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What Kind of E-assessment Feedback is Important to Students? An Empirical Study

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Abstract. E-assessment needs to provide detailed feedback that students would use. To this end, the content of feedback should include assessment information that is important to students. By using a convenient sample of twenty second-year undergraduate students, this study explored the extent to which different kinds of assessment feedback were important to students. Therefore, an online questionnaire was administered which, apart from asking values of some background variables including academic achievement, listed a number of different feedback techniques supporting activities applied in deep and strategic approaches to learning and studying. For each technique, students had to indicate the extent of the importance they assigned to it. It was found that: (1) although feedback techniques supporting a deep approach were as important to students as those supporting a strategic approach, the importance of the former was positively related to that of the latter; (2) feedback techniques supporting a deep approach were more important to females than males; (3) when the importance of all these feedback techniques together was considered in a specific way, their relevance to an increase in students' knowledge, skills and motivation could be demonstrated. Although this study used a small sample that might characterise it as preliminary research, it revealed valuable findings, which due to their considerable effect size, make the sample size less questionable. Suggestions for further research are included.

Keywords: E-assessment, feedback, language learning, learning approach, undergraduate students

1 Introduction

Feedback has one of the highest effects on learning (e.g. [1]). Concerning e-learning, research has identified some kinds of feedback that may be important to instructors (e.g. [2]). Less is known about the kinds of feedback that may be important to students (e.g. [3]), especially about those related to e-assessment. These kinds of feedback should be personalised [4] and have content that engages students in self-regulated learning [5]. Furthermore, students should have some control over learning analytics (e.g. what can

be seen by them, what by other students), respecting their preferences for automated alerts over those sent by teaching staff [3].

As a critical component of education, assessment can be used to improve both learning and instruction (e.g. [6, 7]). In the context of e-learning one may first focus on e-assessment feedback and later on other feedback types sent by teaching staff, which, as mentioned above, may be less preferred than feedback automatically sent by the assessment system. To improve e-learning, among other things, assessment needs to provide detailed feedback that students would actually use [8]. Accordingly, the content of feedback should include assessment information important to students (e.g. [3]). Such information may support students' activities applied in their approaches to learning and studying [9].

The concept of an approach to learning, introduced about forty years ago, made a distinction between a deep approach and a surface approach. While the former aims at understanding the material learned, relating it to previous knowledge and experience and examining evidence supporting conclusions, the latter aims at satisfying requirements of a task or a course through memorising details that would be most likely assessed. The strategic approach was added later to denote a combination of deep and surface approaches applied in order to maximise achievement [10]. The so-called SAL (Student Approaches to Learning) perspective has been mainly concerned with students' behavior that can be described using their self-reports or the questionnaires they complete [11].

Subsequent research has clarified the main features of these three categories. These features may be summarised in the following way: "deep (intention to understand, relating ideas, use of evidence, and active learning); surface (intention to reproduce, unrelated memorising, passive learning, and fear of failure); strategic (study organisation, time management, alertness to assessment demands, and intention to excel)" ([12], p. 433). Note that while deep and surface approaches are approaches to learning, the strategic approach, which combines them, may be considered more as an approach to studying than as an approach to learning [13].

Having in mind the features of the approaches summarised above, to facilitate genuine learning based upon understanding, assessment feedback may support the deep approach. This feedback may also support a strategic approach because it involves a deep approach to some extent (e.g., a good study organisation may contribute to relating ideas).

Are deep and strategic approaches related to achievement? Research suggests that there may be a positive relationship between academic achievement and a strategic approach, whereas this achievement might be unrelated to a deep approach (e.g., [12]).

To contribute to under-represented research on kinds of assessment feedback that may be important to students, this study asked its participants to assign importance to different feedback techniques supporting activities applied in deep and strategic approaches to learning and studying. Hence, they completed an online questionnaire that also collected their basic background data including academic achievement.

The study examined the following research questions:

1. Which feedback techniques were more important to students: those supporting a deep or a strategic approach?

2. Considering each approach, were there any relationships between the importance of feedback techniques supporting it and background variables used?

These questions were answered by a sample of second-year undergraduate students who studied information technologies at a private faculty.

2 Method

2.1 Sample

This study used a convenience sample comprising twenty second-year undergraduate students who studied software engineering, information technologies, information systems, and game development at the Faculty of information technologies. Students enrolled in an English course – “English for IT” were invited to participate in the online survey administered. Of those who completed this course and passed the final exam, about 40% also completed the survey, which is a good response rate, bearing in mind that the average response rate for online surveys is around 30% (e.g., [14]).

The participants’ background data were the following: five students were females; eleven students completed almost all tests; course achievement of ten students was 9 or 10, i.e. they received the highest marks (a 6–10 scale was used with 6 denoting the lowest passing mark); average academic achievement (considering all courses completed) was between 8 and 10 for ten students.

2.2 English Course

Course Content. “English for IT” is an LSP (Language for Specific Purposes) course held in the fall semester in Year 2 following two General English courses in Year 1. It is an upper intermediate course at level B2+ (Strong Vantage), with some elements at level C1, but it is more demanding than the previous two courses regarding the use of specialist language. It combines General English and English for specific purposes (Information technology). The course objective is to consolidate grammar use at upper intermediate level, expand general, and particularly professional vocabulary, as well as practice its use in various language functions. The course helps students to improve and integrate all language skills: speaking, listening, reading, writing, and translation.

This course comprised 15 units regarding IT topics to be covered in 15 weeks of academic work. Each unit focused on different vocabulary, linguistic, and grammatical content. For example, Unit 4 “Networks” focused on vocabulary about computer networks and relative clauses as far as grammar is concerned. Although the content of these units might be considered unconnected at first sight, there was some overlapping content. For example, Unit 2 “ICT in Education” focused on present tenses which appeared later on throughout the course; Unit 3 “The History of ICT” revised all past tenses without which it was also impossible to deal with later grammatical areas (conditionals, etc.).

The syllabus of this course and all learning materials, including tests, were developed by the second author of this study, who taught most students engaged in the

course. The remaining students at another faculty site were taught by a different teacher who followed the approach developed.

E-tests and Feedback Provided. In order to get points for effort as a pre-final exam activity, students had to complete successfully two progress tests in every unit, thirty tests in total. There were two test restrictions to choose from: Time limit and Assessment passing mark. The former was not taken into consideration in this study while the latter was set to 5 questions: each test comprised six questions to answer, and the test was passed if correct answers were given to at least five questions. If the student failed the test, he/she could take another test with similar content.

There were three types of questions in the tests: multiple choice, fill-in-the-blank/short-answer (one word only), and true or false; for example:

Choose the correct idiom to complete the following sentence: In today's world, computers are _____ of daily life.

- a) part and parcel
- b) first and foremost
- c) belt and braces

There were 30 questions prepared in the question base for each test to be included in a 6-question test randomly: 900 questions in total for the whole course. All the questions were meticulously created in order to check if the students had understood the lesson they had just read and interacted with. Each lesson consisted of six learning objects¹. While Test 1 was given after presentation of the third learning object, Test 2 was given at the end of the lesson.

The tests included limited feedback to students. Some of the possibilities in the test settings allowed by the e-learning environment were the following:

- Display all questions and answers once the learner finishes;
- Allow learners to see question feedback after each question;
- Indicate choices that have been answered correctly;
- Indicate choices that have been answered incorrectly;
- Allow learners to see history of responses at the end of each attempt;
- Display overall feedback at the end of each attempt;
- Allow learners to see grades at the end of each attempt.

In this course, the e-learning system only displayed the number of correctly answered questions, and for each question, information on whether the given answer was true or false, i.e. the learners were allowed to see grades at the end of each attempt. For example, when a student answered correctly three out of 6 question, he/she got the following feedback:

Sorry, you haven't scored 5 required to pass the activity. Please, try one more time.
Grade: 3 out of a maximum of 6 (50%)

¹ A learning object is a specifically designed, modular unit of a learning resource – content items, practice items, and assessment items that are combined based on a single learning objective.

This was followed by a list of questions just ticked or crossed. Although different types of automatic feedback were available, the faculty executives decided to use standard summary responses to correct and incorrect answers, as well as the test score. Additional feedback received by students during the course includes the teacher's comments about the outcomes of project work and its presentation, as well as of individual and group practice including and combining various language issues (vocabulary, grammar, pragmatics).

This study aimed to collect students' responses about feedback techniques that were important to them to have solid grounds to improve the system in months to come and to provide feedback that would be more valuable to students.

2.3 Design and Variables

This study mainly used a factorial design and a correlative design. There were four background variables: *Gender* (with values: 1-male, 2- female); *Course achievement* (1-grade 9 or 10 was received, 0-otherwise); *Academic achievement* (1-average achievement for the courses completed was between grades 8 and 10; 0-otherwise); and *E-assessment participation* (1-almost all tests were completed, 0-otherwise).

The main variables were: *Deep approach feedback techniques importance – DAFTs importance* (average value of the importance of five feedback techniques supporting a deep approach, expressed on a 0–10 scale for each technique); and *Strategic approach feedback techniques importance – SAFTs importance* (average value of the importance of five feedback techniques supporting a strategic approach, expressed on a 0–10 scale for each technique).

2.4 Instrument and Procedure

The values of the variables used in this study were collected through an online survey using a questionnaire available on the Internet. Table 1 lists items (indicators) used to measure the two importance variables. *DAFTs importance* was measured using items D1–D5, whereas *SAFTs importance* was measured using items S1–S5. These items were listed in the questionnaire in the following order: D0, S1, D1, S2, D2, S3, D3, S4, D4, S5, D5, S0; D0 and S0 denote discarded items. Although there is no clear-cut solution to ordering items, there may be a certain advantage of intermixing them when different but related constructs are measured within a particular context [15].

The students involved in the English course were invited to participate in the survey by the second author of this study via e-mail. The survey was conducted in March 2021.

2.5 Data Transformation and Statistical Analyses

To attain a more reliable measurement of DAFTs and SAFTs importance, the raw data regarding the indicators of each importance variable were transformed into Guttman's [16] image scores (e.g. [17]). (It should be noted that the means and medians of the transformed data are slightly different from those of the raw data.)

Table 1. Indicators of the two importance variables

Variable/activities to support [12]	Indicators
DAFTs importance / intention to understand, relating ideas, use of evidence, and active learning	<p>D1 Information is obtained about areas that I have successfully mastered in the current knowledge test versus areas that require additional learning.</p> <p>D2 A link is given to a file whose content shows how certain questions from the test are related to the content which needed to be learned.</p> <p>D3 A link is given to a file whose content indicates which test contents are related to other contents that are studied in the course.</p> <p>D4 A link is provided to a file whose content indicates how knowledge and skills that are the subject of the test can be implemented from different point of view.</p> <p>D5 Information is obtained about which areas in the current knowledge test I could receive special learning assistance for, from the professor.</p>
SAFTs importance / study organisation, time management, alertness to assessment demands, and intention to excel	<p>S1 A link is provided to a reminder with the most important facts about the knowledge and skills assessed by the test.</p> <p>S2 Information is obtained about how successful I was in solving the tasks in relation to the success of other students who had already solved the test.</p> <p>S3 Information is given about my individual results and the average result on completion of the knowledge tests.</p> <p>S4 A link is given to a file that, according to the order of presentation, locates the part of the course (lesson) that is the subject of the test in relation to other parts that appeared or will appear in other tests.</p> <p>S5 Information is obtained about the order in which individual knowledge and skills will be assessed at tests that should be completed during the semester.</p>

This resulted in a considerably improved reliability of both importance variables: from 0.732 to 0.936 for DAFTs importance and from 0.730 to 0.942 for SAFTs importance.

Apart from determining medians of the two importance variables, this study made use of two statistical tests. Wilcoxon signed-ranks test for dependent samples was applied to answer research question 1, whereas Wilcoxon rank-sum test for independent samples were carried out to answer research question 2. These nonparametric tests were used because no assumption needs to be made about the shape of the population distribution of variable in question, which is appropriate when small samples are used and the assumption of normality is violated for some variables (e.g., [18]).

To find out effect size, Cohen's r was calculated. As usually assumed, 0.5 evidences a large effect, 0.3 a medium effect, and 0.1 a small effect (e.g., [19]).

A correlative analysis concerning the applied variables was used to signal the relationships among them, if any. To this end, Spearman's correlation coefficients were determined. Note that for dichotomous (binary) variables, these coefficients are equal to those of Kendall or Pearson.

3 Results

The medians of the two importance variables were 7.43 for feedback techniques supporting a deep approach and 7.54 for feedback techniques supporting a strategic approach. These values were not different statistically ($z = -0.747$, $p = 0.469$).

Correlations among the six variables applied and their significances are given in Table 2. Considering relationships between the importance variables and four background variables applied, only one relationship was found (0.571, $df = 18$, $p = 0.009$). This positive relationship evidenced that feedback techniques supporting activities applied in the deep approach were more important to females than males ($W = 129.0$, $z = -2.489$, $p = 0.010$; Cohen's $r = 0.56$ – a large effect).

Table 2. Spearman's correlations among the six variables applied

Variable	Correlations				
	2	3	4	5	6
1. DAFTs importance	0.825**	0.571**	0.000	0.121	-0.044
2. SAFTs importance		0.351	-0.069	0.052	0.009
3. Gender			-0.115	0.346	0.058
4. Course achievement				0.600**	0.503*
5. Academic achievement					0.503*
6. E-assessment participation					

* $p < 0.05$ ** $p < 0.01$

As DAFTs and SAFTs importance were almost unrelated to the four background variables applied, these importance variables were then jointly considered using a new importance variable named *Golden middle feedback techniques importance – GMFTs importance* with values: 1–both DAFTs and SAFTs importance values were between the 25th and 75th percentiles of their values; 0–otherwise. Two significant relationships emerged: between GMFTs importance and Course achievement (0.612, $df = 18$, $p = 0.004$) and between GMFTs importance and E-assessment participation (0.533, $df = 18$, $p = 0.015$). These positive relationships evidenced that participants indicating a golden middle importance not only had a higher course achievement ($\chi^2 = 7.500$, $df = 1$, $p = 0.006$) but also participated in e-assessment more often ($\chi^2 = 5.690$, $df = 1$, $p = 0.017$).²

4 Discussion

The first research question asked which feedback techniques would be more important to students: those supporting a deep or a strategic approach. It was found that both sets

² GMFTs importance and Gender correlated (-0.471 , $df = 18$, $p = 0.036$). Relevant partial correlations concerning GMFTs importance controlling for Gender were: 0.637, $df = 17$, $p = 0.003$ (with Course achievement); 0.444, $df = 17$, $p = 0.057$ (with Academic achievement); 0.637, $df = 17$, $p = 0.003$ (with E-assessment participation).

of techniques were equally important to students, who assigned high importance to them (both medians were above 7 on a 0–10 scale). Correlation between these was also high (Spearman's rho was 0.83, $df = 18$, $p = 0.000$; 95% CI: [0.54, 0.94] – an analytic estimate versus [0.62, 0.92] – a bootstrap estimate [20]). This outcome suggests that these two sets of feedback techniques were viewed beneficial to each other as deep and strategic approaches might contribute to each other positively; measures of these approaches may positively correlate in general (e.g., [21]). This line of reasoning may be used to explain the equal importance found because the participants' responses to adjacent item-pairs (S1, D1; S2, D2; S3, D3; S4, D4; S5, D5) were not similar to one another.³ Another possibility is that the issues in question differ for different sub-groups of students (canceling each other), which was not found in this study.

As underlined in the Introduction, knowledge about feedback that may be important to students is scarce, especially related to e-assessment. However, this feedback should be personalised [4] and have content that engages students in self-regulated learning [5]. Furthermore, students should have some control over learning analytics (what can be seen by them, what by other students; whether information is communicated by the e-learning system automatically or by teaching staff), respecting their preferences for automated alerts over those sent by teaching staff [3]. Bearing in mind these feedback requirements, learning could be improved by applying learning/studying-approaches-based feedback techniques which students find important. In doing that, students' preferences for automated alerts over those sent by teaching staff may hold true in general, as found in this study for feedback technique D5 – “Information is obtained for which areas in the current knowledge test I could receive special learning assistance from the professor” compared to the remaining feedback techniques of not only the deep approach but also both approaches.⁴

The second research question sought to uncover relationships, if any, between the importance of feedback techniques supporting a particular approach and background variables considered. It was only found that feedback techniques supporting a deep approach were more important to females than males. Although gender differences in language learning have not followed consistent patterns, several studies have evidenced that females may be better learners than males due to their higher language proficiency, stronger vocabulary knowledge, and better use of learning strategies (e.g., [24, 25]). To attain and maintain such a status, females may in general more often apply a deep rather than a strategic approach. They thus might, compared to males, assign more importance to feedback techniques supporting a deep rather than a strategic approach.

³ The mean of absolute difference between the responses to these item-pairs was calculated for each participant (e.g., [15]), and the mean and standard deviation of this measure were 1.86 and 1.37, respectively. Furthermore, the measure positively correlated with Course achievement (0.574, $df = 18$, $p = 0.008$), meaning that participants with lower course achievement responded to adjacent item-pairs in a more similar way [22].

⁴ The medians of D5 importance, DAFTs4 importance (the remaining four DAFTs), FTs9 importance (the remaining nine FTs) were 6.66, 7.58, and 7.42, respectively. Their differences in question were significant: D5 importance – DAFTs4 importance: $z = -3.286$, $p = 0.000$; D5 importance – FTs9 importance: $z = -2.688$, $p = 0.005$. D5 importance was of high reliability by applying correction for attenuation (e.g., [23]).

As mentioned in the Introduction, there may be a positive relationship between academic achievement and a strategic approach, whereas this achievement might be unrelated to a deep approach (e.g., [12]). Because of that, it was expected that feedback techniques supporting a strategic approach might be more important to students who had better achievements, but this importance was not related to any achievement variable ($W \geq 98.5$, $|z| \leq 0.492$, $p \geq 0.643$). However, significant relationships in question were found when DAFTs and SAFTs results were combined using variable GMFTs importance mentioned above: there were positive relationships between GMFTs importance on one side and Course achievement and E-assessment participation on the other. These findings provide some evidence that, when considered together in a specific way, DAFTs and SAFTs importance could explain an increase in students' knowledge, skills and motivation. The findings also suggest that instead of focusing on individual relationships between the importance of particular feedback techniques and relevant learning variables, researchers may relate these variables by combining different kinds of feedback techniques.

The previous paragraphs present some educational benefits of the feedback techniques examined. Apart from discussing these benefits, the cost of producing this feedback may also be examined. As the production of quality feedback has a high development time cost (e.g., [26]), the implementation of feedback examined in this study may at first sight appear as a costly enterprise. Typical automated response in a learning management system (e.g., "Correct" or "Incorrect! The answer is bridge!") may be extended in the direction of feedback techniques D1 and S1 (e.g., D1 – "Please go back to Section 3 Vocabulary Building to consolidate basic terminology on Networks"; S1 – "Please refer to our mind map with the basic terminology about Networks"), but this extension requires that each question entity is coupled with different feedback techniques, which may not be supported by the assessment system at hand. Because our feedback techniques need to be connected to various assessment entities at different levels (whole course – S5; lesson – D4, D5, S1, S4; learning object – D1; question – D2), an appropriate form-based editor supporting a field hierarchy needs to be previously implemented at the assessment system. When this editor is available, which increases (possibly not much) the overall production cost, the test developer task would only require modest extra work beyond the typical [27].

Due to different experience with tests, feedback techniques that were important to students who completed almost all tests might differ from those important to students who completed these tests (much) less often or not at all. Because such differences were not found for two importance variables as well as their individual items ($W \geq 70.5$, $|z| \leq 1.846$, $p \geq 0.073$ for all these indicators), it was possible to consider all students as being members of one homogeneous group.⁵

To summarise: this study used a small sample that might characterise it as preliminary research, especially when gender differences were considered (there were only five females). Despite these limitations, the study revealed valuable findings, which due to their considerable effect size, make the sample size less questionable. These

⁵ As expected, E-assessment participation was positively related to achievement (see Table 2; $\chi^2 = 5.051$, $df = 1$, $p = 0.025$ for both achievement variables).

findings may be re-examined in future research using larger samples and a number of background variables. Such elaboration may reveal additional differences among students from different sub-groups. Knowing these differences can support the implementation of e-learning feedback that is more relevant to students, which would hopefully improve their learning outcomes.

5 Conclusion

This study aimed to enhance our knowledge about the feedback techniques that are important to students. Focusing on deep and strategic approaches to learning and studying, this study explored students' opinions about the importance of feedback techniques supporting these approaches and searched for student characteristics that might relate to that importance. It was found that feedback techniques supporting a deep approach were as important to students as feedback techniques supporting a strategic approach. Furthermore, feedback techniques supporting a deep approach were more important to females than to males. Finally, when the importance of these feedback techniques were considered together, their relevance to increase in students' knowledge, skills and motivation could be demonstrated. This survey was conducted for English courses. Further research may examine whether similar conclusions might apply for other courses in different subject areas.

Despite some ambiguity regarding the notion of a learning approach (e.g., [28] often considered as a learning style), this notion can be used to define e-assessment (e-learning) feedback techniques through associating them with key features of particular learning approaches, especially those that contribute to genuine learning (e.g., [9]). Although this study did not consider students' learning approaches, further research may do so through connecting feedback techniques endorsed by students with learning approaches they apply. With such connection at hand, e-learning systems may adapt not only learning content and sequence (path) to student's learning approach (e.g., [29, 30]), but also learning feedback to that approach (done automatically or with respect to students' preferences), aiming at, whenever possible, facilitating self-regulated learning with understanding.

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