

# The impact of using weekly tutorial quizzes on student performance of introductory organic chemistry



Manon Latrille, Dr. Violeta Iosub  
Department of Chemistry, University of Victoria



## Introduction

- It has been shown that students who steadily build their knowledge base throughout the term by applying, analyzing, and synthesizing lecture material perform better on organic chemistry course assessments.<sup>1</sup>
- The use of structured course design and active learning strategies make teaching more inclusive and accessible for all students.<sup>2</sup> Structured course design includes formative feedback via frequent low-stakes assessments intended to offer opportunities to apply content and communicate expectations.
- CHEM 234 (Organic Chemistry with Biological Applications) is a required course for many programs at UVic and many students perceive it as a difficult course.
- CHEM 234 tutorials are a place and a time for students to prepare and potentially shift their attitudes about organic chemistry but they tend not to participate in tutorials, since they are not mandatory.
- The addition of graded quizzes during tutorial time helps achieve five of the Seven Principles for Good Practice in Undergraduate Education<sup>3</sup> and provide more structure to tutorial sessions.

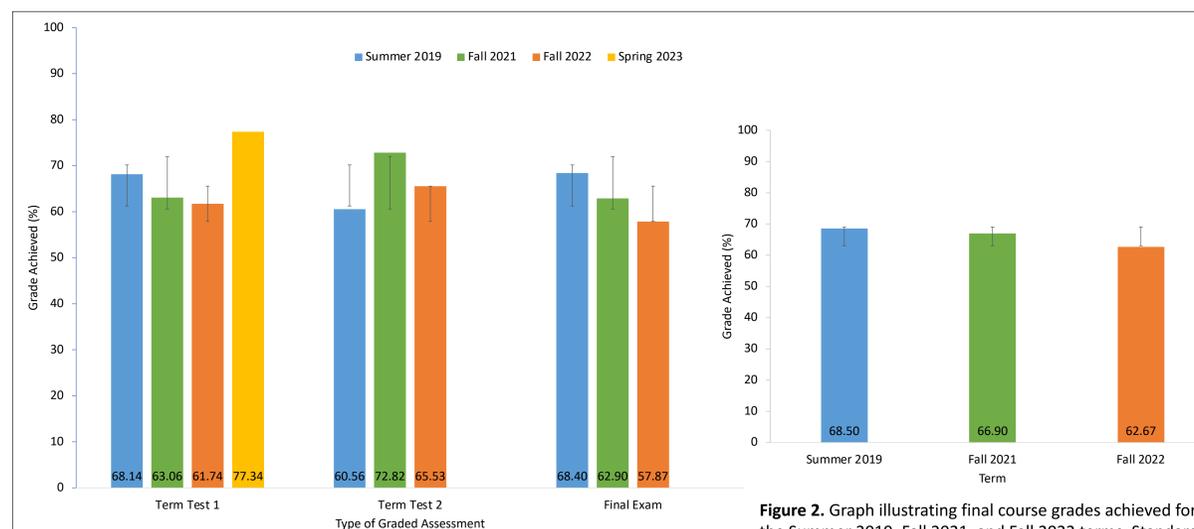
## Research Question

What is the impact of graded tutorial quizzes on student performance in CHEM 234?

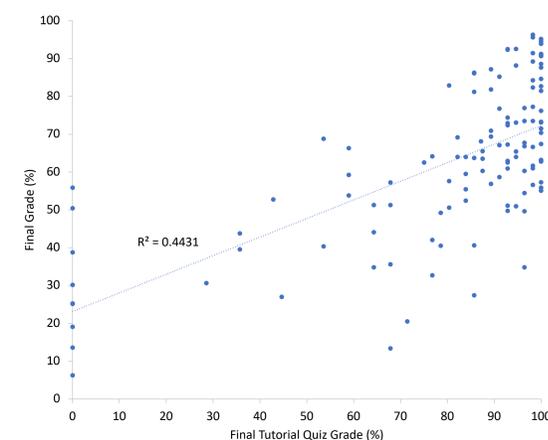
## Methods

- We implemented graded tutorial quizzes in CHEM 234 for the Fall 2022 and Spring 2023 terms.
- The new tutorial quizzes were worth 7% of the students' final grade, a weight that was taken from the final exam.
- Students attended a tutorial session led by TAs that covered the material to be quizzed on at the end of the tutorial session. Notes taken by students during this time could be used during the quiz. Emphasis was placed on understanding and synthesizing the material, not memorization.
- We analyzed and compared CHEM 234 term test, final exam, and final course grades from the Summer 2019, Fall 2021, Fall 2022, and Spring 2023 terms to see how if there is a correlation between the addition of tutorial quizzes and student performance.
- We surveyed Spring 2023 CHEM 234 students to gauge their attitudes and perceptions surrounding the new tutorial quizzes using six Likert questions and one open-ended question.
- A second survey will be sent to CHEM 234 students following completion of term test 2 to see if/how their perceptions/attitudes have changed.

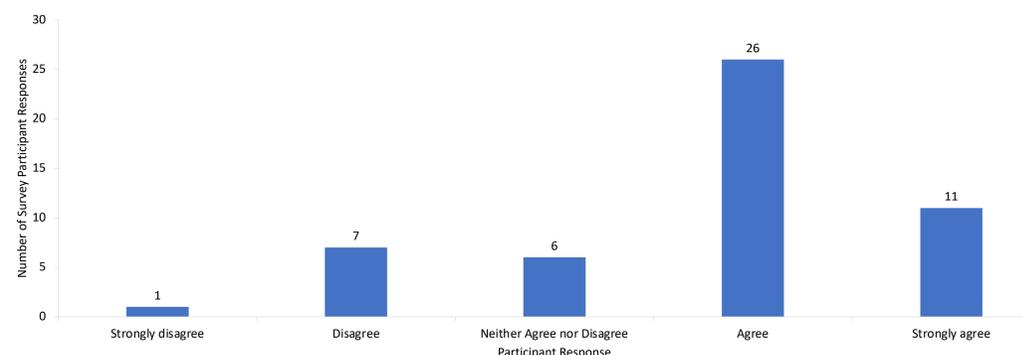
## Results



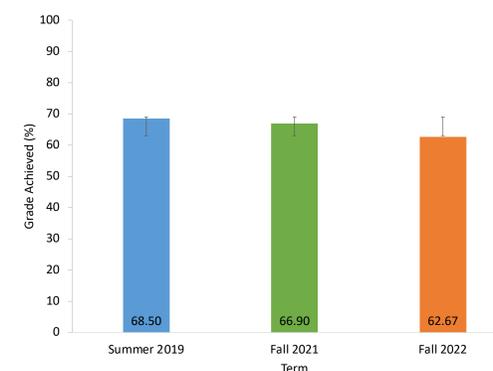
**Figure 1.** Grouped bar graph summarizing trends of assessments throughout the different terms analyzed. Fall 2022 and Spring 2023 terms implemented the graded tutorial quizzes. Standard deviations are shown in the error bars. N = 36 for Summer 2019, N = 122 for both Fall 2021 and 2022, N = 332 for Spring 2023.



**Figure 3.** Correlation graph for Fall 2022 showing the relationship between final tutorial quiz grades and final course grades. Correlation coefficient  $r = 0.6657$ .



**Figure 4.** Student responses to the survey question: This term, tutorial quizzes in Chem 234 are associated with 7% of your final grade. Does having tutorial quizzes encourage you to stay on top of Chem 234 material throughout the term? (N = 51).



**Figure 2.** Graph illustrating final course grades achieved for the Summer 2019, Fall 2021, and Fall 2022 terms. Standard deviations are represented in the error bars. N = 36 for Summer 2019, and N = 122 for Fall 2021 and 2022.

**Table 1.** Responses to two related survey questions whose responses were converted to the Likert survey scale.

Survey Item	Mean (N = 51) <sup>a</sup>	SD
How important did you find the optional tutorial sessions in CHEM 231?	3.41	1.10
How important did you find the optional tutorial sessions in CHEM 234?	3.80	0.96

<sup>a</sup>Likert survey scale: 1 = not at all important, 2 = not so important, 3 = somewhat important, 4 = very important, 5 = extremely important.

## Discussion

- Student survey results show a generally positive response to the implemented changes.
- The majority of students who participated in the survey feel that attributing 7% of their final grade to tutorial quizzes is fair.
- Students attribute more importance to tutorial sessions after the addition of graded tutorial quizzes.
- Students are encouraged to continuously engage with CHEM 234 material through the addition of tutorial quizzes.
- A moderate positive relationship between tutorial quiz grades and final grades was found, but more data is needed to determine if this relationship is causal rather than simply a correlation.
- We expected that the introduction of weekly graded tutorial quizzes would increase exam performance.
- Results thus far do not support the expected outcome.
- Based on preliminary results, the Spring 2023 CHEM 234 class may be an outlier, as results from term test 1 are significantly better than previous offerings of the course for an exam of comparable difficulty.
- Results from this study could be strengthened by increasing the number of terms analyzed after implementation of the tutorial quizzes.
- The analysis of Spring offerings of the course would also allow more robust data as the class sizes are doubled compared to Fall and Summer terms.

## References

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## Acknowledgments

We would like to thank the Fall 2023 CHEM 234 class for their participation in this research project.

We would also like to thank the Department of Chemistry for supporting this research in the field of Chemistry Education.

This research was supported by the Jamie Cassels Undergraduate Research Award, University of Victoria.