



E²Coach – Coaching Students with Computer Tailored Communication



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INTRODUCTION

- Tailored communication is grounded in behavior change theory, and has been extensively tested in public health ^{1,2}
- Through E²Coach (Expert Electronic Coaching), we applied **tailored communication** to four introductory physics courses to provide individualized feedback that recognizes the **students' strengths, weaknesses, performance trends, motivations, and goals.**

WHAT IS E²COACH

E²Coach is a webapp with powerful back-end software that sends tailored messages to students based on their personal background, goals, and class performance.

How it works

Detailed information about thousands of students and their current status: i.e.

- Desired grade and confidence level
- Concentration
- Expected hours of study
- Previous physics experience
- Extracurricular activities
- Values
- U of M Cumulative GPA
- Gender
- Reason for taking the class
- Beliefs about science classes (based on CLASS)
- Grades from the physics department

Expertise of hundreds of students, dozens of professors, and behavior change experts

MTS

The Michigan Tailoring System: a mature open-source software system for creating content designed specifically for an individual based on data about that individual

Individually personalized messages: what we would say to each student, if only we could...



Student Usage

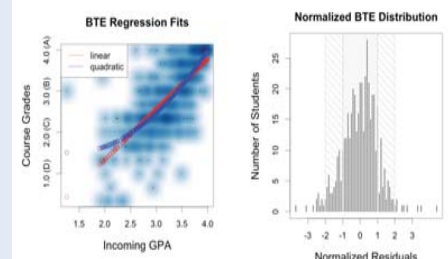
- Opt-in system for two full-length terms
- 5 sets of messages to students – 1 at start of term, 1 a week before exam 1, and after each of the 3 major exams
- Tracked student clicks over course of term
- Median clicks: term 1 = 18, term 2 = 27
- User groups decided as follows:

	<= 2 weeks	3-4 weeks	>= 5 weeks
< term's median clicks	low	mod	mod
>= term's median clicks	mod	mod	high

Description of User Groups

	# Women	# Men	Incoming GPA (M, SD)	Final Grade (M, SD)
Non user	440	1163	3.195, .519	74.94, 12.49
Low user	246	386	3.264, .468	77.00, 11.54
Mod user	263	237	3.337, .431	79.00, 10.39
High user	194	171	3.43, .404	82.76, 8.88

Better-Than-Expected



- The BTE statistic serves as our main measure of student achievement, and compares actual performance to predicted performance.
- Predicted grade based on incoming GPA.
- BTE = students' personal regression residual / (SD of all residuals)
- BTE statistic helps control for selection bias in the E²Coach user group.

CONCLUSIONS

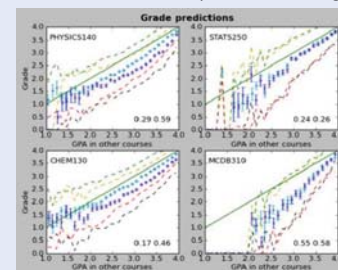
- E²Coach's tailored communication provides personalized feedback for students that has been shown to positively affect their course performance.
- Higher usage predicts better performance in the course, as measured by students' Better-Than-Expected scores. The high users performed significantly better than all other types of users.
- Moreover, E²Coach affects student performance positively in the same manner for both males and females.
- Although preliminary, we have validated the BTE statistic (quadratic curve) an improved measure for detecting changes in student performance.

FUTURE DIRECTIONS

The E²Coach Expansion Project:

- Aims to provide personalized instruction to each of the 11,200 students who take introductory Biology, Chemistry, and Statistics, in addition to Physics.
- In Fall 2011, E²Coach will be in Chem 130, MCDB 310, and Stats 250.

Current Grades and Expectations in Target Expansion Classes

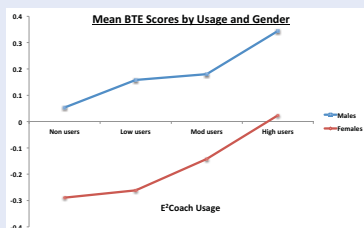
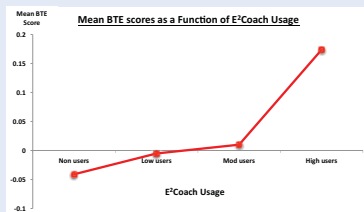


All four courses show significant grade penalties, as do almost all Introductory STEM courses.

In Physics 140 and Chem 130, the grade penalties are much worse for female students. This performance disparity is common in intro STEM courses.

Light blue = male, Dark blue = female
Dashed lines = one sigma dispersion for each group.
Points = mean grade and error on the mean for students entering with the same GPA in other classes
Solid line = grades students would receive if they did as well in these classes as they did in others.
Lower right numbers = mean grade penalty for male and female students

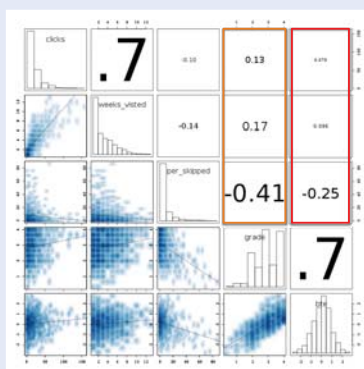
DATA & RESULTS



Effects of E²Coach Usage on Mean BTE Scores

- A similar pattern of results is seen when looking at E²Coach usage versus incoming GPA, Course Grade, difference between Course Grade and GPA, Linear BTE score, and Quadratic BTE score.
- We expected high usage to boost BTE scores relative to all other levels of E²Coach usage. Hence, we conducted planned contrasts to look at the differences between high users and all other types of users. As predicted, all contrasts were significant at the $p < .05$ level.
- No significant interaction between usage and gender ($p = .82$). Both main effects of usage and gender on BTE scores are significant. The pattern of results shows that usage affects BTE scores in the same way for both females and males, and males generally have higher BTE scores predicted than females at all usage levels.

Pearson Correlation Coefficients and Heat Map Plots between Various Performance and Usage Statistics.



- On the diagonal are histograms for a statistic. In the upper right triangle are correlation coefficients for the intersecting statistics. In the lower right triangle are heat map scatter plots of the intersecting statistics along with a linear regression fit.
- Final grade is most strongly correlated with # classes skipped, followed by # weeks someone visited E²Coach, and then # clicks in E²Coach.
- These correlations are reduced when considering the BTE statistic rather than the absolute grade as a performance metric, since the BTE statistic removes some of the E²Coach user group population bias toward better students.
- In magnitude the E²Coach usage correlations with BTE is roughly half the E²Coach usage correlation with grade giving some indication of user group population bias which we believe is partially removed by the BTE statistic.
- Some of the remaining population bias might be removed with resampling techniques.

REFERENCES

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