

# Evaluating Oral Exams in Large Undergraduate Engineering Courses

Curt Schurgers  
ECE, UCSD  
La Jolla, CA 92093  
cschurgers@ucsd.edu

Saharnaz Baghdadchi  
ECE, UCSD  
La Jolla, CA 92093  
sabaghda@ucsd.edu

Marko Lubarda  
MAE, UCSD  
La Jolla, CA 92093  
mlubarda@ucsd.edu

Maziar Ghazinejad  
MAE, UCSD  
La Jolla, CA 92093  
mghazinejad@ucsd.edu

Alex Phan  
MAE/ECE, UCSD  
La Jolla, CA 92093  
mgphan@ucsd.edu

Huihui Qi  
MAE, UCSD  
La Jolla, CA 92093  
huqi@ucsd.edu

**Abstract**— While studies have shown that oral exams are a valuable method of assessment, their use has been limited due to concerns about scalability, examiner bias and student anxiety. This paper presents preliminary results on incorporating oral exams into two large undergraduate engineering courses, examining the potential viability of these assessment strategies. This work was done when the courses were offered remotely due to COVID-19, but the results offer valuable insights that could carry over to in-person instruction as well.

**Keywords**—oral exam, assessments, high enrollments

## I. INTRODUCTION

Assessment is an important component of education. In a broad sense, the term oral exam refers to assessment with dialogic components, such as a class presentation, PhD defense or simulated interaction [1]. However, we focus on oral exams in which a student is being quizzed (interrogated) by an examiner. Studies have found that oral exams are an effective tool to test students' conceptual understanding of the subject matter, due to their adaptive nature where the examiner can ask probing questions in response to prior answers [1-8]. The impact of testing conceptual knowledge is profound as mastering core concepts, rather than rote memorization of procedures, is crucial to engineering. Another oft-cited benefit relates to academic integrity, where interrogative oral examination has been praised as one of the assessment methods least susceptible to cheating [1][8]. On the other hand, one of the main challenges that has held back the adoption of oral exams is how to scale them to larger class sizes. Scalability is one of the open research questions commonly mentioned [5-7], even in the few studies that have reported results for class sizes over 100 students [3][4]. Additional challenges are examiner bias, fairness in the case of multiple examiners, and issues related to student anxiety [1].

In this paper, we report our experiences from an ongoing study, in which we are implementing oral exams in two large lower-division undergraduate courses in electrical engineering. While these courses cover the basics of electronics, we believe the lessons learned regarding oral exams are more broadly applicable. The impetus for our work was the sudden shift to remote instruction in reaction to the global COVID-19 pandemic. Despite the far-reaching challenges, the response of the educational community was one of great resilience and willingness to embrace change. This environment offered a

unique opportunity to try new pedagogical approaches, such as oral exams, which would otherwise have been more difficult to find buy-in for, on the part of the students and the instructors.

## II. ORAL EXAM IMPLEMENTATION

We will present data for two courses, ECE35 and ECE65, for two quarters, Fall 2020 (FA20) and Winter 2021 (WI21). Because of COVID-19, instruction was remote via Zoom. While for each course there were slight differences in how the oral exams were implemented in consecutive quarters, these did not appear to result in significant changes in student performance, perception or behavior. We will therefore report aggregate results for both quarters combined in the next section.

ECE35, "Introduction to Analog Design", had enrollments of 299 (FA20) and 152 (WI21). Zoom-based oral exams were added to the course, which also included written quizzes and a final exam. For the oral exams, each student had a 15 min slot with an examiner, followed by a 5 min buffer. Questions covered fundamental concepts and were based on new circuits that were sent to the students 20 min before their slot. Undergraduate course tutors conducted an oral exam with each student and only those students who did not demonstrate sufficient mastery were required to also do the "real" oral exam with the instructor or one of the two graduate TAs. This pre-filter reduced the latter number to 25%-30% of the class. Furthermore, the tutors never had to fail students, but only decide whether they passed or needed a follow-up, which reduced their stress. Two practice oral exams were added to familiarize students with the process. These practice exams counted only as marginal extra credit (FA20) or were scored on attendance only (WI21). The final oral exam was for credit: it was used as a condition to pass the course (FA20) or accounted for 3% in the course grading rubric (WI21).

ECE65, "Components and Circuits Lab", had enrollments of 90 (FA20) and 165 (WI21). Two oral tests were administered in FA20, each worth 5% of the grade. In WI21, because of the overlap of some holidays with a couple of lectures, only two oral exams, each worth 5% of the grade, were used. No practice tests were provided. Because the course uses a flipped classroom format, students had participated in responding to questions in a style similar to the ones on the oral exams. The exam questions involved analyzing new circuits provided during the exam itself. In both quarters, the oral exams were

---

This work is partially supported through NSF grant # 2044472 "Improving the Conceptual Mastery of Engineering Students in High Enrollment Engineering Courses through Oral Exams".

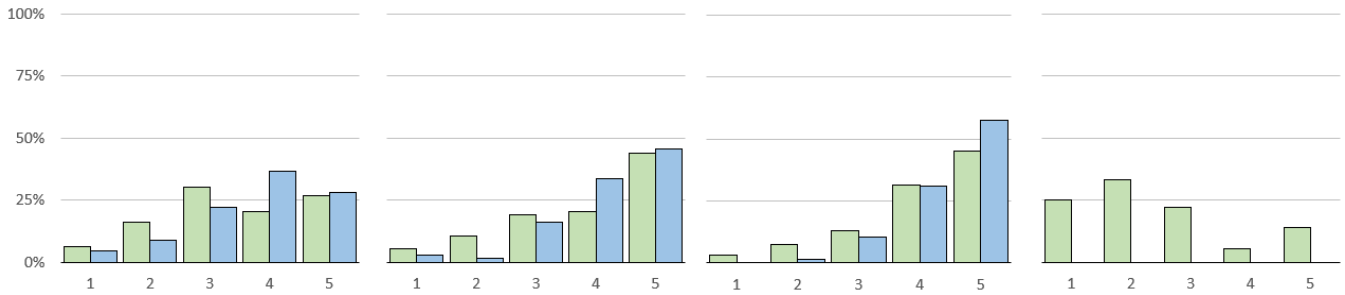


Fig. 1. Survey responses to the questions (a) “Did the oral exam(s) help you master the subject material better or provide extra incentive to do so? Did they contribute positively to your learning in the course?”, (b) “Do you feel the oral exam(s) contributed positively to academic integrity in the course?”, (c) “Did you find oral exam(s) to be fair and accommodating to you?”, (d) “Did the oral exams cause you undue stress?”

conducted through Zoom and students had 15 minutes to answer the questions. In FA20, two TAs who were both Ph.D. students administered the oral tests. In WI21, two senior undergraduate students who had conducted oral exams in ECE35 in FA20, joined the team. The instructor participated in testing some students in both quarters.

### III. RESULTS

We used several surveys to gauge student impressions of the oral exam. Fig.1 shows results for four questions from the end-of-quarter survey, on a 5-point Likert scale (1: not at all, 2: slightly, 3: moderately, 4: significantly, 5: to a great extent). From the first two questions, in Fig 1(a) and (b), we see that students felt that there was a moderate value in terms of improving subject mastery and a stronger positive impact on academic integrity. The latter is valuable since if students believe others are cheating, they are more likely to cheat as well (to remain competitive). Fig 1(c) and (d) show encouraging results about the commonly mentioned downsides of oral exams, namely concerns about fairness and anxiety (for the latter, only ECE35 included this question in the survey).

Fig. 2 shows two additional questions from the same survey, on the same scale. It illustrates that students have a largely positive impression of the value of the oral exams. This is particularly true in a remote setting, see Fig 2(a). This may be due to their impression of how it improves academic integrity, which is a commonly cited issue in the online environment. However, students also see a continued benefit if instruction moves back to in-person, see Fig 2(b).

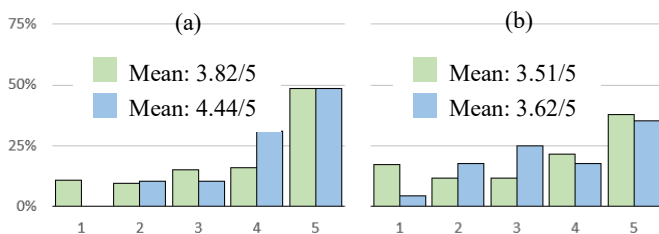


Fig. 2. Survey responses to the questions (a) “Do you feel it is beneficial to have oral exam(s) for this course when it is taught remotely?”, (b) “Do you feel it would be beneficial to have oral exam(s) if this course were taught in-person (i.e., after COVID-19 is over)?”

### IV. CONCLUSIONS

We presented our preliminary results on incorporating oral exam into two large engineering undergraduate engineering courses. Surveys on student sentiments suggest that they see value in this kind of exam, while concerns about bias and anxiety appear manageable. However, a more detailed study is needed, to corroborate these observations and explore benefits such as a focus on conceptual understanding. We are also looking into examiner training and improving exam structure to further address challenges such as implicit bias, anxiety and scalability. We hope that his work demonstrates that oral exams are viable in large classes and a worthwhile complementary assessment strategy to explore further. We believe that, while the remote setting enabled this work, some of the lessons learned will carry over when we return to in-person instruction.

### ACKNOWLEDGMENTS

We would like to thank Carolyn Sandoval, Nate Delson, Leah Klement, Josephine Relaford-Doyle, Joanna Boval, Mia Minnes, Christine Alvarado, Sheri Sheppard, Elizabeth Holcombe, and Adrianna Kezar for their valuable discussions.

### REFERENCES

- [1] G. Joughin, “A short guide to oral assessment,” in Leeds Met Press, 2010.
- [2] P. Iannone, C. Czichowsky, R. Johannes, “The impact of high stakes oral performance assessment on students’ approaches to learning: A case study,” *Educational Studies in Mathematics*, 103(3), pp.313-337, 2020.
- [3] M. Huxham, F. Campbell, and J. Westwood. “Oral versus written assessments: A test of student performance and attitudes,” *Assessment & Evaluation in Higher Education*, 37(1), pp.125-136, 2012.
- [4] D. Grunwald, E. Boese, R. Hoenigman, Andy Saylor, and Judith Stafford. “Personalized Attention@ Scale: Talk Isn’t Cheap, But It’s Effective,” *ACM Techn. Symp. on Computer Science Ed.*, pp.610-615. 2015.
- [5] P. Ohmann, “An Assessment of Oral Exams in Introductory CS,” *ACM Techn. Symp. on Computer Science Ed.*, pp.613-619, 2019.
- [6] B. B. Jensen, “Oral assessment in engineering education,” *International Journal of Electrical Engineering Education*, 47(4), pp.375-379, 2010.
- [7] L. Roecker, “Using oral examination as a technique to assess student understanding and teaching effectiveness,” *Journal of Chemical Education*, 84(10), pp.1663-1666, 2007.
- [8] A. Akimov, M. Malin, “When old becomes new: a case study of oral examination as an online assessment tool,” *Assessment & Evaluation in Higher Education*, 2020.

