Benefits and drawbacks of computer-based assessment and feedback systems: Student and educator perspectives

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Abstract
Providing students with high quality feedback is important and can be achieved using computer-based systems. While student and educator perspectives of such systems have been investigated, a comprehensive multidisciplinary study has not yet been undertaken. This study examines student and educator perspectives of a computer-based assessment and feedback system at undergraduate and postgraduate levels across a range of disciplines, course sizes and educator experience levels. The results suggest that students and educators may enjoy quality, efficiency and quantity benefits from such an approach, without the drawbacks of low personalisation and specificity identified within the literature. Time and effort are, however, required by educators for training and installation. Thus, workload and training allowances are recommended for practitioners, particularly for large courses where group assignments require highly personalised feedback.

Introduction

This study examines feedback to students, the important (Blair, Curtis, Goodwin & Shields, 2013) information that the outcomes of a task provides (Björkman, 1972). General feedback rather than specific types such as feedforward, focusing on improving future performance (Chen, Chou & Cowan, 2014), is examined.

High-quality feedback can be produced by computer-based assessment systems, which assess students electronically and have been in existence for decades. For example, Lumsden and Scott (1988) note advantages such as feedback speed for the Teaching Information Processing System (Kelley, 1968). EFS (Electronic Feedback System) (Denton, Madden, Roberts & Rowe, 2008) and CAFAS (Computer Aided Feedback and Assessment System) (Freney & Wood, 2006) are more recent examples. Objective style testing systems fall outside the focus of this study. Computer-based assessment and feedback have been examined from student and educator perspectives (Denton *et al*, 2008); it can offer many benefits, but set-up can be slow (Stevens & Jamieson, 2002) and installation difficult (Debuse, Lawley & Shibl, 2008).

This study extends recent single discipline (business/marketing) research (Debuse & Lawley, 2011) to examine a computer-based assessment and feedback production system, referred to as SMI (SuperMarkIt), using students and educators from multiple disciplines. Our research question is: what are the benefits and drawbacks of a computer-based assessment and feedback production system (specifically SMI) to both students and educators? The background to the SMI system is presented next, followed by the research method. Results are presented, summarised and discussed. Finally, conclusions are drawn and future research proposed.
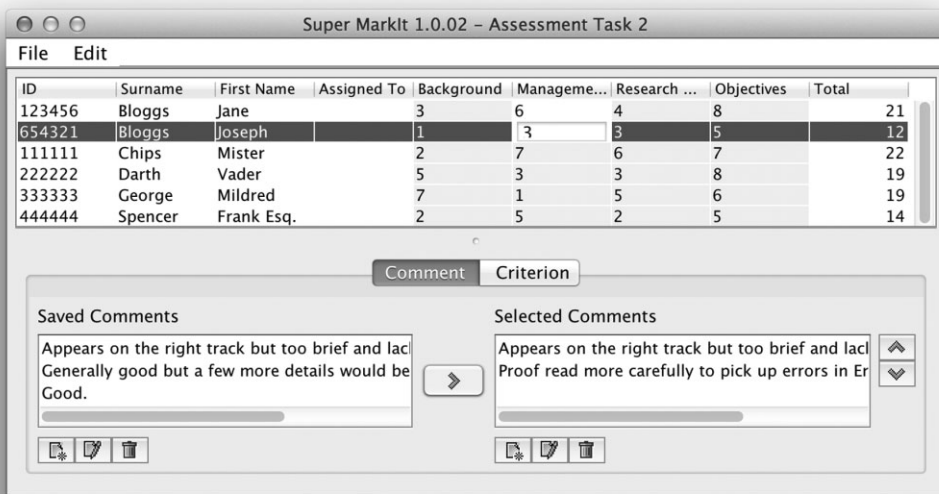
Figure 1: The SuperMarkIt interface.

The SMI system

SMI was developed using action research (Stringer, 2007); the goal was to develop a stand-alone system to improve the quality of student feedback while reducing academic workloads. Educators set up a marking sheet, with rows and columns for students and criteria. Student details, marks and comments are then entered (Figure 1). Feedback is generated as electronic documents. The system includes features aimed at increasing efficiency, such as learning management system import and export, comment reuse and quality assurance measures.

Method

This paper focuses on the latest action research cycle, measuring the efficacy of SMI across a multidisciplinary context, using undergraduate and postgraduate students together with educators. Our goal was to select a sufficient number of educators to yield a reasonable level of diversity. We aimed to recruit between 6 and 10 educators representing a range of disciplines, experience levels, class sizes and class levels to trial the system. We began with eight volunteer educators representing our desired range; however, three educators dropped out before using the system as they had developed matrix-based rubrics. These rubrics were complex to convert to use within SMI, as they relied on set descriptions of achievement for each criteria presented as a full matrix rather than detailed individualised feedback against each criteria. We therefore recruited an additional four educators. Further, three of the nine educators who started using the system dropped out during the teaching period; these are described in detail within the Results section.

Educators were interviewed before and after using the system, using a standardised guide. The pre-usage interview included demographic information, prior usage of marking software, technological competence and course information, together with expectations. The post-usage interview contained questions based upon the Unified Theory of Acceptance and Use of Technology model (Venkatesh, Morris, Davis & Davis, 2003) and covering the following constructs: effort expectancy, based upon ease of use; performance expectancy, covering perceived advantage yielded by the system; social influence, representing the effect of peer pressure; and facilitating

conditions, examining the instructions of the system together with whether the system suits the user. Given the small sample size, the quantitative data gathered were not used statistically but rather to compare ratings between the six educators. Qualitative data, such as key advantages and disadvantages for educators and students, were entered into a spreadsheet and manually reviewed by the research team.

Students were surveyed after receiving feedback from the system. Feedback quality was examined across areas identified as important within the literature: how timely it was; its consistency; how much feedback was produced; the level of detail given; its legibility (Higgins, Hartley & Skelton, 2002); how informative it was (measured as constructiveness); its specificity, corresponding to the extent to which feedback is not too vague and general (Higgins *et al*, 2002); and its level of personalisation, corresponding to the extent to which feedback is not impersonal (Higgins *et al*, 2002). Responses were measured on a five-point scale, where students were asked to compare feedback from SMI with feedback from other courses they were currently studying.

Results
Educators
The six SMI users taught eight courses over both undergraduate and postgraduate levels, covering the disciplines of tourism, nursing, law, public health and marketing, with between 6 and 78 students for a total of 246 students over the eight courses (Table 1). Their teaching experience varied from 5 to 13 years. SMI had been used previously by two of the educators, and a third had experience with MindTrail. The remaining participants had not used marking systems before. The respondents' self-reported competence with information and communications technology was high. The type of assessments used included reports, essays and exams. All courses used SMI for a minimum of one assessment with only one course using SMI for all marking. Reasons for not using SMI for all assessments included: unsuitability for class-based assessment, lack of time to instruct sessional staff, assessment undertaken before knowledge gained of SMI, assessment format (oral or PowerPoint), superior speed of manual approach due to small class size and minor software errors. The latter were unsurprising as changes had been made to create a more user-friendly interface for educators.

As noted previously, three of the nine educators who started using SMI dropped out during the teaching period. The first of these used a rubric to calculate marks, which required too much time and effort to convert to SMI. The second had multiple reasons: inadequate preparation, late assessments, software errors and Macintosh operating system incompatibility. The third taught

Table 1: Courses used

Course	Level	Assessments marked using SMI	Number of students' work marked (response number and rate in brackets)
Tourism	UG	2 reports	78 (42, 53.8%)
Nursing	UG	2 essays	12 (8, 66.7%)
Property	UG	1 essay	26 (25, 96.2%)
Business law	PG	1 essay 2 exams	10 (9, 90%)
Public health	PG	1 report	37 (31, 83.8%)
Public health	UG	1 literature review 3 process evaluation plans	39 (28, 71.8%))
Public health	PG	2 literature reviews	6 (4, 66.7%)
Marketing	UG	3 reports	48 (not surveyed)

PG, postgraduate; SMI, SuperMarkIt; UG, undergraduate.

essay writing style and preferred to insert comments directly into the essay. These three non-users also found comment entry laborious, with personalisation challenging. The benefits and draw-backs of SMI are presented next.

Benefits

In the pre-usage survey, the expected benefits to educators from using SMI included reductions in time and resources; improvements in personalisation, feedback and learning quality; standardi-sation; and greater consistency. Educators expected students to benefit in similar areas: faster turnaround and improvements in feedback quality, learning and consistency.

Responses indicate that educators appeared keen to continue using SMI; all but one gave the highest possible response (Table 2). Responses averaged at least "tend to agree" in most areas: the compatibility of SMI with their work style and context, usefulness/availability of instruction/support, recommending the system to others, having sufficient knowledge to use the system, its

Table 2: Quantitative educator results

Question	Mean	Standard Deviation	Count of responses 0 = not applicable; 1 = strongly disagree; 2 = tend to disagree; 3 = neutral; 4 = tend to agree; 5 = strongly agree					
			0	1	2	3	4	5
I would like to use SMI again in the future.	4.83	0.41	0	0	0	0	1	5
Using SMI fits into my work style.	4.50	0.84	0	0	0	1	1	4
The person-to-person (either face to face or over the phone) instruction given for SMI was useful.	4.50	1.22	0	0	1	0	0	5
SMI is acceptable and compatible with the existing academic culture, practices, values and needs.	4.33	0.52	0	0	0	0	4	2
I would recommend SMI to others.	4.33	0.82	0	0	0	1	2	3
Specialised instruction concerning SMI was available to me.	4.33	1.21	0	0	1	0	1	4
I have the knowledge necessary to use SMI.	4.17	0.41	0	0	0	0	5	1
Overall, I can see several relative advantages of SMI over other options for assessment and feedback in terms of time.	4.17	1.17	0	0	1	0	2	3
SMI was easy to install.	4.00	0.82	2	0	0	1	2	1
Overall, I can see several relative advantages of SMI over other options for assessment and feedback in terms of cost.	4.00	1.41	0	0	1	1	0	3
SMI was easy to use.	3.83	0.75	0	0	0	2	3	1
While SMI is easy to understand holistically, it would be too complex to learn and use effectively without assistance.	3.83	1.17	0	0	1	1	2	2
Overall, I can see several relative advantages of SMI over other options for assessment and feedback in terms of quality of feedback provided.	3.50	1.38	0	0	2	1	1	2
Using SMI takes too much time from my normal duties.	2.17	1.17	0	2	2	1	1	0
I used SMI because my co-workers were using it.	1.20	0.45	1	4	1	0	0	0

SMI, SuperMarkIt.

time and cost advantages and ease of installation, although responses were mixed for the latter. Respondents did not believe that the system took too much time from their regular duties.

Turning now to the qualitative responses, four of the six SMI users found marking faster using the system. Improvements ranged from 2–3 minutes per student for a course using essay assignments to 25–50% for a course using essays and take home exams. Three of the educators reported turnaround time improvements ranging from 3 days to 1 week.

SMI appeared relatively straightforward to learn, principally in relation to the available support and natural, easy nature of the system. One user found the system challenging but "likely to get better over time." The feedback quantity improvements were much more pronounced than the time savings, with three of the six users reporting significant increases.

Educators identified the key advantages to themselves as error reduction through automatic addition of marks and upload, feedback editing, comment reuse and versatility. The most popular features of SMI were its time-related benefits (including reducing repetition, improving efficiency and faster feedback return to students), consistency, legibility and ecological benefits such as savings in fuel and paper incurred by students through an electronic system. Users also appreciated its benefits in areas such as increasing feedback, moderation, allowing feedback to be sent in a single operation, the expectation by students that technology is used and learning management system uploading. Respondents also liked feedback sheet creation, along with visualising all marks simultaneously, and the efficiency of comment reuse.

Speed, emailed feedback and legibility were advantages identified by educators for students. Money saving, consistency and user-friendliness of feedback were also identified. The final qualitative comments were positive including recommending SMI to others, finding it enjoyable to use and noting the resource savings outweigh the effort overheads.

Drawbacks
Although the quantitative responses were positive across most areas (Table 2), they were more neutral regarding the ease of use, whether assistance is required and feedback quality.

Turning now to the qualitative perspective, two of the six respondents identified their major disadvantage was time. Two users did not find marking faster using SMI, with one experiencing delays in initial set-up but then highlighting the potential for faster turnaround once set up. The second respondent who found it slower experienced difficulties ensuring personalised feedback without the ability to write/comment directly on the assessment. In terms of teaching profile, these two educators were marking the largest number of students, were the only educators marking group assessment and gave the highest proportion of personalised feedback. Five of the six educators identified key disadvantages of using SMI as: time, the learning process, criteria sheets that were not tailored for SMI from the start and the save function. The educator reporting the latter appeared to have caused a loss of data, as their response to the part of SMI that they disliked the most was " 'When I lost the data' but problem was the user!"

Overall, the time-consuming elements of SMI were found to be learning and setting up the system, including entering comments and formatting, along with giving individual feedback, re-entering comments and software errors. Specifically, setting up the mark sheets was reported to take between 15 (for experienced users) and 120 minutes per course. Obtaining assignments from the learning management system, along with learning the system, was also noted as time-consuming. Further areas noted included adapting questions and their responses, being unable to create and email reports, creating rich yet succinct comments and accessing individual support. No major disadvantages to students of SMI were identified, although lack of within-assignment comments and feedback reduction were noted as possible issues.

Students

A research assistant attended the final class for seven of the eight courses (Table 1), distributing and collecting the surveys (the eighth was off-campus at this time). The response rate was 74% (147 responses from 198 students), ranging from 53.8% to 96.2% within each course. Responses were similar across all courses, so were aggregated (Table 3). While a variety of assessment types were used within each course, students were asked for overall feedback rather than feedback that was specific to each assessment. The benefits and drawbacks identified by the students follow.

Benefits

The quantitative data, in terms of mean scores, suggest legibility as the key benefit, with all responses being "much better" than feedback from other courses. The overall rating of the system had no response below "somewhat better." Indeed, all but two of the responses for every question were at least "no noticeable difference." Such relatively uniform responses suggest that there would be no differences between students from different courses, faculties and so on. Timeliness, specificity, detail and quantity of feedback proved popular. Students appeared to find their feedback to be personalised and sufficiently varied in content. The only item for which the mean response fell below "somewhat better" was the constructiveness of the feedback; however, this is largely dependent upon individual educators, perhaps reflecting an absence of feedforward.

Turning to the qualitative responses, the best aspects of the system included: convenience; savings in time, cost, paper and travel; greater ease of understanding; and legibility. Some comments suggest that students may prefer receiving feedback in a single sheet to having it embedded in their assignments. Possible improvements suggested were related to layout. Students were overwhelmingly positive regarding online assessment submission and online feedback for reasons such as easiness and savings in time, cost, paper, printing and travel.

Table 3: Student results

Question	Mean	Standard Deviation	Count of responses 0 = not applicable; 1 = much worse; 2 = somewhat worse; 3 = no noticeable difference; 4 = somewhat better; 5 = much better					
			0	1	2	3	4	5
Legibility of feedback	5.00	0.00	0	0	0	0	0	147
Overall rating of feedback received using SuperMarkIt	4.59	0.49	0	0	0	0	61	86
Timeliness of feedback	4.46	0.70	0	0	0	17	45	85
How specific feedback was	4.46	0.60	0	0	0	8	64	75
Detail of feedback	4.40	0.56	0	0	0	5	78	64
Quantity of feedback	4.33	0.68	0	0	0	17	64	66
Were you well informed by feedback?	4.29	0.66	0	0	0	17	71	59
Does feedback meet your needs?	4.27	0.50	0	0	0	4	99	44
Consistency of feedback	4.12	0.65	0	0	0	23	84	40
How personalised feedback was	4.09	0.75	0	0	0	35	64	48
Did feedback increase your understanding?	4.07	0.79	0	0	2	35	60	50
Is feedback sufficiently varied in content?	4.06	0.63	0	0	0	25	88	34
How constructive feedback was	3.82	0.52	0	0	0	36	102	9

Drawbacks

The quantitative data suggested no drawbacks; all but two of the responses for every question were at least "no noticeable difference." A small number of qualitative suggestions for improvement related to feedback were layout improvement and embedding comments in documents.

Discussion

While educators and students agree on feedback benefits such as quantity, legibility and personalisation, in several areas educators are more negative, particularly regarding the lack of comment embedding. Students view feedback extremely positively, and in some cases, suggest that a single page format is preferable to embedding. Embedding may be crucial for some disciplines, such as engineering, where diagrams may require adjustment; SMI, however, does not preclude embedding such comments manually outside the system.

Unsurprisingly, time is a greater benefit to students than educators, as students do not incur the learning and set-up requirements. Indeed, students overwhelmingly favour a fully electronic submission and feedback process. Educators view the feedback quality benefits of SMI as marginal, yet students rate them more positively. While students gave relatively uniform responses across the different disciplines, class sizes and so on, the educator responses suggest that for large classes with group assignments containing highly personalised feedback, SMI is slow to use.

Educators rate SMI highly overall, noting its time benefits, which are supported strongly by the literature (Denton *et al*, 2008). The feedback quantity improvements and error reduction yielded by SMI are also confirmed by existing research. In previous studies, educators have noted benefits to students of feedback systems in terms of feedback quality and consistency (Baillie-de Byl, 2004). The cost benefit of SMI is supported by that achieved by automated spreadsheet feedback software (Blayney & Freeman, 2004). Educators can also gain from related advantages such as the reduction in repetitive tasks and administration (Baillie-de Byl, 2004), and the ease with which marks and comments can be changed (Stevens & Jamieson, 2002).

The most common drawbacks of SMI, namely issues with installation, together with training requirements, do not appear to be unique (Cargill, 2001) and indeed may be contributors to the low uptake of similar systems (Freney & Wood, 2008). Uptake may also be affected by the belief by some educators that comment reuse may fail to deliver personalised guidance and lead to homogeneous feedback (Milne, Heinrich & Morrison, 2008), although this does not appear to be the case for SMI. However, other educators highlight benefits such as consistency, efficiency and quantity (Milne *et al*, 2008). Indeed, time appears to be the principal factor in educators switching from paper to electronic marking (Milne *et al*, 2008).

A number of limitations are associated with this study, including the examination of a single university. However, the university examined is likely to be representative of universities in general. Indeed, the identified benefits and drawbacks of the SMI system such as quality and quantity improvements have broad relevance and thus are likely to be relevant to other universities both within Australia and internationally. Further, while the study covers several disciplines, these all had assessment items that were likely to be well suited to the SMI feedback process, such as essays and reports. Disciplines for which it is less straightforward to produce feedback in the form of a document-containing marks and comments are likely to yield fewer benefits. For example, maths, computing and engineering disciplines may require educators to correct complex formulas or engineering diagrams. Similarly, textual assessments requiring embedded comments, such as grammatical corrections, or rubrics, are a poor fit for systems such as SMI. Finally, students' positive responses to SMI may simply be due to it being new; issues thus may potentially not be identified or reported as SMI is better than the existing approach.

Conclusions

This study addressed an identified research gap by examining multidisciplinary computer-based feedback from the perspective of students and educators. Unsurprisingly, educators appear to produce increased feedback quantity without sacrificing personalisation, with speed benefits being offset by the time required to set up the system. Large courses with group work requiring highly personalised feedback appear poorly suited to computer-based feedback.

A key implication for practice is that electronic feedback appears to yield quantity, quality and timeliness benefits to students and is strongly recommended. However, the low apparent system uptake rate since this study began suggests that educators' reluctance to use such systems is a key impediment to the full realisation of such benefits. Workload allowance and training are therefore recommended, particularly for large courses containing group assignments requiring high levels of feedback personalisation.

Future research should implement key features absent from SMI: group assessment, rubrics, comment embedding and non-textual feedback. There would also be considerable value in determining how best to improve system uptake rates.

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