Implementation of Web-based Problem Solving Computer Coaches in Classroom

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Web-Based Computer Coaches for Problem Solving

Computer coaches align with the cognitive apprenticeship framework for teaching problem solving.

Students at University of Minnesota Rochester use them individually outside classroom and in group in small classroom settings.

Background

- Users (students at University of Minnesota Rochester):
  - health sciences majors
  - majority female (~70%)
  - small class size (~20 students per section, multiple sections)
- Use of coaches:
  - as extra credit homework for the first three semesters
  - integrated as a part of class activity most recently
- Motivation of integrating the coaches in class activity:
  - detailed problem solving steps
  - an alternate to instructor coaching in classrooms
  - as a cooperative problem solving platform

Exploring Integration of Coaches in Classrooms

- Implementation challenges for instructors
  - Students' time of completion varied significantly due to variation in the level of interaction (up to 35 minutes difference between first and last completer).
- Impacts on students' use outside class
  - Students complained less about the technicality and usability of the coaches.
  - No help needed outside classroom for students regarding the coaches use.
- Nature of students' peer interaction
  - Students' groups of 2 most efficient in completion and peer interaction.
  - Peer consultation occurred generally near the final steps of the tasks.
- Utility as a cooperative platform
  - Generally peer scaffolding was not frequent.
  - Students were reluctant to ask peers-rather asked instructors.

Overall Usage in Five Semesters
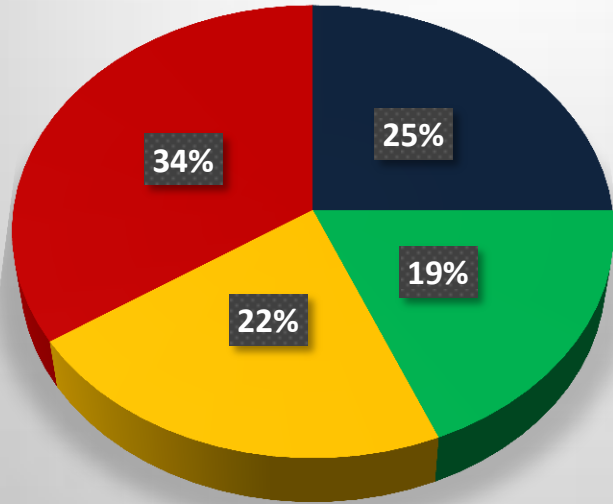
N=Less than 10%
L= 10%-40%
M= 40%-70%
H=more than 70%

- **HIGH USERS** 25%
- **MEDIUM USERS** 19%
- **LOW USERS** 22%
- **NON-USERS** 34%

Nearly half the student population enrolled in an introductory level physics course at UMR have used the computer coaches to some extent in the last five semesters.

Usage of Coaches in Various Semesters

Percentage of Students

- **HIGH USERS**
- **MEDIUM USERS**
- **LOW USERS**
- **NON-USERS**

S12 N= 38   F12 N= 30   S13 N= 35   F13 N= 49   S14 N= 40

Coaches integrated as classroom activity
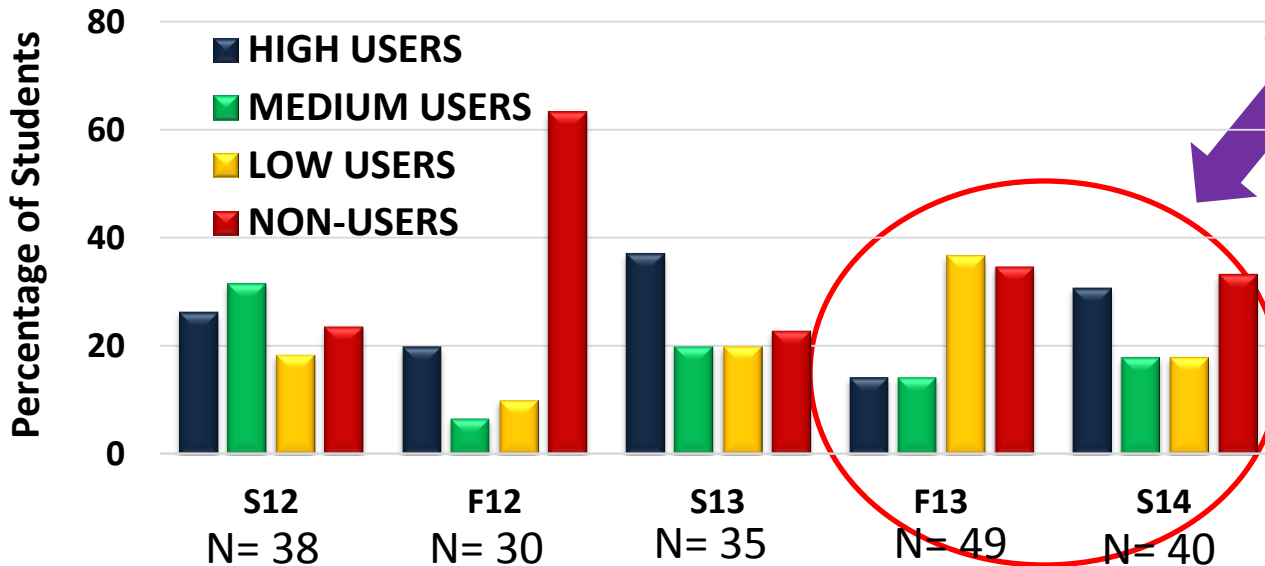
Change of usage despite students receiving the same incentive (extra credit)in all the semesters.

Survey Results:

Strengths of the Coaches Identified by students

Like a human coach
"The computer walks you through the process of the problems. It is like a teacher is right there with you".

Practice platform
"It gives me questions to practice".

Immediate feedback
"It almost immediately tells you what, where and why are you doing wrong as you move along at learning elaborated concepts".

Weaknesses of the Coaches Identified by students

Time Consuming
"Took way too long to do and very complicated to complete".

Repetitive
"Extremely repetitive and there were a lot of little steps that seemed unnecessary".

Lack of Clarity
"Sometimes it was confusing on what they were looking for on any given prompt. The instructions could have been made more clear".

Survey Result: Strengths of the Coaches Identified by Students
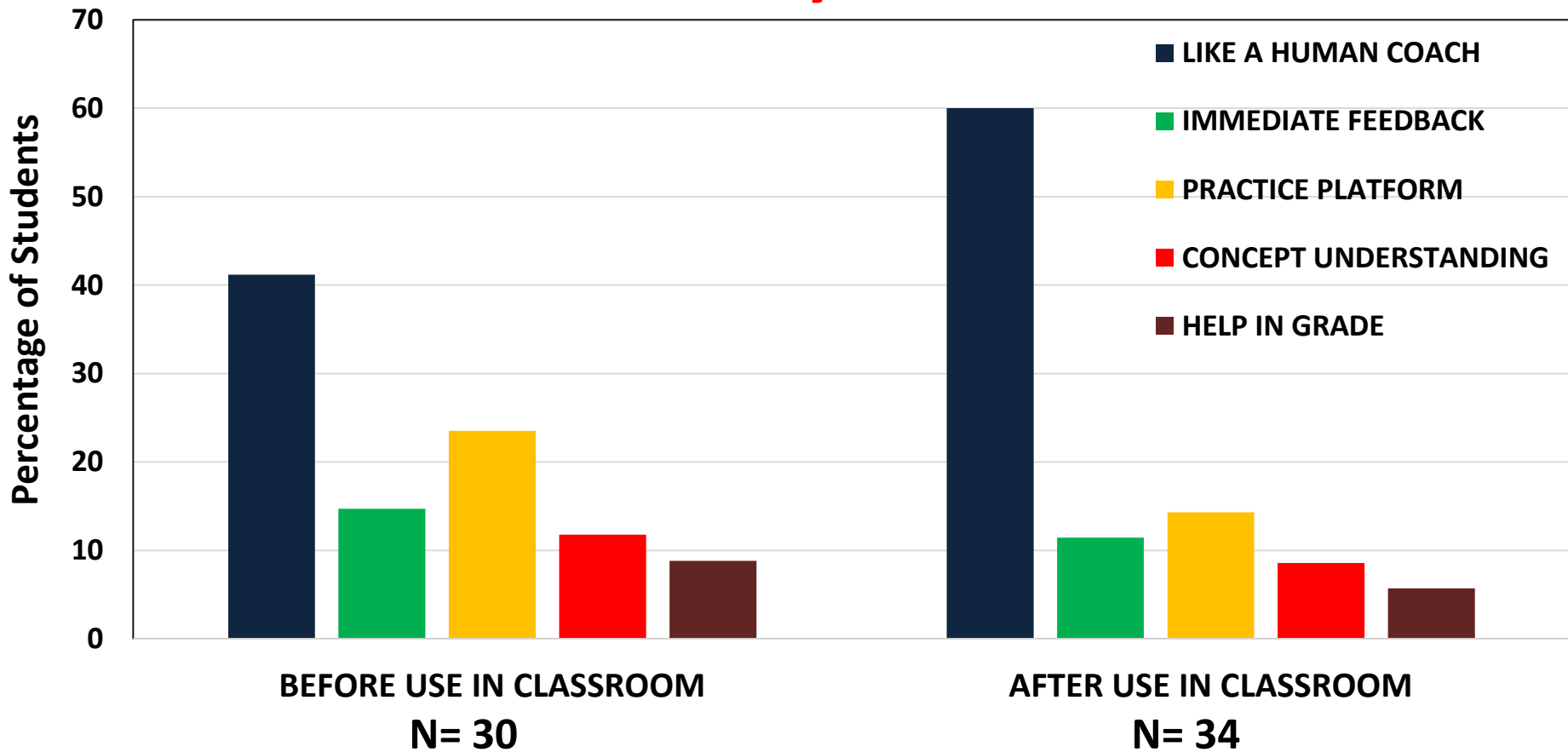
Students responding to an open ended question generally compared the coaches as a teacher/coach helping in the process of problem solving.

Survey Result: Weaknesses of the Coaches Identified by Students
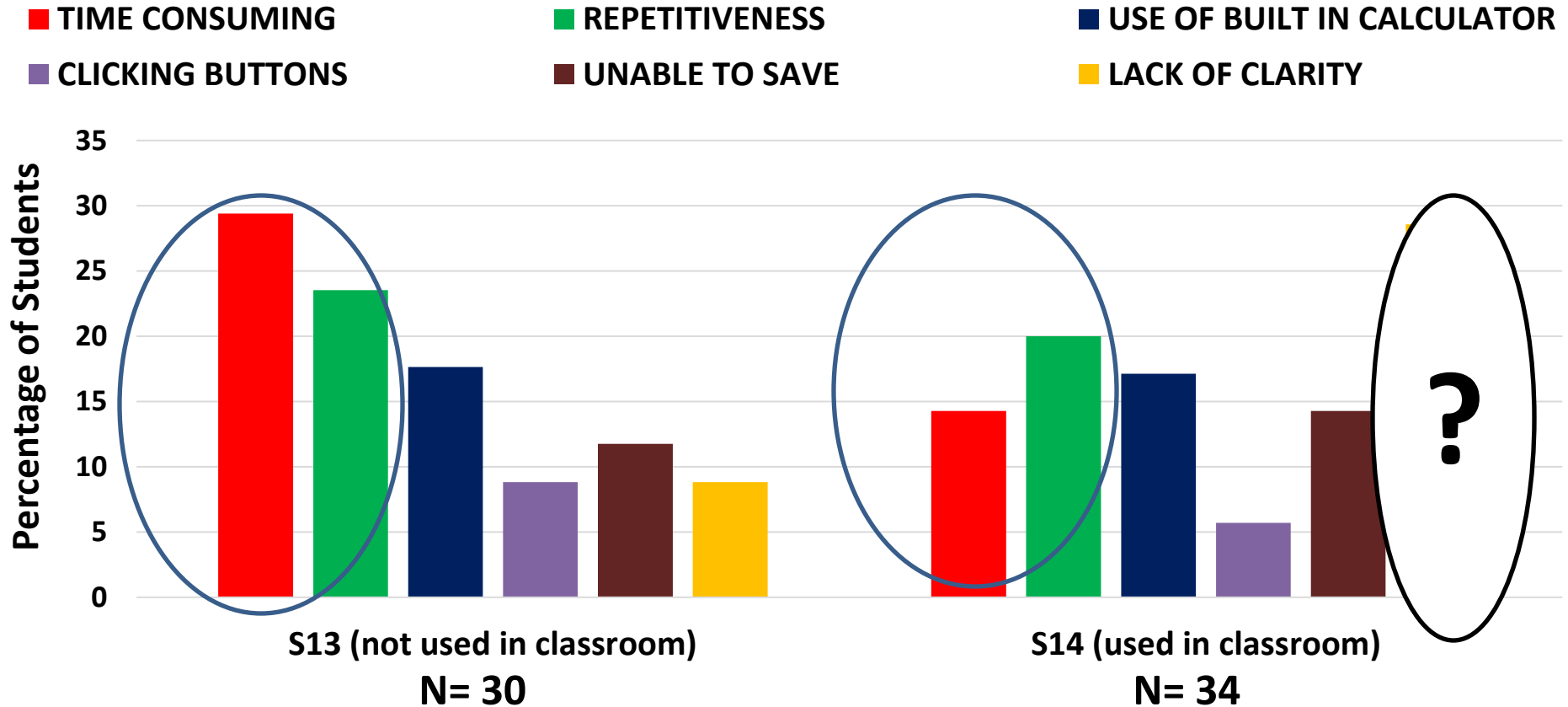
Students responding to an open ended question identified Time consuming, Clarity of instruction and Repetitiveness as major weaknesses the computer coaches.

Students' self reported average time of completion of computer coaches.

The first three semesters (not introduced in classroom): about 35 min
The last two semesters (introduced in classroom): about 28 min

Students' Ranking of the Coaches as a Learning Resource

Students ranked from a list of learning resources from 1 to 10 with 1 the top ranked and 10 the lowest ranked resource.

Lecture	Clicker questions
Exploratory hands-on activity	WebAssign Reading assignments
Computer coaches	WebAssign Problems
Textbook	Group Problem Solving
Office hours	Lab

The Computer Coaches were Ranked

6.56±0.44: when the coaches were **not integrated** as classroom activity
5.47±0.42: when the coaches were **integrated** as classroom activity

Students' Exam Scores

FREQUENT USERS   **NON-FREQUENT USERS**

Average Scores (y-axis: 0, 20, 40, 60, 80, 100)

	S12	F12	S13	F13	S14
p-value t test	0.04	0.008	0.16	0.18	0.03
	N= 38	N= 30	N= 35	N= 49	N= 40
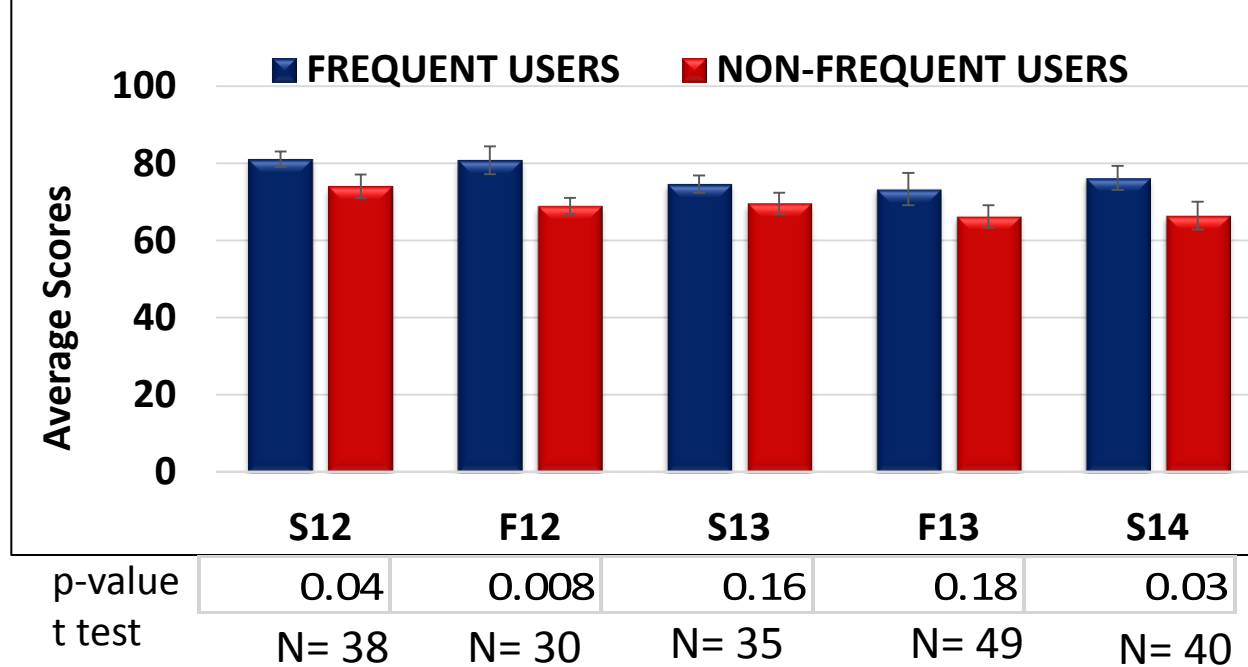
Frequent users: High and Medium users
Non-frequent users: Low and Non-users

Generally Frequent Users of the coaches seem to perform better in exams than Non-Frequent Users.

Students' FMCE Normalized gains

FREQUENT USERS   **NON-FREQUENT USERS**

Normalized percentage gain (y-axis: 0, 10, 20, 30, 40)

S12   F12   S13   F13   S14
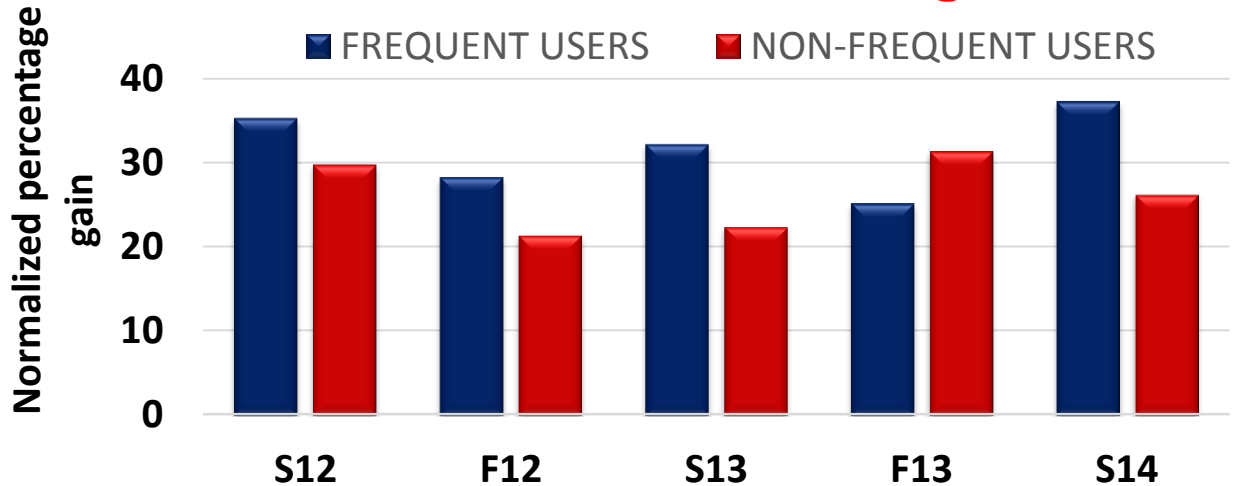
Generally Frequent Users of the coaches seem to achieve better conceptual learning gain as measured by FMCE than Non-Frequent Users.

Survey Result: Usefulness of the Coaches in Various Areas
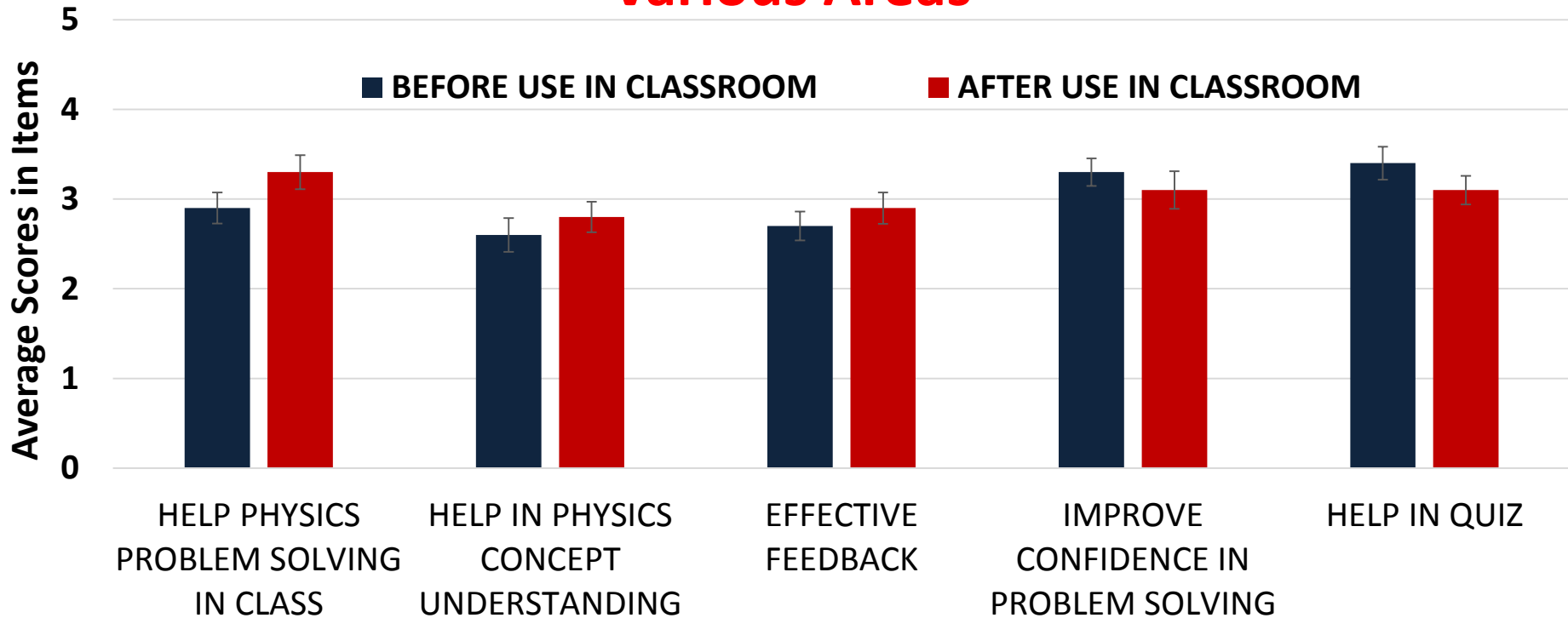
Students' responses to a 5-scale Likert test questionnaire

Scores above 3 are favorable   Scores below 3 are unfavorable

In some areas the coaches did not receive favorable ratings from the students, integrating them in classroom did not improve the favorability.

Summary

- The coaches improved students' performances in an introductory level physics course at University of Minnesota Rochester.

- The students identified the computer coaches as useful coaches.

- Use of the coaches in classroom has
  - helped students in the areas of interaction difficulties.
  - reduced time of completion.
  - helped students to identify the coaches as a useful learning resource.

- The coaches have not been found effective as cooperative problem solving platform in class for a group of more than two students.

- The students have found the current version of the coaches as time consuming and repetitive.

- The new version of the coaches might allow us to adjust grain size of problem solving making it an adaptive coaching tool.

Later today: Talks related to this presentation GC09, GC10

Thank You!!!

For further questions please contact
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