Second Language Acquisition in a Blended Learning of programming languages (SLA-aBLE): Students respond to new materials

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Implementations by Term

Fall 2015
- **Graded** Discussion Board: Weekly topics. Possible comments: questions, answers, examples, resources.
- Open-ended questions in quizzes.
- Videos followed SLA-aBLE methods: Concepts broken into smaller sections. Parts: Syntax, Keywords, Examples, etc.
- Embedded quiz questions in videos.

Spring 2015
- Discussion Board: Used as resource. Includes Q&A from previous term as reference for students.
- Open-ended questions: Rubric fixed to better meet the needs. Questions updated.
- Videos followed SLA-aBLE methods: Videos divided. Length is shortened as much as possible.
- Embedded quiz questions in videos: Prompt added to enable asking questions at the end of video.

Fall 2016
- Discussion Board: Includes Q&A from previous terms as well as examples, discussion questions.
- Open-ended questions: Incomplete script provided.
- Videos followed SLA-aBLE methods: Captions and music added to videos.
- Embedded quiz questions in videos: No changes.

Demographics: Fall 2015 - Spring 2016

<table>
<thead>
<tr>
<th>Language</th>
<th>Not at all fluent (%)</th>
<th>Not very fluent (%)</th>
<th>Moderately fluent (%)</th>
<th>Somewhat fluent (%)</th>
<th>Very fluent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>0</td>
<td>2.41</td>
<td>1.2</td>
<td>9.64</td>
<td>77.11</td>
</tr>
<tr>
<td>Chinese</td>
<td>25</td>
<td>3.85</td>
<td>0</td>
<td>0</td>
<td>7.69</td>
</tr>
<tr>
<td>German</td>
<td>31.75</td>
<td>6.35</td>
<td>4.76</td>
<td>1.59</td>
<td>3.17</td>
</tr>
<tr>
<td>Spanish</td>
<td>11.7</td>
<td>25.53</td>
<td>24.47</td>
<td>4.26</td>
<td>11.70</td>
</tr>
<tr>
<td>Vietnamese</td>
<td>27.45</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>French</td>
<td>22.73</td>
<td>15.15</td>
<td>10.61</td>
<td>4.55</td>
<td>6.06</td>
</tr>
<tr>
<td>Arabic</td>
<td>25.93</td>
<td>0</td>
<td>1.85</td>
<td>0</td>
<td>5.56</td>
</tr>
<tr>
<td>Korean</td>
<td>32</td>
<td>4</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Portuguese</td>
<td>26.83</td>
<td>7.69</td>
<td>1.92</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Other</td>
<td>19.12</td>
<td>11.76</td>
<td>2.94</td>
<td>2.94</td>
<td>14.71</td>
</tr>
</tbody>
</table>

- 49.75% have experience learning a second language.
- Student of Korean ascendance: Saw relation between programming languages and a second language.
- Final grade: 79.75%
- SLA-aBLE tests topics: 93%, 88.21%.

Programming Language Demographics

<table>
<thead>
<tr>
<th>Programming language</th>
<th>Low skill (%)</th>
<th>Moderately low skill (%)</th>
<th>Moderate skill (%)</th>
<th>Moderately high skill (%)</th>
<th>High skill (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATLAB</td>
<td>48.84</td>
<td>20.93</td>
<td>23.26</td>
<td>4.65</td>
<td>2.33</td>
</tr>
<tr>
<td>Fortran</td>
<td>96</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Java</td>
<td>53.66</td>
<td>17.07</td>
<td>17.07</td>
<td>9.76</td>
<td>2.44</td>
</tr>
<tr>
<td>C/C++</td>
<td>73.53</td>
<td>11.76</td>
<td>14.71</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Visual Basic</td>
<td>80</td>
<td>10</td>
<td>10</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Python</td>
<td>58.14</td>
<td>16.28</td>
<td>20.93</td>
<td>4.65</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>70</td>
<td>10</td>
<td>13.33</td>
<td>3.33</td>
<td>3.33</td>
</tr>
</tbody>
</table>

- One third of the students have been exposed to programming before.
- Prefer new-video format; consider changing all topics to SLA-aBLE format.
- 27.87% of students learned MATLAB to some extent before taking the course.

Grades: Fall 2016 and Fall/Spring 2016

- Comparison of students’ final grades in the SLA-aBLE and non-SLA-aBLE courses for three semesters – Fall 2016, Spring 2016, Fall 2016.

K-12, Outreach

- Flash-drive with SLA-aBLE contents distributed to professors at Digifest in Embry-Riddle.
- Included: Read-me file with instructions, quizzes, Think-Pair-Share, Discussion Board prompts, SLA videos, and publications.

One-on-One Interviews

- Comments taken directly from One-on-One interviews:
  - Fall 2015 → Comments will help in graded quizzes.
  - Fall 2015 → New videos preferred. Helps grasp concepts better.
  - Spring 2016 → Preventing skipping in videos is good because it actually makes you watch them.
  - Interactive videos (SLA) are preferred to old videos. Old (Non-SLA) videos lack explanation. SLA videos are detailed and thorough.
  - Fall 2015 → Quizzes should be shorter. Divide into multiple quizzes.
  - Implemented in Spring 2016.
  - Spring 2016 → Short quizzes are good and preferred.
  - Spring 2016 → Add incomplete files to online programming quizzes. Will help reduce heavy workload.
  - Implemented in Spring 2017. Completion rate of programming question increased. Issue with incompatible files almost eliminated.
  - Spring 2016 → Add examples and issues other students have had related to the topic to Discussion board.
  - Implemented Spring and Fall 2016. Response still low. Students want to keep Discussion Board as resource.
  - Spring 2016 → Captions would be good. Specially for second language students.
  - Fall 2016 → Captions are helpful to clarify (from second language speaker).

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SLA-aBLE started in 2014. The researchers have been implementing second language acquisition methods, frameworks, and cognitive skills to the learning process of programming languages in Introduction to Computing for Engineers (MATLAB) courses at Embry-Riddle Aeronautical University for four terms. The new materials are focused on developing problem-solving skills and include: new slides and videos with embedded quizzes to keep students engaged, open-ended programming quiz questions, discussion boards online and think-pair-share in-class activities. Surveys and one-on-one interviews were conducted to obtain feedback from students, which was used to improve the materials.