**MEDIA-1 ONLINE MEDIA SPECIFICATION SHEET: EXAMPLE**

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| **DOMAIN:** Materials and Manufacturing Technology (MMT) |
| **MODULE TITLE:** Materials and Materials Process (E&T Ch.3) |
| **MEDIA FORMAT:** Simulation |
| **BRIEF SCENARIO:** Tensile testing is often a confusing area of materials testing since students confuse physical and conceptual aspects. Giving students the opportunity to simulate the testing of a range of materials might improve that situation. |
| **DETAILED DESCRIPTION OF THE ANIMATION/SIMULATION/ASSESSMENT:**  I think there are a number of materials science concepts that can engage and interest students while providing a solid pedagogical foundation to explore mechanical properties and other related materials science ideas. Mechanical properties testing is fun and visually exciting because thing are broken and/or explode while putting various materials under different forces such as tension, compression, shear, etc. page 152. My suggestion would be to create short YouTube style vignettes for each mechanical testing mode which include animation and video segments. Students may get confused with the terms used for testing since they already have a specific physical and conceptual meaning for them such as elastic region and elastic limit (yield point). Tensile testing is one of the most important mechanical properties tests to characterize the performance of a material. The tensile stress stain curve needs to be broken down into segments so students can understand it for various material categories such as ceramics, metals, plastics and elastomers. It is sometimes difficult for students to understand that all materials even ceramics have “elastic” properties but is difficult to visualize since the elastic limit is so small. It is also important to point out to students that the elastic limit is usually the “working limit” of a material since beyond the yield point materials do not recover and undergo permanent deformation. A simulation could also be developed similar to the one discussed above to review the specific concepts with regard to tensile strength. A tensile test video could be run for each category of material highlighting their respective elastic limits and discussing its application to various products. Again the same format can be used as above and there are many examples of tensile product/structure failure out there. The simulation should allow exploration of a wide range of materials, including those that are not considered elastic (such as ceramics). The simulation should show the characteristics of the materials being tested for the full range of the elastic behavior through to the yield point (or conversely, the fact that the yield and breaking point are the same for non-elastic materials). The student should be able to control the force (and see the units of force/area displayed) and at the same time see the extension as a measurement and see a stress strain graph.The simulation should show the elastic limit very clearly (often the safe working limit of a material – beyond which some deformation) and either invite the student to determine the elastic point, or have some kind of response that flags the elastic point.One forgotten and critical property that can be determined by a tensile strength test is energy to break which is the total area under the stress strain curve. This could be an engaging exercise to introduce calculus concepts such as integration. The area (energy to break) under the stress strain curve can be determined mechanically by simply weighing a square of the graph paper which represents some unit of energy then cutting out the entire stress strain curve and determine its weight. A simple proportion can then be set-up to calculate the energy to break. The only tool that is needed is an analytical scale and stress strain graphs of various materials. There are numerous testing facilities out there. One exotic example is the Cold Regions Research Laboratory in Hanover, New Hampshire. They actually do physical properties testing on ice in a refrigerated laboratory. In addition, these concepts can be tied to the sports dynamics show that demonstrates the stress and strains of various sports on equipment and players.  |
| **LEARNER BEHAVIOR:** The learner will interact with the simulation in such a way that they control the force applied to the testing system. Some of the terms used might be clickable for a definition to aid student comprehension. |
| **ASSESSMENT EVIDENCE GATHERING METHOD(S) AND QUESTIONS:** The student should have to answer some questions to help the teacher judge the student understanding of the concepts. Perhaps a few carefully chosen multiple choice questions and a matching item of two would help determine student familiarity, plus an essay type lab report describing the activity undertaken. |