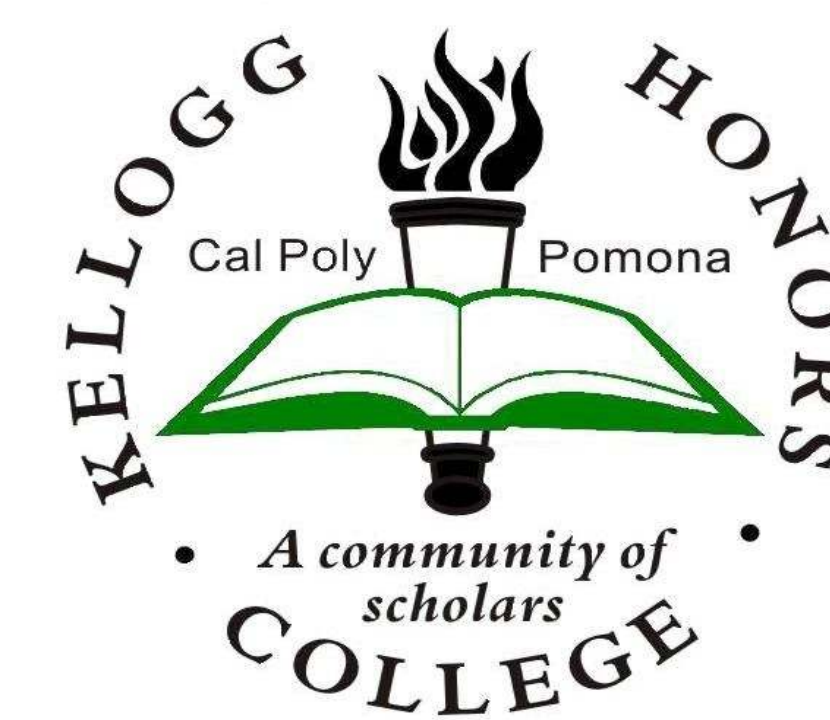


Assessing the Benefits of Computer-Based Tutorials in Organic Chemistry

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Introduction

Oftentimes struggling students find the problems in textbooks too difficult, resulting in them falling further and further behind. Cognitive thinking defines a problem as a question in which there is a gap between the current level of knowledge and what is necessary to determine the answer. An exercise on the other hand does not possess this gap and helps enforce pattern recognition. Effective learning converts problems into exercises for the brain can only think in terms of what it already knows. Therefore, problems sets were designed with a heavy emphasis on mechanistic repetition to develop and strengthen pattern recognition to the arrow pushing formalism of organic chemistry in an attempt to bridge the gap between a struggling student and the level of textbooks while maintaining within a student's regiment of competence. Surveys were then created to assess the success of these tutorials.

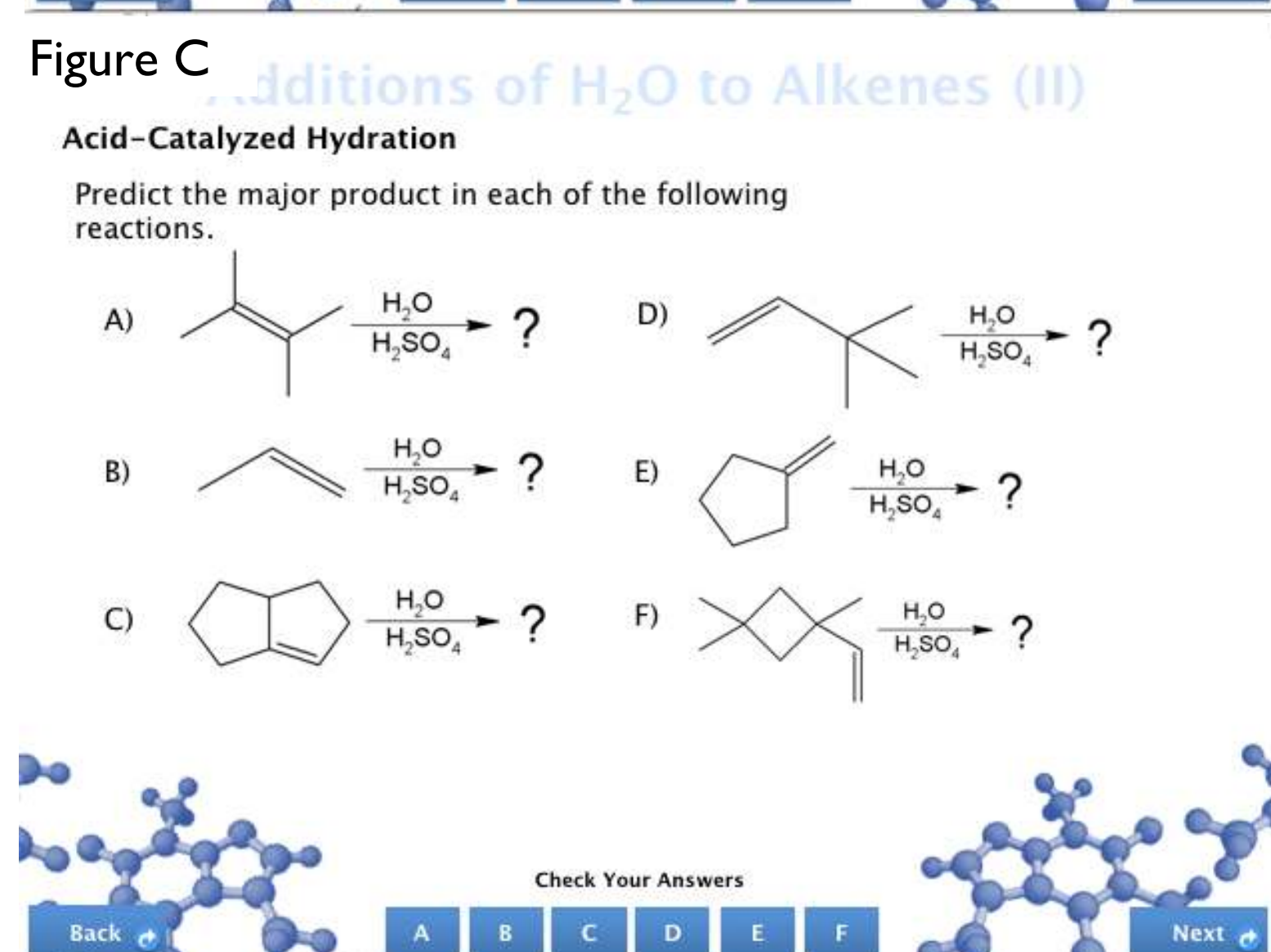
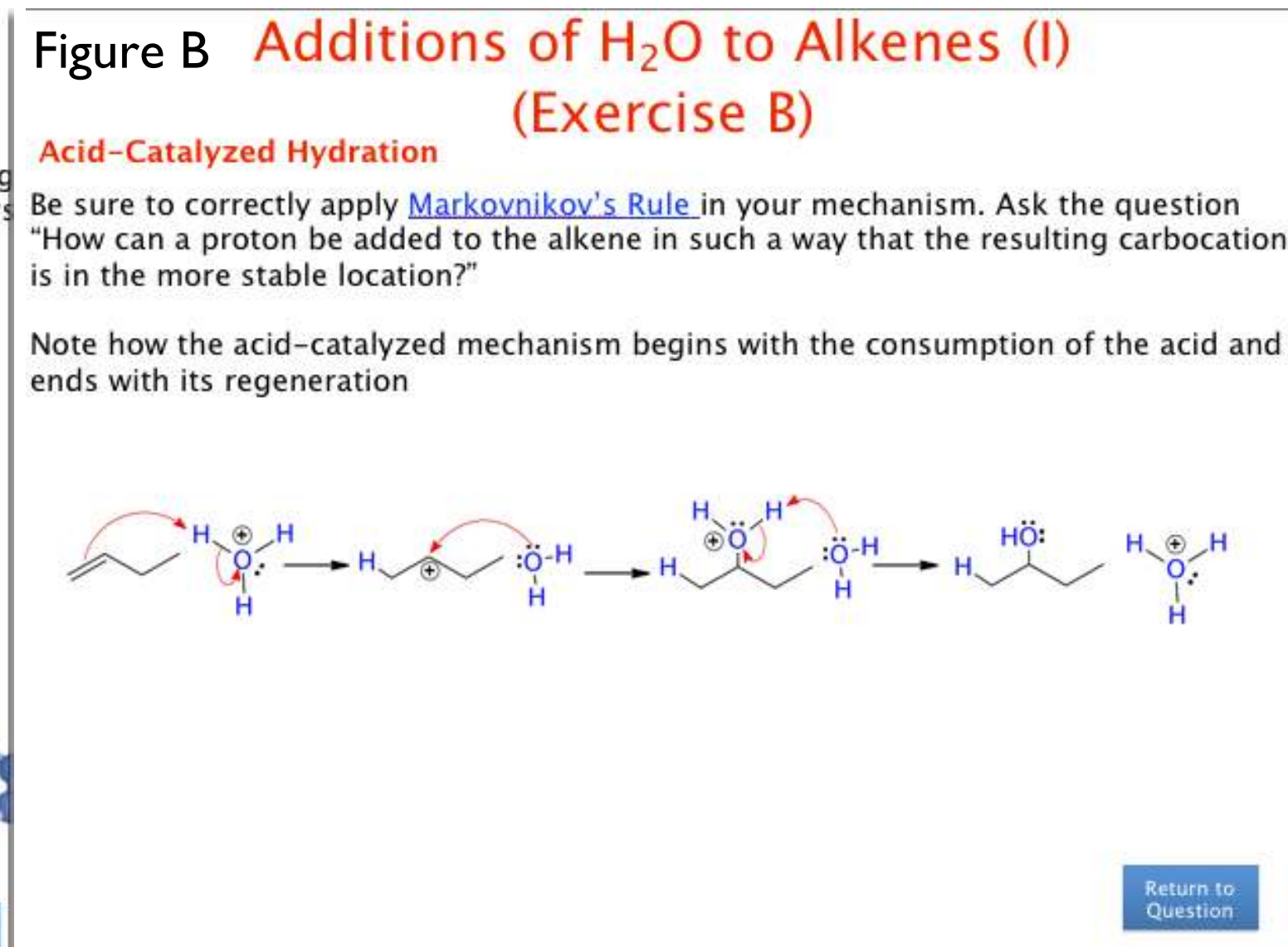
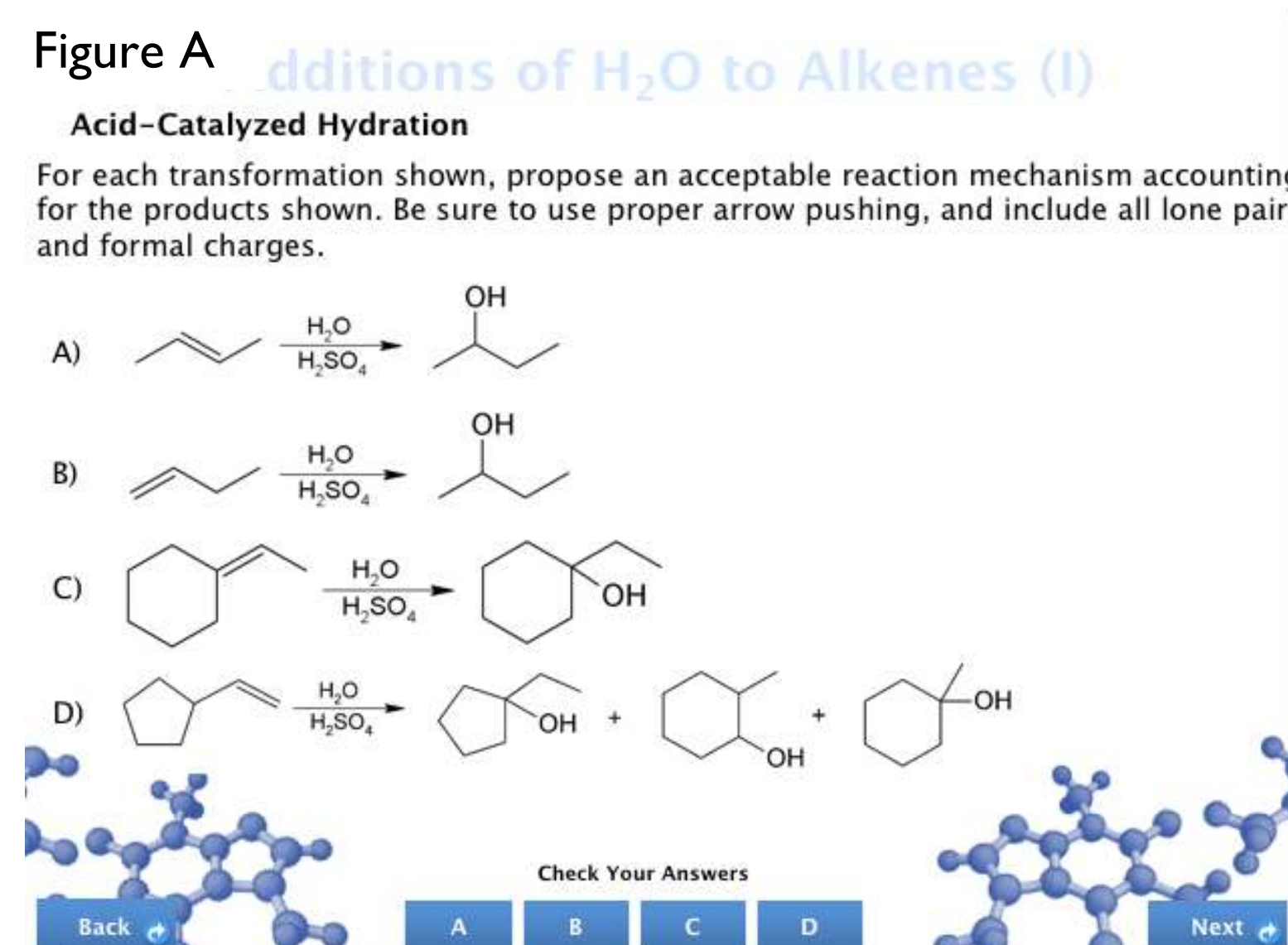
Methods

- Three online problem sets on carbocation rearrangements, elimination reactions, and alkene additions. Self-guided by student.
- Online surveys asking about understanding and confidence before and after the problem set, time spent, effectiveness, demographic information, and a brief question to test understanding.
- Mac Numbers, Microsoft Excel, and IBM SPSS Statistics programs used for data analysis

Initial Hypotheses

- Females will see greater benefit because they tend to be more visual learners
- Chemistry majors will see the smallest benefit due to prior exposure

Tutorial Sample



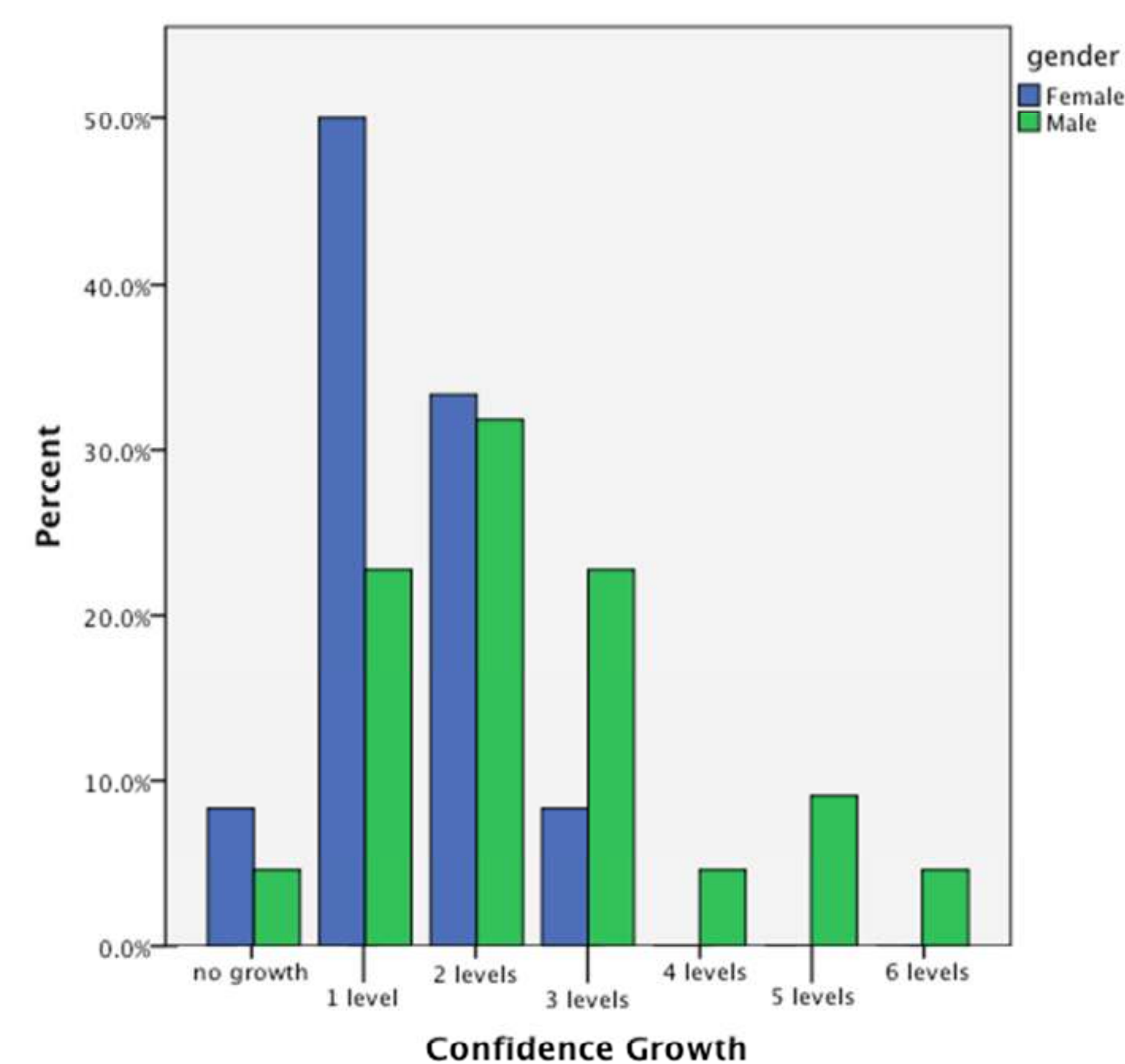
These figures are examples of the tutorial for alkene additions. The tutorials work in a step-wise fashion, building on the previous problems. First students are asked to propose a mechanism for a reaction (Figure A), then asked to predict the product of the same type of reaction (Figure C). Students can click to see the answer of any problem before proceeding to the next question (Figure B). This order is designed to build pattern recognition. This method of organization by topic is favorable for learning versus textbook problems that have a random assortment of problems at the end of a chapter.

Preliminary Conclusions

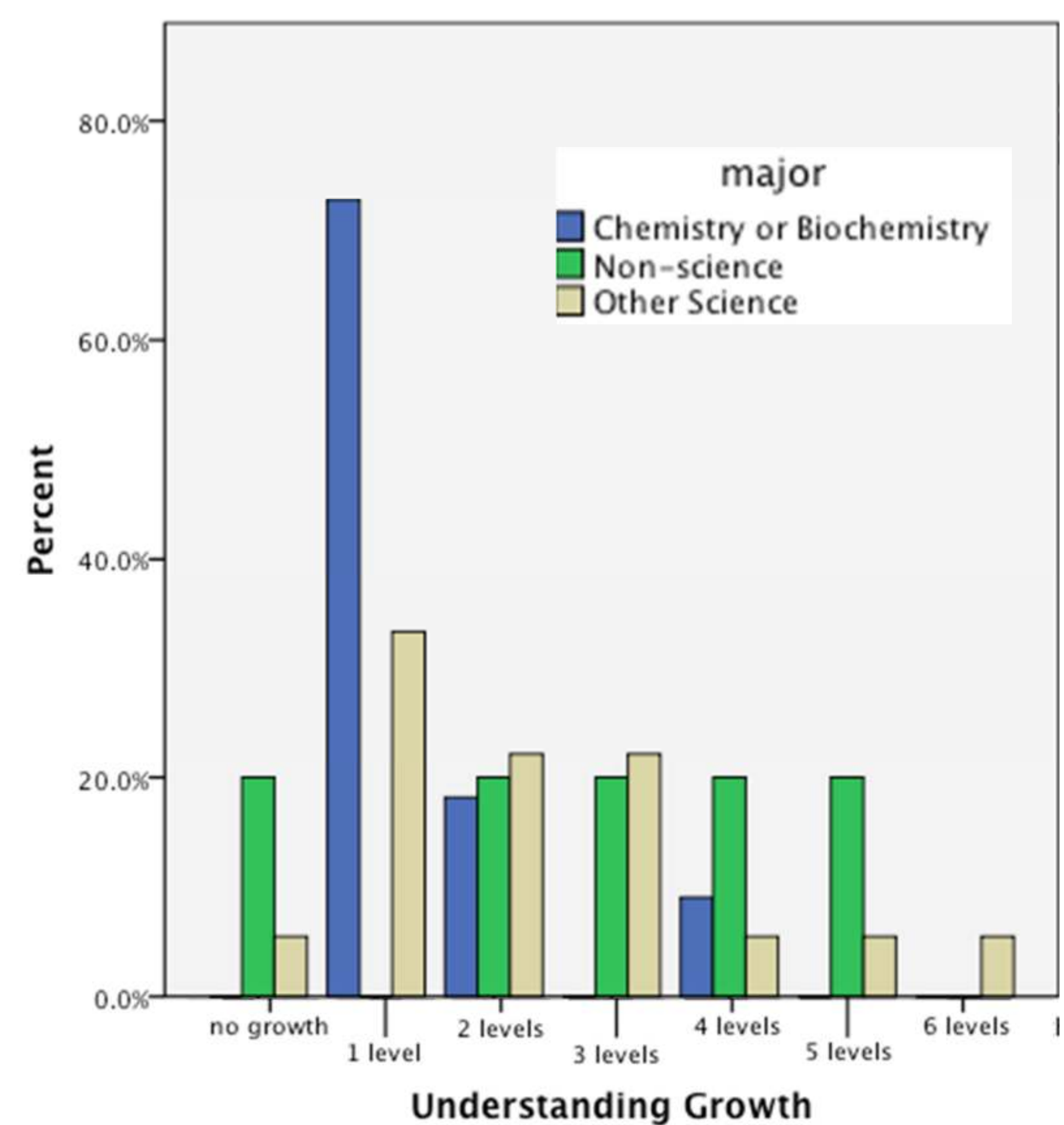
Initial tests reveal that nearly all students see an increase in both understanding and confidence following each of the three problem sets. Contrary to initial hypotheses, male students saw a greater growth than female students, although it is important to note that the data could be affected by random error due to large standard deviations.

Confirming initial hypotheses, students outside of the chemistry major were more greatly impacted by the tutorial and reported greater increases in confidence and understanding than those who reported to be a chemistry or biochemistry major. This is expected because chemistry majors are more likely to have been exposed to the arrow pushing formalism of organic chemistry before or possibly have been since they took organic chemistry, thus reporting higher start values. Overall, the tutorials were successful as the average student increased both his/her understanding and confidence by two levels.

Data and Results - Organized by Gender



Data and Results - Organized by Major



Data and Results - Overall

