Towards More Authentic Assessments: Technical Interviews as Alternatives to Traditional Exams

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Abstract

Traditional written exam and quiz assessments rarely represent actual experiences of practicing engineers, while other assessment modalities such as traditional homework and "take-home" exams are not robust to challenges posed by generative artificial intelligence or portals such as Chegg and Course Hero. Alternative assessments incorporating authentic professional experiences within engineering classrooms may instead be preferred. Authentic assessments can provide students with experiences that they will encounter in their careers while, at the same time, providing instructors with an opportunity to assess students' grasp of topical engineering content. This work seeks to examine the question "how do students perceive more authentic assessments?" by documenting a "technical interview" oral midterm exam administered as a major assessment in a core Introduction to Thermal-Fluid Sciences (ITFS) engineering course. Interviews were led by the course instructor, who asked each team to respond to a previously provided prompt. After each team's exam interview, each student on the team was anonymously surveyed regarding her or his own perceptions of the oral assessment. Broadly speaking, students indicated positive perceptions of the oral interview approach, indicating that they thought deeper about, gained a better understanding of, and learned new things about course content while preparing – more intensively as a team – for the oral exam compared to traditional exam instruments. Overall positive sentiment regarding individual student experience, enhanced learning outcomes, team dynamics, and modeling of professional engineering reality suggests that oral examinations can serve as an effective alternative and/or complement to traditional non-oral assessment instruments.

Introduction

Shortcomings of traditional written assessment instruments are well-documented and such exam and quiz assessments rarely represent actual experiences of a practicing engineer. Indeed, this manner of assessment may lead to counterproductive anxiety [1] and overemphasized student preparation for the *assessment instrument* at the expense of focus on

(1) the content to-be-assessed and/or

(2) exercise of desirable supra-technical skills such as teamwork, lateral thinking, and effective communication.

Other assessment modalities such as traditional homework, "take-home" exams, and even some kinds of "authentic assessments" [2] are not robust to challenges posed by generative artificial intelligence (AI) [3, 4] or educational support portals such as Chegg (among several others) [4, 5]. Accordingly, assessments that incorporate authentic professional experiences within engineering classrooms may instead be preferred. Key notions of "authenticity" used in present context are indicated below since, as indicated by Ullah [2], among others, this term is associated with varying definitions across the literature (e.g., [6, 7]).

Authentic assessments can provide students with experiences that they will encounter in their careers while, at the same time, providing instructors with an opportunity to assess students'

grasp of topical engineering content. The work presented here examines the question "how do students perceive more authentic assessments?" by documenting a "technical interview" oral midterm exam administered as a major assessment within one section (33 students) of a core undergraduate Introduction to Thermal-Fluid Sciences (ITFS) engineering course at Rowan University. This course addresses topical content primarily from traditional introductory mechanical engineering thermodynamics coursework for which some study of the impact of oral exams on course performance has been already been undertaken (e.g., [8]). However, issues of thermodynamics are not emphasized herein. Instead, the results presented below and the intentional omission of specific thermodynamics content are together intended to address the core question of this study regarding student perceptions of oral examinations (in complement to studies such as [8-11]), and can reasonably extrapolate more broadly in many engineering/STEM curricula.

Implementation Approach

Roughly two weeks before the first scheduled exams, students were randomly assigned into eight teams of 4-5 students each. At this time, the overall interview format, including accommodation of "hybrid" remote and in-person interviews, the general theoretical content to be assessed, and the rationale of the oral assessment instrument - including its intended value as a mid-semester formative assessment tool - was explained to the class. The exam prompt was provided to each team two days prior to its scheduled exam interview. Within these two days prior to the interview, students were permitted to develop a team response to the quantitative prompt questions using any resources available to them (e.g., textbooks, internet, computational platforms such as MATLAB, …), except for interaction with non-team members. At the time these interviews were administered, generative AI was neither as mature nor as easily accessible as it is presently.

The situation for developing a team response as described above sought to emulate, to first order, an authenticity found more widely in engineering as practiced outside of the traditional classroom environment, including, but not limited to

   a) small team dynamics in addressing problems of moderate complexity, moderate ambiguity, and moderate solution duration,

   b) a comparatively long (relative to a timed exam) time for response to the prompt, reflecting lower time-pressure in formulation of a response to *prior* known questions (i.e., no overt surprises), and

   c) largely unrestricted access to problem solution resources.

Aside from prompting each team with unique parametric inputs (e.g., one specific value in a range of reasonable diameters or power input rates), no effort was made to vary the exam prompts presented to individual teams. Instead, to combat lapses in academic integrity, students

   1. were reminded of the University academic integrity policy,

   2. had the key authenticity motivations, (a)-(c) above, of the interview assessment explained to them, and

   3. were asked to treat other teams as "competitors" despite no distinct exogenous incentive to do so.

It is reasonable to assume that some degree of self-policing within teams may have also helped avoid significant relaxation of academic integrity standards.

Interviews were held across three consecutive class sessions during scheduled exam interviews. Those students *not* participating in a scheduled exam during a particular class session were provided the opportunity to work with other teammates on a separate coursework-relevant project to effectively use class time to maintain progress toward overall course goals. Interviews were led by the course instructor, who asked each team to respond to the previously provided prompt. Team responses were assessed against a pre-determined rubric. To avoid propagating viable exam questions, neither the specific prompt nor its companion grading rubric is made available here. However, this context permits the results presented below to more generally reflect the prior assertion that authentic assessment implementations can be discipline-agnostic.

Shortly after each team's exam interview, each student on the team was anonymously surveyed regarding her or his own perceptions of the oral assessment. The survey was conducted by an outside (of the course section) evaluator who was not the course instructor. The survey consisted of 14 Likert-type elements as well as two open-ended prompts regarding the assessment format. Of the 33-student course enrollment, N = 32 survey responses were received. A formatted copy of the survey, which was originally administered through an online portal, appears below in Appendix A along with annotations in brackets (e.g., [Effort]) briefly indicating the primary interrogative intention of each individual Likert element.

Results and Discussion

Results from the Likert survey are presented below in Figure 1. Broadly speaking, students indicated positive perceptions of the oral interview approach. Aggregate results show

- that students thought deeper about (Element 5), gained a better understanding of (Element 13), and learned new things about (Element 10) course content while preparing – more intensively (Elements 1 and 2) *as a team* (Element 8) – for the oral exam; and

- that students agreed that the exam instrument was "more authentic" (Element 14) compared to their collective experiences with non-oral assessments.

Notably, perceptions regarding the student experience also indicate an overall strong agreement with student enjoyment of the interaction with the course instructor compared to the lack of direct interactions during traditional non-oral assessments (Element 4). This was attended by neutral sentiment regarding exam anxiety associated with the oral instrument (Element 3).

The overall positive sentiment regarding individual student experience, enhanced learning outcomes, team dynamics, and modeling of professional engineering reality suggests, as elsewhere (e.g., [10-14]), that oral examinations can serve as an effective alternative and/or complement to traditional non-oral assessment instruments.
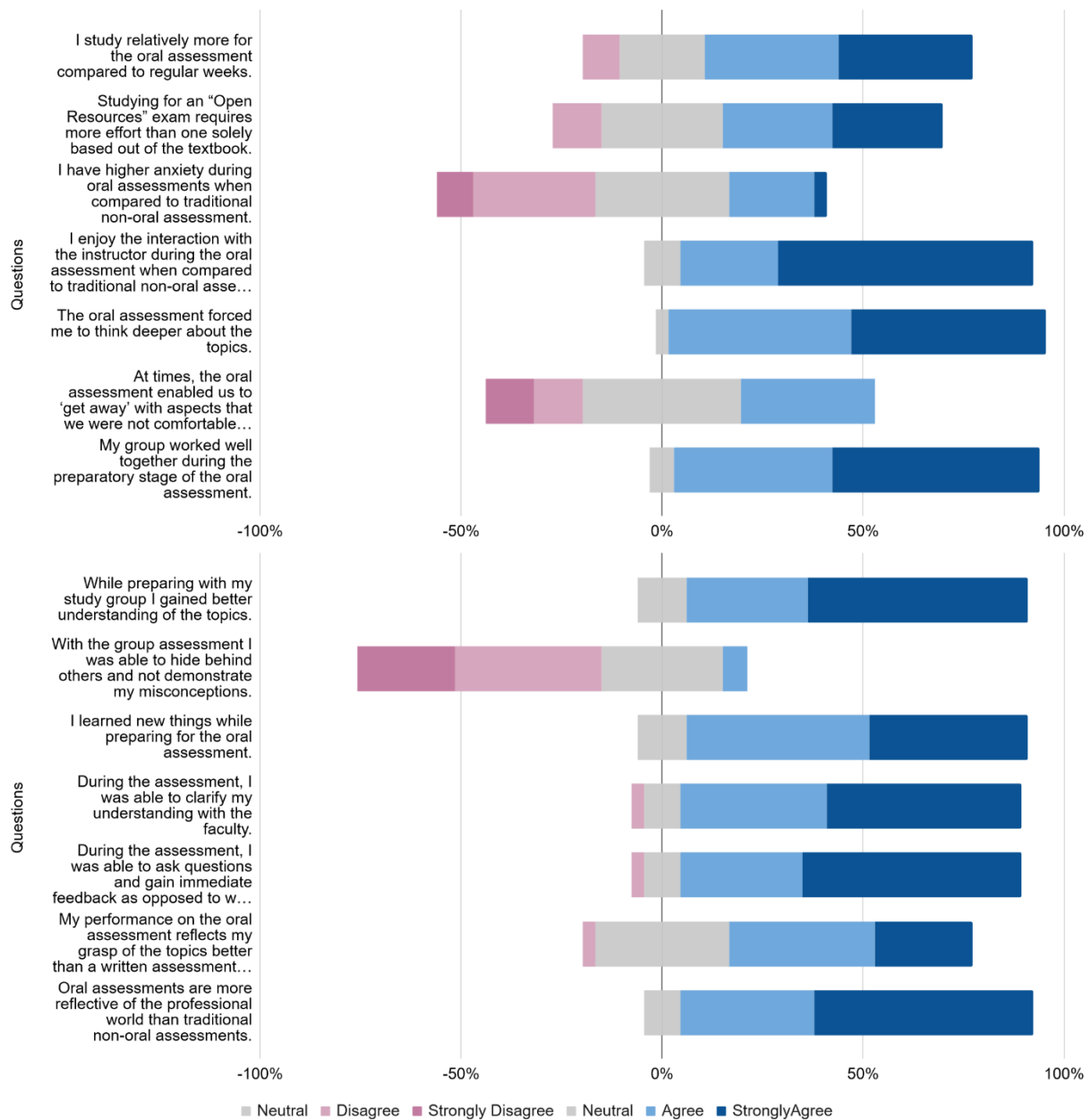
Figure 1. A summary of the Likert scale rating question responses (N = 32)

In addition to the Likert Elements so far presented, the two open-ended questions posed in the post-exam survey were:

1. *Q1*: "Please provide additional comments on whether engaging in discussion with the instructor impacted your preparation for this assessment. Why or why not?" and

2. *Q2*: "Please provide additional comments related to the oral assessment that you would like to share."

Some common and representative responses are shared below.

Q1 Examples

"It definitely had a positive impact, it allowed for a constructive discussion about the material. We focused on building our understanding of the material and our ability to explain the material."

"I think engaging with the instructor was very helpful, especially in problem settings where there are multiple approaches but few correct answers, it was beneficial to be able to rapidly think of different approaches and be encouraged in the correct direction. Also, the immediate feedback and changing of our thinking style was helpful in understanding the content."

Q2 Examples

"Overall, I like this format and it felt much more relaxed than a non-oral exam. In addition, it is very realistic to a working environment we will be working in and we are attacking real world problems. However, the downside of such an exam is that if you are too relaxed, you tend to lose track of the time constraint given for such an exam or "interview". In the future for students, it is important to keep track of time and get your point across in the least amount of words and as clear as possible. Also, working on a group can be a potential for conflict (however my group was good)."

"Due to this not being in a typical test-taking format, I had a very high amount of anxiety before this exam. During the assessment, I was no longer anxious."

"I think that this model of assessment is effective, but I do not think that it should be implemented in every course. I think that this assessment could work provided there is also a written assessment during the semester. Maybe earlier on in the semester when the concepts are still new, a written exam is more appropriate, but later on in the semester or perhaps for the final exam, this format might be more appropriate because students have a more well-rounded knowledge on the subject."

Conclusions

This study adds to an existing database of studies that indicate some of a variety of enhancements that may benefit students who are administered authentic oral exam assessments. Such assessments have the potential to improve student understanding, combat growing issues related to violation of academic integrity, and permit deeper instructor engagement with students.

Acknowledgements

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Appendix A – Survey Instrument

ITFS Oral Assessment Survey

This survey is designed to capture outcomes of the oral assessment in this course. This survey will not affect your grades. The survey is anonymous. I appreciate your input because it helps us design meaningful learning experiences.

Rate the following statements using the following scale:
1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree

1. [Effort] I study relatively more for the oral assessment compared to regular weeks.
2. [Effort] Studying for an "Open Resources" exam requires more effort than one solely based out of the textbook.
3. [Attitude] I have higher anxiety during oral assessments when compared to traditional non-oral assessment.
4. [Attitude] I enjoy the interaction with the instructor during the oral assessment when compared to traditional non-oral assessment.
5. [Advantage] The oral assessment forced me to think deeper about the topics.
6. [Disadvantage] At times, the oral assessment enabled us to 'get away' with aspects that we were not comfortable with.
7. [Group Dynamics] My group worked well together during the preparatory stage of the oral assessment.
8. [Group learning] While preparing with my study group I gained better understanding of the topics.
9. [Free rider] With the group assessment I was able to hide behind others and not demonstrate my misconceptions.
10. [Advantage] I learned new things while preparing for the oral assessment.
11. [Advantage] During the assessment, I was able to clarify my understanding with the faculty.
12. [Two-way assessment] During the assessment, I was able to ask questions and gain immediate feedback as opposed to written assessments.
13. [Assessment preference] My performance on the oral assessment reflects my grasp of the topics better than a written assessment would.
14. [Realistic] Oral assessments are more reflective of the professional world than traditional non-oral assessments.

Open-ended Question 1
Please provide additional comments on whether engaging in discussion with the instructor impacted your preparation for this assessment. Why or why not?

Open-ended Question 2
Please provide additional comments related to the oral assessment that you would like to share.