Evaluating Teaching Through Reflection on Hidden Student Feedback in Continuous Assessment Reports

A McNabola[1]
Assistant Professor
School of Engineering, Trinity College Dublin,
Ireland.
E-mail: amcnabol@tcd.ie

C O'Farrell
Senior Academic Developer
Centre for Academic Practice and eLearning, Trinity College Dublin,
Ireland.
E-mail: cofarre@tcd.ie

Conference Key Areas: Curriculum development; Engineering education research; Students as key actors in change process of engineering education

Keywords: Continuous Assessment; Reflection; Curriculum Design; Student Feedback

INTRODUCTION

The impact of assessment on students' learning has been well documented in the literature [1-5]. 'Assessment defines what students regard as important, how they spend their time, and how they come to see themselves as students and then as graduates' [6]. Assessment has different roles and functions. It has a summative function as it needs to measure performance and achievement, accredit learning and provide evidence to satisfy quality measures [5]. It can also have a formative or diagnostic function when it provides feedback and promotes future performance. Continuous assessment is both summative and formative, and thus can be an assessment of and for learning. It both provides formative feedback for learning but contributes to the overall results of the module, thus fulfilling a summative function as well as potentially supporting student learning [7].

The literature has strongly evidenced that assessment is one of the most significant drivers of student learning [3, 6, 8]. But while summative assessment typically provides an extrinsic motivation, we also need to consider other forms of motivation when devising assessment, especially assessment that promotes more complex learning rather than one which is focused on memorisation and reproduction. In an interesting approach to assessment within a discipline context, Reyes and Galvez divide the motivations of second year civil engineering students into three levels: those who just want to pass; those who want to accumulate useful knowledge for a future career; and those who want to enquire more deeply into the subject [9]. They note that

'Teaching and assessment methodologies need to address three levels of student motivation if they are to "attract" the student and to optimise achievement, regardless of academic interests.'

Effective assessment is a complex, multi-factorial process with many aims. However, we must remember that for academics too, assessment can play a pivotal role in evaluating their teaching: 'There is more leverage to improve teaching through changing assessment than there is in changing anything else' [10]. In so far as assessment can provide information about how students learn and what they achieve, assessment thus not only facilitates student learning, but can also be used to evaluate teaching.

Teaching is a complex and personal activity that is best assessed and evaluated using multiple techniques and broadly based criteria [11]. Teaching evaluation is an integral part of the process of reflective practice in Higher Education. Many models of this process have been highlighted in the literature and many are based on the pioneering work of Schon in this area [12]. The collection of evidence on the quality of one's teaching upon which to reflect and formulate actions for improvement in teaching quality and student learning is a key element in the cycle of many models of reflective practice.

Best practice in the evaluation of teaching is often cited in literature as taking a multidimensional approach in higher education [13]. As such many techniques may be used to evaluate ones teaching, such as the development of a teaching portfolio, student ratings, peer observations, etc. [11]. This paper presents the findings of an investigation into the use of reflection on student assignments as a form of teaching evaluation in practically based Civil Engineering modules. Through this process of reflection on practice, evidence obtained from teaching evaluations based on student assessment, demonstrated that improvements in student learning and engagement could be achieved.

1 CASE STUDIES

Reflections on practice from the delivery of two Civil Engineering modules: Engineering Surveying at undergraduate level and Engineering Hydrology at postgraduate level are outlined below. The reflections, written by the corresponding author as an early career stage academic, serve to outline the formulation of evidence on teaching quality arising from past experience and the results of subsequent action taken in both cases. Further evidence is subsequently presented from additional data collection in the form of student feedback surveys and the collection of data from an additional module.

1.1 Engineering Surveying – Reflection on Practice – Narrative 1

As a new lecturer in an Engineering School my first major teaching role was the delivery of a module on Engineering Surveying for a group of 3rd year Civil Engineering Students. The assessment of this subject was heavily weighted on an end of year examination (85%) when I first took over the delivery of the course with 10% given over to practical laboratory sessions and 5% to an end of year practical examination.

After my first year of teaching this subject the mean practical exam result was high indicating that students had attained strong practical engineering surveying skills during the course. The overall marks including the written exam and laboratory practical report was also quite good. However on reflection of my experience of

conducting the practical exam for the first time and adopting the approach taken in previous years I noted that few of the students impressed me with their surveying abilities and in fact many had simply learned the tasks required by rote but could not survey in practice. Indeed I did not feel that the modules assessment marks adequately reflected the student's practical surveying abilities and hence the assessment design was not satisfactory.

On reflection I felt that placing more emphasis on the end of year practical exam would encourage students to change their attitudes towards it. As noted earlier, 'Assessment defines what students regard as important' [6]. It was clear here that many of the students did not regard the practical examination as important and focused on the theory and written exam. Subsequently in the following year the weighting of the practical exam was doubled and the exam was also modified to make it more challenging. As a result in the following year, the mean exam mark in the practical was considerably lower. Examining the more stringent practical examination results in detail only 12% of students completed the practical exam tasks within a reasonable time limit and only 6 out of 88 students completed, what could be considered as very basic surveying tasks, perfectly or near perfectly.

On reflection, as an evaluation of my teaching of surveying, I considered this a very poor performance and that my actions to increase the exam weighting of the practical elements of the course in the previous year had only served to highlight the short comings of the student's practical surveying skills further. Over the past number of years with or without my involvement, assessment of engineering surveying had been heavily weighted towards the end of year exam and as such students have concentrated their efforts on preparing to pass this exam. A minor practical examination is given minor attention by many students but this has been shown in this evaluation to be non-satisfactory. A more appropriate balance between written exam and practical examination should have been struck in this case to encourage students to engage in the practical elements of the course more fully. Perhaps at least a 50:50 split between written and practical assessment is desirable in this case.

1.2 Engineering Hydrology – Reflection on Practice – Narrative 2

In more recent years I have had the responsibility to teach one half of an MSc course on Engineering Hydrology. My element of the module deals with overland flow measurement techniques and flood flow analysis. The subject was assessed through a number of short individual assignments as well as a group field trip and end of year examination (80%). In this case 50% of my component of the module is highly practical in nature and the field trip assessment pertains almost entirely to that element of my teaching. Following the submission and correction of these assignments it struck me that some of the students discussions or conclusions on the field trip were, without prompt, very supportive of the assessment and of its educational benefit. A sample of some of the comments from separate students are shown in Box 1.

These comments, while encouraging, initiated some further reflection on the structure of this course and the similarities that exist between my teaching of this topic and the previous. While Engineering Hydrology only has some practical elements to it in comparison to the heavily practical surveying, this teaching evaluation again highlighted the issue of the appropriate balance between opportunities for real world learning and theoretical content/process based learning. It was clear that the students enjoyed the field trip practical and that they recognised its value for their learning. On the basis of their observations, it was recognised that sufficient thought

had not been given to the appropriate balance of practical and desk-based learning environments or to the appropriate balance between practical and desk-based assessment in this module.

Box 1. Sample comments encountered in student field trip reports

'*The hands on practical experience gained by the MSc Engineering Hydrology Class has proved invaluable. By physically measuring various parameters of a stream one can learn so much more. Using the data retrieved on site to manually estimate the flow rate of the .... River was an excellent educational tool*'

'*The field trip to the .... River in Dublin was interesting, educational and informative. It was a great way of allowing the students to get a hands on approach to the different methods used in measuring stream flow*'

'*Finally, this practical has given me a better grasp of relating the theoretical results to the actual river profile and discharge'*

1.3 Further Data Collection – Student Surveys

Rather than continue the initial approach adopted in Engineering Surveying of trialling an increased summative weighting for the field trip assignment or trialling additional field trips it was felt that it would be worthwhile to obtain further feedback from students on their experiences in undertaking the module as a whole. Again, as highlighted earlier, the best practice of gathering evidence from a number of sources could only aid in our understanding of teaching quality on the course.

The students were surveyed online and based on a 55% response rate students gave the module an average rating of 8.4 out of 10, an encouraging performance. In addition, each of the individual components of the course (the lectures, assignments, field practical, and final exam) were also rated highly with all components scoring in the region of 4 out of 5 or higher. However more detailed responses given to non-rating based questions provided considerable evidence of the scope for improvement in the module's design.

Many students highlighted that they enjoyed the practical aspects of the module and learned a good deal from the field trip. E.g. in response to a question on which aspects did students most enjoy: *'The practical aspect accompanied by the write up was enjoyable and I learned a lot from it.'* and *'I thought the assignments and field trip were extremely useful for understanding the course'.*

Students also highlighted the aspects of the module they enjoyed least. Some respondents felt that there was quite a lot of continuous assessment in comparison to other modules even though it was still only worth 20%. Some students also felt that the field trip, while valuable, was rushed and that more than one field trip should be included in the course. The field trip was typically carried out over a half day comprising the practical measurement of flow in a river using a range of techniques covered in the lecture material. However when asked about the appropriate balance between continuous assessment and end of year exam (20%:80% at the time of the survey), most students were satisfied with the balance. Only some requested a 'slight' increase in the CA component marks or a general increase in the number of field trips.

1.4 Action and Further Demonstration of Hypothesis

Following on from the collection of the evidence outlined above, the balance between continuous assessment and end of year written exam was examined in detail and modified to reflect the practical nature of the subjects. In Engineering surveying the CA weighting was increased dramatically. In Engineering hydrology the CA weighting was increased moderately and the length and number of field trip practicals were also increased.

Recognising the value students placed on practical learning experiences in practical modules it was also considered that such forms of assessment also offered students the ability to relate classroom theory to practice, a key component of the klob learning cycle [14]. Such learning opportunities are indeed important for all engineering modules and as such this extension of the hypothesis was trialled further in a considerably more theoretical module, Hydraulics for Civil Engineers at final year undergraduate level.

Final year Hydraulics for Civil Engineers comprised an end of year written exam (85%) as well as a number of short tutorial assignments and laboratory practical reports (15%). To test the hypothesis, this CA was increased to 20% to incorporate a class field trip to a local water treatment works. The subsequent report addressed aspects of the course such as pipe flow, and hydropower turbine design & selection. Again following the submission and correction of these assignments a number of the students, without prompt, in their discussions or conclusions sections outlined the value of the trip for their learning. Box 2 highlights a number of sample comments in student assignments.

Box 2. Supportive student feedback in Hydraulics field trip reports

'This field trip to Vartry Reservoir and Treatment Works was overall very successful and very beneficial. We learned how slow sand filters worked in practice and saw the benefits of the installation of a micro-hydropower station. This field trip helped to reinforce many of the topics covered in the lectures.'

'The analysis of the plants micro-hydropower system has complemented the lectures and has proven to be a useful learning tool for this aspect of the course.'

Comments such as these originate from a handful of students in both cases and those students are likely to already be highly engaged in their programme and have a good understanding of what benefits their learning. However for the same pattern to be repeated across 2 separate modules at undergraduate and postgraduate level, and independently across a number of students without prompt, is clear evidence of the opportunity that exists to evaluate one's teaching through reflection on student assignments.

2 DISCUSSION

2.1 Student Assignments as a Means of Teaching Evaluation

The evaluation of teaching was noted earlier as best performed using a multifaceted approach. The current study has proposed, in addition to online questionnaires, focus groups, etc, that evidence of teaching quality may be gathered in the hidden or unsolicited feedback obtained from continuous assessment reports and overall class performance in continuous assessment. This pattern of unsolicited feedback was repeated across a number of modules and was not an isolated occurrence. It is also worth noting that the unsolicited feedback in reports tended to come from good to

high achievers academically and these students obviously understood what was of noticeable benefit to their learning in contrast to the typical classroom environment.

When asked about the balance of continuous and end of year assessments the majority of students were satisfied with the current balance. This highlighted that many students were comfortable with the idea of assessments that are heavily weighted on the end of year exam, and perhaps increasing the weighting of practical assignments was outside the comfort zone of the majority.

The gathering of evidence on teaching quality then facilitated a process of reflection and action to modify the assessment elements of the curriculum design in the hope of improving student learning. It was clear here that the act of assessing had an effect on the assessor as well as the students. Previous investigators have also reported similar experiences 'Assessors learn about the extent to which they [students] have developed expertise and can tailor their teaching accordingly' [15]. Many models of reflection exist across the literature and the practice of critical reflection is often cited for its positive impacts on teaching quality and student learning [16]. Brookfield proposes that critically reflective teachers gather an increased awareness of their teaching from many different vantage points [17]. The vantage point proposed here is yet another perspective from which the educator can gain an understanding of the quality of the students' learning experience.

Reflection on the evidence gathered in this study has resulted in the initiation of a change process in the curriculum design. The evidence gathered here was focused on module assessment techniques and as such it is advocated here that using student assignments for teaching evaluations is a valuable method of evaluating this aspect of a module. This technique will compliment other methods of gathering data on teaching quality which may be more focused on other aspects of the module such as lecture delivery, feedback, etc. Critically reflecting on student performance in continuous assessments and on unsolicited feedback has offered a new perspective on the teaching quality in the modules investigated, above that which would have been obtained from generic questions in online student feedback surveys.

2.2 Curriculum Change

Fraser and Bosanquet note the role of the student in curriculum development, as well as in curriculum design: 'Curriculum change and development occurs as an ongoing dialogue between teachers and students, framed by the more holistic understandings of the teacher' [18]. In this investigation it is clear that student feedback through the non-conventional route of student assessments was the key trigger in the curriculum change process that took place. The practice of critical reflection was complimented by this new evaluation data, and a flexible approach to the design of assessment in the curriculum has led to improvements in student learning and engagement.

2.3 Creating Opportunities for Students to Relate Theory to Practice

As evidence for the previous assertion, it is argued here that one of the reasons why the introduction or enhancement of field-based practicals in the aforementioned modules resulted in positive feedback from students and improvements in their learning was that these assessments created opportunities for the student to relate theory to practice. Students were presented with theory and other content relevant to the modules in the traditional classroom setting. In the field students were presented with opportunities to relate this classroom theory to tangible examples or experiences

of Engineering practice. Following on from these experiences and in the process of writing up field reports students were given the opportunity to reflect on the experience and would later be able to apply this knowledge to new settings.

Klob's experiential learning theory outlines four essential components in the learning cycle [14]. Klob proposes that in order to learn successfully one must first have a learning experience such as the presentation of a theory or solution of a problem. Subsequently the learner must reflect on this experience and formulate the concepts in order to apply this learning experience to a new situation. Therefore the learner creates a link between theory and application/practice by planning, experimenting, reflecting and relating experiences back to the theory. The best learning is achieved where opportunities to address all 4 components of the learning cycle are built into the curriculum design [1].

In the current study opportunities for students to relate theory to practice in the practical aspects of modules in surveying, hydrology and hydraulics were shown to be of benefit to the students, to have fostered reflection on course material, and to improve student learning and engagement. The value of creating such learning opportunities for students was also recognised by many of the students in their written assignments and online survey feedback.

Prior to the process of critical reflection triggered by the unsolicited feedback, the curriculum design in the modules presented was not achieving the desired outcomes to varying degrees. In all three cases this curriculum change process brought out some degree of improvement in student learning. The experience gained as part of this investigation highlights both the importance of reflection and teaching evaluation but also the diversity in which information on teaching evaluation can be obtained. It is this diversity of perspectives and information that can bring about positive changes in Engineering Education that are well founded in education theory and literature.

3 CONCLUSIONS

In conclusion, this investigation highlights the value of using student assignments as a form of teaching evaluation which focuses on the role/performance of the assessments in the curriculum design. In addition the paper highlights the importance of reflection in maintaining a process of continual improvement in teaching quality and student learning. Finally, the importance of creating opportunities to relate theory to practice was outlined, and this is particularly important in Engineering modules with strong to moderate practical elements.

REFERENCES

[1] Biggs, J. and Tang, C. (2003) Teaching for Quality Learning at University. Buckingham, SRHE and Open University.

[2] Gibbs, G. (2006). How assessment frames student learning. In C. Bryan & K. Clegg (Eds.), Innovative assessment in higher education, Routledge, London, pp. 23–36.

[3] Ramsden, P. (2003). Learning to teach in higher education (2nd ed.). Routledge/Falmer, London (1st edition 1992).

[4] Rust, C. (2002). The impact of assessment on student learning. *Active Learning in Higher Education*, Vol. 3(2),pp145–158.

[5] Price, M, Rust, R, O'Donovan, B, Handley, K. and Bryant, R. (2012), Assessment literacy: The Foundation for Improving Student Learning, OCSLD: Oxford.

[6] Brown, S. and Knight, P. (1994) Assessing Learners in Higher Education, Kogan Page, London, pp7.

[7] Hernandez, R (2012). Does continuous assessment in higher education support student learning? *Higher Education*, Vol. 64(4), pp489-502.

[8] O'Donovan, B, Price, M and Rust, C (2004) Know what I mean? Enhancing student understanding of assessment standards and criteria*. Teaching in Higher Education,* Vol. 9(3), pp325-335.

[9] Reyes, E and Galvez, J. (2011). Introduction of Innovations into the Traditional Teaching of Construction and Building Materials, *Journal of Professional Issues in Engineering Education & Practice,* Vol. 137(1), pp28-37.

[10] Gibbs, G. and Simpson, C. (2004) Conditions under which assessment supports student learning, *Learning and Teaching in Higher Education*, Vol. 1(1), pp3-31.

[11] Senate Committee on Teaching and Learning (2002), York University. Teaching Assessment & Evaluation.

[12] Schon, D.A. (1984). The reflective practitioner: How professionals think in action.

[13] Ghedin, E and Aquario, D. (2008). Moving Towards Multidimensional Evaluation of Teaching in Higher Education: A Study Across Four Facilities. *Higher Education*, Vol. 56, pp583-597.

[14] Klob, D. (1984). Experiential Learning: Experience As The Source Of Learning And Development. Prentice-Hall.

[15] Yorke, M. (2003). Formative assessment in higher education: Moves towards theory and the enhancement of pedagogic practice. Springer, p428.

[16] Boud, D, Keogh, R, and Walker, D. (1996). Promoting reflection in learning. IN: Edwards, R. Hanson, A.

[17] Brookfield, S. (1995) Becoming a Critically Reflective Teacher. San-Francisco: Jossey-Bass.

[18] Fraser, S, and Bosanquet, M, (2006). The Curriculum? That's just a unit outline, isn't it? *Studies in Higher Education,* Vol. 31(3)*,* pp269–284.