

First Use of Re:View: A Tool to Combine Assessment Tasks, Marking Criteria and Graduate Attributes for Biochemistry Students

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Abstract

In order to improve clarity of the link between assessment tasks and graduate attributes to students, Re:View was introduced across three undergraduate biochemistry subjects. Re:View is an online assessment tool which provides a direct visual link between graduate attributes and marking criteria. It also provides students with an easy access portal to retrieve their grade and assessor feedback on assessment tasks. Our aim was to improve the second and third year biochemistry student laboratory-based learning experience by developing and clarifying the link between assessment tasks, marking criteria and graduate attributes, using Re:View as the assessment tool.

Student opinion showed Re:View was of benefit to align marking criteria with graduate attributes, and provided easy access to feedback which could be used to improve future work. This first use of Re:View, with development of criterion-referenced marking criteria and rubrics, has revolutionised assessment in the three biochemistry subjects under study. With the use of Re:View we have clarified the link between assessment tasks and marking criteria, and enhanced student engagement with laboratory-based assessment tasks, which has improved their written assessment performance.

Keywords: assessment, feedback, graduate attributes, online tool, Re:View

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Introduction

Graduate attributes (GAs) are a set of skills each university graduate should possess at the completion of their study, and are seen as a critical outcome of university education (De la Harpe & David, 2012). There are seven GAs within the Faculty of Science at the University of Technology, Sydney (UTS), and we aspire to embed these in all our degrees: (i) Disciplinary knowledge; (ii) Professional skills and their appropriate application; (iii) Inquiry-oriented approach; (iv) Ability and motivation for continued intellectual development; (v) Engagement with the needs of society; (vi) Communication skills, and (vii) Initiative and innovative ability. Not every subject studied within a degree will cover and assess all GAs, however, over the course of their degree students will be exposed to, develop, and be assessed in all of these GAs. It is up for debate how well universities develop attributes in their graduates (Barrie, 2006), and universities continue to grapple with the integration of GAs into learning activities and assessment tasks (De la Harpe & David, 2012). Teaching and assessment of GAs must be aligned to ensure the skills underpinning GAs are developed in students, in order to produce employment-ready graduates.

Criterion-referenced assessment is based on specific and detailed definitions of work required for students to be awarded a specific grade (from fail to high distinction) (Ndebele & Maphosa, 2013; Price & Rust, 1999). Rubrics take these criterion-referenced marking criteria and create a matrix, linking marking criteria to levels of performance required to gain a certain grade (Andrade, 2000; Barney, Khurum, Petersen, Unterkalmsteiner, & Jabangwe, 2012). The use of a matrix to explicitly distinguish levels of performance in a rubric, as an external reference for assessment, has potential to decrease or remove marker subjectivity (Andrade, 2005; Isaacson & Stacy, 2009; Ndebele & Maphosa, 2013; Newell, Dahm, & Newell, 2002; Shipman, Roa, Hooten, & Wang, 2012; Turley & Gallagher, 2008; Young, Ridgway, Prudich, Goetz, & Stuart, 2001). Rubrics are also a tool to provide students with feedback about strengths and weaknesses (Andrade, 2000; Shipman et al., 2012), thereby guiding student learning by identifying standards needed for a 'good' report (Young et al., 2001). Rubrics improve the turn-around-time for tasks to be assessed and returned to the student (Andrade, 2005; Isaacson & Stacy, 2009; Young et al., 2001), and provide a method to assist assessors with providing feedback, as it removes the need to write the same comment repeatedly on different students' work (Isaacson & Stacy, 2009).

Feedback is instructional and an essential component of student learning (Hepplestone, Holden, Irwin, Parkin, & Thorpe, 2011; Narciss, 2013). Feedback can be shared between teacher and student in order to improve student understanding and performance, and effective feedback often demonstrates several key characteristics including: (i) be criterion-referenced; (ii) use technology; (iii) be actively sought by the student; (iv) have detailed and specific content; and (v) be timely in delivery (Rucker & Thompson, 2003). Feedback provides students with information on strengths and weaknesses, and identifies ways to make improvements (Srivastava, Waghmare, Vagha, & Mishra, 2013). However, for the student to benefit from feedback, s/he needs a gap analysis between current performance and the expected requirements for a 'good' report, and knowledge of how to close this gap (Nicol & Macfarlane-Dick, 2006). As this knowledge may not be held by the student, a rubric and clear guidelines may assist this process (Black & Wiliam, 2010), as can the student and academic, being open to a two-way dialogue about feedback (Carless, Salter, Yang, & Lam, 2011; Nicol & Macfarlane-Dick, 2006; Price, Handley, Millar, & O'Donovan, 2010). In many cases, students are heavily marks-focused and not interested in the content of the feedback (Bailey & Garner, 2010; Black & Wiliam, 2010), and academics regularly complain that feedback is not read nor applied (Price et al., 2010). Hence, Hepplestone and colleagues (2011) suggest supplying feedback first and withholding the grade for publication at a later time. This may encourage students to see comments as 'feed-forward' rather than feedback, and may improve engagement with the information, and they may see it as a tool for learning and future improvement (Bailey & Garner, 2010; Carless et al., 2011; Voyer & Pratt, 2011).

Metabolic Biochemistry (MB) is a second year, stage three, core subject within the School of Medical and Molecular Biosciences (MMB), Faculty of Science, UTS. Approximately 400 students take the subject each year. Medical and Diagnostic Biochemistry (MDB) and Biochemistry, Genes and Disease (BGD) are third year, stage five and six (respectively), elective subjects within MMB. Approximately 100 students take each subject each year. These subjects consist of two hours of lectures, and three hours of laboratory practicals each week during semester. The students are assessed via several methods, with the assessment tasks relevant to this project being a general laboratory component including datasheets, and written reports in the style of a journal article, based upon laboratory practicals.

Pre-set laboratory datasheets give students experience in accurate data recording and help guide students through data analysis. Open-ended discussion questions are incorporated into the datasheets. The skills learnt by the students via these tasks are relevant to future employment, for example, as a hospital scientist. The journal-style written reports develop the professional skills of results presentation and communication required by graduates who, for example, may enter research science. Prior to this study, both types of laboratory report were marked on an individual basis and feedback provided via the hard-copy report. Not all assessments had established marking criteria, and it was not always clear how these marking criteria linked to GAs. The development of a clearer alignment between assessment tasks, marking criteria, and GAs may aid student understanding of the relevance of these assessment tasks to their overall development as employment-ready graduates. Thus, providing a transformative integration of GAs into these three subjects (Barrie, 2006, 2007).

For feedback to be of use to students, it is important that it is delivered in a timely fashion (Gibbs & Simpson, 2004; Ndebele & Maphosa, 2013). Use of online technology may increase efficiency of marking and provision of student feedback (Cabrera & Villalon, 2013; Kuh, 2003) and can address many obstacles of teaching large classes (Williams, 2008). Re:View (Figure 1) is an online assessment system developed at UTS, designed to improve student and teacher engagement with GAs (Thompson, 2009). It is a software solution to link criterion-referenced assessment with GAs. The use of Re:View has revolutionised marking in the three biochemistry subjects under study, while providing value-added service of explicit demonstration to the student cohort of the link between assessment tasks and development of GAs. Students were able to view results of their marked report via online tools, providing rapid access to their results and assessor feedback, thereby increasing student engagement and (indirectly) the skills needed after graduation (Kuh, 2003).

The aim of this research project was to improve the second and third year biochemistry student laboratory-based learning experience by developing and clarifying the link between assessment tasks, marking criteria and GAs, using Re:View as the assessment tool. It was expected that: (i) Re:View would enable increased clarity of the link between assessment task, marking criteria and GAs within two types of laboratory-based assessment tasks (diagnostic datasheets and journal-style reports); and (ii) the gathered data would influence and inform change (if required) to achieve long-term embedding of GAs within MB, MDB, and BGD assessment tasks.

Methods

The methodology employed included preparation of clear marking criteria for each assessment task, followed by development of a marking rubric for each assessment task (criterion-referenced marking criteria). Marking criteria and associated rubrics (Table 1) were developed in consultation with subject coordinators and assessors. Each marking criterion was linked to a GA, in some cases several marking criteria were attributed to one GA. The marking criteria document was distributed via a web-based student portal (UTSOnline), in order to provide student access prior to assessment task submission date.

Student opinion was acquired via anonymous feedback surveys (paper-based or online), and focus groups (face-to-face or online; Ethics Approval UTS HREC REF NO. 2012-129A). Paper-based feedback surveys were used for MDB and BGD, being distributed and completed in a class close to the end of semester. An online feedback survey was used for MB due to timetable restrictions, and was available after the exam period. The focus groups

were conducted in two formats. For MDB a face-to-face format was used but generated low student participation. Due to timetable restrictions in MB, an email format was used and generated sufficient student involvement. Due to the success of this format, it was used again for BGD. In both formats, students were offered the incentive of two movie tickets for their participation. The anonymous feedback surveys were analysed using the Likert scale, with open-ended questions analysed manually by grouping responses under similar themes. The focus group (open-ended) questions were analysed in the same way.

The screenshot displays the 'Writing' and 'Scientific enquiry' criteria sections. Each section includes a list of criteria (e.g., 'Easy to read, language clear and succinct') and a corresponding progress bar with grade markers (F, P, C, D, HD) and a weight percentage (17% for Writing, 16% for Scientific enquiry). Below each criterion, there are 'Hide Criteria Comments' buttons and a text box for feedback. The 'Overall Comment' section at the bottom contains a message to the student: 'Dear David, A well written report. Below I have provided some comments on the three assessment criteria that could be improved most. Reading both my comments and the assessment criteria that matches your grade is especially important if you intend to revise and resubmit your report.' The overall task mark is shown as 'C'.

Figure 1: Assessor view of a single student's assignment assessment and feedback in Re:View. Re:View is an online assessment tool which provides a direct link between graduate attributes and marking criteria. It also provides students with an easy access online portal to retrieve their grade and assessor feedback on assessment tasks. (a) Student self-assessment of their performance in that individual criterion; (b) The average result for the entire student cohort for that individual criterion; (c) Assessor determined result for that individual criterion; (d) Assessor free-text feedback for that individual criterion; (e) Assessor free-text feedback for the entire report; (f) Overall results (student self-assessed, entire student cohort, and assessor) for the entire report.

Results

Student feedback survey

Students were invited to voluntarily participate in an anonymous feedback survey that was delivered either in a paper-based fashion (MDB and BGD), or online (MB). For MB and MDB there were 37 responses for each class, representing approximately 15% and 35% of the student cohort, respectively. For BGD 87 students completed the survey, representing an excess of 80% of the students in that subject.

Table 1: Excerpt of a marking rubric for a journal-style written report in Biochemistry, Genes and Disease (BGD).

Criterion	High distinction	Distinction	Credit	Pass	Fail
Graduate Attribute: Disciplinary Knowledge					
Demonstrate an understanding of the scientific concepts associated with the topic being studied	Very well written introduction; covers cancer, cell cycle control, PTEN, mutation and function; P-loop/motif; Intro incl aims; discussion is comprehensive and draws on literature; able to link mutation, structure and function of PTEN to cell cycle; includes references.	Well written introduction; covers cancer and PTEN, may include cell cycle and maybe mutation; discussion is present but not all points covered.	Introduction does not sufficiently (in detail) cover cancer, cell cycle and PTEN; aims not included; discussion is brief and does not cover all results; does not explain mutations; little literature used.	Introduction is brief and does not cover all the main points; written without understanding the concepts; some misconceptions about the experimental aim are evident; discussion is very brief and shows some lack of understanding of the results.	Introduction does not cover cancer, cell cycle and PTEN; report too brief; poorly written; clear lack of understanding of experimental aim;
Graduate Attribute: Professional Skills					
Correctly perform statistical analysis	Correct t-test results; correct p-values; correct presentation of p-values in scientific notation OR, simply $p < 0.05$; correct explanation of values being either significantly higher or lower and not just 'significantly different'.	Correct t-test results; correct p-values; not adequate explanation of values being either significantly higher or lower.	Correct t-test results; correct p-values; not presented in scientific notation or $p < 0.05$; no (or incorrect) explanation of values being either significantly higher or lower.	Statistics performed but incorrect results; statistical analysis incomplete.	No statistical analysis performed

This was the first time Re:View had been used in MMB. Students in each of three biochemistry subjects were instructed in class on how to access and use Re:View, they were also supplied with instructions in text format available via UTSONline. For students in MB and MDB, it was the first time they had been exposed to Re:View and only 57% of students found the interface user-friendly, however, this increased to 88% in BGD (Figure 2).

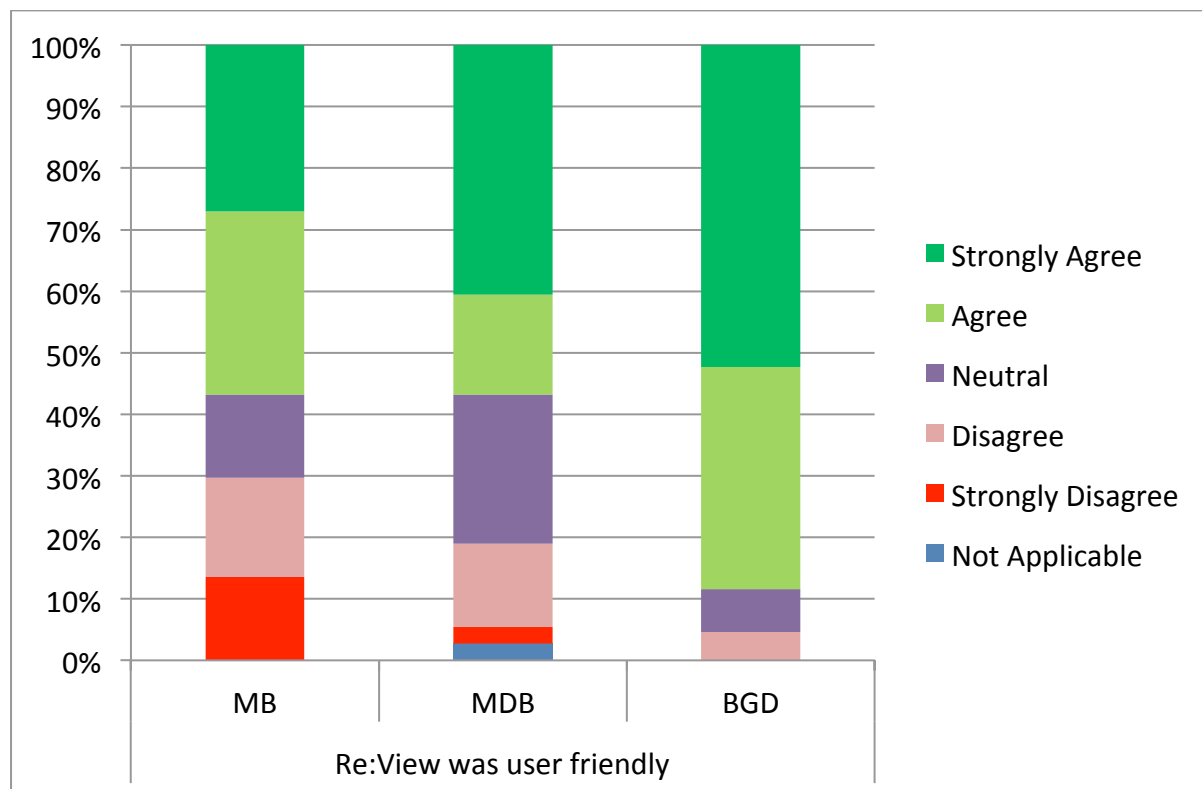


Figure 2: Student opinion on the user-friendly nature of the Re:View software for online access to assessor feedback and grades. Student opinion was canvassed via an anonymous feedback survey. Approximately 60% of students in Metabolic Biochemistry (MB) and Medical and Diagnostic Biochemistry (MDB) found Re:View easy to use. This increased to approximately 90% in Biochemistry, Genes and Disease (BGD).

In all three biochemistry subjects students were assessed via datasheets and written, journal-style reports. For each assessment task students were provided with a list of marking criteria which included the link to GAs. In all three subjects students were satisfied with the assessment criteria, with greater than 65% of respondents agreeing that assessment criteria were defined and clear (Figure 3). Each subject within the Faculty of Science at UTS has a subject outline, in which GAs are listed, including how the content of the subject addresses and assesses these GAs. For MB and BGD, higher than 80% of students were aware of the GAs, however, this figure fell to 61% in MDB (Figure 4). This lower figure for MDB was also reflected when students were asked if assessment tasks aligned with the GAs, where less than 50% of students agreed, however, greater than 70% of students in MB and BGD agreed (Figure 4).

Re:View has been used in this study to provide students with online access to assessor feedback, and to improve the tangible link between assessment criteria and GAs. In MB, less than 50% of students agreed that Re:View provided a clear link between marking criteria and

GAs, with 17% strongly disagreeing with this statement. In contrast, BGD students could see the link via Re:View (86% agreed; Figure 5). This positive response from BGD was mirrored when students were asked if Re:View provided ease of access to assessor comments, where greater than 90% agreed, in comparison to the 52% from MB. Approximately 70% of students in MB and MDB agreed that the online access to Re:View was of benefit to them, in comparison to the greater than 90% in BGD (Figure 5).

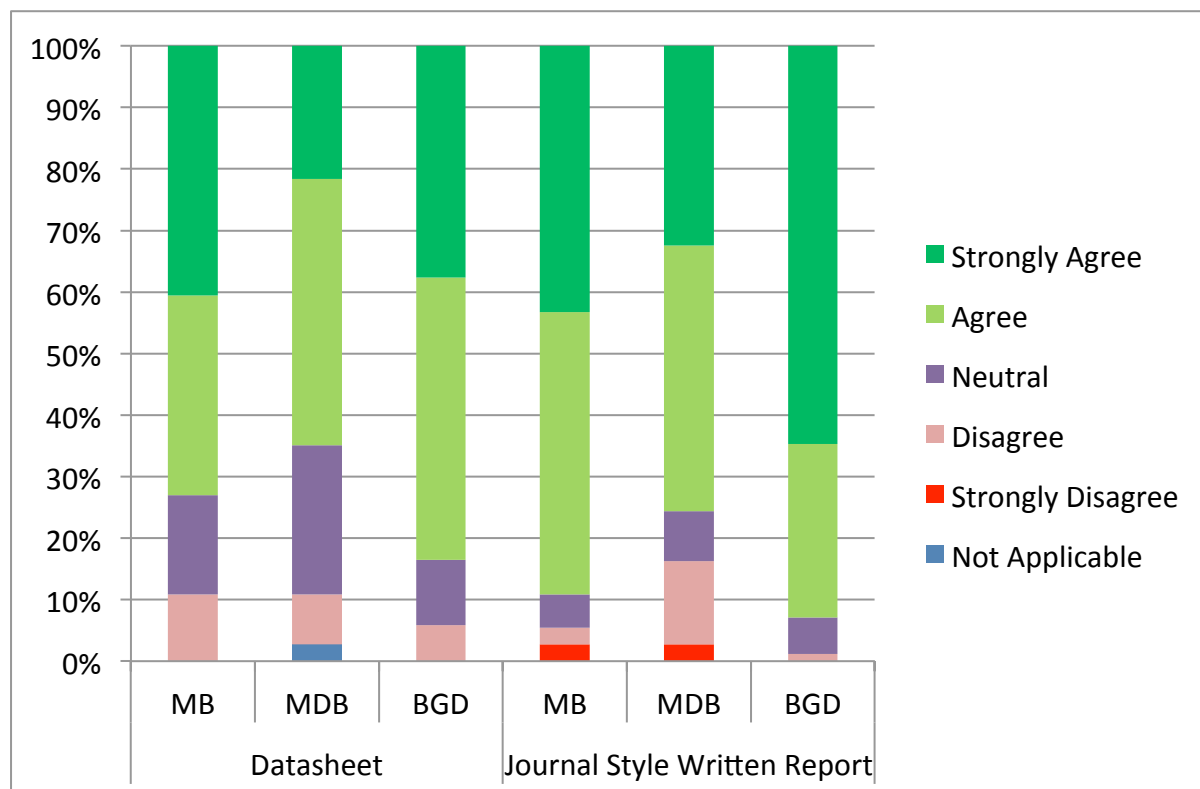


Figure 3: Student opinion on whether the criteria for two assessment types were defined and clear. Students were assessed via datasheets and journal-style written reports in each of three biochemistry subjects, Metabolic Biochemistry (MB), Medical and Diagnostic Biochemistry (MDB) and Biochemistry, Genes and Disease (BGD). In each subject student opinion was canvassed via an anonymous feedback survey. Across both assessment types, in all three subjects, students agreed that assessment criteria were defined and clear (minimum 65%).

The marks-focused nature of students is highlighted in the second year (third stage) MB students, where greater than 90% of students were only interested in their mark available via UTSONline. This trend steadily decreased in the third year (fifth stage) MDB (78%) and sixth stage BGD (65%). The focus on improving their skills rather than their marks improved in BGD, over MB and MDB, where 74% of BGD students recognised how Re:View helped them focus on improving their skills, in comparison to less than 40% in the other two subjects (Figure 6).

Student focus groups

UTS human research ethics approval was obtained for the face-to-face student focus groups sessions (UTS HREC REF NO. 2012-129A). Students were invited to voluntarily participate in these focus group sessions, with the incentive of a double pass to the movies, and were informed that their comments would be de-identified in any report, and that their involvement

had no bearing on their results in the subject. These sessions were held face-to-face for MDB, but via email for MB and BGD, as this resulted in greater student participation. Three students participated in MDB focus groups, 15 in MB and 11 in BGD. The responses to the open-ended questions of the anonymous feedback survey, and the focus group comments, were sorted into themes, and the two datasets combined into common identified themes (Tables 2-5). The minimum number of responses to characterise a theme was three students, however, in most cases the number of responses per theme exceeded 10 students per subject.

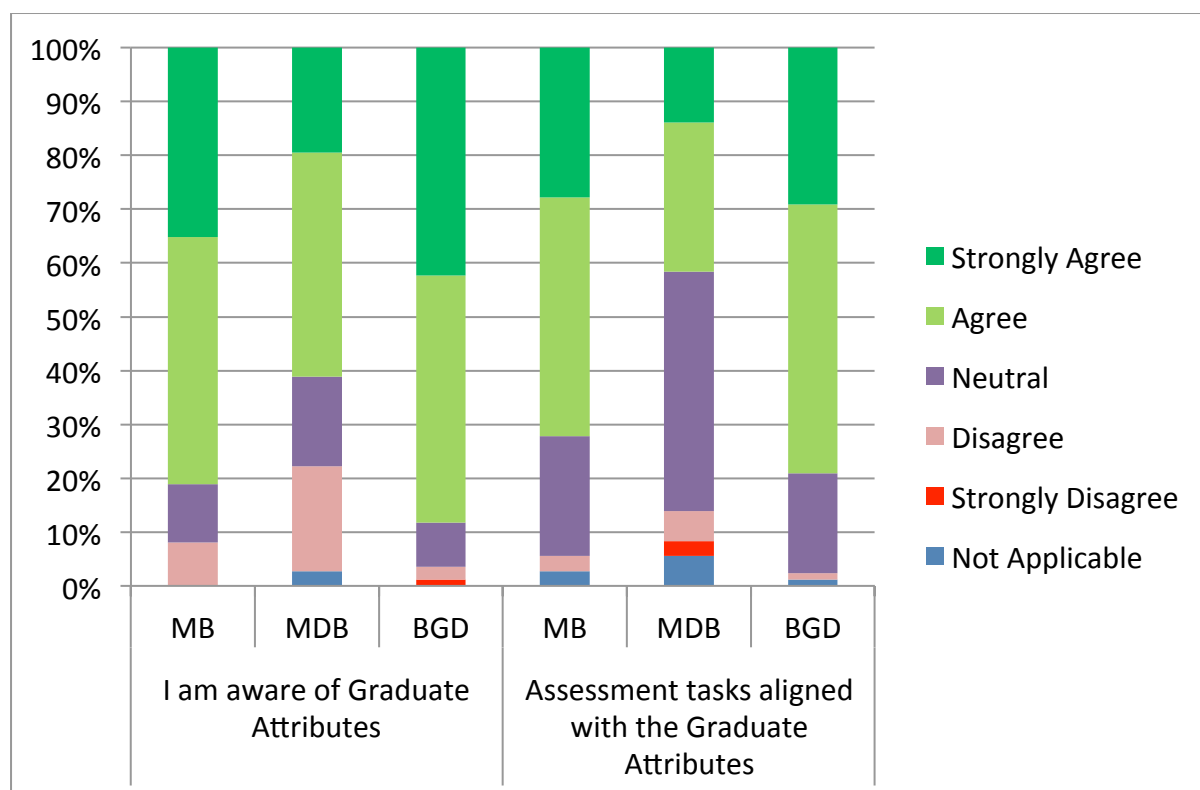


Figure 4: Student opinion on knowledge and alignment of graduate attributes within assessment tasks across three biochemistry subjects. Students in Metabolic Biochemistry (MB), Medical and Diagnostic Biochemistry (MDB) and Biochemistry, Genes and Disease (BGD) were asked (via an anonymous survey) if they were aware of Graduate Attributes (GAs) within the Faculty of Science at UTS, and if the assessment criteria for their submitted work aligned with these GAs. More than 50% of students in all three subjects were aware of GAs. Greater than 70% of students in MB and BGD thought the assessment tasks aligned with GAs, but this dropped to 42% in MDB.

Table 2 shows the themes identified from student responses to general questions relating to the use of Re:View in all three subjects. Responses to question R1 indicated that students in all three subjects believed Re:View provided a clear alignment between assessment tasks and GAs. Students in MB and BGD commented that Re:View provided effective feedback and showed clear mark breakdown (R1). Question R2 highlighted possible improvements for Re:View, and students across all three subjects wanted the numerical percentage mark be released at the same time as the feedback. It was also noted across all three subjects that students wanted written feedback on their actual assignment hardcopy (R2). In all three biochemistry subjects students found that individual marking criteria could be used to identify in which skills (GAs) they were lacking, and hence where marks were lost, and

identify where improvements could be made in future assessment submissions (Table 3; Table 5 F1).

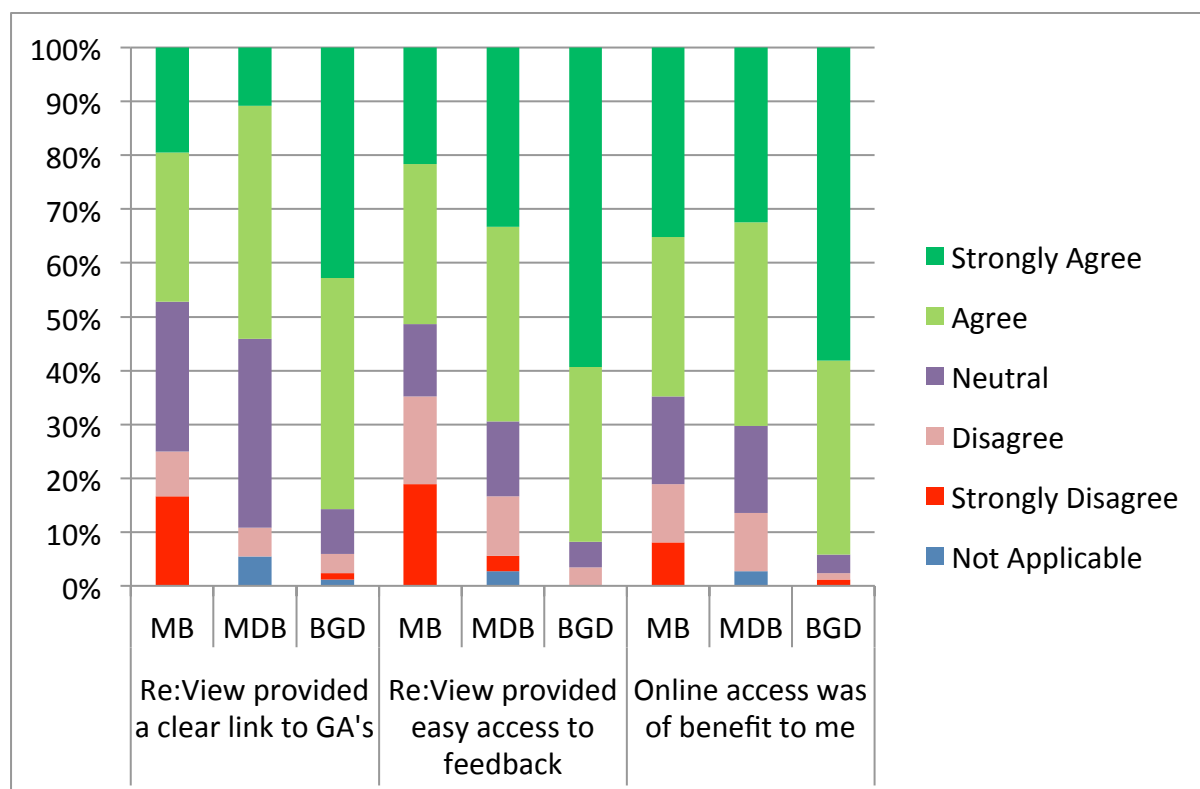


Figure 5: Student opinion on the benefit of Re:View software for providing easy access to assessor feedback and linkages to graduate attributes. Students in three biochemistry subjects, Metabolic Biochemistry (MB), Medical and Diagnostic Biochemistry (MDB) and Biochemistry, Genes and Disease (BGD), were asked via an anonymous survey several questions about assessment tasks and the use of Re:View, an online assessment tool. Students in MB and MDB did not think Re:View provided a clear link between assessment criteria and Graduate Attributes (GAs) (<60% agreement), whereas 86% of students in BGD agreed. Only 52% of students in MB agreed that Re:View provided easy access to assessor feedback, whereas this increased to 92% in BGD. For MB and MDB approximately 70% of students saw the benefit of online access to assessor feedback, whereas 94% of students in BGD agreed the online access was of benefit to them.

The vast majority of students were aware of GAs (Table 4, G1). Students across all three subjects also indicated that Re:View clearly links GAs to assessments and marking criteria (Table 4, G2). Although students in MB and BGD used feedback to identify areas for improvement, responses in all three subjects also showed students did not use feedback provided via Re:View (Table 5, F1). Approximately half of the students indicated that Re:View provided easier access to feedback, in comparison to traditional methods (Table 5, F3).

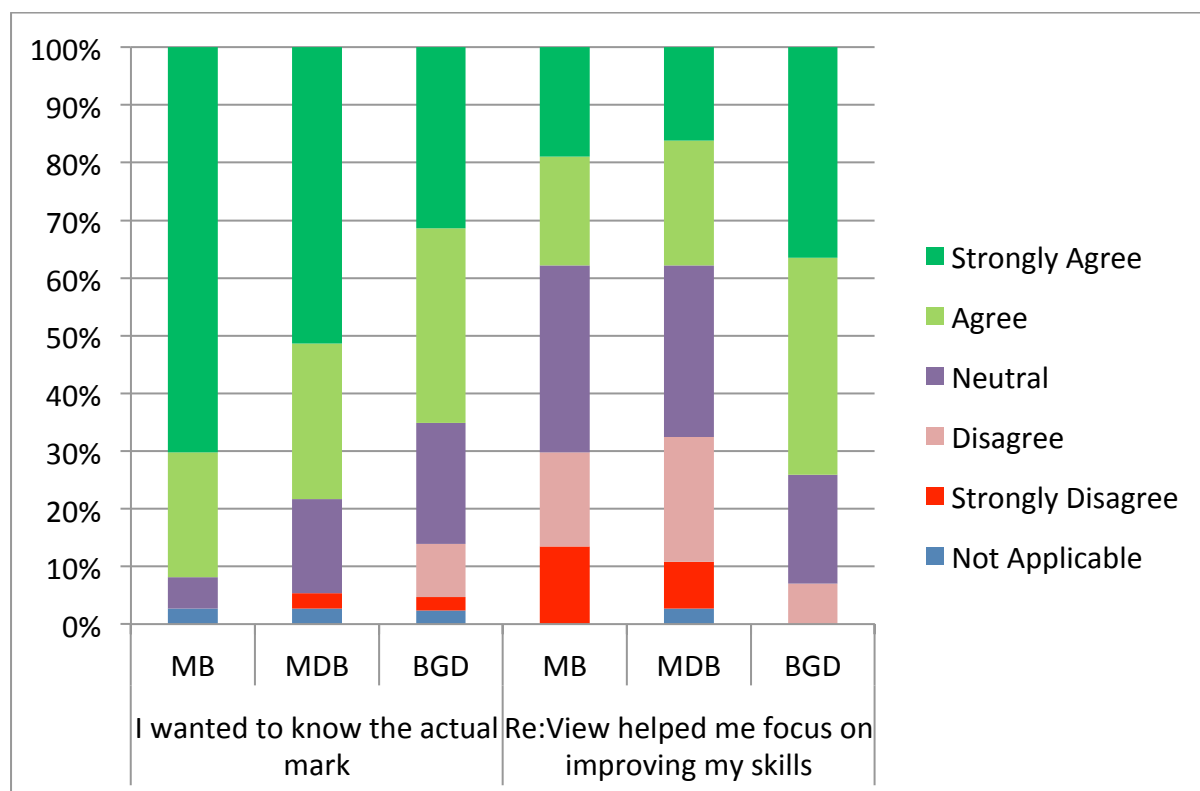


Figure 6: Student opinion on preference for marks, and their focus on skill improvement. Student opinion was canvassed via an anonymous feedback survey. Subjects under study were Metabolic Biochemistry (MB), Medical and Diagnostic Biochemistry (MDB) and Biochemistry, Genes and Disease (BGD). The marks-focused nature of students is demonstrated in MB, where 92% of students wanted to know their actual mark. This was similar, but to a lesser extent, in MB and BGD. Only 38% of students in MB and MDB thought Re:View helped them focus on improving their skills, which is vastly different to BGD where the number increases to 74%.

Discussion

This project aimed to improve the student learning experience by clarifying the link between assessment tasks, marking criteria and GAs, using the online assessment tool, Re:View. The majority of students were aware of GAs (Figure 4), and perceived the benefit of using Re:View to align marking criteria and GAs (Table 2, R1). While some students commented that Re:View was hard to use at first (Table 2, R3), the majority of students believed that Re:View provided easy access to assessor feedback and online access was of benefit to them (Figure 5). This perceived benefit was related to seeing where they could improve for future assessment tasks (Table 3), including using feedback via specific marking criteria and personalised feedback (Table 5, F1 & F2).

Students graduate from University with much more than disciplinary knowledge. Within the Faculty there are seven GAs: disciplinary knowledge, inquiry-oriented approach, professional skills, continued intellectual development, engagement, communication, and innovation. Students in MB and BGD indicated they were aware of GAs (>80%), while 36% of MDB students were neutral or not aware (Figure 4). Despite the MDB result, the use of subject outlines and GA linked marking criteria has been successful in increasing the awareness of

GAs in these three biochemistry subjects. This project provided a major step in the alignment of marking criteria and GAs, via the use of Re:View (Figure 1), an online criteria-based marking tool for assessment tasks (Thompson, 2009). This was the first time Re:View has been employed in MMB. Re:View provided a domain in which each marking criterion was linked pictorially to a GA. Although Re:View clearly demonstrates the tangible link between these two items, less than 60% of students in MB and MDB thought Re:View provided this link. This increased in BGD (86%) which is likely to be due to student familiarity with the software (Figure 5).

Table 2: Re:View - summary of student responses to open-ended (feedback survey) and focus group questions.

R1: What did you like about using Re:View?

Theme	MB ^a	MDB ^b	BGD ^c
The feedback given.	✓		✓
The mark breakdown.	✓		✓
Alignment of criteria to graduate attributes.	✓	✓	✓

R2: What didn't you like about using Re:View?

Theme	MB	MDB	BGD
No marks/feedback returned on paper.	✓	✓	✓
No numerical mark given.	✓	✓	✓

R3: What did you think about the online access to Re:View?

Theme	MB	MDB	BGD
Easy/convenient.	✓		✓
Still needs work.	✓		✓
Hard at first.	✓	✓	

^a Metabolic Biochemistry

^b Medical and Diagnostic Biochemistry

^c Biochemistry, Genes and Disease

Table 3: Marking criteria - summary of student responses to open-ended (feedback survey) and focus group questions.

M1: How were the individual marking criteria of use to you?

Theme	MB ^a	MDB ^b	BGD ^c
Identified skills that are in need of improvement; helpful for future assessments.	✓	✓	✓
Helpful to see assessment performance broken down.	✓		

^a Metabolic Biochemistry

^b Medical and Diagnostic Biochemistry

^c Biochemistry, Genes and Disease

The use of Re:View also facilitated the integration of rubrics within the three biochemistry subjects under study (Table 1). Prior to this research project, these subjects had not used rubrics for assessment of laboratory-based assignments. Development of criterion-referenced marking criteria for laboratory assessment tasks and the associated rubric provided assessors with clear expectations of the level of student work required to achieve particular grades (pass, credit etc), thereby decreasing variability both within one, and between multiple

assessors. This was seen as a major advantage, as it is a consistent student complaint that judgements differ widely amongst assessors (Young et al., 2001). This also removed 'academic instinct' (Fry et al., 1999 as cited in Campbell, 2005) that has been historically used in laboratory assessments, particularly journal-style written reports.

Table 4: Graduate attributes - summary of student responses to open-ended (feedback survey) and focus group questions.

G1: Are you aware of the Faculty graduate attributes?

Theme	MB ^a	MDB ^{b,d}	BGD ^c
Yes.	75%	✓	82%
Kind of.	0%		18%
No.	25%		0%

G2: How did Re:View help you to see the link between graduate attributes and individual marking criteria?

Theme	MB	MDB	BGD
Clearly links graduate attributes to the skills assessed.	✓	✓	✓

^a Metabolic Biochemistry

^b Medical and Diagnostic Biochemistry

^c Biochemistry, Genes and Disease

^d Number of student replies too small for representative quantitation

Table 5: Feedback - summary of student responses to open-ended (feedback survey) and focus group questions.

F1: How did you use the individual marking criteria as feedback to help you improve your work?

Theme	MB ^a	MDB ^b	BGD ^c
Feedback showed which skills are lacking for future improvement.	✓		✓
Re:View showed the performance of my peers on the same task.	✓		
Did not use it.	✓	✓	✓

F2: How did you use the individual, personalised feedback to improve your work?

Theme	MB	MDB	BGD
Identified areas for improvement.	✓		✓

F3: Was the feedback via Re:View easier to obtain than traditional (previously experienced) feedback methods?

Theme	MB	MDB ^d	BGD
Yes.	46%	✓	56%
No.	54%		0%
About the same.	0%		36%
N/A.	0%		8%

^a Metabolic Biochemistry

^b Medical and Diagnostic Biochemistry

^c Biochemistry, Genes and Disease

^d Number of student replies too small for representative quantitation

Associated with use of rubrics in this project was development of specific marking criteria linked to specific GAs. For example, for Disciplinary Knowledge students needed to show understanding of the subject material, with the depth and application of knowledge being related to performance levels; and for Professional Skills students were required to present laboratory results in the required format of a journal article, and use the appropriate referencing style. The specific linking of GAs to individual marking criteria was two-fold: (i) this is part of the mapping activity of the Faculty; and (ii) it is an aid to the students in their understanding of how they are developing generic skills needed for employment. Across all three subjects students agreed (greater than 65%) that marking criteria were clear for both assessment types (Figure 3), with comments such as “*individual marking criteria highlighted exactly what was required in the assessment*”. For students in MB and BGD greater than 70% of students agreed that assessment tasks were aligned with GAs (Figure 4), with comments including “*I was able to see how I was developing my graduate attributes; they became more real as opposed to a bunch of words in the [subject] outline*” and “*Re:View highlights how well an individual has performed in each of the graduate attributes*”. Hence, the use of rubrics and provision of clear links to GAs is of benefit to students in these biochemistry subjects.

In this project students were not provided with the detailed rubric matrix prior to completing the assessment tasks, as has been suggested (Ndebele & Maphosa, 2013; Young et al., 2001), as the provision of such a resource prior to assessment submission may encourage students to use it as a checklist to gain marks rather than a tool for learning and feedback (Norton, 2004; Turley & Gallagher, 2008). This decision was based on: (i) datasheets were step-by-step reports with distinct break-down of required work; and (ii) for journal-style reports, students were provided with in-depth tutorials on expectations prior to submission of their reports, and students were also provided with marking criteria (but not expected performance levels) and how these linked to GAs. In the future for MDB and BGD, which have two consecutive, journal-style reports, it may be an aid to the students to provide the rubric matrix with expected performance criteria after the first task is assessed, before the second task is due, in order to improve transparency of the expected level of work, to help them determine ‘why’ a particular grade was awarded for each marking criteria, which may also help them concentrate on, and develop associated GAs.

Assessment tasks vary in design and content, however, it is common that the greatest proportion of a student’s final mark/grade is derived from mark-driven exams (Thompson, 2009). Students are conditioned through their educational experience to receive marks and be awarded a grade (Isaacson & Stacy, 2009), and students focus on the grade rather than learning as an outcome from assessment tasks (Carless, 2006). The student feedback survey results from MB and MDB show a strong student bias towards wanting their mark, however, fewer BGD students were only interested in their marks (Figure 6). This is attributed to two factors: (i) BGD students are final stage and through several semesters have developed their skills and may be focused more on employment/generic skills; (ii) many students in BGD had been exposed to Re:View in MDB (an earlier subject) and so had experience in using the software and understood its intended application. This latter point is supported by Young and colleagues (2001) who believed students see second phase subjects as an extension of their first phase subject. While responses in the focus groups showed students used feedback to identify areas for improvement (Table 5, F2), students in all three subjects also stated that they did not use the feedback (Table 5, F1), which reflects comments of Price and colleagues (2010). Although, students continue to be marks-focused, continued provision of their grade

and feedback prior to release of their actual percentage mark, may lead to improved focus on building skills rather than chasing marks.

Breaking down the final grade/mark received by the student into several marking criteria linked to GAs enables students to see their strengths and weaknesses in particular areas of their work. For example two students may both receive a credit grade, but excel and struggle in different areas of the assessment task, yet the average generates the same grade (Newell et al., 2002). Therefore, mark breakdown provides clarity of where marks were lost and enables students to learn more from their results (Andrade, 2000). For example, one student commented,

“[Re:View] outlined not only the negatives but also the positives of what I was doing right and wrong. That way I had the chance not only to improve my weaker areas but also know my strengths”.

Students in MB and BGD commented that Re:View provided a clear breakdown of their final mark (Table 2, R1), and students across all three biochemistry subjects agreed that defined and separate marking criteria helped them identify their skills (GAs) that required improvement (Table 3), with comments such as, *“Re:View gave me individual feedback rather than just a final grade, which specifically outlined areas in the assessment that need improving”.*

Living in the digital age with a large contingent of students under 25 years of age it was surprising that 19% of MB students disagreed that Re:View provided easy access to feedback (Figure 5). This could be related to the observation that only 57% of these students found Re:View to be user-friendly (Figure 2). In BGD, 88% of students found Re:View to be user-friendly (Figure 2) and 92% agreed that Re:View provided easy access to assessor feedback (Figure 5). This is likely to be due to the fact that BGD students may have also completed MDB and had previously been exposed to Re:View. The higher percentage of students in BGD agreeing that online access to assessor feedback was of benefit to them (Figure 5) is also likely to reflect the timetable of assessment tasks. In BGD, one journal-style written report was due before, and the second similar report due after, the mid-semester break. Assessment and feedback of the first task was available online via Re:View during the mid-semester break, and hence could be accessed by the students anytime, and could be used to make improvements to the second report. For example, comments included, *“I was able to take the comments made by the assessor and improve my second assessment”.*

As described above, BGD students were assessed via two journal-style written reports, with the feedback on the first report being available online via Re:View during the mid-semester break, before the submission date of the second report. The marking criteria for both reports were the same, albeit with a different focus of the disciplinary knowledge for each report. The use of two-stage assessment tasks such as these has been shown to aid students in their response to feedback (Carless et al., 2011), as students can address issues in the subsequent, equivalent task (Taras, 2002). BGD students showed an improvement in marks from an average of 70.6% in the first report to an average of 80.5% in the second report. Results of the feedback survey (Figure 6) showed that Re:View helped BGD students focus on skill improvement. Considering that components of good feedback are that it is timely (Rucker & Thompson, 2003), provides advice on improvement (Black & Wiliam, 2010) and is applied in future work, our results demonstrate that feedback content, use of criterion-referenced marking criteria, provision of specific/individual text-based feedback, and rapid online access to feedback in Re:View led to an improvement in student learning outcomes.

Students commented that they wanted feedback to be written on the submitted, hard-copy of their work (Table 2, R2). For example, “prefer having feedback written on the paper pointing out where mistakes are occurring” and “I would have liked a marked paper to be handed back with comments on the paper”. Feedback written on the actual report may be easier for students to understand, and personalised feedback on individual reports can aid students in identifying particular mistakes (Bailey & Garner, 2010; Cabrera & Villalon, 2013). Although it is possible for the students to print the Re:View output (as a PDF) and compare this to their work, it would appear this was an option used by few students. Despite this, students did comment that online access was of benefit, for example, “quick and easy access to results and feedback” and “online access anytime and from anywhere is so much better than having to pick up assessments in person from uni”.

The use of Re:View has been a positive experience for the students across these three biochemistry subjects, with feedback showing an improvement in student assessment marks, providing greater transparency of the link between assessment tasks, marking criteria and GAs, and delivering a faster turn-around of results and feedback.

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