Bryn Bishop
Endeavor PSIM Fall 2018
Elective 9: Exploring Physics Education Research

Using Lawson's Classroom Test of Scientific Reasoning Ability

Lawson's Classroom Test of Scientific Reasoning Ability (CTSR) is a multiple choice assessment developed by Anton Lawson in order to assess a learner's current reasoning ability and developmental levels (Lawson, 1978). It is a short, multiple choice assessment. Coletta et al. (2007) used Lawson's CTSR, along with the Force Concept Inventory (FCI) to look at the relationship between a student's pre-score and post-score on the FCI and the student's reasoning abilities.

I know that my student population can be at different developmental stages from year to year. Some years, I have an extremely bright and focused group of students while some years both that focus is lacking. I also know that in the coming years, the demographics of my area are changing. With the knowledge of many low-income housing being developed in the area, I need to be reflexive with my student expectations and teaching strategies.

Coletta et al (2007) recommends using Lawson's CTSR in order to see which students could be at the greatest risk in an introductory physics class. Having this information early can help an instructor plan remediation and support for individual students who scored poorly.

Using the FCI as a pre/post assessment and measuring gains from year to year can help an instructor determine areas of needed growth and can help an instructor set instructional goals. For example, students might not be making the gains in Newton's Third Law so the instructor might plan more activities each year to help drive that understanding. Coletta et al (2007) suggests that if using the FCI in this way, instructors need to take into consideration a student's reasoning ability. They found a correlation between Lawson's CTSR and the normalized learning gains from the FCI for both college level and high school level students.

Many instructors give diagnostic exams in the first week of instruction. I have been giving diagnostics for my physics classes such as the FCI or basic math assessments that my physics team has been giving. The problem with basic math assessments is that it can just discourage students who struggle with math. As traditional high school physics courses are transforming into NGSS's Three Course Model "Physics of the Universe" courses, having higher levels of mathematical ability will likely be less important than a student's reasoning ability.

I plan on using Lawson's CTSR as a diagnostic in the beginning of each term, as a pre-test only, along with the FCI which will be used as a pre/post test each term, in order to track yearly changes in shifting demographics and track changes in educational shifts with the implementation of NGSS. Using Lawson's CTSR to help interpret my FCI pre/post scores and learning gains will help me plan my course from year to year. As student's reasoning abilities

shift, I must be able to shift my instruction strategies to support students. This might include activities to improve reasoning abilities and possibly spatial development.

I teach on semesters so I will begin implementing Lawson's CTSR in January when my *almost*-NGSS aligned Physics of the Universe begins, but I will immediately talk to my collaborating physics teachers about this assessment so that we can plan to use this information together. Coletta and Phillips are also members of the Southern California AAPT and are often at the biannual meetings. I know that I can get ahold of either of them for discussing results for my classes and help with remediation efforts for students.

Citations

Coletta, V, Phillips, J, & Steinert, J. 2007, 'Interpreting Force Concept Inventory Scores: Normalized Gain and SAT Scores', *Physical Review Special Topics - Physics Education Research*, 3, 1, pp. 010106-1--010106-5. DOI: 10.1103/PhysRevSTPER.3.010106

Coletta, V, Phillips, J, & Steinert, J. 2007, Why You Should Measure Your Students' Reasoning Ability, *The Physics Teacher*, 45, pp.235-238. https://doi.org/10.1119/1.2715422

Lawson, A.E. 1978, 'The development and validation of a classroom test of formal reasoning,' *J. Res. Sci. Teach.* 15, 11–24