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

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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.

Implementations by Term

Fall 2015

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

Spring 2015

- Discussion Board: Used as <u>resource</u>. 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 <u>shortened</u> as much as possible.
- Embedded quiz questions in videos: <u>Prompt</u> added to enable <u>asking questions</u> at the end of video.

Fall 2016

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

Demographics: *Fall 2015 - Spring 2016*

Language Demographics

| Language	Not at all fluent (%)	Not very fluent (%)	Moderately fluent (%)	Somewhat fluent (%)	Very fluent (%)
English	0	2.41	1.2	9.64	77.11
Chinese	25	3.85	0	0	7.69
German	31.75	6.35	4.76	1.59	3.17
Spanish	11.7	25.53	24.47	4.26	11.70
Vietnamese	27.45	0	0	0	0
French	22.73	15.15	10.61	4.55	6.06
Arabic	25.93	0	1.85	0	5.56
Korean	32	4	0	0	2
Portuguese	26.92	7.69	1.92	0	0
Other	19.12	11.76	2.94	2.94	14.71

- 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 topics tests: 93%, 88.21%

Programming Language Demographics

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

- 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.
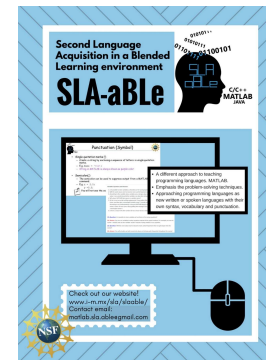
Grades: *Fall 2016 and Fall/Spring 2016*

Frequency count of grades in SLA-aBLe and non-SLA-aBLe courses in three semesters
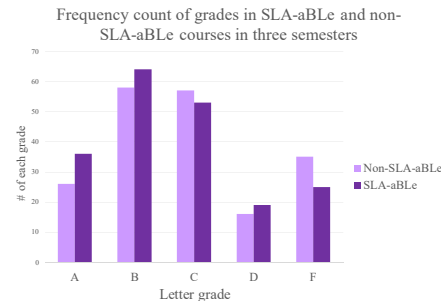
- Comparison of students' final grades in the SLA-aBLe and non-SLA-aBLe sections for three semesters – Fall 2016, Spring 2016, Fall 2016

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
  - *Implemented in Spring 2016. Added comments to quizzes. Grader specified mistakes and points taken. Rubrics available for students.*
- 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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