

A Multi-Institution Study on the Effectiveness of ClassAction to Promote Student Understanding in Astro 101

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Think-Pair-Share (TPS)

- Well-known, research-validated, active-learning technique
- Pose conceptually rich multiple-choice question, typically post-instruction
- Students vote individually
 - colored flashcards, personal response systems, or simply hands
- Results dictate plan of action
 - move on
 - students discuss with peers ("find someone that voted differently and convince him/her that you are correct")
 - remedial instruction
- Both students and instructors benefit from real-time feedback

ClassAction

- Suite of 22 freely available computer modules
 - <http://astro.unl.edu> (run online or download & run locally)
 - runs in web browser with Adobe Flash plug-in
 - designed specifically for introductory astronomy
 - some concepts in physics, chemistry, and earth science
 - 400+ multiple-choice and discussion questions
 - 60+ interactive simulations and animations
 - dozens of topic outlines and images
- Questions vary in form and function
 - interpretation of images, diagrams, animations
 - interpolate, extrapolate, estimate, identify functional dependencies, mathematical/geometric reasoning involving graphs, charts, equations
 - schematic and Venn diagrams, tables, flowcharts, concept maps
- Specially designed to maximize effectiveness of TPS and voting
 - ability to recast many questions into alternate permutations
 - provide feedback and/or remediate using accompanying interactive resources

Light and Spectroscopy Concept Inventory (LSCI)

- Assessment instrument covering the EM spectrum, Doppler shift, Wien's law, Stefan-Boltzmann law, and Kirchhoff's laws
 - multiple-choice
 - research-validated
- ClassAction's "Light & Spectra" module overlaps significantly with LSCI

A Multi-Institutional Study

- Measure efficacy of ClassAction "Light & Spectra" module in Astro 101
- 6 institutions; 9 classes; 240+ students; local IRB-approved
- Methodology
 - 2-day workshop for instructors to learn and practice implementation of ClassAction materials – all instructors were first-time users
 - undergraduate assistants recorded ClassAction usage in class
 - taught light and spectra portions of introductory astronomy courses exclusively with ClassAction materials
 - LSCI administered as both pre- and post-test
- Results
 - pre-test scores, spread in normalized gain, and average gain (27.9%) parallel work by Prather *et al.* (Am. J. Phys., Vol. 77, No. 4, April 2009)
- Conclusions
 - gain is correlated with number of questions used
 - gain spread indicates proper implementation is a key factor
 - ClassAction is research-validated

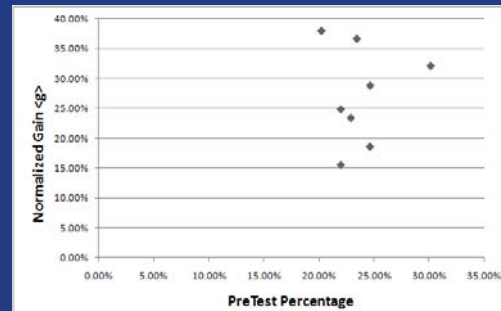


Figure 1. Normalized gain <g> vs. pre-test percentage

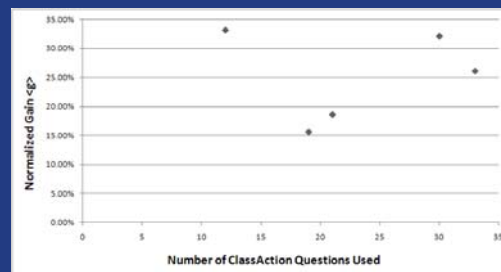


Figure 2. Normalized gain <g> vs. number of questions used

Improving ClassAction

- Instructors requested additional questions on EM bands and properties of light
 - the following questions have been added

- Two LSCI questions had gains near zero; ClassAction did not cover these topics
 - the following questions have been added

- Active development continues
 - filling in sparse topic areas
 - refining questions
 - better linkages between questions and feedback mechanisms

- Future initiatives
 - editor that allows instructors to create their own modules from subsets of existing ClassAction materials
 - capability to incorporate your own questions into existing modules

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