

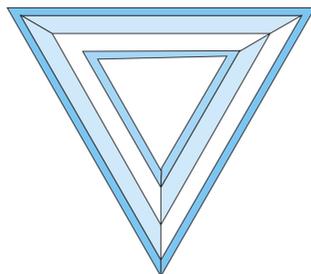
Using Outcomes-Based Assessment Data to Improve Assessment and Instruction: A Case Study

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A Model of Cognition

Instruction
How you get there.



Assessment
How you will know if you got there.

Outcomes
Where you are going.

| Objective # | Objective | Importance | Number of Questions | Points per Question | Points per Objective |
|---------------|---|------------|---------------------|---------------------|----------------------|
| 1 | Identify historical events in computer security | 3 | 3 | 1 | 3 |
| 2 | Describe the various types of threats that exist for computers and networks, and costs associated to those threats. | 5 | 5 | 1 | 5 |
| 3 | Identify different avenues of attack | 6 | 3 | 2 | 6 |
| 4 | Describe how a layered defense relates to both physical and computer security | 4 | 4 | 1 | 4 |
| 5 | Describe and define CIA and basic security concepts. | 24 | 13 | 1,846 | 24 |
| 6 | Describe the basic models of security. | 3 | 3 | 1 | 3 |
| 7 | Identify authentication protocols and their uses. | 9 | 9 | 1 | 9 |
| 8 | Identify Good / Poor security practices | 8 | 4 | 2 | 8 |
| 9 | Describe why physical security education is important. | 4 | 4 | 1 | 4 |
| 10 | Identify the different algorithms & terminology of cryptography | 5 | 5 | 1 | 5 |
| 11 | Identify the key components of PKI | 8 | 8 | 1 | 8 |
| 12 | Describe encryption standards and protocols | 6 | 6 | 1 | 6 |
| 13 | Identify Network protocols, topologies, architectures and administration. | 15 | 15 | 1 | 15 |
| Totals | | 100 | 82 | | 100 |

Matching Exam Questions to Objectives

To increase the validity of the exam, questions were developed based on the outcomes of the course. The table shows all of the outcomes for the first half of the introductory Information Assurance course. Column three shows the relative importance of each outcome. The sum of the outcomes is obviously 100% as the outcomes are the totality of what you want students to achieve.

| Student | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | |
|---------------------------|---|-----|-----|-----|-----|-----|-----|-----|---|----|-----|-----|-----|------|------|-----|
| 1 | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | X | X | |
| 4 | | | | | | | X | | | | | | | | | |
| 5 | | | | | | X | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | X | | |
| 7 | | | | | | | | | | | | X | | | | |
| 8 | | | | | | X | | | | | X | X | X | | | |
| 9 | | | | | | | | | | | | | | X | | |
| 10 | | | | | | | X | | | | | | | | | |
| 11 | | X | | | | | X | | | | | | | | | |
| 12 | | | | | | X | X | | | | | | | | | |
| 13 | | | | X | | X | X | | | | | | | X | | |
| 14 | | X | | | X | X | X | | | | | | X | | | |
| 15 | | | X | X | X | X | X | | | | | X | | X | | |
| 16 | | | X | X | X | X | X | | | | | X | X | X | | |
| 17 | | | | | | X | X | X | | | | | X | | | |
| 18 | | | | | | | X | | | | X | | X | | | |
| 19 | | | | | | X | X | | | | | | | | | |
| 20 | | | | | | X | X | | | | | X | | | | |
| Item Difficulty Index (p) | 1 | .9 | .9 | .85 | .85 | .8 | .35 | .95 | 1 | 1 | 1 | .95 | .8 | .75 | .7 | .95 |
| p (upper) | 1 | 0.8 | 0.8 | 0.7 | 0.7 | 0.6 | 0.1 | 0.9 | 1 | 1 | 0.9 | 0.7 | 0.7 | 0.8 | 1 | |
| Item Discrimination Index | 0 | 0.2 | 0.2 | 0.3 | 0.3 | 0.4 | 0.5 | 0.1 | 0 | 0 | 0.1 | 0.2 | 0.1 | -0.2 | -0.1 | |

Calculating an Item Difficulty and Item Discrimination Indices

Two tools that are used for determining the validity of criterion-referenced assessment are the item difficulty index and the item discrimination index. The purpose of both item difficulty and item discrimination analysis is to improve examinations by identifying ineffective test items and then rewriting them or deleting them. The item difficulty index is calculated by dividing the number of students who answered the question correctly by the total number of students. The item discrimination index can be used to see if the question is answered correctly more times by the students who scored above the median and was missed more frequently by those students who did worse than the median.

RESULTS:

It was decided that four questions will be removed from next semester's exam because of high difficulty indices. Another four questions with negative discrimination indices less than -.2 will be modified and/or revised with more instructional time dedicated to those topics. By this continuous process of post exam analysis, more was learned about the course, instruction, and the actual examination itself than was ever learned from student evaluations. Evaluations helped gain student perspectives of the overall course, while post-exam analysis has provided specific feedback for improving 1) the examination itself, as well as 2) instruction. Treasures of information were hidden in an unexpected location. Specific feedback on objectives, validity problems with questions, and the time required for students to master topics were gleaned from this analysis.