

Student Response System and How to Make Engineering Students Learn Oral Presentation Skills*

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Feedback and assessment play an important role in teaching and learning. This study describes the implementation and evaluation of an innovative instruction format that builds on the integrated use of a Student Response System (SRS) for peer assessment of oral presentations of third-year engineering students. A large number of oral presentations were assessed and participants played both the role of assessor and assessee. First, the analysis results demonstrate that the psychometric qualities of the peer assessment approach supported by SRS are acceptable. Secondly, students' learning process and their perceptions about the learning process in this particular instructional setting were investigated. Results mirror a very positive student attitude towards SRS. The SRS was reported as an effective way of producing feedback for presenters, assessors and educators. The learning effect concerning assessment remained rather limited. Lastly, the relationship between personal characteristics, performance and assessment was studied. Results point to a significant positive correlation between self-efficacy and oral presentation performance.

Keywords: Student Response System; feedback; peer assessment; oral presentation skills; higher education; self-efficacy; learning from assessment

1. Introduction

Oral presentation skills are a key characteristic of modern engineers and that is why they are an essential component in engineering education [1]. According to the social cognitive perspective [2], feedback and assessment play a crucial role in the learning cycle. Recent developments in the assessment field [3] stress the influence of assessment on the learning process and resulting performance, and show a switch in assessment responsibilities from the teacher to students. Both parties involved in assessment, the assessor and the assessee, benefit from this switch in responsibility. Peer assessment seems beneficial to foster student learning [4]. Falchikov [5, p. 16] even posits, '... involving students in the assessment of presentations is extremely beneficial'. Students gradually understand and incorporate assessment criteria and thus improve their future performance [6]. Students adopt a form of vocabulary that is more easily understood by peers [7] and develop tact [5]. Peer assessment is also hypothesised to help resolving one of the problems in the development of oral presentation skills, namely the time-consuming nature of assessment and feedback. Feedback is generally accepted to guarantee the increase in mastery of oral presentation skills. Practice, formative assessment and related feedback are critical in this context [8, 9].

Peer assessment raises questions about the reliability and validity of assessment, and about the

attitudes of students towards peer assessment. Liow [10] found, for instance, that engineering students rated oral presentations of their peers higher than did their teachers, but they also noted that variations in student scores were smaller. Students' trust in their own and their peers' abilities to assess seems to influence the perceived learning impact of the assessment approach [3]. Since much depends on the quality of the feedback, this quality of peer feedback can be raised, for instance, by providing training and rewards or sanctions depending on the quality of the feedback [11], or by averaging the marks of several peers [12]. In the literature, it is repeated that the lack of anonymity during verbal peer assessment can cause group interaction problems. Also, feedback given by peers can become dependent on social conformity. Students might worry about the impact of their feedback, especially when disagreeing with other students [13]. Such problems can be solved when assessment is made anonymous by implementing a student response system [14]. We elaborate on the use of this system below.

1.1 A Student Response System (SRS)

A student response system is a wireless mobile technology that makes use of handheld devices that allow students to answer—mostly multiple-choice—questions. The results are immediately collected, summarized and presented in a visual format. Many names have been given to such

systems, like Classroom Communication Systems, Electronic Voting Systems, Clickers, Audience Response System, Personal Response System, Voting Machines [15, 16]. The devices have a unique number and students can be assigned to use the same device each time. In their review of the literature, Kay and LeSage [15] report the benefits of SRS for the classroom, the learning process and the assessment process.

As SRS is a tool, a theoretical framework to present a rationale for its use should be considered and related empirical research should be conducted. In the present study, students use an SRS to assess oral presentations of their peers, as suggested by Premkumar and Coupal [17] and carried out by Chen [4]. This assessment is designed to providing feedback. All parties involved are expected to benefit from the feedback derived from peer assessments [18].

The first goal of feedback is to give presenters information about their performance (feedback) and about future actions to be taken (feed-forward) in order to improve their oral presentation skills [19]. An SRS helps to deliver immediate feedback, which is expected to have a stronger impact than feedback given at a later stage [20]. The amount and quality of the feedback (and the reliability) is enhanced by the anonymous character of the SRS, as described in the previous paragraph. Reliability is expected to be fostered by the simultaneous use of various assessors [21].

The second goal of feedback is to enable assessors to compare their approach with the approach of others and, as a result, to become better assessors. With an SRS all the assessors can immediately compare their marks with the marks given by other assessors. Diverging marks are expected to stimulate reflection about differences and foster metacognition. This could improve future presentation performance. Casteleyn and Mottart [22] stress in this respect the objective to provide as much feedback moments as possible for the students, so that a related attitude can be interiorised. The third goal of feedback is to provide educators with information about the learning process of presenters and assessors and to help them to become better educators [23]. Without an SRS, educators easily build on wrong expectations as to student progress and mastery, especially because information from only a few students can be obtained. With an SRS however, all the students will take part and provide a clear picture of their understanding of the criteria. This picture can be an uncomfortable eye-opener when students are found to understand less than expected [24]. The present study concentrates on the second goal of feedback.

1.2 Student characteristics

According to the social cognitive perspective [2], student characteristics not only influence the quality of the presentation but also the quality of their assessment. That is why we included three critical student characteristics in our study: self-efficacy, an initial level of presentation skills and perception of the learning process with a focus on the perceived ease in assessing peers. The first student characteristic, self-efficacy, is central to the theory of Bandura [2]. He defined self-efficacy as ‘. . . beliefs in one’s capabilities to organize and execute the courses of action required to produce given attainments’ [2, p. 3]. Bandura [2] sees a reciprocal relationship between performance and self-efficacy. The motivational concept of self-efficacy has received much research attention in education [25]. Research results indicate that learners with a positive self-efficacy are more likely to work harder, are more persistent, and attain higher achievement levels [26]. Consequently we expect to observe a positive correlation between self-efficacy and presentation performance.

The second student characteristic is the initial level of presentation skills. Inspired by Kruger and Dunning [27] we assume that good presenters know the criteria of a good presentation better than weaker presenters, and that good oral presentation performers are also better assessors. Students who find it very difficult to assess oral presentation skills, on the other hand, are hypothesised to avoid giving extreme scores. This brings us to the last student characteristic.

The third student characteristic is perception of the learning process: more specifically, perceptions related to peer assessment. Student perceptions mediate between teaching and learning outcomes [28]. Most studies [29] report that students like to use an SRS, but so far no studies have been traced using SRS in the context of peer assessment of oral presentations. Literature describing perceptions about peer assessment shows mixed results. Cheng and Warren [30], for instance, report that peers had low levels of comfort and confidence in their ability to assess peers.

2. Presentation

2.1 Research questions

1. Are students good assessors?
2. Do students become better assessors by practising?
3. Is there a positive correlation between self-efficacy and presentation performance?
4. Are good presenters also good assessors?
5. Are student perceptions of the learning process

related to the avoidance of giving extreme scores?

2.2 Method

Participants

Oral presentation performance of third-year higher education students, enrolled in an engineering program ($n = 95$, 83 male) were assessed by their peers ($n = 79$). In total, peer students scored 1105 oral presentations. This was carried out in six small groups and each presentation was assessed by, on average, 12 peers.

The assessment instrument for oral presentations

A previously developed rubric [31] was used to assess the oral presentations. The rubric builds upon nine criteria (three content-related criteria, five delivery-related criteria and one overall criterion). Assessors are required to give a rating of one to five.

Self-efficacy questionnaire

To measure self-efficacy, two scales were constructed: one measuring self-efficacy related to the 'content' criteria ($n = 3$) and one measuring self-efficacy related to the 'delivery' criteria ($n = 5$). The instrument was designed on the basis of the design guidelines of Bandura [32]. The questionnaire items link self-efficacy to the specific criteria focused upon in the assessment instrument for oral presentations. Items in the instrument were rated by respondents on the base of a 5-point Likert scale.

Perception of the learning process

A subscale, focusing on perceptions of peer assessment was adopted from the questionnaire of Sluijsmans *et al.* [33], and was adapted and validated for the specific oral presentation situation in [34]. The subscale consists of six items rated on a five point Likert scale.

An additional subscale ($n = 27$), focusing on students' perception of their learning process, included four types of questions, rated on a nine point Likert scale:

- How difficult did you find it to mark your peers with the nine criteria of the assessment instrument? (from 1 = very difficult to assess, to 9 = very easy to assess).
- How much did you learn from the following instruction elements ($n = 7$)? Examples: assessment of the presentation of peers, discussion about the feedback, giving a presentation.
- How important is it that we preserve the following instructional elements ($n = 4$)? Examples: an SRS, the video recordings.
- How important is it that we make the following

changes to the instructional format ($n = 7$)? Examples: add a summative assessment, a second presentation.

Procedure

The scoring of 1105 presentations (about 10 000 separate scores to be attributed) was fostered by using a student response system (Turning Point™). Students were asked to assess their own presentation skills immediately after the oral presentation and prior to the assessment of their own presentation by their peers. The oral presentations were videotaped and a short fragment of each presenter was shown before assessment took place. The assessment scores on the nine criteria of the rubric were immediately summarized and pie charts were created for each assessee. This summary made it easy for presenters to compare the scores from their peers with their self-assessment scores. This approach also made it possible to compare similarities and differences in scores attributed by the different assessors. Students were asked to write a short report in their portfolio about the assessment. The data generated by the SRS were stored on the university server and used by students to develop their personal report.

The SRS was also used in the last session to collect answers to the questionnaires.

Analysis approach

First, the factor structure (Principal Component Analysis) and the reliability (Cronbach's alpha) of the two components of presentation skills, 'content' and 'delivery' was explored. A one-way analysis of variance (ANOVA) was conducted and the amount of explained variance (η^2) in the evaluation scores accounted for by the factors 'assessee', 'assessor' and 'group' was computed. It was expected that a substantial amount of variance could be explained by the factor 'assessee' and that this amount of variance would be larger than the variance explained by the factor 'assessor'. The latter is a prerequisite for accepting the validity of the instrument and assessment approach when studying differences in the mastery of presentation skills. The amount of variance explained by the factor 'assessor', on the other hand, is considered an indicator for the amount of influence assessor characteristics have on the scores. In that case it is important to find out which characteristics of the assessor are responsible for assessor bias.

To determine whether students evolved and became better assessors, the distribution of scores of the first and the last session was compared. It is hypothesised that the initial distribution (standard deviation) would be larger at the start than at the final session (independent samples t-test). Follow-

ing this hypothesis, it could be argued that participants in the last session develop a better understanding of the criteria.

Discrepancies were calculated between the scores given by an individual and the mean score of all the peer evaluations of one presentation. The sum of these discrepancies is considered a raw indicator of the assessment quality.

Following the hypothesis that good presenters are also good assessors, the correlation between this discrepancy and the presentation scores was calculated.

Self-efficacy-scores were obtained of all participants, independent of their role as 'assessor' or 'assessee', since most participants adopted both roles. Self-efficacy is expected to be related to received scores, and to assessment scores given to peers. The related analyses build on a correlation analysis, a principal components analysis, a reliability analysis and ANOVA.

Building on the hypothetical relationship between student perceptions about the ease of this type of assessment and the ease with which they assign extreme scores, correlations will be calculated between these measures.

2.3 Results

Quality of the rubric for assessing oral presentation skills

The Principal Component Analysis (Varimax rotation) resulted in the identification of two components of presentation skills, namely 'content' and 'delivery'. Three items ('introduction', 'structure' and 'conclusion') reflect the highest loadings on Component 1 and five items load hugely on Component 2. The component loadings vary between 0.70 and 0.88. The two components, together, explain 74.93% of the variance. The two scales, labelled 'content' and 'delivery', reflect an acceptable Cronbachs' alphas of 0.67 and 0.79.

The correlation coefficients reveal that the two

subscales of the assessment instrument, 'content' and 'delivery' are clearly intercorrelated ($r = 0.66$, $n = 72$, $p < 0.01$, two-tailed) but have even stronger correlations with the overall evaluative item called 'professionalism'. The results show that professionalism is correlated to a stronger extent with delivery ($r = 0.94$, $n = 72$, $p < 0.1$, two-tailed) than with content ($r = 0.78$, $n = 72$, $p < 0.01$, two-tailed). These analysis findings are considered as indicators of good validity.

Research question 1: Are students good assessors?

The results of a one-way ANOVA helped to calculate the amount of explained variance to be attributed to the factor 'assessee' and 'assessor'. The results (Table 1) show that a substantial amount of variance is explained by the factor 'assessee'. The η^2 allied with the eight items used to construct the two subscales 'content' and 'delivery' varies from 26% explained variance (quality of speech) to 39% explained variance (clarity of the conclusion). Both scales explain 46% of variance. It is worth looking at item 9 'professionalism' that reflects the highest proportion of explained variance related to the factor 'assessee'. In Table 1 the percentages of explained variance by the factor 'assessee' and by the factor 'group' are summarized. For each item and scale these η^2 's allied with the 'assessor' are lower than the η^2 allied with the 'assessee'.

The moderate η^2 values related to the assessor suggest that the evaluation results are at least partially biased by assessor characteristics. For this reason we examine the correlations between the scores given by the assessors on the one hand and, on the other hand, the assessor characteristics self-efficacy and perceived ease of the assessment.

Research question 2: Do students become better assessors by practising?

The research hypothesis that students become better assessors as a result of their assessment and

Table 1. Descriptives and explained variance

9 rubric criteria	N	M	sd	F	η^2 a	η^2 b	η^2 c
Introduction	1138	3.28	0.83	7.94 _(78.1137)	0.37**	0.23**	0.06**
Structure	1155	3.29	0.76	7.60 _(78.1154)	0.36**	0.22**	0.03**
Conclusion	1155	2.95	0.94	8.90 _(78.1154)	0.39**	0.25**	0.07**
Public contact	1154	3.19	0.79	7.08 _(78.1153)	0.34**	0.18**	0.07**
Enthusiasm	1137	3.23	0.82	10.50 _(77.1136)	0.43**	0.13**	0.03**
Eye contact	1154	3.24	0.88	7.92 _(78.1153)	0.36**	0.14**	0.01*
Speech	1154	3.22	0.78	4.91 _(78.1153)	0.26**	0.15**	0.01
Body language	1155	3.23	0.82	5.75 _(78.1154)	0.29**	0.22**	0.04**
Professionalism	1156	3.25	0.72	8.70 _(78.1155)	0.39**	0.17**	0.03**
Content subscale	1136	3.17	0.65	11.45 _(78.1135)	0.46**	0.28**	0.08**
Delivery subscale	1126	3.22	0.60	11.52 _(77.1125)	0.46**	0.17**	0.04**
Total score (Sum of nine criteria)	1105	3.21	0.56	13.25 _(77.1104)	0.50**	0.21**	0.05**

η^2 a = proportion of the variance explained by the assessee; η^2 b = proportion of the variance explained by the assessor; η^2 c = proportion of the variance explained by the group. ** $p < 0.01$, * $p < 0.05$.

presentation practice was only partially confirmed. Standard deviations of peer evaluations in the last lesson are smaller for seven out of nine criteria. The decrease in variance of the assessment results after practice was only significant for one of the nine criteria used, namely the quality of the conclusion ($t = 3.71$, $df = 27$, $p < 0.01$).

Significant positive correlations are found between self-efficacy and the mean level of the 'given' peer evaluation scores ($r = 0.32$, $n = 95$, $p < 0.01$, two-tailed). There is a negative but non-significant correlation between the experienced ease in assessing and the 'given' scores.

Research question 3: Is there a positive correlation between self-efficacy and presentation performance?

We look at self-efficacy from the viewpoint of the assessee. We can derive from Table 2 that there is a significant positive correlation between the self-efficacy level of the assessee and the assessment scores. This is the case for all the criteria and the total score, except for the 'speech' criterion.

Research question 4: Are good presenters also good assessors?

This research question can also be formulated as follows: Is there a positive correlation between the quality of the presentation and the quality of the assessment? The sum of the discrepancies between the scores given by an individual and the mean scores of all the peer evaluations of one presentation is considered as a raw indicator of the assessment quality. Results show a negative, but non-significant, correlation between the sum of the discrepancies and the presentation scores ($r = -0.06$; $n = 71$, $p = 0.60$).

Research question 5: Are student perceptions of the learning process related to the avoidance of giving extreme scores?

At a general level, student perceptions about the SRS-supported learning process were positive. Results indicate that students appreciate the SRS

very much, due to its immediate feedback nature. Students also have a positive view about the learning potential of peer assessment ($M = 4.4$). When asked what aspect of the instruction they learned most from, students put feedback in first place, followed closely by the opportunity to deliver presentations and the feedback they could give to other students. Although students are very positive about learning by doing, they were less enthusiastic about incorporating a second presentation in the course. Results also showed that participants found content-related criteria more difficult to assess compared with delivery-related criteria. Lastly, students appreciated the formative character of assessment and were unwilling to introduce summative assessment.

There was a significant positive relationship between the perceived ease to assess and the standard deviation of the scores given to their peers for two criteria: quality of the conclusion ($r = 0.29$, $n = 94$, $p < 0.01$, two-tailed) and quality of speech ($r = 0.25$, $n = 94$, $p = 0.01$, two-tailed). There is, in other words, a positive correlation between perceived ease to assess and giving extreme scores for two criteria. Results, however, showed, also for both criteria, a positive correlation between perceived ease to assess and assessment mistakes.

3. Discussion

After discussing the psychometric qualities of the assessment instrument, we present conclusions about the quality of the assessments and the mediating role of student characteristics.

Principal component analysis revealed that the assessment instrument reflects good internal consistency and a construct validity that is in line with the underlying components 'content' and 'delivery'. Most available assessment instruments used in the field of oral presentations can be structured along these two dimensions [35].

The research question about the quality of the self and peer assessment show that a substantial propor-

Table 2. Correlation self-efficacy of the assessee and scores on the criteria of the rubric

Self-efficacy of the assessee	Scores on criteria of the rubric	r
Self-efficacy—Introduction	Introduction	0.43**
Self-efficacy—Structure	Structure	0.37*
Self-efficacy—Conclusion	Conclusion	0.31*
Self-efficacy—Public contact	Public contact	0.50**
Self-efficacy—Enthusiasm	Enthusiasm	0.51**
Self-efficacy—Eye contact	Eye contact	0.43**
Self-efficacy—Speech	Speech	0.20
Self-efficacy—Body language	Body language	0.40**
Self-efficacy—Presentation (sum of nine criteria)	Total score (sum of nine criteria)	0.49**

r = correlation, * $p < 0.01$, ** $p \leq 0.001$.

tion of the variance in the assessment scores can be explained by the factor 'assessee'. The amount of variance explained by the assessor is clearly smaller. We also found significant differences between the groups but the amount of explained variance is rather low. We can conclude that students are reasonable good assessors. But, as Gibbs [36] suggested, assessment should also lead to better learning. The feedback generated from the peer assessment in this study offered learning opportunities to all the parties involved. Presenters used the feedback generated by the SRS and stored on the electronic learning platform, when developing their portfolio. Assessors discussed their assessment differences in a much more grounded way by using the SRS charts. It was for the teachers much easier, with the SRS, to analyse weak points in the oral presentation skills of students. This provided an opportunity to adjust their instruction in the way promoted by Hattie [23]. It can be concluded that the results are promising for those wishing to find a ground for alternative evaluation practices, such as peer assessment.

The limited learning impact that could be attributed to the SRS based assessment process needs further investigation. Knowledge of stronger and weaker points seems not to be sufficient. Students seem to need additional information to know what actions they have to carry out to improve their presentation performance. In addition, we also think students need more opportunities to practise. This can be linked to the feed-forward influence of feedback [37, 38]. It is possible that the duration of the instruction was too short to develop assessment skills—thus stressing the need for more time to exercise—and/or that the feed-forward aspect of feedback was insufficiently addressed during the classroom discussions. Also, the training of the assessors could have been too short. Additional instructional elements could first build on providing assesseees with meta- feedback: feedback-on-feedback [39]. Secondly, we could centre on the report written by the assesseees, that includes their reaction to the feedback: what did they learn from the feedback and what was their reaction to the feedback [11].

Self-efficacy is an important student characteristic. The positive correlation between self-efficacy and performance is in line with other research results [31] and we therefore recommend that educators promote self-efficacy. Nevertheless, the relationship between self-efficacy and given scores, and between perceived ease of assessment and given scores needs further exploration. What is the implication, for instance, of the result that assessors with a high self-efficacy level tend to give more extreme scores and higher scores? It is also remarkable that a

positive correlation is observed between the perceived easiness of assessment and the standard deviation of given scores in relation to two evaluation criteria. This means that assessors felt confident enough to give extreme scores on two criteria they found easy to assess. Unfortunately assessors also made more mistakes assessing those two criteria.

A positive correlation was expected between the quality of the presentation and the quality of the assessment. The results contradict this expectation. Good presenters are not automatically good assessors. These results need further investigation.

The very positive student perceptions of the use of the SRS and of peer assessment are good news, because students' perceptions are important mediators between instruction and learning outcomes [28]. We can add that the pleasant atmosphere during the SRS classes contrasted with other cohorts where students gave feedback without the SRS and were less motivated. The reported positive attitude is in line with findings in the literature [15]. Kenwright [29, p.75] described that 'a sense of camaraderie' was added to the group. Emotion-related educational research has been growing over the last decade [41] and results point at the positive impact on motivation and learning [42]. This theoretical and empirical finding could be corroborated in further research about the impact of an SRS on learning performance.

4. Conclusions

The psychometric characteristics of the assessment instrument and the positive student perceptions about peer assessment justify the use of the rubric in further research and in teaching and learning practice. A less positive aspect, from the viewpoint of the teacher using an SRS, is that developing the questions is time-consuming. This was also reported by Kenwright [29].

Future research could adopt a longitudinal perspective and study the learning effect of peer assessment on consequent oral presentations and see how observing and assessing peers enhances presentation skills. Future research could build on studies that compare SRS groups and non-SRS groups through experimental designs with pre and post-tests [43]. Ethical constraints have, of course, to be taken into account.

The present study has implications for future research and practice. One of the study's strengths is the large number of students involved in assessing a large number of oral presentations. Another strength is that participants played at the same time the role of assessor and of assessee. This reflects, according to Shaw [44, p. 142], the establishment of a learning community where students

are connected with each other as 'doers' and 'evaluators'. Also, the display and storage of the assessment data made it possible for students to reflect on their personal assessment scores and scoring, and their personal presentation performance. Presenters could efficiently detect strong and weak points in student presentations in view of giving feedback. Also the second feedback goal was fostered—feedback helped to develop better assessment skills, since the SRS pie chart forms the start of short class discussions about the way scores were attributed. These two assessment goals help teachers to become better educators. The use of an SRS is, so far, a positive and efficient way of providing feedback to presenters, assessors and educators, which deserves further research.

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