MAXIMIZING CONTENT LEARNING FOR ENGLISH AS A SECOND LANGUAGE STUDENTS

Raja S. Kushalnagar and Joseph S. Stanislow
Department of Information and Computing Studies
National Technical Institute for the Deaf / Rochester Institute of Technology, Rochester, NY 14623
(rskics, jssnbs @rit.edu)

R·I·T National Technical Institute for the Deaf

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BACKGROUND

The introductory programming college course is usually difficult for many new students whether proficient in English or not, as it is a struggle for them to master basic programming concepts and to develop logically correct programs. Surveys in college have estimated that around 30 percent of these students drop out or fail it [2]. These tasks are even more difficult for students that are learning or have recently learned English as a second language (ESL). ESL students typically comprise of international students or recent immigrants. Moreover, Thomas, et al., found that verbal learners outperform visual learners in introductory programming courses [3], which is an additional barrier to ESL students who usually have more access to visual information such as illustrations and diagrams. Finally, most versions of the introductory programming lectures and laboratories introduce and explain new vocabulary rapidly through prior vocabulary. Failure to appreciate the specific technical context of this vocabulary can result in vague or unclear understanding by ESL students.

LEARNING BARRIERS

1. Visual Learning
   - Most students learn through multimodal (auditory and visual). Some students have preference for visual over aural learning or vice versa.
   - As ESL students struggle to understand the auditory information, they have to rely on visual learning.
   - Over-reliance on visual learning can result in an exhausting classroom experience.
   - By adding more visual examples you benefit BOTH regular and ESL students.

2. Educational experience
   - Most students have enough background to learn and relate to abstract concepts through abstract descriptions. Some students may not have enough background and need more concrete, real-life examples and descriptions to learn abstract concepts (e.g., loops: See the example in Figure 1).
   - Faculty teach a fast pace to complete all courses' outlines in the course.
   - Slowing the pace allows all students to follow and absorb the information.
   - ESL students do not receive as much information from classroom lectures as their peers. ESL students need more time due to communication barriers. Diversity in delivery methods is a good thing to do!!!
   - Rote is not enough.

3. Translation issues
   - ESL students often struggle to categorize new vocabulary.
   - For example, in the database field, the terms 'link,' 'connectivity' and 'relationship' are frequently used. An ESL student would not understand the common category for all of these definitions. The deeper meaning behind the words is then lost to the ESL student.
   - ESL students also struggle to master multiple meanings of words.
   - For example, in the Operating Systems field, the definition of "fault tolerance" cannot be understood based on the everyday definition of "fault" and "tolerance", where "fault" means "to assign blame", and "tolerance" means to accept differences. Instead the students have to explicitly be aware of these words' engineering technical definitions, where "fault" roughly equates to an error condition, and "tolerance" roughly equates to range of normal operation. If students are aware of these technical definitions, it is much easier for them to understand during the lecture that this word involves something about the ability to continue operations in the presence of faults. Eventually, they can appreciate the usual technical definition of "fault tolerance", which refers to the ability to continue operations, possibly at a reduced level, rather than failing completely, when some part of the system fails.
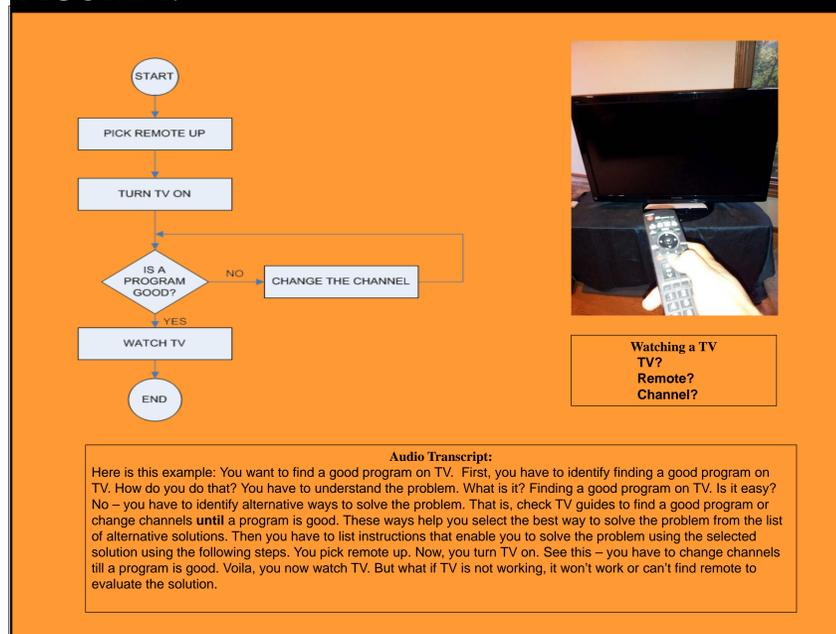
EXAMPLE

General Problem-Solving Concepts with Six Steps
(Algorithm and Flowchart Structures From Figure 1.)

Here is the example: You want to find a good program on TV.

1. Identify the problem.
   Finding a good program on TV.
2. Understand the problem.
   Watch a good program on TV.
3. Identify alternative ways to solve the problem.
   a) Check TV guides to find a good program.
   b) Change channels until a program is good.
4. Select the best way to solve the problem from the list of alternative solutions.
   b) Change channels until a program is good.
5. List instructions that enable you to solve the problem using the selected solution. (Prepare the steps.)
   a) Pick remote up
   b) Turn TV on
   c) Change channels till a program is good
   d) Watch TV
6. Evaluate the solution.
   If TV is not working, it won't work
   Can't find remote

FIGURE 1.

Audio Transcript:
Here is this example: You want to find a good program on TV. First, you have to identify finding a good program on TV. How do you do that? You have to understand the problem. What is it? Finding a good program on TV. Is it easy? No – you have to identify alternative ways to solve the problem. That is, check TV guides to find a good program or change channels until a program is good. These ways help you select the best way to solve the problem from the list of alternative solutions. Then you have to list instructions that enable you to solve the problem using the selected solution using the following steps. You pick remote up. Now, you turn TV on. See this – you have to change channels till a program is good. Voila, you now watch TV. But what if TV is not working, it won't work or can't find remote to evaluate the solution.

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TECHNICAL SOLUTIONS: MULTIPLE VIEWS

As shown in Figure 2, a possible technical solution is to present the video of the lecture along with a separate window where students can type in words they do not understand and read this definition as the teacher is discussing it. This would allow the ESL students to read the definitions while being able to keep within their vision the teacher's actions so that they do not miss important gestures or demonstrations as they are reading the definitions.

FIGURE 2.
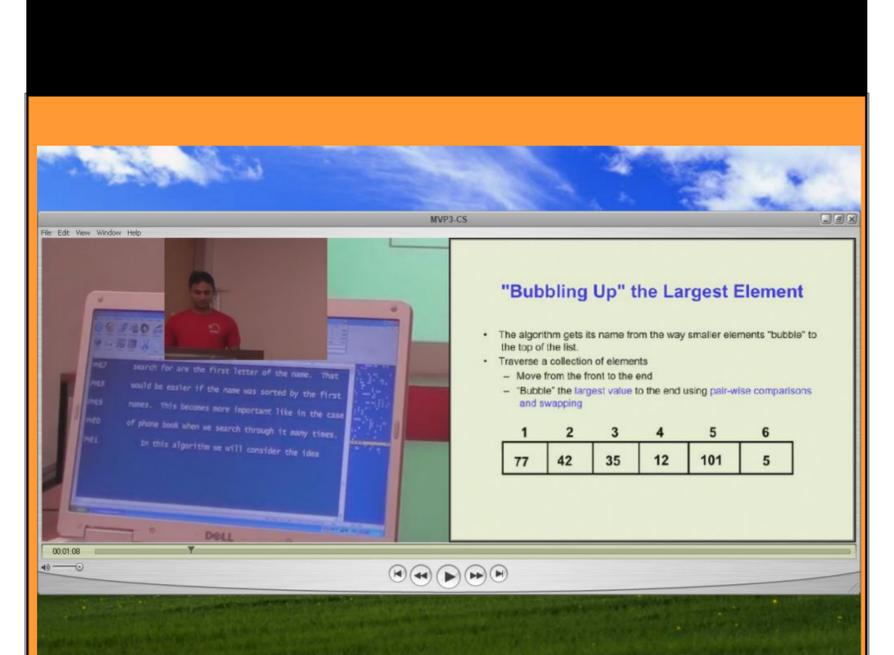
Example
Figure 2 shows an actual multiple video view of the classroom on the students' laptop. For example, if the ESL student does not understand the colloquial expression "bubbling up", then the student can quickly google "bubbling up" and review the definition on their screen. The advantage of multiple views is that the student does not lose sight of the teacher's gestures and of the screen, while retrieving and reading the definitions they do not understand.

CONCLUSIONS

- Extended learning
- One solution is to have faculty members spend more time on explaining each concept explicitly rather than implicitly. Although this may take more time, the payoff is that this will benefit more students, both ESL and native speakers.
- Foundations and the provision of solid foundations are essential.
- Could take online courses with signing faculty in CS/IT to have extra time to review vocabulary and other missed information.
- No 'one' way to teach. The key is to be flexible and acknowledge that some methodologies do not benefit ESL learners. These methodologies also probably don't benefit some native English learners!
- Good Methodology to use Problem Solving with Six Steps.