



# Evaluating competency development using interactive oral assessments

Saeed Shaeri <sup>a</sup>, Danielle Logan <sup>b</sup>, and Amita Krautloher <sup>c</sup>

<sup>a</sup> School of Computing, Mathematics and Engineering, Charles Sturt University, Australia

<sup>b</sup> Griffith Business School, Griffith University, Australia

<sup>c</sup> Division of Learning and Teaching, Charles Sturt University, Australia

Corresponding Author Email: [sshaeri@csu.edu.au](mailto:sshaeri@csu.edu.au)

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## ABSTRACT

### CONTEXT

Charles Sturt University Engineering students complete four one-year, full-time, paid work placements during their 5.5 years of combined Bachelor of Technology/Master of Engineering studies. During their first and third work placements, students also complete four subjects, in which they are required to compile a professional portfolio claiming and demonstrating their skill development in a number of competency elements.

### PURPOSE

Given the 2020–2021 pandemic and lockdowns, many institutions strived to implement assessment approaches that suited their immediate needs in conducting fair and integral online assessments. In the meantime, Interactive Oral Assessments (IOAs) have been gaining popularity due to the benefits they offer. An IOA is an authentic, scalable, interactive and time-effective method of assessing students' achievements of the learning outcomes. This paper discusses the use of an IOA in the Professional Portfolio – Advanced subject in 2021 and presents and evaluates the outcomes of a successful implementation.

### METHODOLOGY

This mixed-method study elaborates the experience of the authors in implementing an IOA in the mentioned subject and offers a reflection on the success of the IOA approach to assessing particular aspects of knowledge and experience acquisition. The arguments are supported by self-observation, comparison of the current and previous subject offerings, as well as the results of the end-of-semester subject experience survey (SES).

### ACTUAL AND ANTICIPATED OUTCOMES

The results/observation confirmed that adoption of the IOA allowed for an authentic, unscripted conversation between each student and the assessor, shaped by a unique scenario (e.g., engineering skill development, similar to the EA CPEng application process). Implementation of the IOA also resulted in a higher level of student engagement with the content and learning material, as well as better achievement of the outcomes. There were also greater effectiveness and efficiency for the assessors in the marking process, as well as enhanced levels of academic integrity. Finally, students were expected to achieve enhanced employability skills and a sense of connection to their future careers/professions.

### CONCLUSIONS

From an assessor's point of view, using an IOA and stepping away from the barriers of traditional assessments, provided greater assurance of the students' quality of learning. Moreover, students' achievements were demonstrated through both 21st-century and higher-order thinking skills, in line with the institution's aspirational graduate learning attributes.

### KEYWORDS

Interactive Oral Assessment, Work Placement Learning, Professional Engineering Portfolio

# Introduction and Background

Within the context of workplace learning, assessment of students' professional development and competence in engineering is generally performed through assignments, exams, and projects. However, written assessments put limits on the ways that such competence can be assessed. For instance, students respond to a set of given questions or defined tasks that are the same for the cohort, and not necessarily relevant to individual circumstances. Moreover, mostly, the written submissions have limitations for the number of pages or words, in order to make the evaluation plausible with limited staff and time resources, and as such, they limit students' ability to present their achievements in varied aspects of the workplace learning environment. This paper discusses a new approach to efficiently, effectively and verbally assess the level of students' competence development in a number of elements of competency. In the following, the context of the corresponding subjects and their assessment approaches are explained, with the focus on the design and re-design of the relevant subjects and assessments.

## Professional Portfolio

Charles Sturt University (CSU) hosts CSU Engineering as part of the School of Computing, Mathematics and Engineering in the Faculty of Business, Justice and Behavioural Sciences. CSU Engineering is known to be one of the emerging engineering schools in Australia and internationally (Graham, 2018). The CSU Engineering's first intakes in the combined Bachelor of Technology/Master of Engineering (Civil System) degree was in 2016 (Lindsay and Morgan, 2021) and is expected to have its first group of graduates in December 2021. Based on the curriculum model, after completing three face-to-face, on-campus semesters, students complete four one-year, full-time, paid work placements towards their degrees. Alongside their employment, students also complete a number of subjects. In this context, a subject is a unit of study in which a student enrolls for a semester. Accordingly, Engineering Portfolio (EP) and Performance, Planning and Review (PPR) are two series of five subjects in the degree, their details are presented in Table 1.

The overall aim of the PPR subjects is for students to set and measure tangible, individual goals related to their work placement activities and personal skill development plan, and then work towards achieving these goals by the end of their respective PPR subject. Within the course of any of the PPR subjects, each of the students complete reviews of their progress with their academic mentor and placement supervisor, to demonstrate adequate progress towards achieving their goals.

The overall aim of the EP subjects is to guide students on how to collect evidence of their professional skill development in their workplace, and then document claims of competency against certain indicators of attainment. Such competency elements are ideated from the 'Engineers Australia Stage 1 – Competency Standard For Professional Engineer' (Engineers Australia, 2019) and 'Australian Engineering Competency Standards Stage 2 – Experienced Professional Engineer' (Engineers Australia, 2018). Similar to the Engineers Australia Chartered Professional Engineer (CPEng) application process (Engineers Australia, 2021a), the evidence that students collect from their workplace tasks and projects provide the support and justification required by the EP subjects to make a claim of competence about a number of elements of competency and their respective indicators of attainment. Examples of the elements of competency include 1) knowledge of engineering tools, standard engineering methods, and stages of the engineering design process and approaches to synthesise various design stages; 2) communication and professional skills; 3) ethics and accountability in engineering practice; and 4) expertise and knowledge of information needs, collection and management of information, and collaboration and co-creation of information.

Such elements are not all covered in all of the EP subjects, meaning that at various stages of students' development in their four work placements, as well as the stages of their identity development, they are required to demonstrate achievement of a collection of the

abovementioned elements. Moreover, the way that each of the elements is described varies across the first four subjects, with an increasing level of complexity and difficulty from the earlier subjects towards the later ones. Consequently, through the EP-Professional Engineer subject, 16 competency elements (the same as Engineers Australia, 2018) for an Experienced Professional Engineer are discussed and assessed, providing the opportunity for students to assess their readiness (or otherwise the gap) to make a strong application for a CPEng status. Currently, there are discussions that CPEng (as a nationally recognised status) becomes a required method of certification for nationally registered engineers in Australia (Engineers Australia, 2021b). Similar lines of thought derive students' desire to succeed in the series of EP subjects.

**Table 1 Subject details**

Underlying Degree	Academic Year	Subject Name in the PPR* series	Duration	Subject Name in the EP** series	Duration	Offering mode
Undergraduate	1 <sup>st</sup>	Student Engineer	2 semesters			On-campus
	2 <sup>nd</sup>	Junior Cadet	1 year	Introductory	1 semester	Online
				Developing	1 semester	
	3 <sup>rd</sup>	Intermediate Cadet	1 year	-	-	
Postgraduate	4 <sup>th</sup>	Senior Cadet	1 year	Consolidating	1 semester	
				Advanced	1 semester	
	5 <sup>th</sup>	Professional Engineer	2 semesters	Professional Engineer	1 semester	

\* Performance, Planning and Review (PPR) subjects

\*\* Engineering Portfolio (EP) subjects

Before the start of the academic semester, students have access to a Subject Outline (SO) containing a description of what the subject entails including assessment regime and descriptions. On that account, for the first four of the EP subjects, the assessment items can be categorised into three groups: 1) discussion on collecting and collating appropriate evidence for particular competence claims; 2) development of the competence claims supported by previously discussed (and agreed upon) evidence; and 3) self-evaluation and reflection (and/or peer-evaluation) of the developed competence claims. Accordingly, the focus of this paper is on the evolution of the reflective assessment items across the two iterations of the EP-Consolidating and EP-Advanced subjects, and the adoption of an Interactive Oral Assessment approach.

### Interactive Oral Assessment

Oral assessments have long been used in various disciplines and contexts (Joughin, 2010). They can take the form of an interview, viva voce, oral defence, presentation, or pitch to name a few (Karlton and Karlton, 2014; Learning Futures, 2020). An Interactive Oral Assessment (IOA) approach, on the other hand, is a genuine, unscripted, synchronous conversation between an assessor and a student (or a group of assessors/students) around an 'authentic workplace scenario' (Sotiriadou et al., 2019) which can be performed face-to-face or online.

The unscripted nature of the assessment is related to the fact that, instead of set questions, the assessor uses normal conversational cues based on the individual student's circumstance,

to assess the student's learning and achievements (Sewagegn and Diale, 2020) in light of the introduced scenario. The scenario (or put it simply, the topic of the conversation) is defined as part of the assessment description for students to prepare themselves (and any necessary supporting evidence for the conversation) in advance. In this regard, the scenario is purposefully outlined as 'authentic' rather than hypothetical, as such an assessment strategy proved to be a lot more effective (Karunanayaka and Naidu, 2021). Such authenticity can easily be achieved when the scenario is strongly linked to students' workplace (or real-life) experiences. For instance, in the context of the EP subjects, the scenario is defined around the students' skill development in their workplace and their preparedness to become chartered professional engineers, and hence is considered authentic as it deals with real and current work experience each of the students is engaged in, as well as their plan for further skill development.

During the conversation (i.e., the assessment process), the assessor may use prompts to steer students in the right direction and ensure the requirements of the assessment are satisfied. However, as there is no pre-defined series of questions to be asked by the assessor, the conversation is interactive in the sense that the assessor uses the student's responses to bring forward the next point for discussion, and identify the clues and evidence to support a given grade. This makes each student's IOA unique because their experiences are unique to their circumstances and workplace. The dialogue continues (within the limit of time) until the assessor covers all that is needed based on the marking rubric and assessment requirements.

Such opportunities truly focus on the assessment for learning paradigm (William, 2011) while adequately assures evaluation of the achievement of the Subject and Graduate Learning Outcomes. Moreover, the genuine and unscripted nature of the conversation about the chosen scenario has proven to be an accurate and effective means of evaluating the students' learning (Sotiriadou et al., 2020).

During this IOA process, the assessor can also provide immediate feedback to students, while being sure that such feedback is in fact heard. This also allows students to immediately ask for clarification, reflect on and synthesise their learning, or present their counterargument if they disagree with any feedback. This assists the conversation to be more engaging and interactive. Such an effective exchange of feedback elevates the conversation to a higher level, and this is how longer-lasting learning is expected from the IOA approach (Sotiriadou et al., 2020; Griffith Business School, 2021).

## Context

The first author of this paper coordinated and taught the EP-Consolidating and EP-Advanced subjects during their first two offerings. Accordingly, Table 2 presents details of the four reflection assessment items that were designed in those two subjects. It is worth noting that the subject and assessment designs have always been limited by the given autonomy in the framework of the curriculum, the number of credit points assigned to the subjects, and the designated workload hours. Given these, the main design rationale informing the 2020 offering was to familiarise the students with the concept of reflective writing through the lens of competency claims (Lawson et al., 2015; Lake et al., 2016; Helwig et al., 2019). In contrast, in the EP-Advanced subject in 2021, deeper and more comprehensive reflections were required as technically the students were in their Master's part of the combined degree. Moreover, through longitudinal scaffolding between subjects, the aim in the EP-Consolidating subject was to make students ready for their successive subject; i.e., EP-Advanced.

As depicted in Table 2, one element of competency was deemed sufficient given the imposed limitations for such an assessment in the EP-Consolidating subject in 2019, where there was also a one-page limit (approximately 450 words). However, after the first offering, the quality of the students' reflections soon proved that the written reflection format limited students in terms of discussing all aspects of their achievement and competence development, because there was no space for creativity, or non-textual content (e.g., evidence in the form of screenshots, graphs, tables, etc.). Therefore, the choice of a video recording was introduced

for the EP-Advanced subject in 2020 – each student could choose one element of competency and record an 8–10-minute video reflection, which equates to approximately 1200–1500 words in written form. Furthermore, autonomy was also given to students to be creative in professionally editing their recordings with the use of audio-visual effects, embedded evidence, etc. Nevertheless, in the end, the results were not satisfactory as a whole, as many of the students recorded a very basic video, with them reading directly from a prepared script. So, the most important aspect of the assessment, i.e., the discussion and evidencing the reflection, was not achieved in most cases. There was also little indication of spontaneous, deep, critical reflection of the chosen competence element (Krych-Appelbaum and Musial, 2007).

**Table 2 EP Subject offering details**

Subject Name	Offering year (Semester No)	Assessment Title	Assessment Type	Submission Length
Consolidating	2019 (S3)	A Reflection	Written	One page, only text, one competency element
Advanced	2020 (S1)	A Video Reflection	Video	8 to 10 minutes of recording, one competency element
Consolidating	2020 (S3)	Portfolio Consolidation: A Reflection	Written	800 to 1000 words + one evidence page, one competency element
Advanced	2021 (S1)	A journey towards higher-level competencies	Verbal	20 to 25 minutes of conversation, two competency elements

Equally important, the effectiveness of the exchange of feedback between the marker/assessor and the students in their usual written form of feedback was not measurable in either of the subjects. This was reinforced by the observation that few students had ever proposed an actionable plan for further development of their reflective writing skills (i.e., through the relevant PPR subjects) after having access to their personal feedback. Perhaps their decision not to access the feedback was influenced by the fact that the reflective assessment came at the end of the EP subjects when students were focusing on the following semester's subjects.

Informed by these results, the 2020 offering of the EP-Consolidating subject, still comprised the written reflection form, however, with an extended word count, there was also an opportunity to provide evidence. That is, students were allocated 800–1000 words for reflection for one competency element, and one page for evidence (Table 2). This change resulted in significantly better outcomes in terms of the depth and breadth of reflections. However, the efficient exchange of feedback was still the missing element as there was no evidence of cross-subject adjustment of a personal development plan in the relevant PPR subjects. Concurrently, with the aim for a more effective assessment regime, the idea of an IOA was adopted for the second offering of the EP-Advanced subject design in 2021, as explained below.

## **Development, Implementation and reflection**

The development of the IOA assessment within the EP-Advanced subject involved a course of actions with the support of the second author as a mentor within a Community of Practice (CoP) at CSU and the third author as the Educational Designer. Accordingly, a holistic approach was taken to redesign or re-align the different aspects of the subject, various assessments and their respective marking rubrics, subject content and materials, and the subject outline to ensure that the reflection assessment was scaffolded adequately to help prepare students for their IOA.

To start with, the title of the assessment (Table 2) was changed to “A journey towards higher-level competencies” to more carefully align with the concept of an IOA. Moreover, the required scenario for the conduct of the IOA was designed to be about a conversation between a senior and a junior staff, where the latter has planned to apply for CPEng and seeks feedback about their preparedness. In more detail, students were able to choose two of the six competency elements discussed in the subject, and develop their case. This entailed reflecting on how the actions and decisions for each student, in their tasks, projects, and works, had been instrumental in enhancing their competency in their chosen elements from an introductory level to a more advanced one.

The choice of competency elements, on the one hand, provided greater flexibility for students to demonstrate their achievements over the course of their work placement years, given the different places they worked in and the varied journeys undertaken to acquire advanced skills, thus ensured the dialogue to be personalised and unique. On the other hand, it provided more opportunities for the assessor to evaluate different layers of each student’s achievement, which equated to better quality assessment outcomes. That is, the conversations were personalised, genuine, authentic and engaging for each student, offering a more relaxed and less stressful environment. Moreover, using evidence to support the interactive conversation, enriched the authenticity of the conversation as students were able to discuss their lived experience in a semi-casual/formal setting, far from to normally stressful examination venues.

In the second place, the marking rubric was developed in a way to assess students’ soft skills along with their content knowledge, as well as their ability to apply that knowledge to other real-life scenarios. For instance, instead of applying for CPEng, the conversation could be about a staff’s performance review or promotion. The marking rubric encompasses criteria to seek for evidence in the conversation about:

- 1) A critical reflection, analysis and recognition of the processes involved in students' careers and subjects which were instrumental in the development and improvement of their chosen elements of competency,
- 2) A critical reflection, analysis and recognition of students' strengths and limitations, and the changes in their personal assumptions, habits, and values,
- 3) A critical analysis and evaluation on the relationship between students' actions and decisions, and any resulted improvements in their chosen competency elements,
- 4) An examination and discussion of a metacognitive, pro-active concrete, meaningful and attainable action plan for further actions and learning.

In the next stage, the subject content and materials were also updated. Specifically, students were provided with 1) a written guide on how to prepare themselves for their IOA session (including the booking); and 2) two exemplars of mock IOA recordings of different standards that were purposefully prepared for the subject to give students a sense of what to expect in their IOA. Furthermore, in one of the online classes, a separate time was allocated for students and they were given the opportunity to review and discuss the exemplars to enhance their understanding of the assessment requirements. Students applied the assessment rubric to the interactive oral examples and shared their feedback with their class peers, suggesting improvements regarding preparation, presentation, reflection, etc.

At the time of IOA, students were given about 10–12 minutes to present their case and scenario in a typical verbal presentation format, and then the assessor and the student discussed various aspects of the presentation for 10–13 minutes in a simulated workplace setting. The objective was to not reassess students on what they had already been assessed on through other assessment items, rather to provide students with the opportunity to synthesise their knowledge and apply it to other scenarios. Such an approach is key to help develop students' higher-order thinking skills, 21<sup>st</sup>-century skills and graduate learning attributes. The entirety of each IOA was facilitated via an online meeting platform for two reasons. Since the students were at their workplaces and not on-campus, anyone could join the meeting (i.e., the assessment) without physically attending in person. Moreover, easily achieved using the online

platform, all the IOAs were recorded for any future quality control, moderation, or accreditation purposes.

Considering aspects of an assessment such as reading a written submission, providing (written/verbal) feedback, completing the evaluation and filling the marking rubric, one of the advantages of IOAs for the assessors is a significant reduction in the time required for evaluation. Because all the abovementioned tasks can occur concurrent with the conversation itself. According to the institutional workload policy details and the context of EP subjects, 45% of the first author's time in the subject was allocated to assessment marking. However, by adopting the IOA approach, the required marking time for an individual student was reduced by about 60%. Such productivity can better be used for the development of resources or student consultation time. Nevertheless, it needs to be noted that while such a reduction would benefit future iterations of an IOA, because it was the first time such an approach was adopted by the first author there was no saving in time experienced overall owing to the time invested in redesigning the subject and developing the necessary resources.

The other advantage of IOAs was a better assurance of the level of students' knowledge and developed skills, rather than a lack of confidence or thorough evidence whether they had actually understood certain concepts based on their in/ability to express themselves confidently via a written medium.

The final advantage of IOAs relates to the exchange of feedback during the interactive discussion. At any stage of the scenario presentation, the assessor can provide immediate feedback or seek clarification. Likewise, the student can immediately ask for clarification, or provide more evidence and justification if required to support their case, and accordingly extend and synthesise the conversation further. For participants with English as the second language, this aspect is deemed very important. These factors equate to a highly effective exchange of feedback with expected longer-lasting learning. Students also found this experience resembling what might happen in their workplace. That is, most of the engineers engage in conversations and exchange of ideas on a daily basis, where they might be spontaneously asked about their opinions which by itself requires drawing upon past knowledge and experience. Accordingly, the authenticity of the discussed scenario in the subject achieves another aim of the IOA, which is learners' performance beyond graduation.

## **Supporting Evidence**

A comparison of the student outcomes from this and the previous offering showed the following. In general, the second offering of the subject was found to be significantly more successful:

- 1) Based on the subject access analytics hosted on the learning management system site, the average number of access to the subject site increased from 7 to 32. Accordingly, the average duration of access improved from 54 minutes to 271 minutes. This indicated that there was an overall more interest in engagement with the subject materials.
- 2) The class attendance increased from an average of 60% to about 79%, which by itself was demonstrative of more interest to participate in class activities and successful completion of the subject.
- 3) The average mark of the students increased by one band from Credit to Distinction. This was partly affected by the improvement in the marks for the peer-review assessment item, and partly related to the IOA, where the average of the marks increased from Distinction to High Distinction.

Apart from self-evaluation of and reflection on the success in implementing the IOA approach, students' feedback was also received. In June 2021, as part of the normal end of session subject experience survey (SES), the students responded to the following statement on their experience with the IOA: "The Interactive Oral Assessment approach supported my learning." The responses could be any of the following five options: a) To a very large extent, b) To a large extent, c) Somewhat, d) To a small extent, and e) To a very small extent.

With a response rate of approximately 65%, about 78% and 22% of the responses were given as 'to a very large extent' and 'to a large extent', respectively, meaning that all the students had a positive experience with the assessment item. Moreover, overall, the second offering of the subject scored an 88% SES score which exhibited a 48% increase compared to the first offering. Such level of satisfaction has been above expectation as normally students do not unanimously respond positively to fundamental changes. Factors such as dedicated class hours, preparatory activities, scaffolded assessment, and exemplar/sample recordings were found to be effective tools in this regard.

## **Discussion and Conclusion**

In this paper, the design and implementation of an interactive oral assessment approach to an engineering professional portfolio postgraduate subject were presented and discussed. The steps taken by the subject coordinator to prepare the teaching materials and design a robust assessment, in collaboration with an expert mentor and an educational designer, were elaborated. Some qualitative data about the subject performance and students' responses to the subject experience survey were also presented, which indicated the success of the re-design of the subject including the assessment design. It is believed that through assessing students' ability to demonstrate the depth of their knowledge and its application in responding to other 'what if'-type questions and challenges, all the expected benefits of an IOA were achieved. From an assessor point of view, using an IOA and stepping away from the barriers of traditional assessments, provide better assurance of the students' quality of learning, which is expected to be longer-lasting with benefits for their future. Moreover, students' achievements are demonstrated through critical, higher-order thinking skills, 21<sup>st</sup>-century skills and transversal competencies, in line with the graduate learning attributes.

Based on the success of the first iteration of an IOA, the first author is enthused to implement other IOA approaches within this subject. Moreover, at this stage, the above conclusions, as well as the applicability and possibility of reformatting the existing assessment items, encouraged and justified the adoption of an IOA approach to two more subjects (from the PPR series) within the same course. Limitations of the adopted approach and how this approach can be used in a broader context are briefly discussed below.

### **Limitations**

At this stage, for the discussed EP subjects, and similar ones (e.g., the mentioned PPR subjects) there appears to be no barrier to adopting and implementing an IOA where an authentic conversation between the assessor and students is expected. Having a clear scenario, students should be able to participate in an authentic professional conversation for the purpose of assessment. While in the current subject there was only one assessor for a cohort size of 14 students, IOAs are also considered scalable (Griffith Business School, 2021); that is for larger cohorts, it would be necessary to have multiple assessors, total hours of assessment allocation, and consistency of administering an IOA, as well as marking (which in many cases is not an issue as there are more staff in a teaching team for larger cohorts). Having said that, it would be required to train the staff involved and complete a moderation process to address issues such as bias and ensuring equity and consistency across multiple evaluators (Chakraborty et al., 2021) – a matter which is already practised in different contexts.

### **Broader applications within engineering subjects**

In this paper, the adoption of an IOA approach for individual student assessments was discussed. However, there are also other types of assessments in engineering education, such as assessing group works, team contribution, and peer assessments. Certainly, for a group-informed assessment in a verbal format, an IOA can also be used. For instance, the group should report to the assessor on the steps they have taken to complete a given task, much as they would discuss such steps with a supervisor or client on a team project in the workplace. For the assessors, rather than considering set questions, they can initiate an authentic



conversation through which any required aspects of the task can be covered and evaluated.

Likewise, peer evaluation of another student's performance can be shaped as a paired IOA. This provides the opportunity for the student evaluator to ask questions about the candidate's performance, while at the same time, the candidate can defend themselves against any criticism that they might receive from the evaluator, much as they would in a performance review scenario in the workplace. When such paired IOAs take place in the presence of the subject assessor, an evaluation of both the students can also be completed at once, improving efficiency. Whereas, in written form, the main assessor needs to access and evaluate two separate documents (i.e., for the candidate and evaluator), which is time-consuming and unproductive. The two abovementioned opportunities are suggested for readers who are interested in exploring the IOA approach further.

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