

Mapping Force Fields: Conceptualizing Electrostatics

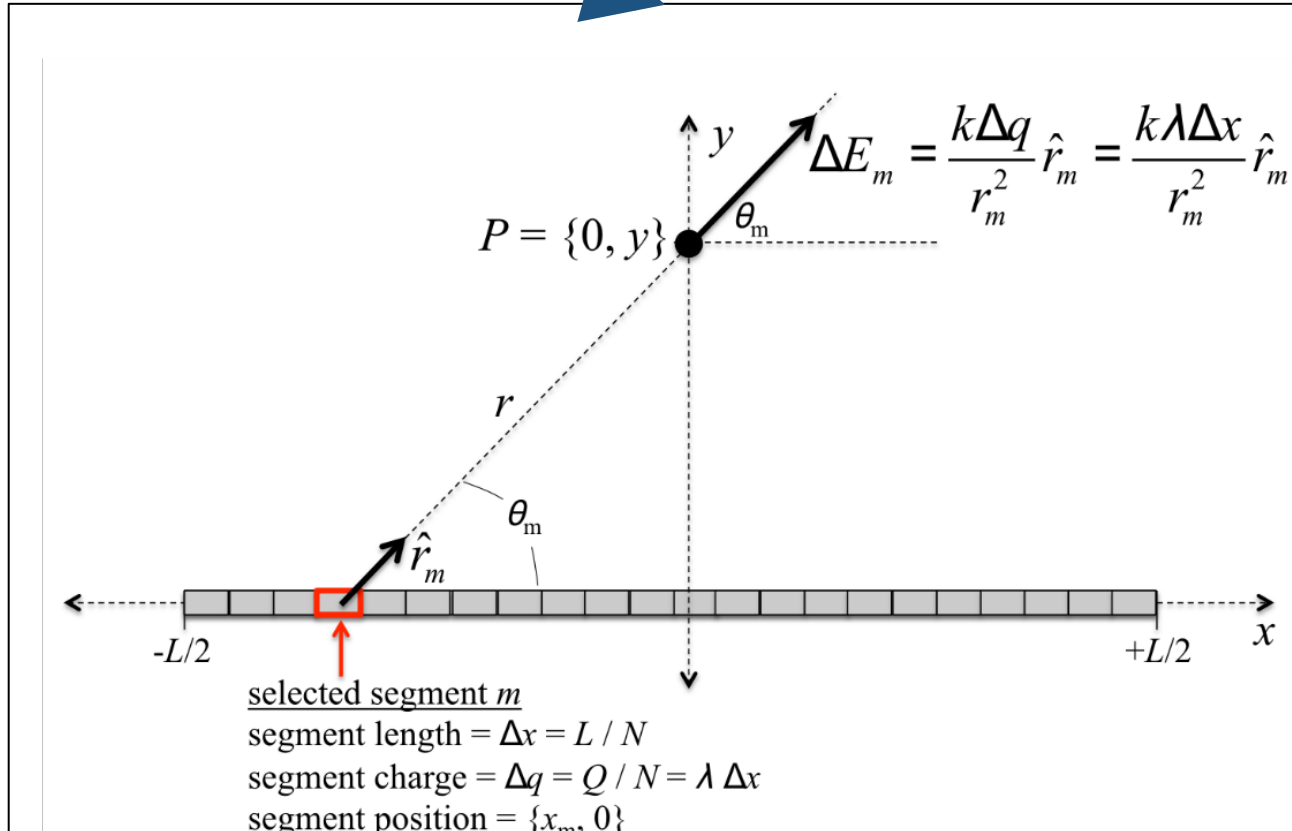
W. Tyler McCleery^{†,‡}, Erin C. Rericha[‡], Cynthia J. Brame[†], M. Shane Hutson[‡]
[†]Center for Teaching, Vanderbilt University, Nashville, TN 37203
[‡]Department of Physics and Astronomy, Vanderbilt University, Nashville, TN 37240



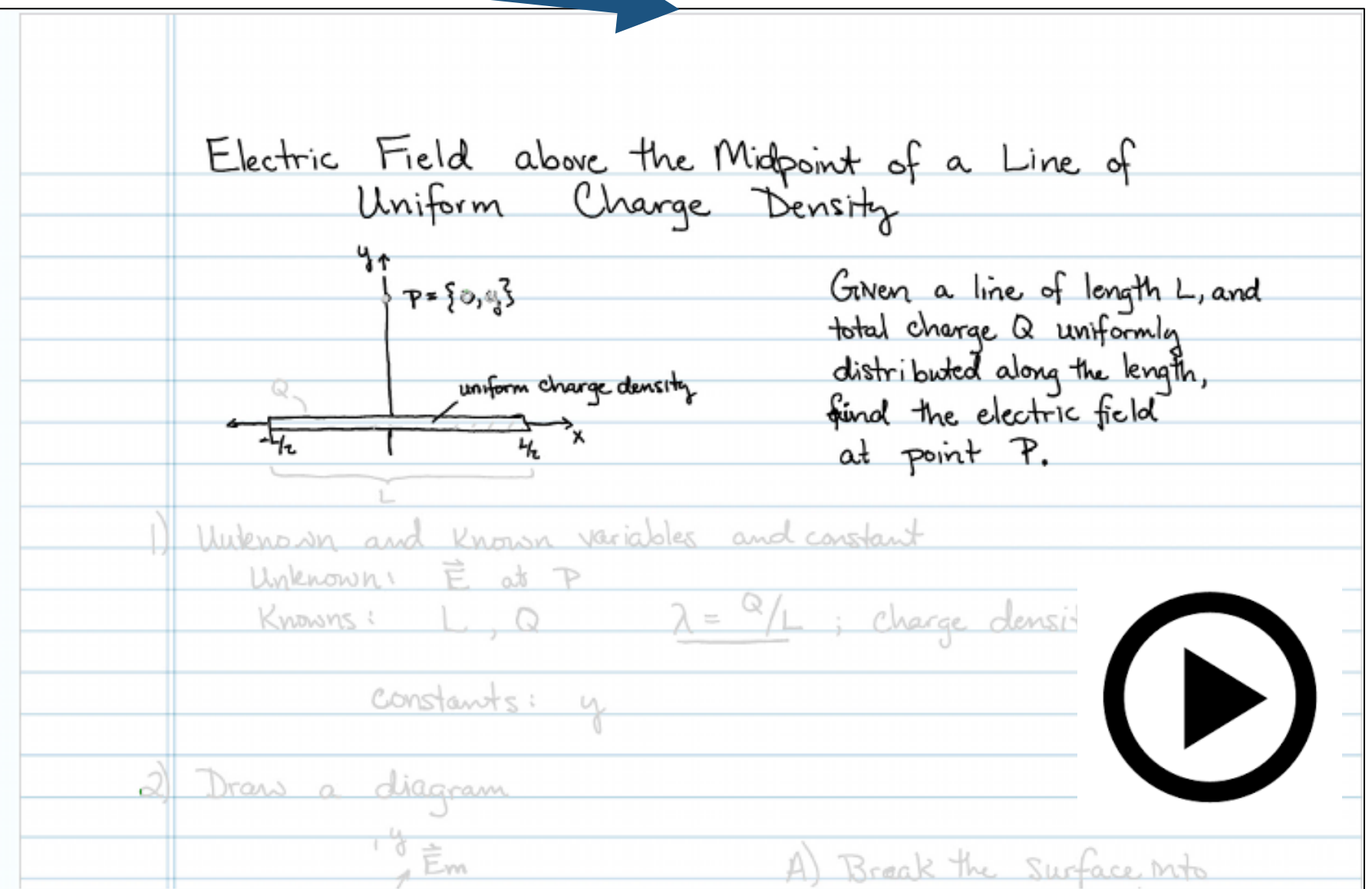
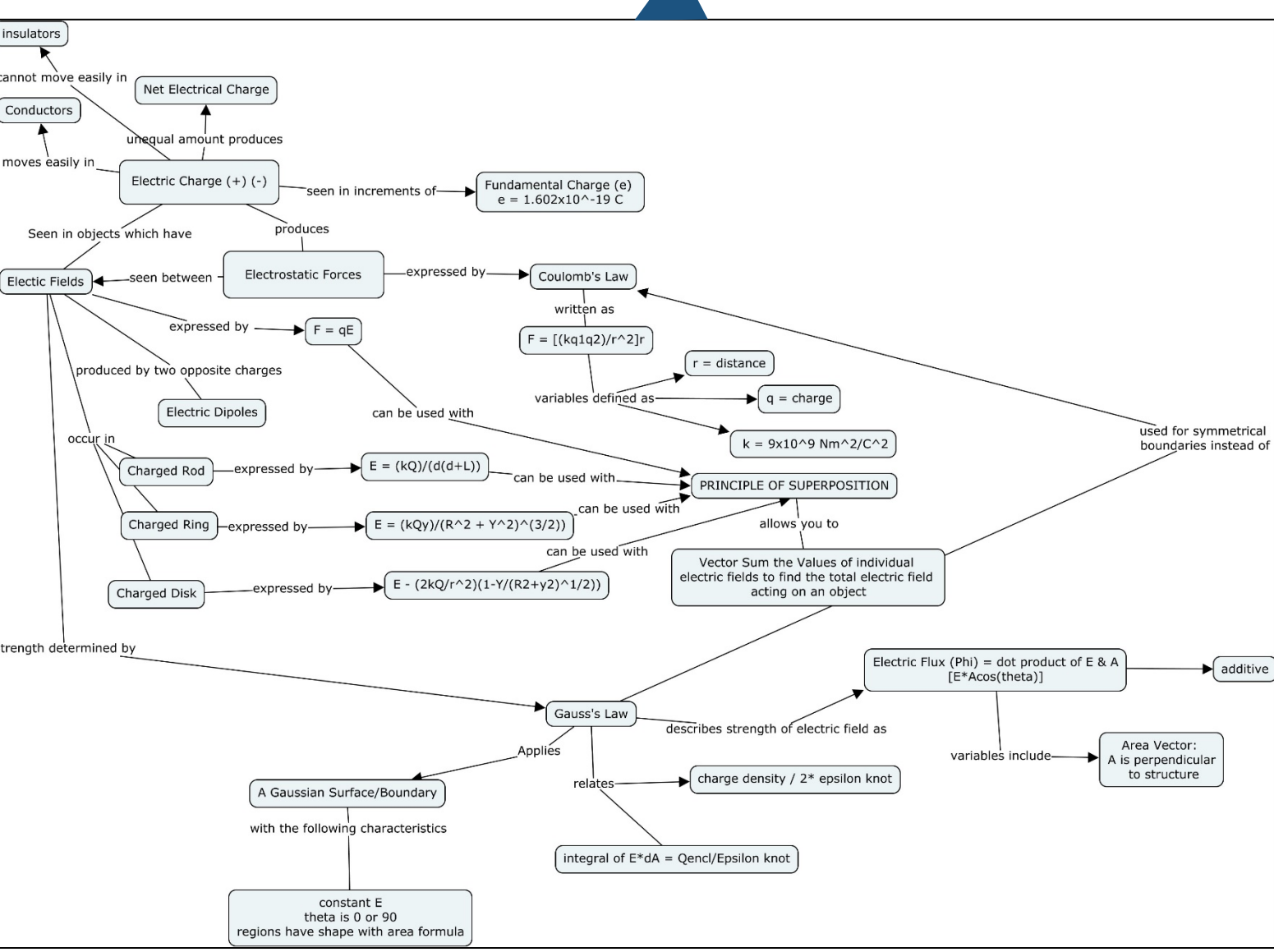
Graduate Research Fellow
&
Grant No. DUE-1231286

PHYS 113B: Introductory Physics for the Life Sciences

Students struggle to build structured knowledge from textbook reading, as well as setting up integrals to calculate fields and forces in electrostatics.

$$\vec{E} = \frac{kQ}{r^2} \hat{r}$$


Students created and revised concept maps^{1,2} representing their understanding of the relationships among concepts. A video tutorial was also provided to enhance instruction on calculating electric fields.

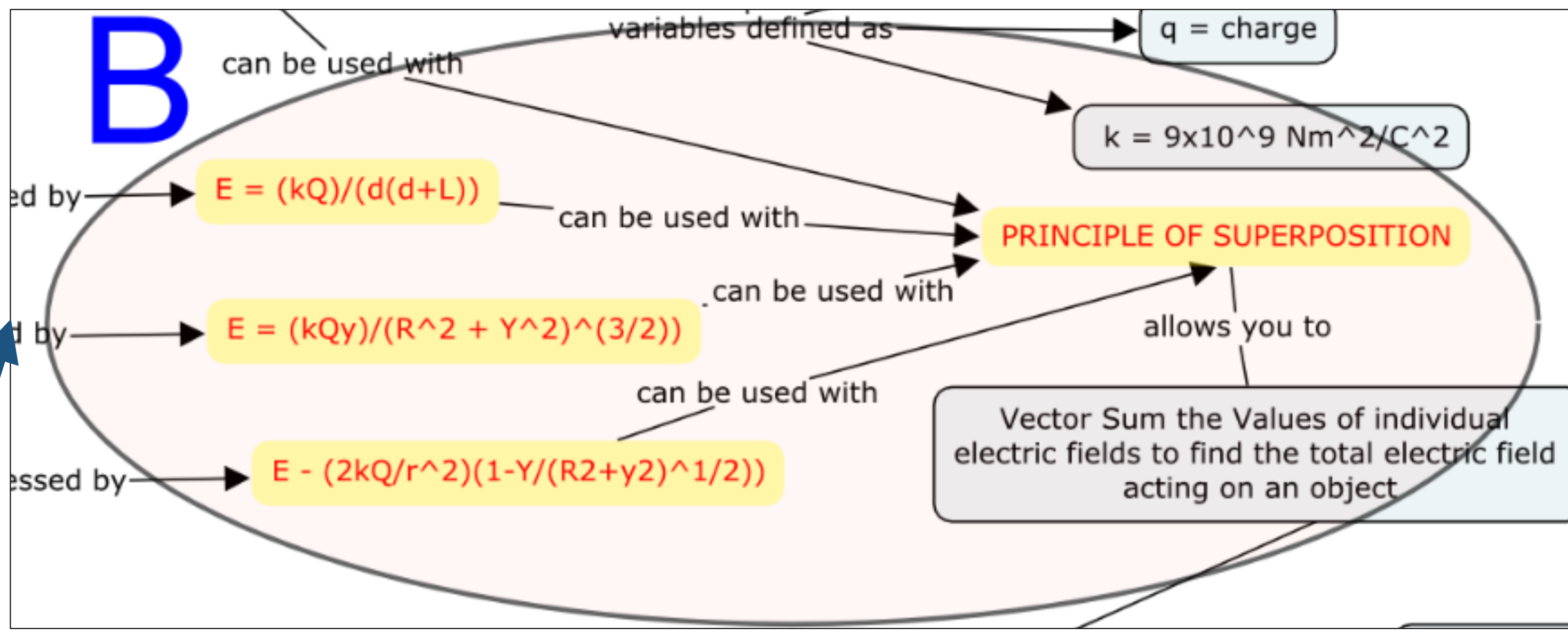
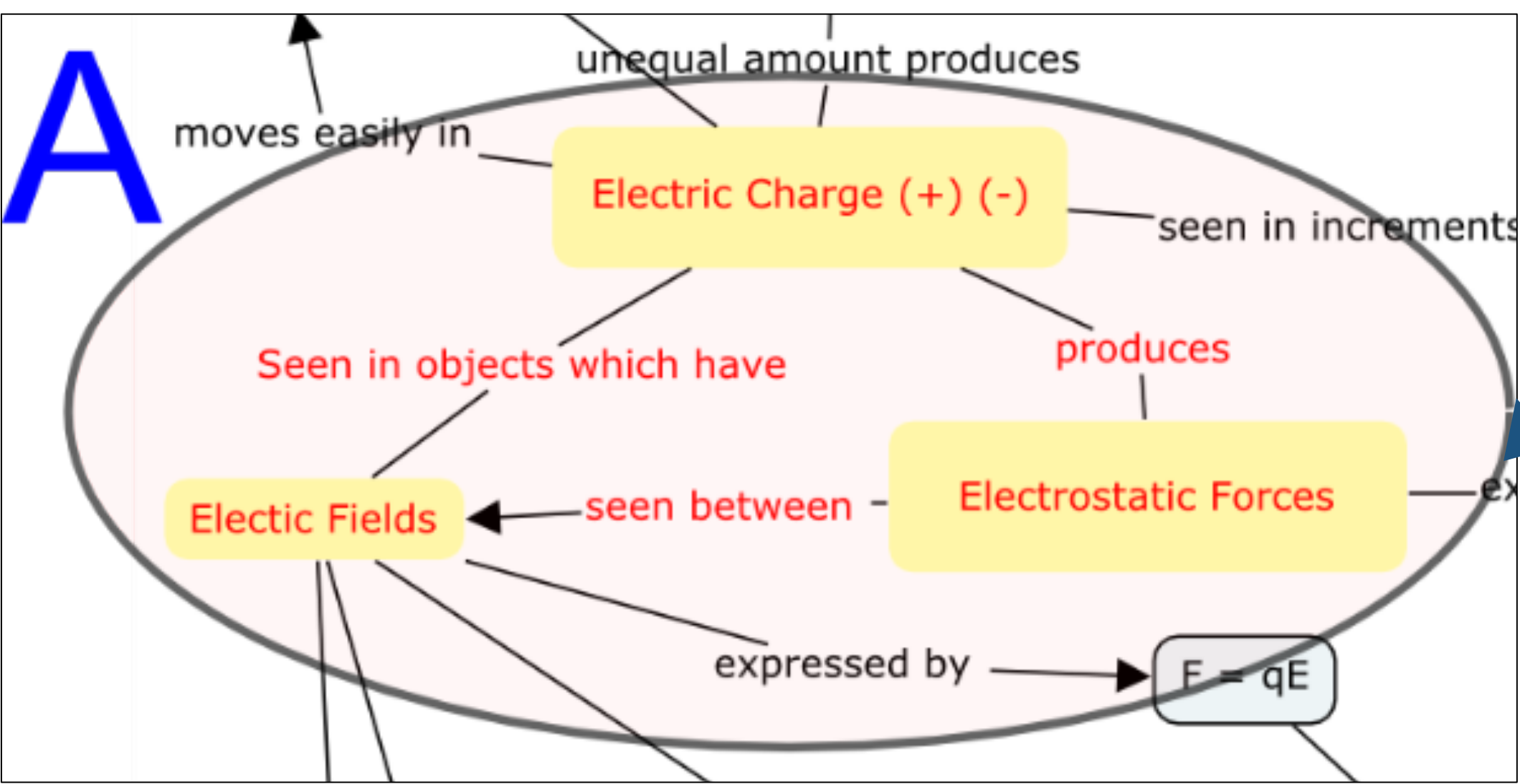


Concept maps³, in-class clicker questions, homework assignments, exam questions, and pre-/post-module Concept Survey of E&M.

Class
Problem

Approach

Assessment Data



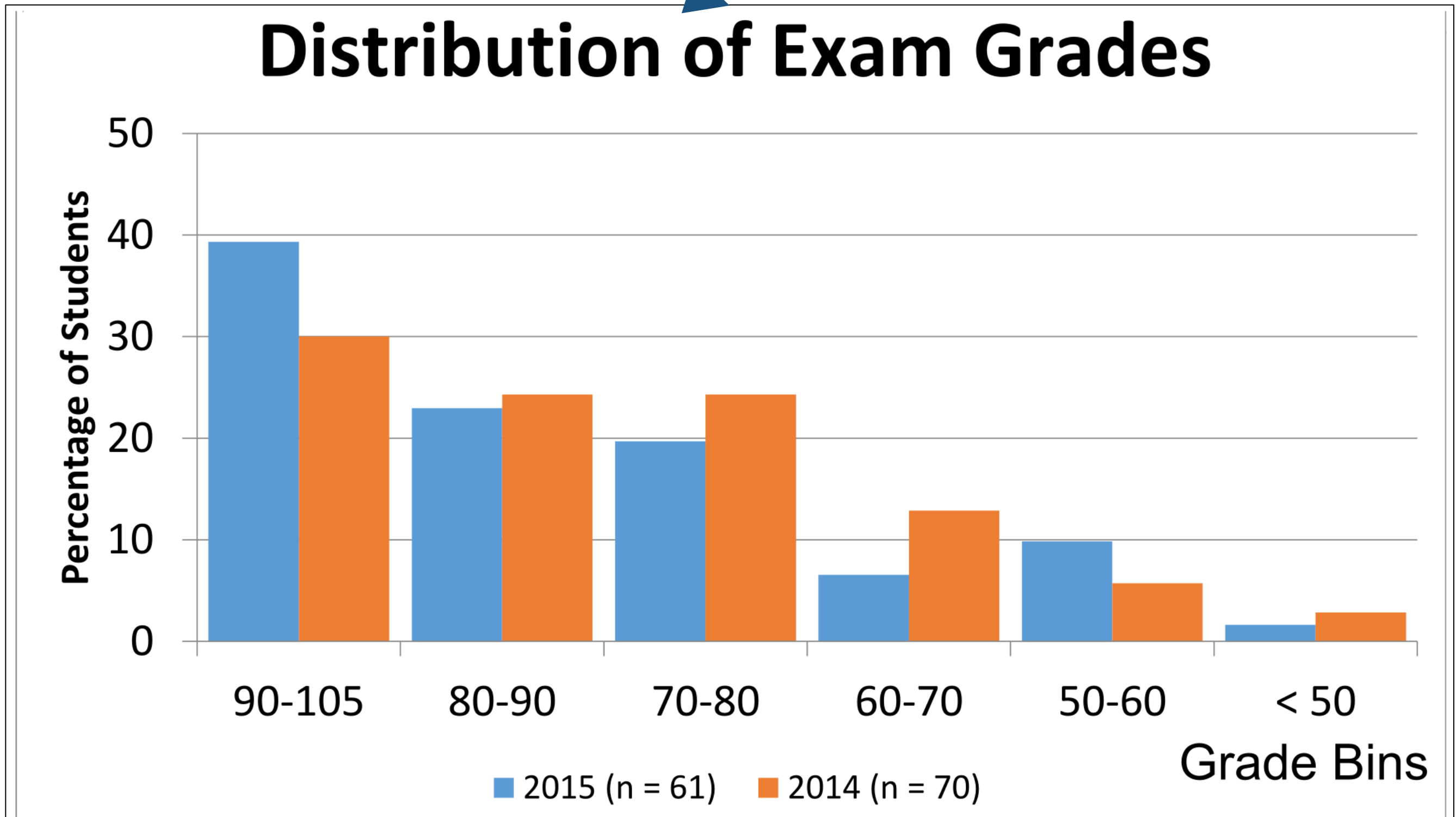
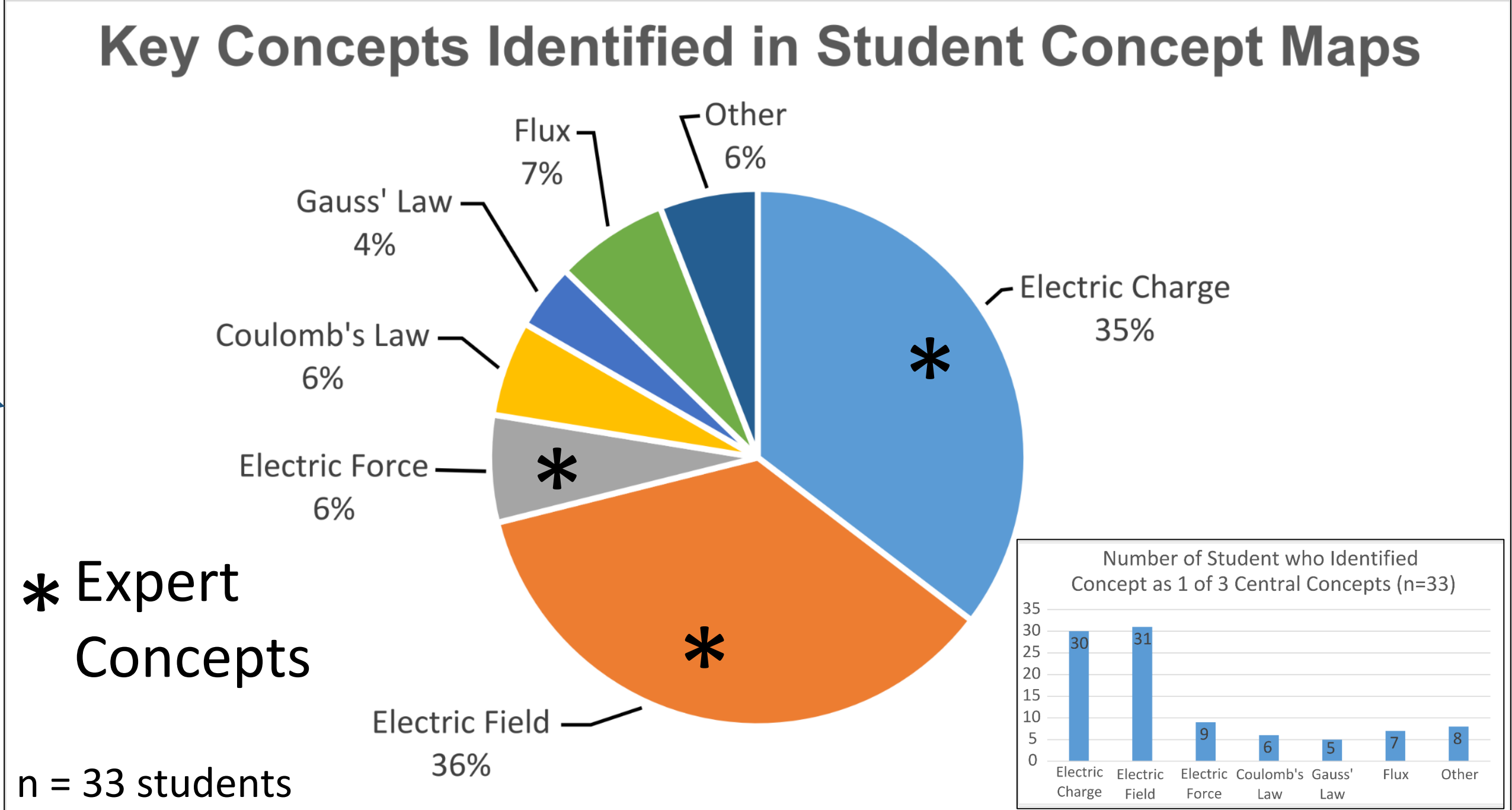
Concept Map Features that Corresponded with Strong Performance:

- Circular Connection of Three Key Concepts: Charge, Force, and Field (Fig. A)
- Direct Connection of Superposition to Electric Field Equations (Fig. B)

Results: Trends in Conceptual Learning

Conclusions

Effectiveness



1. Module was effective in positively shifting distribution of student performance. It should be continued.
2. Students identified 2 out of 3 expert concepts. Instructor should emphasize "Electric Force."
3. Strong performance correlated with specific concept links. Instructor should focus on these conceptual connections.

References

1. Novak, J.D., (1990). *Concept mapping: A useful tool for science education*, Journal of Research in Science Teaching, 27(10), 937-949.
2. <http://cmap.ihmc.us/>
3. <https://code.google.com/p/cmapanalysis/>