



## Main aims of the project

- Create an interactive framework for students to solve proficiency exercises.
- Capture and understand students' thought processes in problem solving activities.
- Use student activity data to provide accurate targeted feedback, improve analytical skills and understanding of fundamental concepts, and objectify grading.

## Introduction

- Online tutoring systems greatly enhance learning experiences for students.
- We present a simple, intuitive system for teaching and practicing problem-solving skills in engineering mechanics.
- The system supports solving problems in single or multiple steps through creating complex systems of equations, currently aided by suggestions on error fixes.
- We observe student progress and analyze problem solving steps by collecting interaction events in a systematic manner.

## Evaluation Setup

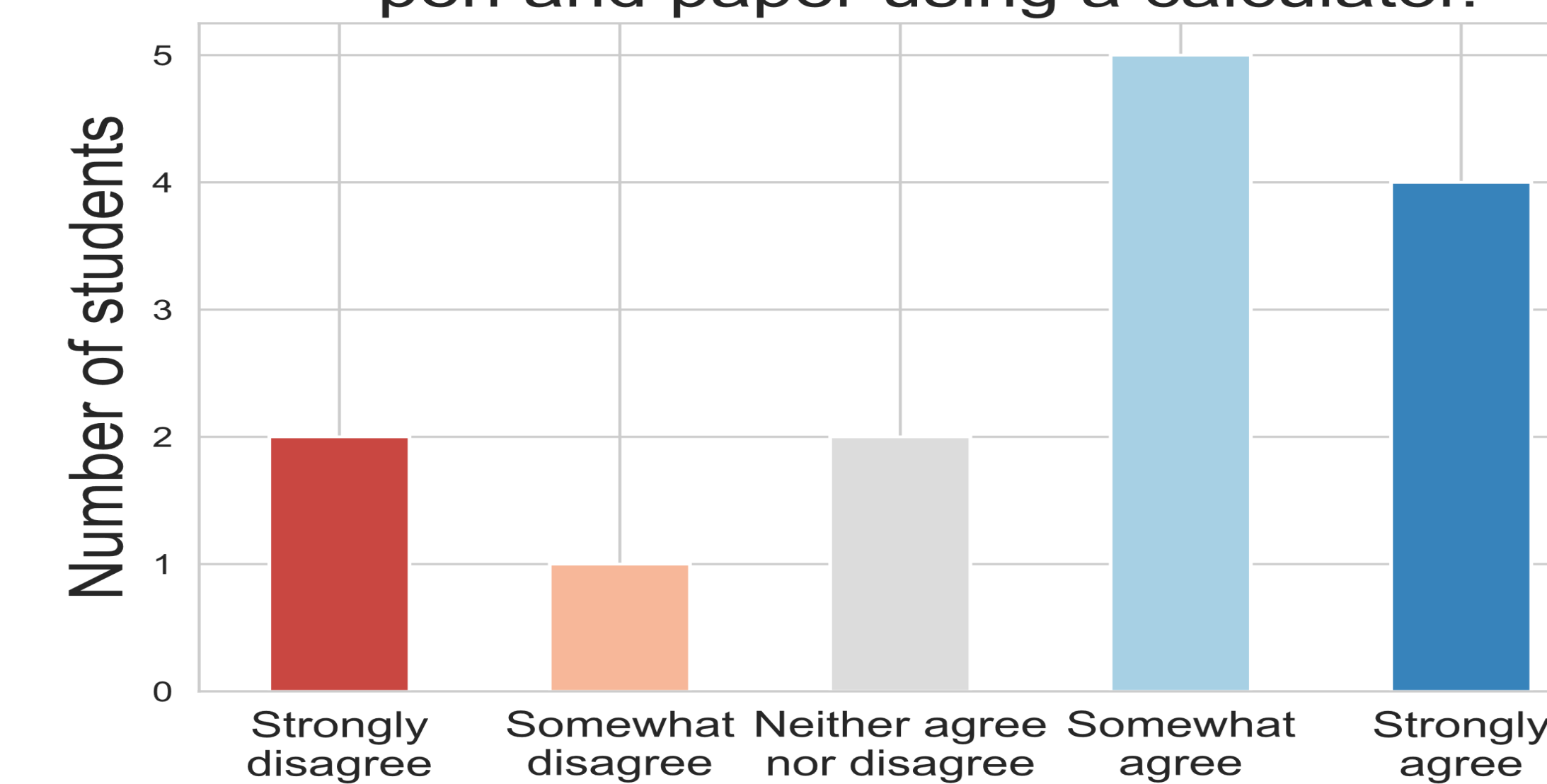
- We conducted several preliminary evaluations in one course section prior to the final exam.
- Students were tasked with solving four problems of increasing difficulty through the interface, deployed via Canvas.
  - Content for the problems was drawn from various stages of the class to observe how students explored different concepts.
  - After completion, students were asked to complete a usability survey outlining their experiences.
  - Event data (button clicks, etc.) was collected.

## Summary of Feedback

- Overall, students found the interface very helpful.
- They found the interface easy to navigate to find help, although the help material needs to be improved somewhat.
  - Having an accessible equation bank at all times was useful, although the equations supported could be more flexible to create customized systems.
  - Creating variable associations was simple.
  - The workspaces were useful in separating work to do, although the arrangement of items in the interface got mixed reactions, indicating that a redesign is required.
  - Intelligent unit computations and interactive notifications were found to be generally helpful.

## Usability Survey (n=17)

Survey Q: "The interface mapped very intuitive to my experience of solving problems on pen and paper using a calculator."



## Future Plans

- Core system development
- Improve core solver to detect errors and deviations from correct solutions
  - Improve suggestions for targeted feedback at different stages
  - Create more problem questions
  - Support instructor-defined guidance schemes varying from none to maximum guidance and support for learning from mistakes.
- Based on user feedback
- Improve the user interface,
  - Flexible equation support
  - Organize functionality into menus
  - Improve interactions to minimize steps taken and make more intuitive

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Click and drop operations to insert values from prose and figures

Attempts evaluated and graded; student progress recorded on submission

Intelligent feedback mechanism with guidance to point out errors during solving

Workspaces separate tasks/attempts

Solve all-at-once or in steps with partial results

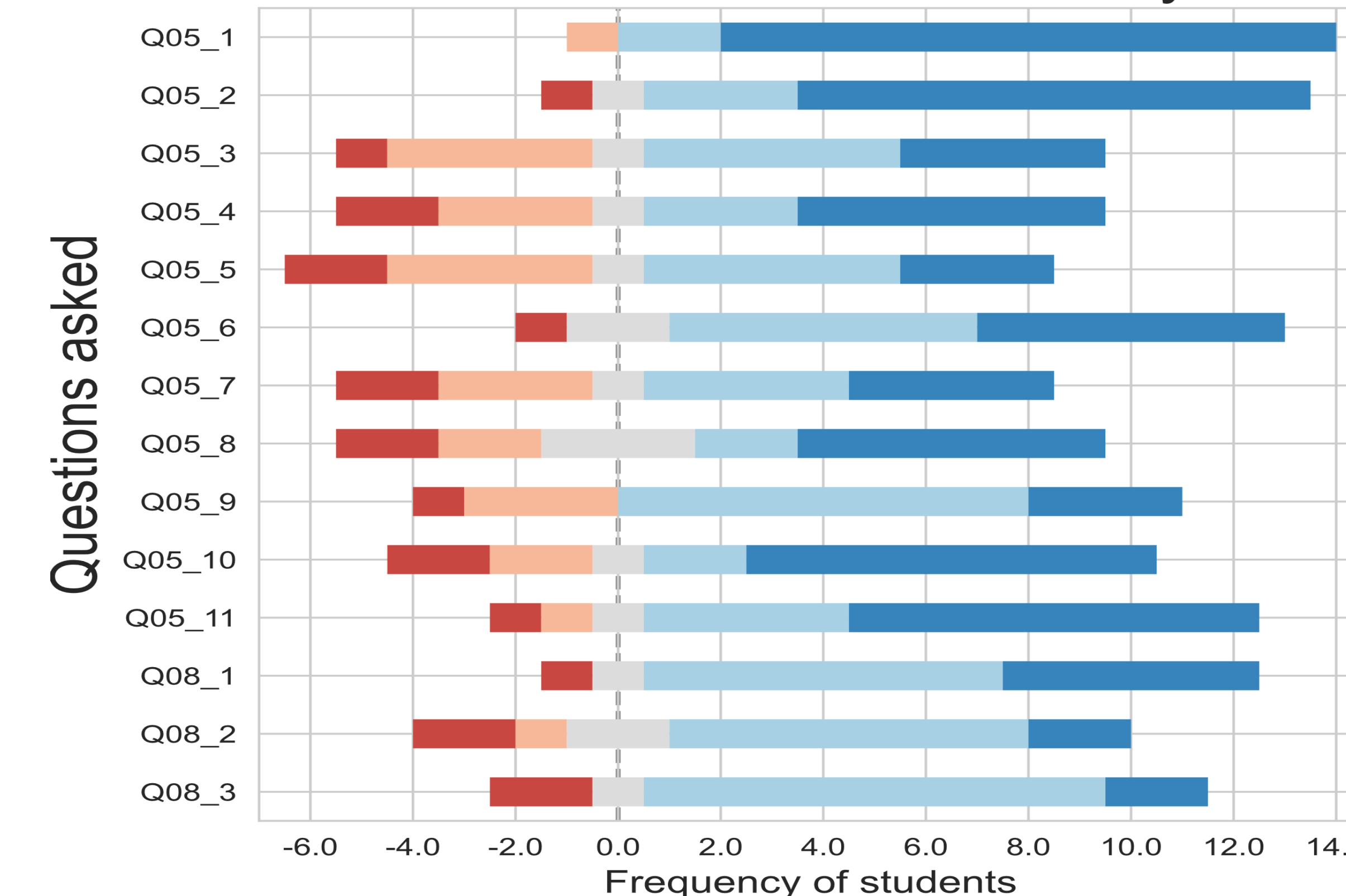
Built-in tutorials and help material for guidance

Intelligent solver for building and solving complex systems through variable associations

Easy-access equation palette with groups of relevant equations and arithmetic equation builder

Warning: Some units were implicitly converted. Click here to see more.

## Feedback responses on Interface and Notifications systems



## Feedback responses on supportive features (tutorials, etc.)

