

INTERACTIVE ORAL ASSESSMENT SUPPORTING ACTIVE LEARNING

Anette Karlton, Johan Karlton

Industrial Engineering and Management, School of Engineering,
Jönköping University, Jönköping, Sweden

ABSTRACT

The CDIO standards stress the importance of using a variety of examination methods for effective learning assessment as well as active learning methods to help the students develop skills in applying knowledge to new settings. Oral assessment methods in a more traditional form where students answer questions in oral form instead of in written seems to be underrepresented in practice as well as in the literature although it has many benefits in supporting active learning and reaching learning outcomes. The oral examination method has been used during ten years within the field of Industrial Engineering and Management at the School of Engineering at Jönköping University in Sweden. The aim of this paper is to show how the oral assessment method has been successfully used in contributing to active learning in engineering education and lessons learned from this experience. The experience shows that by having students undertaking the assessment in groups, an active learning occasion is created by interaction between students as well as students and teacher. Through the design of the assessment the teacher has the opportunity to help the students to make connections between detailed knowledge and system understanding as well as among key concepts and to the application of knowledge to new settings. The assessment procedure also supports the teacher to discern the learning outcomes from each student. Further, the interaction between the teacher and the students during the assessment helps the teacher to capture what improvements need to be made in teaching and learning.

KEYWORDS

Oral assessment, Learning outcomes, Active learning, Learning process in assessment, Standards: 2, 7, 8, 11.

INTRODUCTION

The importance of using a variety of examination methods for effective learning assessment is emphasized in the CDIO standards as it improves learning skills if matched appropriately to intended learning outcomes. It also accommodates a broader range of learning styles as well as increases the reliability and validity of the assessment data (Crawley et al., 2007).

The CDIO standards further stress the importance of using active learning methods engaging students in reasoning about concepts, explaining different ways of contextualizing new knowledge and thereby also reflecting on their own learning process (metacognition) and thus helping them to develop skills in applying knowledge to new settings (ibid).

If the examination moment itself is designed so that it becomes an active learning opportunity, it could further enhance the learning process and outcomes. It is suggested in this paper that oral examinations have advantages in terms of facilitating active learning if designed and managed in a proper way and therefore could be used more frequently.

The oral examination method has been used during ten years in the course “Work-Human-Technology” within the field of Industrial Engineering and Management at the School of Engineering at Jönköping University in Sweden.

The aim of this paper is to show how the oral assessment method has been successfully used in contributing to active learning in engineering education and lessons learned from this experience.

Background

The CDIO syllabus learning outcomes are specified in CDIO standard 2 by comprising what students should know and be able to do at the conclusion of their engineering programs. The outcomes include personal, interpersonal, as well as product and system building learning outcomes. *Personal* learning outcomes focus on individual students' cognitive and affective development, for example, engineering reasoning and problem solving, experimentation and knowledge discovery, system thinking, creative thinking, critical thinking, and professional ethics. *Interpersonal* learning outcomes focus on individual and group interactions, such as, teamwork, leadership, and communication. *Product and system building* skills focus on conceiving, designing, implementing, and operating systems in enterprise, business, and societal contexts (Crawley et al., 2007).

In order to achieve various types of learning objectives it is important to choose assessment methods that support students in achieving the objectives. These methods may include written and oral tests, observations of student performance, rating scales, student reflections, journals, portfolios, and peer and self-assessment (ibid).

The learning assessment process

According to the CDIO approach assessment should be viewed as an integrated learning-centred part of the teaching process in contrast to more traditionally being regarded as separated from it (Crawley et al., 2007; Huba & Freed, 2000).

The process of assessing students' learning has four key phases according to Huba & Freed (2000) adopted by the CDIO standards. They are: 1) specification of learning outcomes, 2) alignment of assessment methods with learning outcomes and teaching methods, 3) use of a variety of assessment methods to 4) improve teaching and learning (see figure 1) where the fourth specification is regarded as maybe the most important (Crawley et al., 2007).

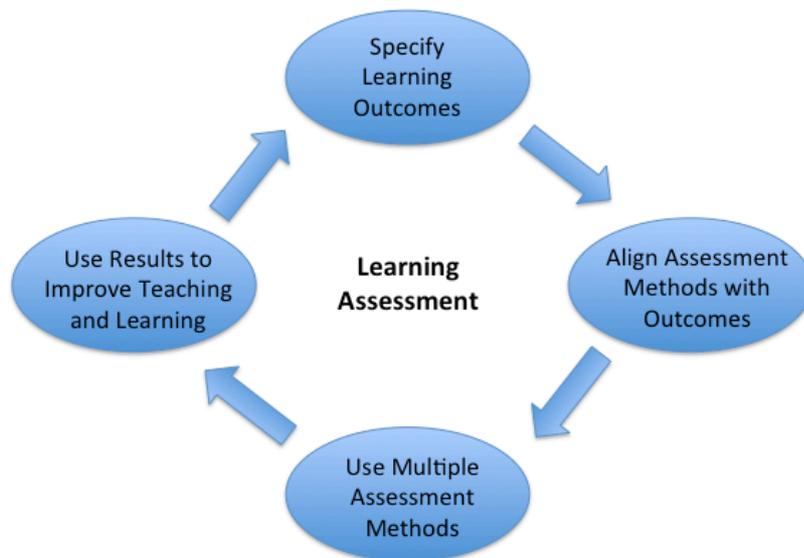


Figure 1. Student Learning Assessment Process reproduced according to Crawley et al., (2007) p. 155.

Consequently, one cannot speak of good or less good assessment methods without relating to the learning outcomes. Just as different learning outcomes require different teaching methods they also require different assessment methods.

In this paper the authors argue that the potential of oral examinations could be taken advantage of in order to enhance active learning and learning outcomes. Oral assessment is in the literature described and exemplified mostly by oral presentations of tasks and projects, by the teacher providing feedback on the oral presentation per se and giving some feedback on content and eventually creating some dialogue (Crawley et al., 2007; Toohey, 2002). Examples of the use of oral examinations in a more traditional form where students answer questions in oral form instead of in written are scarcer.

There are however some examples. Huxham et al. (2012, 135) divided biology students in two random groups and let one group perform a traditional written exam and the other group an oral exam with the same assessment questions. They found significantly better performance in the oral test group than in the written test group. They argue that "there is a sense of fluidity, of students 'trying things out' during the interchange of the oral assessment /.../. This stands in contrast to the 'static' representation in written assessments, and it is a powerful endorsement of the use of oral assessments." Thus the advantages of oral exams also appear to have to do with the greater dynamics of the examination process. An oral examiner says: "So that's probably the main difference: the writing exam is a product whereas this oral examination really shows us the process" which relates to the students' "thinking, their ability to construct an argument, their ability to recall appropriate evidence, their facility with text ..." (Badger, 2010, 86). Badger (ibid) used King and Kitchener's (1994, 2004) model of reflective thinking as a conceptual framework to interpret college students' critical, reflective thinking skills in an oral examination. The author conclude that oral assessment allow examiners to determine students, critical thinking skills by probing their ability to explicate, amplify, or justify their understanding. He also suggests that it may foster students' critical thinking abilities through their preparation for and participation in an oral examination.

ORAL ASSESSMENT METHOD IN THE COURSE “WORK-HUMAN-TECHNOLOGY”

As mentioned above, the oral examination method has been used during ten years in the course “Work-Human-Technology” (7,5 ECTS credits) at the School of Engineering at Jönköping University in Sweden. The objectives of the course are to give students a deeper understanding of the human at work and the interaction with the surrounding technology and organization in an industrial context. The course further aims at providing insights into the strengths and limitations of the human at work and how products and industrial systems can be designed to result in high efficiency and sustainable production.

Learning outcomes

After completed course the students are supposed to fulfil the following learning outcomes divided and summarized into the main categories required by the Swedish Higher Education Authority:

Knowledge and understanding

- demonstrate knowledge about different abilities and limitations of the human at work
- demonstrate knowledge about the legislation regarding work environment

Skills and abilities

- show ability to apply methods and models for analysis of the human at work and the system interactions involved

Judgement and approach

- show insights into how work systems design will affect the performance and well-being of the human at work.

The course is examined by four different assessment methods: 1) seminars 2) laboratory work 3) applied project work and 4) oral examination of theory (table 1).

Table 1: Examination Methods, Credits and Swedish Grading in the Course

Name of Test	ECTS value	Grading
Oral examination of theory	3 credits	F/3/4/5
Applied project work	3 credits	F/3/4/5
Laboratory work and seminars	1.5 credits	F/P

All examination methods include elements of oral assessments. The focus of this paper however is the examination called “oral examination of theory” in table 1, which consists of solely oral assessment.

During the course the students have access to a number of study questions designed to stimulate active learning of theory, methods and reflections on applications in practice. These questions then form the basis for the formulation of the assessment questions in the oral examination. Most questions are phrased to provide students with the opportunity to give answers that connects to all three learning outcomes described above. This allows the examiner to assess factual knowledge, holistic and context view, application, and capacity for critical reflection, which are the four assessment criteria used during assessment. Examples of assessment questions are:

- Describe the differences and similarities between model "X" and model "Y" in an analysis of a work system and give examples of the contexts in which the different models are suitable for use. Motivate and exemplify your answer.
- Describe problems with lifting work and what different principal methods that are available for evaluating the risk of injury in lifting work. Exemplify.
- Explain what aspects are important to consider when deciding which functions should be automated and which should be left to the operator and the problems associated with this? Motivate and exemplify your answer.
- Describe different types of naturalistic decision making according to model "X", how they relate to various types of human errors and what can you do to counter and remedy these? Exemplify.

Procedure of assessment and examination

Two teachers in the course having overlapping areas of expertise perform the oral assessment. The students are assessed in groups of three in two parallel groups. The assessment takes about 45 minutes per teacher and student group, which means that it takes an hour and a half to assess 6 students for two teachers.

Before the examination starts the teacher explains the procedure of the assessment process. Information is given that misunderstandings of the questions will be corrected but wrong or less correct answers will not. The teacher then has the opportunity to ask students how they feel about the oral assessment situation, which for most of them is a new experience, and detect if someone seems uncomfortable with the situation. This introduction and "warm-up" usually make the students more at ease with the situation.

An examination protocol is prepared in beforehand for each student on which they initially fill in their name and personal ID. The teacher then uses the protocol to take notes during the assessment by judging the answers according to the four criteria mentioned above: 1) facts, 2) holistic and context view, 3) application, and 4) critical reflection.

The assessment questions are designed so that the students in addition to displaying their theoretical knowledge can express how to apply it in practice by describing different application areas and by giving specific examples. The assessment questions are printed on a separate sheet per question. The same question is distributed to all three students in the group at the same time. Before the students answer a question they can prepare for about five minutes during which they can make short notes on the question sheet to collect their thoughts.

Students then respond in turn to the same question. Student A begins to answer the first question and when he or she has provided an answer within a reasonable time student number two is allowed to provide an additional answer whereupon student number three add further supplementary comments if he or she desires. Then student A is allowed to add further relevant comments that may have matured meanwhile. These comments are however not assessed on the same basis as the primarily answers but the process contributes to active learning for the students. If, however, any of the students provide a wrong answer, the other students are expected to be able to identify this and give a more correct answer or view. Then question number two is addressed first to student B and in turn to student C and A, and

finally question number three is addressed first to student C according to the same procedure.

When all three students have responded to each of the questions the teacher gives concluding remarks, addressing any misunderstandings and giving additional explanations to provide direct feedback and thereby further increase the learning outcomes in the assessment. This phase also allows for some dialogue with the students. They then shift from one teacher to the other and the assessment procedure is repeated, although with the opposite answering order.

When the first six students have completed the assessment the two teachers make a first grading of the results together according to the assessment protocols and their fresh experiences of the students' responses. This process is continued until all students are assessed, and two teachers can examine 24 students per day using this procedure. After examining all students, a second comparison of all results is made to ensure that the assessments have not changed during the examination due to the experiences during the examination. The authors' experiences are that a class of maximum 48 students can be examined in this way as efficient as with a written exam. Furthermore, the students can receive feedback on the results after just another day for administration work.

BENEFITS OF ORAL EXAMINATION

Through this arrangement of the oral assessment a number of advantages are achieved in line with the CDIO standards described above.

An active learning occasion is created as the students listen and learn from each other and from the teacher's additional comments and direct feedback during the assessment process. During the assessment procedure the students are encouraged to reason about concepts, explaining different ways of contextualizing new knowledge and thereby also reflecting on how to apply knowledge to new settings according to the CDIO standard number eight. The process further contributes indirectly to the students reflecting on their own learning process.

The assessment procedure gives an opportunity for the teachers to clarify things if required. As many of the students in this course are not native English speakers and originate from many different countries and cultures it makes it easier to avoid possible misunderstandings. Furthermore, the teacher can ask follow-up questions that help him or her to determine the depth of knowledge and the ability to reflect of each student. This is also one way of taking into account students' different learning styles and their way of presenting their learning outcomes. As applied examples are asked for in the assessment questions the teacher can help the students to make connections among key concepts and facilitate the application of knowledge to new settings. The ability of the students to relate detailed knowledge to systems understanding is also experienced being more apparent in a reasoning oral communication than in written answers.

Although this is a separate examination session it has the advantage of integrating learning into the assessment process consistent with the CDIO approach and this is true not only for the students but also for the teachers (compare Huba & Freed, 2000).

Furthermore the teachers have opportunities to help the students manage their nervousness by creating an atmosphere that is relaxing. The interactive oral assessment also creates a good relationship between teacher and student.

Validity and reliability are important aspects regarding assessment methods. The teachers regularly participate in each other's assessment sessions to calibrate their assessments and the results have proved highly reliable. As two teachers assess the same student and compare their results, the validity and reliability of assessment is further ensured.

The evaluation of the oral assessment method shows that the students find that they learn also during the assessment occasion. International students taking this course say that previous oral assessments they have experienced (at the universities in their home countries) don't allow for this type of active learning. These oral assessments had been designed with only oral questions and answers face-to-face with the teacher without time for any reflection and feedback, which they perceived as negative from a learning perspective. The students also think they learn more in an oral assessment design in the way described above compared to written assessments.

The fourth step in the students learning assessment process and perhaps the most important according to the CDIO standard (figure 1) is the use of assessment results to improve teaching and learning and improve courses and programs as a whole. In order to work with quality improvement in teaching, it is important that teachers are able to discern aspects of teaching that need to be improved to achieve better learning outcomes. We consider that the oral assessment method described above has advantages regarding achieving teaching and learning improvements. The close interaction with the students during the assessment process facilitates the discerning of how each assessment question captures what we want to achieve according to the learning outcomes. It helps the teachers to understand how they can improve the assessment questions. They also get indications about what might need to be changed regarding course structure, course content, pedagogics, etc. in a more straight forward experienced way compared to correcting written exams, not the least because it is possible to ask follow-up questions that show the potential gaps in teaching related to learning outcomes.

LESSONS LEARNED

The oral assessment method described in this paper has been proven successful in contributing to active learning according to the CDIO standards in engineering education. According to the CDIO standard number two presented above the learning outcomes should include personal, interpersonal, as well as product and system building learning outcomes. The authors suggest that the process of oral assessment described has the potential to contribute to the achievement of these goals. The students are overall pleased with the interactive oral examination form and think they learn more compared to written assessments. It has also shown to be a beneficial form of assessment for teachers. The main lessons learned from this example are:

- By having students undertaking the assessment in groups of three, an active learning occasion is created by interaction between students as well as students and teacher.
- As applied examples are asked for in the assessment questions the teacher can help the students to make connections between detailed knowledge and system under-

standing as well as among key concepts and to the application of knowledge to new settings.

- The teacher has an opportunity to clarify things if required which is an advantage especially when it comes to students who are not native English speakers.
- The interactive assessment procedure helps the teacher to discern the learning outcomes from each student.
- Although the assessment occasion requires more time, no correcting of written exams is required and we estimate that there is a saving of time for the teacher if it is not more than 48 students who are assessed.
- The oral assessment method helps the teacher to capture what improvements need to be made in teaching and learning.

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BIOGRAPHICAL INFORMATION

Anette Karlton is an Assistant Professor in Work organization in the Department of Industrial Engineering and Management at School of Engineering, Jönköping University Sweden and at School of Technology and Health, KTH Royal Institute of Technology, Sweden. She teaches in management and human factors engineering. Her current research focuses on organization for quality and safety in complex organizations. She is also heading a master program in Human, Technology and Organization in collaboration with KTH.

Johan Karlton is an Assistant Professor in Work Organization in the Department of Industrial Engineering and Management at School of Engineering, Jönköping University, Sweden. He teaches production management and human factors engineering. His current research focuses on production activities and the interaction between humans, technology and organization at work and its consequences for productivity and health. He is also heading a master program in Production Development and Management.

Corresponding author

Dr. Anette Karlton
Industrial Engineering and Management,
School of Engineering,
P.O. Box 1026
SE-551 11 Jönköping, Sweden
anette.karlton@jth.hj.se



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