Case Studies
Instructional Technology used to support mastery learning

Context:
Performance criteria within instruction should be aligned with the severity of the consequences for not meeting the performance criteria in authentic practice situations. For example, pilots should be able to land the plane successfully 100% of the time. In contrast, fifth grade math students should be able to complete long division problems with 80% accuracy. Undergraduate students studying exercise science need to be proficient at reading and interpreting reports generated by electro-cardiograph (EKG) equipment. In their professional practice as health and fitness instructors, strength and conditioning trainers, and personal trainers, they will encounter situations where the ability to identify abnormal heart rhythms is critical to saving the life of their client.

The Problem:
The goal for students in the three credit undergraduate (senior level) Exercise Testing course was to learn the basic knowledge of exercise testing and interpretation. Specifically the principles of EKG function and interpretation and an understanding of what information exercise testing can and cannot yield, and what tests would be appropriate for specific populations (elderly, athletes, diseased etc.). The current instructional methods were resulting in a normal distribution of scores on a standardized exam when the result should have been a positive skew indicative of mastery by a majority of the students.

The Study:
The course instructor presented the problem situation to the first author who shared the problem with a team of five students enrolled in a Masters level course on instructional design. The goal for the Masters course was to prepare students through authentic learning experiences to be successful practitioners of the instructional design process. The team of students (mentored by the first author) met with the course instructor to better understand the nature of the instructional challenges. This generated three aspects of the learning problem that could be addressed by instruction.

1. Obtained mobile EKG equipment and Logger Pro hardware for classroom use. Students were trained on procedures to connect EKG patches and display the heart rhythms of fellow students. Instructions on proper set up were developed.
2. Revised the Power Point presentations used by the instructor to improve consistency, read-ability and to incorporate screen captures of EKG readouts. Student handouts for taking notes were aligned with PPT slides.
3. Created an interactive and diagnostic quiz to test knowledge of EKG displays. Combined the interactive capabilities of Macromedia Flash with a database of dynamic (moving) EKG images to display the images and selection options for the student.
To elaborate on the drill and practice component, the students on the ID team designed it using both learning theory and a gaming perspective. The 16 motion videos (AVI movies) were selected at random and displayed with four choices (also randomly selected). The choices contained one consistent option – “None are correct” – which appeared 25% of the time. Mastery involves knowing both what something is and what it is not.

Research to date:
Instructional materials were finalized in Fall 2005. Student test scores on the standardized exam were kept as baseline data. Revised instructional approach was implemented in Spring 2006 semester. Table 1 below shows the different scores on the standardized exam (Fall 05 N=22; Spring 07 N=20).

<table>
<thead>
<tr>
<th>Grades</th>
<th>Fall 05</th>
<th>Spring 06</th>
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<tbody>
<tr>
<td>A (90-99%)</td>
<td>16%</td>
<td>18%</td>
</tr>
<tr>
<td>B (80-89%)</td>
<td>46%</td>
<td>62%</td>
</tr>
<tr>
<td>C (70-79%)</td>
<td>36%</td>
<td>18%</td>
</tr>
<tr>
<td>D (0-69%)</td>
<td>2%</td>
<td>2%</td>
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The shift in demonstrated increased competence was greatest in the students who moved from a grade of C to a grade of B – while having only a minor positive effect on the A students. This pilot test of the new materials produced a significant gain for those students who (apparently) benefited from additional opportunities to review material and practice skills. The repetition of examples, the interactive design of the practice environment and the availability of remediation or distraction in combination appear to have produced learning gains.

The same instructor taught two sections of the Exercise Testing course in Fall 2006. One class received the old instructional materials and one class received the revised instructional materials. Results are currently being analyzed and will be reported at the conference.

References

An overview of mastery learning is available at:
http://tip.psychology.org/mastery.html