Delineating the Learning Objectives for "Laser Challenges" in Nathan Balasubramanian's MESA Class

THE KNOWLEDGE DIMENSION	THE COGNITIVE PROCESS DIMENSION					
	1. REMEMBER	2. UNDERSTAND	3. APPLY	4. ANALYZE	5. EVALUATE	6. CREATE
A. FACTUAL KNOWLEDGE Terminology Specific details and elements	– Students will recall the expansion of LASER – Students will recognize the importance of isolation tables for optics experiments – Students will recognize the importance of laser safety	– Students will illustrate the laws of reflection using labeled ray diagrams – Students will illustrate the size of micron by comparing it with the thickness of human hair		– Students will find the similarities between bike reflectors, road signs, cat's eyes, small boat radar cross-sections, and lunar retro-reflectors		– Students will generate a list of jobs available for students' personal career choices using Monster's website
B. PROCEDURAL KNOWLEDGE Subject-specific skills and algorithms Subject-specific techniques and methods		– Students will classify different surfaces as good and bad reflectors	– Students will measure angles accurately using a protractor	– Students will organize their graphs to discern a relationship between incident and reflected angles		– Students will design their set up for hitting the target with three mirrors and a laser
C. CONCEPTUAL KNOWLEDGE Classifications and categories Principles and generalizations Theories, models, and structures Specific details and elements		– Students will compare and contrast the reflection of light from a laser with a bouncing ball – Students will paraphrase what they learned from the " Measuring Reflections" Lab – Students will predict the path of reflected ray from different surfaces, given an incident ray	– Students will use a protractor to verify the laws of reflection	– Students will distinguish between specular and diffuse reflection	– Student will test their set up for hitting the target with three mirrors and a laser – Student will test their set up of a retro-reflector for hitting the LASER with three mirrors	– Students will generate appropriate designs for reflecting light in all directions using only 3 mirrors – Students will construct a retro-reflector for their " Hit the LASER" competition
D. META-COGNITIVE KNOWLEDGE Strategic knowledge Cognitive tasks, including appropriate contextual and conditional knowledge Self-knowledge		– Students will explain their set up, challenges, and costs incurred for their "Hit the Target" competition – Students will summarize their learning experience with "Laser Challenges"	– Students will use geometry to arrange 3 mirrors to reflect a laser beam 180* and parallel to incident laser beam	– Students will deconstruct the *Benchmarks* from "failure, lines or reasoning, and interacting parts" using examples from their own experimentation	– Students will judge their own and their peers work based on five criteria: design, creativity, explanation, cost efficiency, and test-endurance	

Adapted from Anderson, L. W., & Krathwohl, D. R. (Eds.). (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives* . New York: Longman.