT STEP Lab
ksmoore@mit.edu

Helen Zhang, co-PI
Senior Research Associate
Boston College
zhangzm@bc.edu

Irene Lee, PI
Research Scientist
MIT STEP Lab
ialee@mit.edu

Thanks to the generous support of NSF ITEST 2048746
Brief Introduction to the Project
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Research Questions

RQ1: How can we best prepare a wide variety of teachers to use the DAILy curriculum to help their students learn AI concepts and gain awareness of careers of the future with AI?

RQ2: How and to what extent do teacher-led implementations of the DAILy curriculum impact student knowledge and interest in AI and AI-related careers?

RQ3: What teaching practices positively affect students’ learning with these innovative materials?

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Partner Programs and Locations

**Aim to recruit diverse populations** including:

- Teachers of color
- Students of color

**Why?**

- Most impacted by negative aspects of AI
- Sensitive discussions on ethics, race, bias
- Seeking to address inequities in AI education

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**Everyday AI (EdAI) Professional Development Sequence**

<table>
<thead>
<tr>
<th>April</th>
<th>April-June</th>
<th>Summer</th>
<th>Academic Year</th>
<th>March</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Facilitator PD</strong></td>
<td><strong>AI Book Club</strong></td>
<td><strong>Summer Camps / Practicums</strong></td>
<td><strong>Classroom Implementation</strong></td>
<td><strong>Make-a-thon</strong></td>
</tr>
<tr>
<td>Facilitators prepared to support teachers in districts and at camps.</td>
<td>Teachers discuss AI and engage with AI lessons &amp; activities</td>
<td>Teachers run student summer camps as practicum experiences for teachers (with help from Facilitators)</td>
<td>Teachers implement lessons during the regular school day (and Facilitators and EdAI research team check-in)</td>
<td>All members of the EdAI community come together to modify and build the DAILy curriculum and EdAI Project</td>
</tr>
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Everyday AI Professional Development Sequence

- **April**
  - Facilitator PD
  - Teachers discuss AI and engage with AI lessons & activities

- **April-June**
  - Al Book Club
  - Teachers run student summer camps as practicum experiences for teachers (with help from Facilitators)

- **Summer**
  - Summer Camps / Practicums
  - Teachers implement lessons during the regular school day (and Facilitators and EdAI research team check-in)

- **Academic Year**
  - Classroom Implementation

- **March**
  - Make-a-thon
  - All members of the EdAI community come together to modify and build the DAILy curriculum and EdAI Project
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Findings from Year 1

Student interest in AI grew after teacher implementation during the academic year.

Table 1. Change in Student Attitudes Towards AI from Academic Year, 2021-2022

<table>
<thead>
<tr>
<th>Constructs</th>
<th>n</th>
<th>pre mean</th>
<th>SD</th>
<th>post mean</th>
<th>SD</th>
<th>t</th>
<th>p</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest</td>
<td>240</td>
<td>3.05</td>
<td>0.87</td>
<td>3.36</td>
<td>0.77</td>
<td>6.26</td>
<td>&lt;.001</td>
<td>0.86</td>
</tr>
<tr>
<td>relevance</td>
<td>207</td>
<td>3.27</td>
<td>0.52</td>
<td>3.32</td>
<td>0.47</td>
<td>1.38</td>
<td>0.17</td>
<td>0.77</td>
</tr>
<tr>
<td>anxiety</td>
<td>237</td>
<td>2.56</td>
<td>0.73</td>
<td>2.5</td>
<td>0.8</td>
<td>-1.04</td>
<td>0.3</td>
<td>0.85</td>
</tr>
<tr>
<td>career awareness</td>
<td>205</td>
<td>3.1</td>
<td>0.84</td>
<td>3.16</td>
<td>0.73</td>
<td>1.03</td>
<td>0.3</td>
<td>0.74</td>
</tr>
<tr>
<td>career adaptability</td>
<td>182</td>
<td>3.59</td>
<td>0.87</td>
<td>3.66</td>
<td>0.74</td>
<td>1.09</td>
<td>0.28</td>
<td>0.89</td>
</tr>
</tbody>
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**Findings from Year 1**

Students learned about AI from teacher implementation.

**Table 2. Student Learning Gains from Academic Year, 2021-2022**

<table>
<thead>
<tr>
<th>From teachers who taught...</th>
<th>n</th>
<th>pre mean</th>
<th>SD</th>
<th>post mean</th>
<th>SD</th>
<th>t</th>
<th>p</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>All items</td>
<td>58</td>
<td>0.55</td>
<td>0.09</td>
<td>0.59</td>
<td>0.12</td>
<td>3.03</td>
<td>&lt;.01</td>
<td>0.44</td>
</tr>
<tr>
<td>AI general</td>
<td>222</td>
<td>0.62</td>
<td>0.13</td>
<td>0.66</td>
<td>0.14</td>
<td>4.08</td>
<td>&lt;.001</td>
<td>0.32</td>
</tr>
<tr>
<td>Logic system</td>
<td>236</td>
<td>0.63</td>
<td>0.25</td>
<td>0.60</td>
<td>0.26</td>
<td>3.88</td>
<td>&lt;.001</td>
<td>0.27</td>
</tr>
<tr>
<td>Supervised Learning</td>
<td>202</td>
<td>0.43</td>
<td>0.17</td>
<td>0.47</td>
<td>0.19</td>
<td>2.66</td>
<td>&lt;.01</td>
<td>0.22</td>
</tr>
<tr>
<td>Machine Learning</td>
<td>192</td>
<td>0.66</td>
<td>0.23</td>
<td>0.68</td>
<td>0.23</td>
<td>1.28</td>
<td>0.2</td>
<td>0.11</td>
</tr>
<tr>
<td>Neural Networks</td>
<td>196</td>
<td>0.34</td>
<td>0.28</td>
<td>0.35</td>
<td>0.28</td>
<td>1.28</td>
<td>0.2</td>
<td>0.11</td>
</tr>
<tr>
<td>Generative Adversarial Networks (GANs)</td>
<td>73</td>
<td>0.5</td>
<td>0.17</td>
<td>0.57</td>
<td>0.21</td>
<td>2.45</td>
<td>&lt;.05</td>
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Students learned about AI from teacher implementation.

Table 2. Student Learning Gains from Academic Year, 2021-2022

From teachers who taught... | n  | pre mean SD | post mean SD | t   | p     | d   |
---|----|--------------|--------------|-----|-------|-----|
All items                  | 58 | 0.55 0.09    | 0.59 0.12    | 3.03 | <.01  | 0.44|
AI general                 | 222| 0.62 0.13    | 0.66 0.14    | 4.08 | <.001 | 0.32|
Logic system               | 236| 0.63 0.25    | 0.6  0.26    | 1.28 | 0.2   | 0.1 |
Supervised Learning        | 202| 0.43 0.17    | 0.47 0.19    | 2.66 | <.01  | 0.22|
Machine Learning           | 192| 0.66 0.23    | 0.68 0.23    | 1.18 | 0.24  | 0.11|
Neural Networks            | 196| 0.34 0.28    | 0.35 0.28    | 0.31 | 0.76  |     |
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How did the PD Impact Teachers?

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<table>
<thead>
<tr>
<th></th>
<th>Wave 1</th>
<th>Wave 2</th>
<th>Wave 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Concept Inventory</strong></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><strong>Personal beliefs and values</strong></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Qualitative data</strong></td>
<td>observation, Slack posts</td>
<td>daily debrief meetings</td>
<td>focus group interview</td>
</tr>
</tbody>
</table>
How did the PD Impact Teachers?

- **Positive impact on AI Content Knowledge**, significant gains after the AI Book Club. Measured with the teacher concept inventory.

<table>
<thead>
<tr>
<th>Content</th>
<th>n</th>
<th>Pre</th>
<th>SD</th>
<th>Post</th>
<th>SD</th>
<th>t</th>
<th>p</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>All items (20 items)</td>
<td>26</td>
<td>12.58</td>
<td>2.37</td>
<td>14.38</td>
<td>2.06</td>
<td>2.94</td>
<td>&lt;.01</td>
<td>.81</td>
</tr>
<tr>
<td>AI general concepts (10 items)</td>
<td>26</td>
<td>5.96</td>
<td>1.48</td>
<td>6.92</td>
<td>1.47</td>
<td>2.35</td>
<td>&lt;.05</td>
<td>.65</td>
</tr>
<tr>
<td>Logic system (3 items)</td>
<td>26</td>
<td>2.34</td>
<td>0.75</td>
<td>2.46</td>
<td>0.71</td>
<td>.57</td>
<td>0.57</td>
<td></td>
</tr>
<tr>
<td>Machine Learning (7 items)</td>
<td>26</td>
<td>4.27</td>
<td>1.22</td>
<td>5</td>
<td>0.98</td>
<td>2.38</td>
<td>&lt;.05</td>
<td>.66</td>
</tr>
</tbody>
</table>
How did the PD Impact Teachers?

- **Positive impact on AI Content Knowledge**, significant gains after the AI Book Club Measured with the teacher concept inventory.
- **Positive impact on attitudes towards AI**: significant gains after the PD Measured with survey of teacher personal beliefs and values.

### Table 4. Teacher Learning Gains from EdAI PD (AI Book Club + Practicum), 2021

<table>
<thead>
<tr>
<th>Construct</th>
<th>n</th>
<th>pre mean</th>
<th>SD</th>
<th>mid mean</th>
<th>SD</th>
<th>post mean</th>
<th>SD</th>
<th>repeated ANOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relevance</td>
<td>29</td>
<td>4.34</td>
<td>.62</td>
<td>4.56</td>
<td>.35</td>
<td>4.52</td>
<td>.58</td>
<td>F(2,28)=1.51, p=.23</td>
</tr>
<tr>
<td>Interest</td>
<td>29</td>
<td>4.72</td>
<td>.42</td>
<td>4.84</td>
<td>.36</td>
<td>4.8</td>
<td>.36</td>
<td>F(2,28)=1.28, p=.29</td>
</tr>
<tr>
<td>Anxiety</td>
<td>29</td>
<td>2.70</td>
<td>.52</td>
<td>2.63</td>
<td>.66</td>
<td>2.44</td>
<td>.33</td>
<td>F(2,28)=1.80, p=.18</td>
</tr>
<tr>
<td>Beliefs in Students</td>
<td>29</td>
<td>4.14</td>
<td>.64</td>
<td>4.27</td>
<td>.58</td>
<td>4.31</td>
<td>.58</td>
<td>F(2,28)=.78, p=.47</td>
</tr>
<tr>
<td>Career awareness</td>
<td>29</td>
<td>3.73</td>
<td>.61</td>
<td>4.15</td>
<td>.45</td>
<td>4.29</td>
<td>.50</td>
<td>F(2,28)=6.39, p&lt;.01</td>
</tr>
</tbody>
</table>
How did the PD Impact Teachers?

- **Positive impact on AI Content Knowledge**: significant gains after the AI Book Club
  Measured with the teacher concept inventory.

- **Positive impact on attitudes towards AI**: significant gains after the PD
  Measured with survey of teacher personal beliefs and values.

  Personal values and motivations for teaching AI, F(2, 28)=4.52, p<.05
  - **Interest in AI** - e.g., “I am interested in learning about AI”
  - **Relevance** - e.g., “I will use my knowledge about AI to help my community”
  - **Career awareness** - e.g., “I know about jobs that use AI.”
Key Constructs & Instruments

- **Positive impact on AI Content Knowledge**: significant gains after the AI Book Club
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Key Constructs & Instruments

- **Positive impact on AI Content Knowledge**, significant gains after the AI Book Club
  Measured with the teacher concept inventory.

- **Positive impact on personal values and motivations for teaching AI**: significant gains after the PD
  Measured with survey of teacher personal beliefs and values.

  Personal values and motivations for teaching AI, F(2, 28)=4.52, p<.05
  - **Interest in AI** - e.g., “I am interested in learning about AI”
  - **Relevance** - e.g., “I will use my knowledge about AI to help my community”
  - **Career awareness** - e.g., “I know about jobs that use AI.”

These are modified versions of validated instruments...
  - Science Motivation Questionnaire (Glynn et al., 2011)
  - Attitudes Towards Science Inventory (Weinburgh & Steele, 2000)
  - Career Futures Inventory (Rottinghaus et al., 2012)
Challenges in Instrument Adaptation

Challenge Item Sensitivity
Maintain item sensitivity to the constructs - AI concepts and attitudes - while simultaneously designing items that are accessible and meaningful for middle school age audiences.

Resolution How we are working through this challenges:

1. **Trimming**
   We are currently working on trimming the number of items to stay within the limitations of middle student attention span, and classroom constraints.

2. **Scenarios**
   Middle school student responses show more meaningful variation to answers that are written as scenarios.

3. **Complexity Reduction**
   Simplifying language removes barriers for low-level readers. Getting the right balance of language is tricky.

4. **Representing Abstraction**
   We are studying how to best design items with representations of abstract concepts and processes.
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