

Problem Solving and Critical Thinking in Introductory Physics Courses by Preparing Proper Resources

Susmita Hazra

Cameron University, Department of Chemistry, Physics and Engineering
Lawton, OK 73505

Abstract:

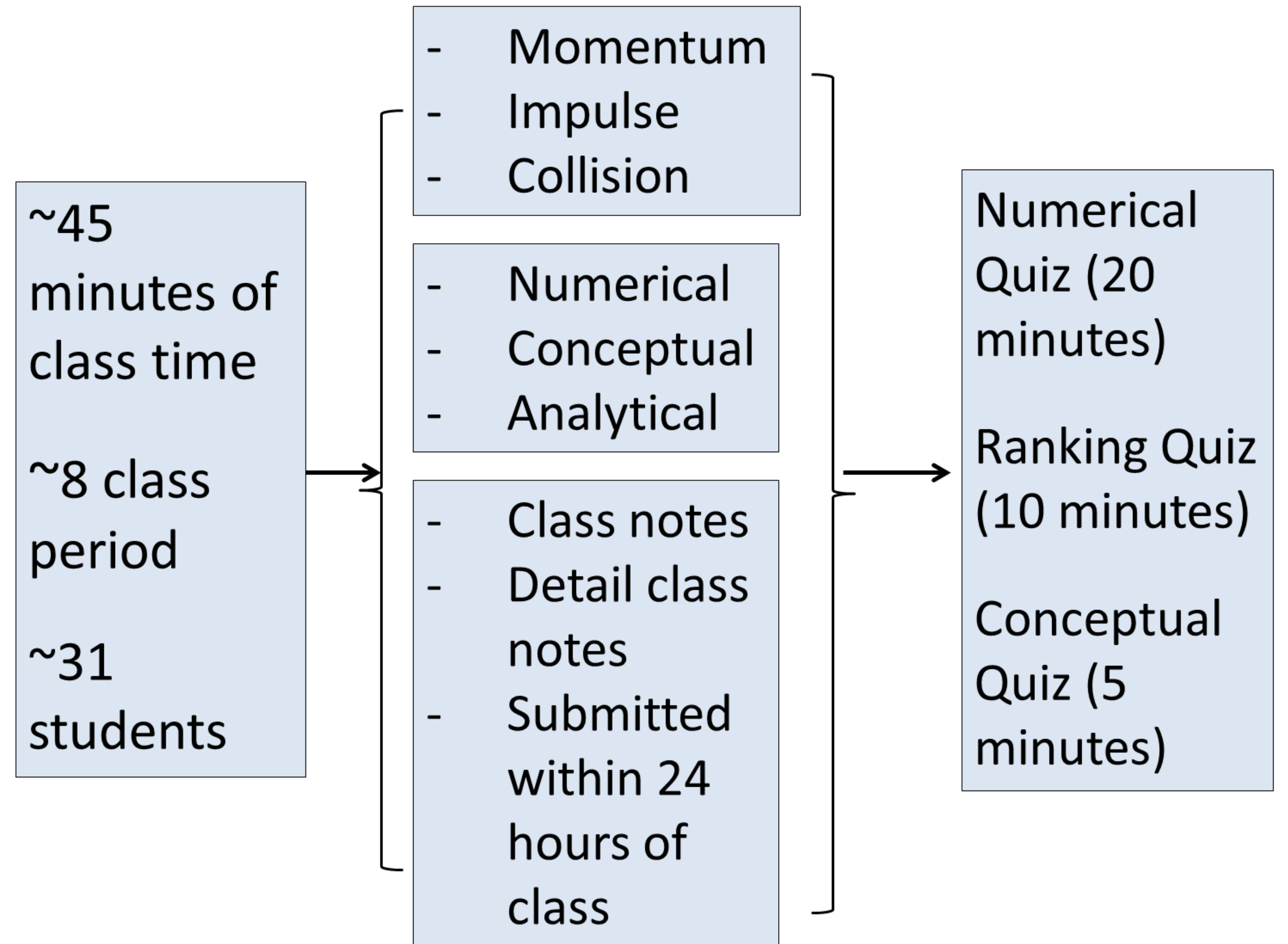
This poster will focus on how a few simple study skills can make a big change in student learning abilities in physics courses. With adequate mathematical skills, students can still do well in physics as long as they are willing to do hard work in the proper direction and want to be successful. This research contains data from a moderate size introductory physics class with 31 students. Initial survey shows correlation in performance of open book, open notes quizzes with poor notes taking skills. The questions in the quizzes involved critical thinking to connect integrated concepts in different areas of physics. Several important tips in writing notes and re-writing detail notes within same day after the class using class notes, textbook and other reference materials can help significantly in student learning. With having a better-organized resource, it is easy to refer to and understand. Students participate in classroom discussion better, and show improvement of performance on quizzes involving both conceptual and numerical problems. Possible reasons behind their better performance will also be discussed.

Methodology

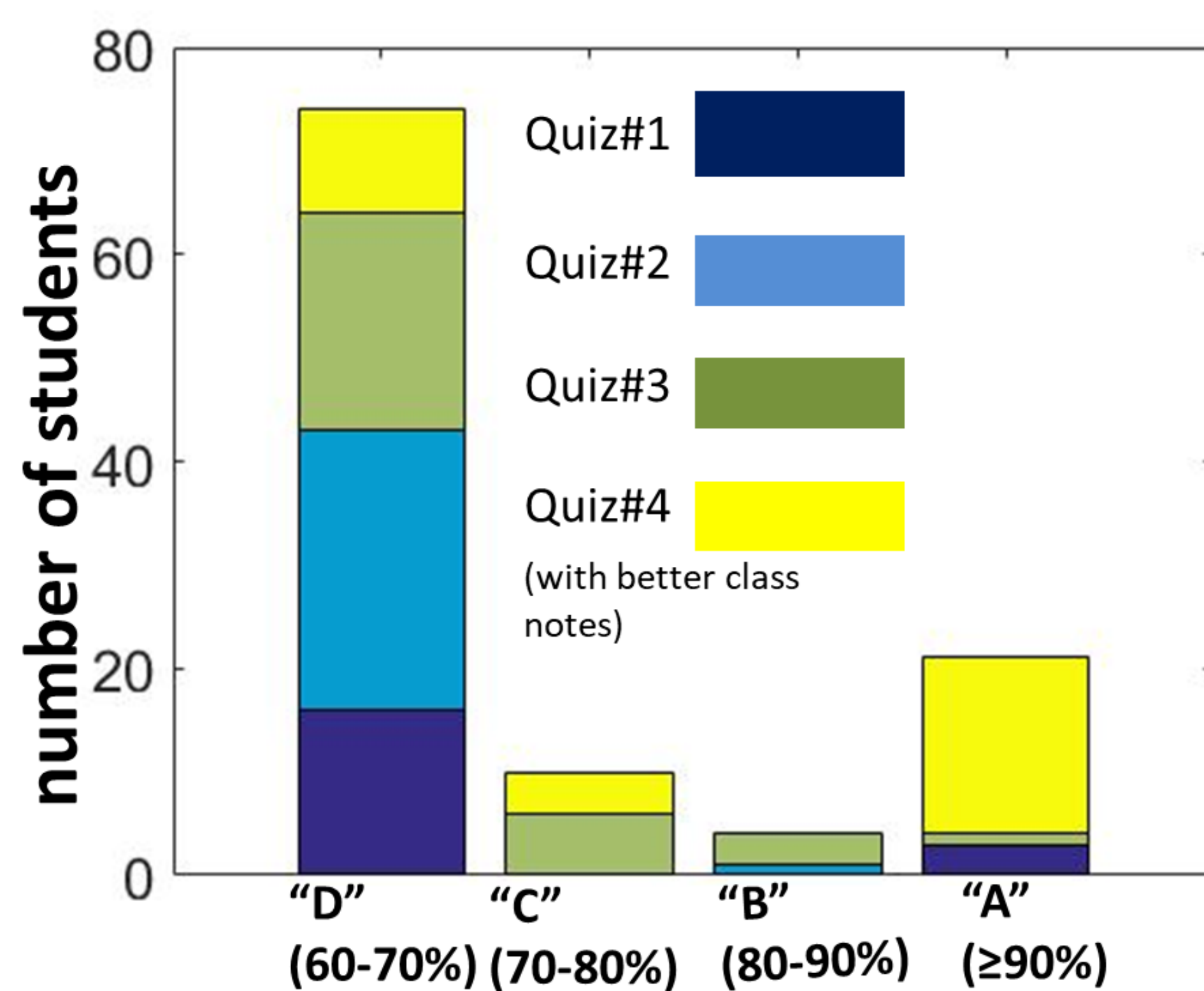
- 31 students from algebra based physics course
- Five different problems on momentum; This includes conceptual, analytical, ranking, numerical problems
- Problem solving approaches; showing vector diagram with axis of reference; writing down the known and unknown variable names; writing the correct equation; solving vector addition/subtraction correctly
- Apply correct reasoning and equation in conceptual questions

Research Questions

- What are proper note taking skills related to problem solving?
- How can problem solving skills be improved with proper notes?

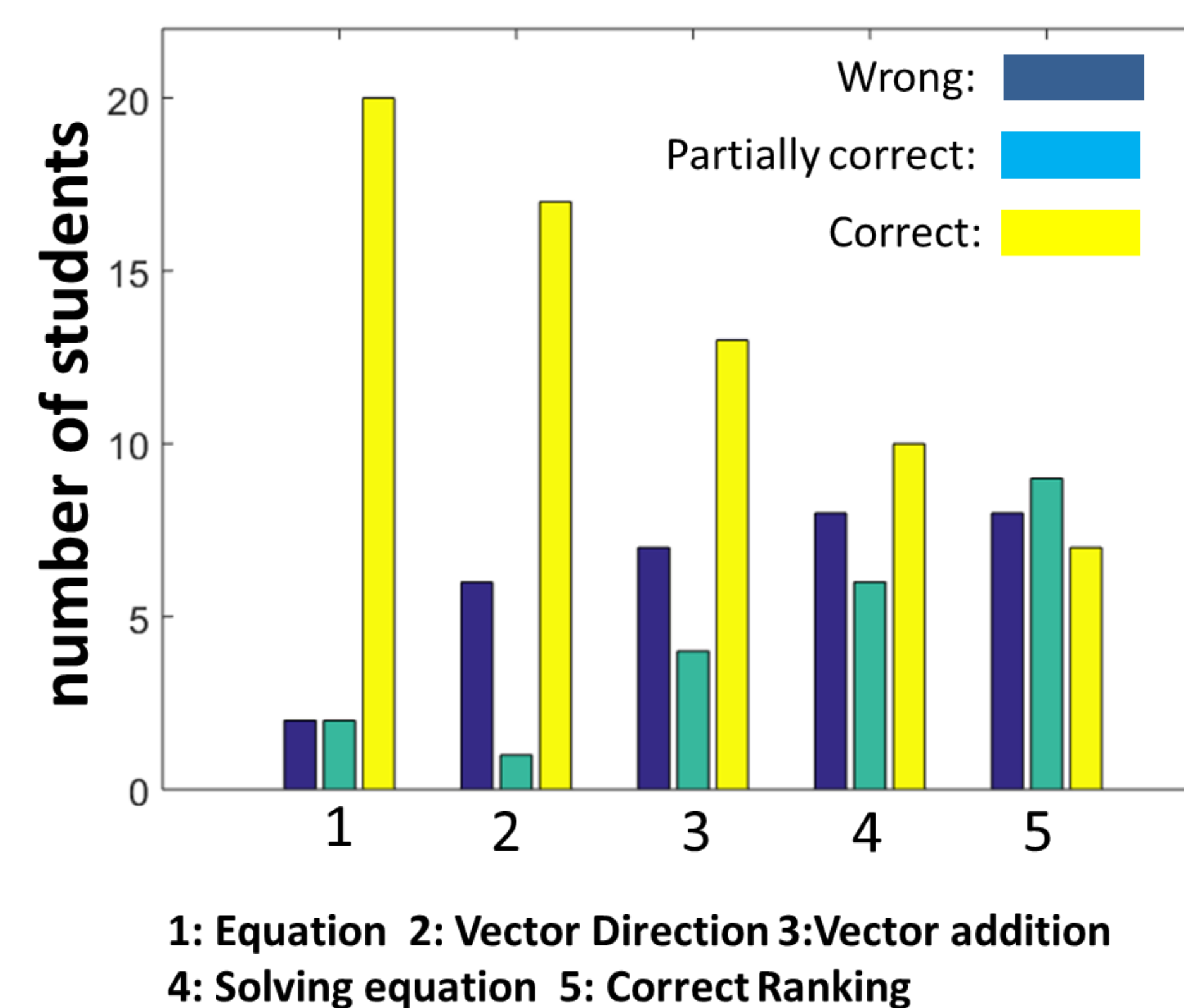


Results: (Comparison of performance of quiz with better notes to the other quizzes)



- All four quizzes are open books open notes
- Questions are not exactly similar as done in class
- Highest number of students received "A" (~50%) in Quiz#4 compare to rest of the quizzes

Results: (Student performance on Ranking problem on Impulse and change in Momentum)

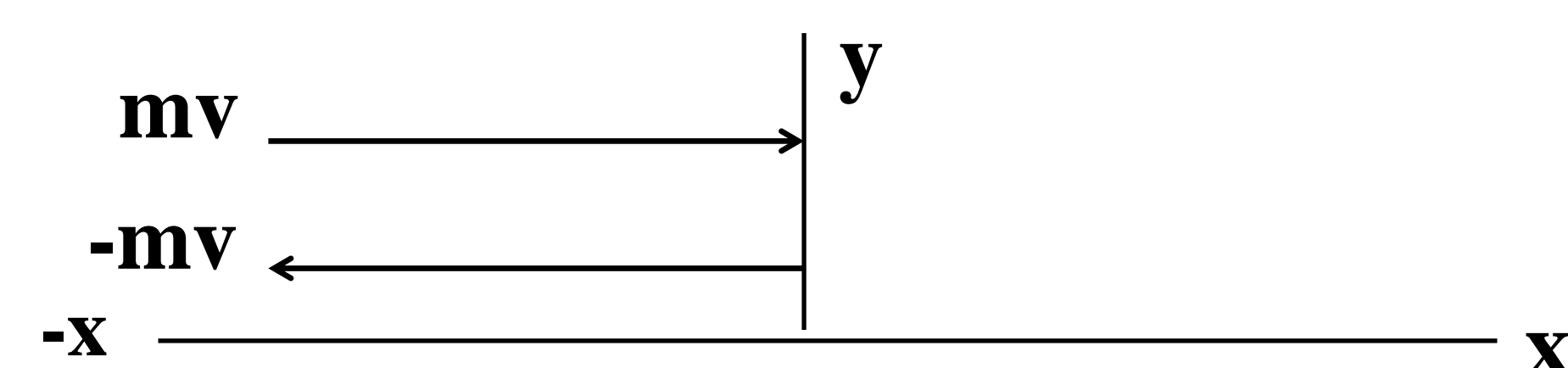


- ~90% of the students were able to apply correct equation
- ~80% of the students were able to draw initial and final momentum vector directions correctly.
- ~60% of the students have shown the vector addition correctly
- However, only ~15% of the students showed the ranking correctly

Correct Notes Taking Skill:

- Writing the physical parameter's name, unit, categorization (vector or scalar), definition with diagram and examples
- Equation connecting the physical parameter and its dependence on different variables

e.g. $I = Ft = \Delta mv$



How Impulse is related to force and time? How Impulse is related to change in momentum (explanation with examples)?

- Unit of Impulse is Ns and kg.m/s
- Explaining why impulse is a vector quantity from both force and time equation and change in momentum equation

Conclusion & Future work:

- Students showed improvements in some aspects of problem solving approach like drawing correct diagram with axis, direction, writing correct equation, ranking problems
- Poor performance of the students are correlated to poorly written notes.
- Motivate students with better organization and note taking skills for all physics courses
- Apply this method to improve students' group quizzes, take home quizzes
- Prepare students for more difficult level of problem solving with online homework programs.