

Student perspectives on learning physics and their relationship with learning force and motion concepts: A study using Q methodology

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Intro: Considerable research and curriculum development has focused on students' learning of force and motion concepts yet research shows that many students fail to gain Newtonian-based understanding of force and motion concepts. Researchers have demonstrated the connection between learning in physics and students' personal epistemologies. Yet this research has typically used time intensive qualitative methods or Likert scale surveys which can result in loss of meaning. Thus this study used Q methodology, a sophisticated technique for determining the various perspectives on a topic by correlating people with similar views. Four distinct perspectives about learning physics concepts in a first semester physics classroom were revealed with Q. One of these four perspectives was positively correlated with the posttest scores on the Force and Motion Conceptual Evaluation (FMCE) while the remaining perspectives were negatively correlated with the FMCE posttest scores. Implications of these results will be presented.

How Q-Methodology Works:

Statements are developed / selected
 Each statement is on a separate piece of paper
 Participants sort the statements into 3 piles
 Most like my view, Least like my view, Neutral

Statements are sorted into a grid
 Analyses include correlation & factor analysis

Products of analyses allow the researcher to determine sorters views by creating a representative sort for that view, determines distinguishing statements & consensus.

Assessment:

- 1) Students sorted 30 Q statements about learning physics in class & lab; used to determine different student views
- 2) FMCE Post-test scores
- 3) Correlation of Views & FMCE scores

4 Views about learning:

1. **View 1 - 7 students: Reflective, help seeking, and enjoyed math / problem solving; sought a coherent view of force and motion. Only positive correlation (0.46) with the Force and Motion Conceptual Evaluation (FMCE) posttest scores.**
 2. **View 2 - 3 students: Struggling to learn physics which they are uninterested in. Non-reflective about learning (negative correlation = -0.39)**
 3. **View 3 - 3 students: Enjoys math, sees relevance of lab, learning must be immediate or not at all, does not see force & motion concepts as coherent (negative correlation = -0.20)**
 4. **View 4 - 1 student: asks questions, reflects on prediction mismatch w/ results, doesn't enjoy solving problems, F & M not coherent (negative correlation = -0.11)**
- Consensus - students ask peers for help in lab but don't combine ideas across labs.**

Conclusions

- 1) Views determined by Q give rich descriptions of students views.
- 2) Q enabled the researcher to examine each distinct student perspective.
- 3) Q allowed the researcher to investigate consensus among the students.
- 4) Only 1 view had a positive correlation with the FMCE post. The distinguishing statements indicate that realizing the coherence of the concepts of force and motion is important in understanding these concepts.
- 5) Students with the most Newtonian views were seeking coherence in force & motion concepts.
- 6) May need to change activities to help students combine ideas across labs & focus on coherence of force and motion concepts in order to improve student learning!
- 7) Q allows the researcher to examine student views differently from other methods such as lengthy interviews or Likert type surveys like the VASS & CLASS.