C2Learn Software:
Utilizing current technology to improve comprehension of programming concepts among deaf students

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“Pictures, beside the pleasure they give, act as definers of the text, and convey far more correct ideas than could be gained from words alone.”

– James H. Logan (1870)
Learning Styles

Limitations of vision

Direct vs. Mediated instruction

Instructional Tool Study
Learning Styles

- Three different learning styles
  - auditory, visual, kinesthetic

- Deaf students –
  - Inherently visual learners due to sensory compensation

- Visual learners –
  - Want to see the process of how things are done.
    “Can I see that again?”

- Presentation should show clear demonstrations
  - Concrete examples, graphs, charts, visual representations of abstract concepts
Limitations of vision

- Solely rely on vision to gather information
- Adequate time needed to gather all information
- Two visual sources of information:
  - Visual presentation (PowerPoint, video without CC)
  - Interpreter or Instructor
- Regardless of choice, some information will be missing
Direct vs. Mediated Instruction

- **Direct instruction**
  - Information from an instructional source is presented directly to the audience

- **Mediated instruction**
  - Information is presented through an interpreter
  - Usually in mainstream environment

- **Comprehension test of lecture content (Marschark & Sapere, 2004)**
  - Highly qualified interpreter provided
  - Deaf students consistently scored lower than hearing peers

- **Access services are not at fault**
  - Direct instruction cannot be replicated with mediated instruction even under optimal conditions
Instructional Tool Study

- Study conducted by Dowaliby and Lang (1999)
- Various multimedia strategies examined
- 11 lessons on the human eye
- 144 deaf participants
  - Split into three categories based on their reading skills (low, middle, high)
Instructional Tool Study – Cont’d

- Comparison of scores (maximum of 11 points)
  - Text only
    - Low: 5.6
    - Middle: 7.5
    - High: 8.2
  - Combination of text reading, content video, sign video, and adjunct questions
    - Low: 8.4
    - Middle: 10
    - High 10.4

- An average of 2.4 points increase with instructional tool

- Adjunct questions alone proved to be the most effective in improving scores
Conclusion of Literature Review

- Mediated instruction in classroom not optimal for deaf students

- A learning tool can be beneficial to deaf students without changing current method of instruction in the classroom

- C2Learn software should not be perceived as a “magic wand”

- It could be ideal to use it as a supplemental tool to course materials
Learning Tool Application

- User-driven application
- Four modules: focuses on decisions and advanced decisions in Java
- Average of 12 slides for each module
- 50+ minutes of video
- 30+ adjunct questions
- 10+ animated examples
Methodology

- Pilot study undertaken to investigate the effectiveness of the C2Learn software

- Participants – Deaf and hard-of-hearing IT students registered in introductory programming courses
  - 14 students registered
  - 9 students were part of the study
Methodology – Cont’d.

- Test #1 – Administered before C2Learn software was given to participants
- Learning Tool – Participants were informed to start with if statement module
- Test #2 – Administered when participants completed all modules in C2Learn software
- Learning Tool Survey – Inquire thoughts and gather feedback
Test Results

- Each test has 14 questions
- One point is given for each question that is answered correctly
- A combination of multiple-choice questions and fill-in-the-blanks
Comparison of preliminary and post test scores among participants

Individual Test Scores

Test Scores for each student ID:

- Student ID 1: Test 1 Score = 7, Test 2 Score = 10
- Student ID 2: Test 1 Score = 5, Test 2 Score = 9
- Student ID 3: Test 1 Score = 8, Test 2 Score = 11
- Student ID 4: Test 1 Score = 6, Test 2 Score = 9
- Student ID 5: Test 1 Score = 2, Test 2 Score = 7
- Student ID 6: Test 1 Score = 7, Test 2 Score = 10
- Student ID 7: Test 1 Score = 6, Test 2 Score = 9
- Student ID 8: Test 1 Score = 8, Test 2 Score = 11
- Student ID 9: Test 1 Score = 7, Test 2 Score = 10
Comparison of average test scores (percentage) among participants

Average Percentage

Test Score (Percentage)

<table>
<thead>
<tr>
<th>Test</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>54%</td>
</tr>
<tr>
<td>2</td>
<td>71%</td>
</tr>
</tbody>
</table>
Test Results Conclusion

- 8 out of 9 students scored better on the second test
  - One participant had worse score on post-test
  - Spent less than 20 minutes with learning tool

- Other participants averaged 75 minutes

- Average of 2.33 point increase on post-test

- Average score on pre-test: 54%

- Average score on post-test: 71%
Conclusion

- C2Learn software proved to be effective in improving comprehension
- A 17% increase in average score (21% excluding student 5)
- 8 out of 9 showed improvement on the second test
- C2Learn Software demonstration
Learning Tool Survey

- Nine questions were rated in Likert Scale
- Likert scale ranged from 1 to 4
  - 1 represents strongly disagree
  - 4 represents strongly agree
- Neutral evaluations eliminated
- Four open-ended questions to gather feedback
Q1: Overall the program on the CD is an excellent learning tool.
Q2: I am satisfied with the scope of information presented.
Q3: I am satisfied with the quality of the content presented.
Q4: I would prefer to use this tool in conjunction with the textbook.
Q5: The examples helped me understand the concepts better.
Q6: The questions helped reinforced what I just learned.
Q7: The content clearly presented the concepts in Java.
Q8: The video in the program helped me understand the concepts better.
Q9: I would use this program again.
Survey Results

What was the most effective part of the learning tool?

- By giving true examples and providing students with multiple choice questions
- Now I understand the part in switch statements and else-if statements better
- The animation part. I like to see an example of output in conjunction with the given statements
- The part regarding animations was most effective because I was able to see the actual process of applying the new concepts being taught
Survey Results

What was the least effective part of the learning tool?

- Slow loading times and some bugs were detected
- Could use more multiple choice questions
- The animations were a little slow
- There were not enough lessons
- The animations ran too slow for a person who understands quickly.
Survey Results

What improvements should be made to enhance your experience with the learning tool?

- Add more advanced coding (complex concepts)
- More animations of examples
- Add a blank box of some kind for students to input and test out their codes
- Animation speed adjuster
- Videos should run in conjunction with the animated examples and text statements
Survey Results

Would you recommend the learning tool to others? Why or why not?

- Definitely. It is very interactive and easy to follow. It allows you to be on your pace and allows you to go back to where you want to reread something.
- Yes, because it will help others understand better.
- I would recommend this CD to others because it is like a virtual classroom and the concepts presented by the CD was easy to grasp due to well-organized presentation.
- It would help others to master Java effectively.