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Designing feedback spirals to motivate and promote student learning

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Abstract

In this study, the terms ‘iterative feedback" or ‘feedback spiral’ are used interchangeably to stress the importance of dialogical tutor-student interactions in enhancing learning and moving to a higher level. Embracing this view, we present the results of a pilot initiative to improve students' engagement, motivation, and learning, part of a core undergraduate module in economics at the University of Sussex. The scheme, an iterative feedback process, was designed to help students with a piece of coursework by providing detailed grading criteria, setting expectations on quality of performance, and eliciting their views on the effectiveness of the iterative feedback process. The detailed information and the class discussion and dialogue around the task helped the students prepare the assessment, providing clear feedforward guidance upon which the final feedback on the summative piece was based.

We use Beta regression models, quantitative data on students' summative assessments, data analytics on their use of resources, and qualitative data on their experience of the grading criteria and feedforward to investigate how the pilot iterative feedback scheme may have affected students' performance. Our findings suggest that a more frequent engagement with Canvas during the weeks closer to the assessment dates positively impacts their performances, while attendance below the median has a detrimental effect on grades. Moreover, students who reported more detailed feedback on their use of grading criteria and feedforward guidance tended to gain higher scores and perform better in all assessments. In addition, the use of grading criteria helped particularly those students with specific reasonable adjustment requests linked to anxieties and mental health reasons compared to students without or with different learning disabilities.

Keywords: grading criteria, iterative feedback, feedforward guidance

Introduction and background of the study

Formative learning opportunities might significantly impact students' experience and achievements (Black et al., 2003; Wiliam & Thompson, 2007). The iterative feedback (teacher-to-students and back) process is an example of good formative learning prompting a dialogue between students and teachers to set correct expectations, clarity on learning goals, and success criteria before students start the assessment task. In this respect, it has an element of feedforward information. It can be seen as a ‘loop’ that ends with the final descriptive feedback on the submitted work. But we believe that, if well designed, this process may act more like an upward ‘spiral’ than a loop, helping students beyond their submitted task, enabling them to progress towards challenging learning intentions and goals, and eventually take independent control of

their learning. The spiral works for the teacher as well: based on students' feedback, teachers can modify the process and improve it.

This research explains the different phases of the feedback 'spiral' we applied to a core module of a second-year Economics course. We remark on the importance of the feedforward aspect of the process when students know in advance and have understood the rationale of the task, the learning goals, and the detailed grading criteria used to assess their performance. Finally, we aim to explore the effectiveness of feedforward instructions and the application of specific grading criteria in affecting students' engagement with the task and their achievements

Numerous studies have focused on the crucial role of feedback and feedforward in a learning-oriented assessment and provided evidence on the impact of the type of feedback on the learning process and its correlation with better student results. Hattie and Timperley (2007) found the type of feedback was decisive; having the corrective feedback such as the highest effectiveness for enhancing the learning of new skills and tasks. In addition, they showed that specific written comments and feedback letters are more effective than providing grades themselves. Greenberg (2015) stressed the value of the feedback given according to detailed specific grading criteria information, making explicit the learning goals and requirements of a particular assignment. Furthermore, Wisniewski, Zierer and Hattie (2020) studied feedback's impact on student learning. They developed empirical research with a meta-analysis through quantitative integration of empirical research comparing the effects of feedback on student learning outcomes. Their findings suggest that the impact of feedback is influenced by the information content. In their study, Barker and Pinard (2014) emphasized the conversational dimension of iterative feedback and how its recursive cycle or spiral nature of the interaction between tutors, lecturers, and students can improve the learning process. Although iterative feedback has not consistently been implemented, the authors highlighted the value of integrating feedback into the assessment process. Their results suggested that timing, the credibility of the tutor, type of feedback, and intensity of feedback matter for students.

The literature on this topic has developed some fundamental principles of good feedback practice, such as: making students understand what good performance means; simplifying the improvement process of self-assessment in learning; providing quality information to students about their learning; allowing peer dialogue in understanding the feedback; and inspiring positive motivational beliefs, among others (Ahea et al., 2016). Although there is a recognition and value of iterative feedback as a necessary modern approach, academics might argue against it since it is highly time-consuming; and then there is a significant group that still opts for the traditional form of feedback.

One of the most studied tools within the feedback and feedforward process have been on grading criteria schemes or rubrics. Jonsson and Svingby (2007) pointed out some advantages of using a rubric as facilitating valid judgment of complex competencies and promoting learning. They found the scoring of performance assessments can be enhanced using rubrics and concluded about the potential of rubrics for promoting learning and/or improving the instruction of the task since they make expectations and criteria explicit, facilitating feedback and self-assessment. In the same line, Greenberg (2015) found that students who used the APA style report rubric produced higher-quality reports than students who did not use the rubric, which supports what was previously seen by Reddy and Andrade (2010), who suggested that rubric use was associated with improved academic performance. In this aspect rubrics, or generally, grading criteria schemes, act as feedforward information.

The feedback spiral

We will refer to the iterative feedback process as to the feedback spiral. We piloted it in a 12-week level 5 (intermediate, second-year level) core module attended by over 300 students to guide students in submitting a piece of coursework (essay) due in week ten. The various steps of the journey can be summarised as follows: in week three, we surveyed the students to gauge their views and expectations about feedback and in week six, we set the task, essay title, adding a feedforward package that offered a rationale for the task, explained the learning objectives, provided clear instructions and grading criteria, and indicators of a good performance. The dialogue continued during weeks seven and eight with a class discussion of the task and the grading criteria and in week ten students submitted the task and provided written feedback to the tutor, reflecting on their performance and the overall iterative feedback process. After three weeks students received written descriptive feedback and justification of grades (against the discussed marking criteria) and suggestions on ways to improve their future performances.

This two-way communication process allowed students to form more precise expectations and the tutor to see learning through the eyes of the students. As a result, students became more aware of the gaps in their performance and how to better themselves in their learning journey. Finally, the tutor received suggestions valuable to improving instructions and criteria in the teaching journey and the iterative interaction helped feed into the next cycle of the teaching and learning process. The next section provides a brief overview of the module, a description of the grading criteria, and data collected for the empirical analysis.

Module organisation

Our teaching team of one lecturer and two seminar tutors carried out the delivery and the grading of the module. Lectures delivered content, whereas seminars aimed to apply knowledge. Due to Covid restrictions, the weekly two-hour lecture and a one-hour seminar were offered synchronously online via Zoom, recorded, and made available to students in Canvas, the Virtual Learning Environment (VLE). The Canvas website provided students with information about module organisation, learning outcomes, assessment methods, weekly teaching material, essential and optional readings, exercise questions and solutions and optional videos, and links to events and news. We used ‘break-out rooms’ to prompt participation during the virtual seminars. Break-out rooms allowed small groups of students (3-4 students per room) to discuss the pre-assigned questions within the specified time (3-5 minutes) before participating in the plenary discussion. The tutor visited all groups facilitating interactions.

To overcome some of the challenges of online teaching and promote a friendly and supportive environment, we introduced other ‘teacher-student’ interaction initiatives, ranging from surveys to extra office hours, chat rooms, and online meetings to discuss weekly macroeconomic news and events. Many students took advantage of such additional support and expressed their gratitude informally and formally in the module satisfaction rate. The use of Canvas material and its frequency was monitored via Data analytics.

Assessments, grading criteria and feedback spiral

A variety of assessment modes (formative and summative) were used to develop and test different types of knowledge, skills, and aptitudes. The assessment diet was explained clearly on Canvas and discussed by

both the teaching team from the first week of the term. It consisted of an engagement component, based on weekly active participation in seminar work, a piece of coursework (an essay), and a final exam.

Overall, there were more than 300 students who participated in the module, organised in 11 seminar groups. Table 1 reports some descriptive statistics of the Macroeconomics 2 module.

Table 1 Module Performance

Averages	Essay (30% of final grade)	Final exam (60% of final grade)	Engagement (*) (10% of final grade)	Final exam (total)
Female	61% (N=78)	63% (N=78)	79% (N=78)	61% (N=78)
Male	56% (N=213)	62% (N=206)	72% (N=214)	58% (N=205)
Econ Depart.	58% (N=84)	65% (N=80)	72% (N=84)	61% (N=80)
Other Departs.	57% (N=207)	61% (N=204)	75% (N=208)	58% (N=203)
Total	57% (N=291)	62% (N=284)	74% (N=292)	59% (N=283)
(*) Engagement was recorded during seminars, and it required participation in an online individual quiz and teamwork in Zoom break-out rooms.				

The engagement component was recorded during each of the ten seminars only after the attending students had taken an individual online quiz and participated in break-out room activities to discuss homework exercises. It contributed to 10% of the final grade (or a proportion of it). The total class average engagement and attendance at seminars was about 74%.

The final exam consisted of a one-hour randomised Multiple Choice Question (MCQ) quiz that focused on assessing the ability to use the knowledge of the subject rather than simply testing the memory for facts. Overall, students performed well, with an average score of 61%.

The coursework component consisted of a 1,500-word essay that students had to submit on week 10 of the term. An average grade for all submitted coursework reached nearly 60%. Following the School's regulations on moderation of assessments, in week six, students received precise details about the essay requirements, the rationale of the task, the specific marking schemes, and additional information and material and guidance to understand good performance standards. During the same week and until the submission date, essay details were explained and discussed in the class, with attention to generic and specific grading criteria.

The School's generic criteria aim to explain how well students achieve task objectives and justify rewarded grades at different stages of progression. The Connector scheme, a staff-student partnership supported and funded by the Office for Students to improve practices, produced a new "student friendlier" version of the criteria during the summer. In addition to this reworded version, we developed and used essay-specific marking criteria related more closely to the essay questions. These specific criteria contextualised and adapted the generic ones to the particular assessment topic, adding more transparency and helping students better judge the extent to which they demonstrate achievements. Table 2 below shows both sets of marking criteria.

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Table 2 Marking Criteria Rubric for Level 5 (second year, intermediate level of a Course)

Generic Marking criteria **What does each criterion mean?**		**Specific Marking criteria** **What does each criterion mean for this essay?** **Hint: to develop your essay, use the Definition, Explanation, Example, Diagram, Evaluation (DEEDE) approach**	**Allocation of mark**
Knowledge and understanding	Understanding of principles, concepts, theories, and terminology. Knowledge of discourse within the context of individual modules.	Explain and illustrate the Wage setting/Price setting and the IS-LM-PC models Explain and illustrate an alternative (micro) model of wage setting	20
Application	Appropriate use of relevant theories, concepts and/or techniques from module content to solve/explain familiar scenarios. Application of relevant theories, concepts and or technique outside of the context in which they were first studied.	Discuss and illustrate the increase in minimum wage (MW) in the Wage setting/Price setting and in the IS-LM-PC models Discuss and illustrate the increase in MW in an alternative model of wage setting	20
Critical thinking	Identification of principles and concepts underlying theoretical frameworks or approaches, identifying their strengths and weaknesses. Recognition of competing perspectives and ability to make justified choices about which approach to take.	Evaluate the advantages and disadvantages of increase in MW in the Wage setting/Price Setting and in the IS-LM-PC models Evaluate and illustrate the increase in MW in the alternative model and compare results	30
Reading and research	Correct referencing and use of reliable sources of information Undertaking own research/reading Use of appropriate theoretical models to judge the significance of data collected	Read and research the relevant material (textbooks and the published papers indicated in the reading list) Include a bibliography and reference in Harvard style	15
Presentation and style	Accurate and effective communication with structured and coherent arguments Ability to explain competing points of view and ambiguities	Produce an essay with an Intro, Body, Conclusion, and reference Use a different paragraph for each argument and link paragraphs Use own words, avoid too long quotations Using equation editor and draw own graphs and tables (do not copy and paste) Number pages, formulae, and figures Proofread and include the word count	10
Reflections on Guidance/Feedforward		Use instructions and feedforward uploaded in Canvas and discussed in class. Reflect on what you found useful in preparing the essay (marking criteria, instructions, good performance document, feedback received in class/emails/discussion boards). Is there any specific feedback you would like to receive in this essay?	5

Source: University of Sussex and tutors' elaboration

Together with the marking criteria, a "Clarity of good performance" document was discussed in class and uploaded to Canvas. It provided indicators of what represents a good performance, guiding the students to

understand standards (indicating what a good essay should have and should not miss), helping them structure the essay and appreciate its learning objectives. A final part of the assessment task, but not included in the word count, required students to provide feedback on documents and guidance received to produce the essay, and, in particular, the relevance of the marking criteria.

Additional students' feedback was prompted at different points during the teaching term. In week four, students were surveyed to gauge their learning experience and their views on what feedback should be. Such questionnaires were designed for the teaching team to hear students' views on feedback to encourage dialogue around it.

The essays were graded using the template reported in Table 3, based on the marking structure of the grading criteria. The scheme was attached to each script, making students aware of their grade components, receiving additional comments on strengths and weaknesses, and responding to specific requests of feedback they had put forward in the reflective section of the essay.

Table 3 Feedback Template

Criteria	Feedback Task A	Feedback Task B	Feedback Task C
Knowledge and understanding Application Critical thinking Grade (on content)	(out of 20)	(out of 30)	(out of 20)
Reading and research (out of 15) Presentation and style (out of 10) Reflections on guidance/Feedforward (out of 5)	(Tasks A, B, C) (Tasks A, B, C)		
Total (out of 100)	Descriptor (poor/ insufficient/ satisfactory/ good/ very good/ excellent/ outstanding)		
<u>Overall comments and improvements for future submissions/essays:</u> 1. This essay is (very well/ well/ satisfactorily/ etc..) organized and structured 2. It demonstrates (excellent/ very good/ good/ solid /some/ inaccurate and limited) understanding of the topic and (very good/ good/ satisfactory) use of DEEDE approach. 3. Very good in: (evaluation/ graphs/ explanations…). 4. To improve for future essays: (definitions/ explanations/ discussion/ evaluation/ applications/ presentation and style/ graphs)			

Source: Tutors' elaboration

Overall, students expressed strong positive views and valued the process, indicating that they would like to see it implemented more often in their studies. They also recognised the value of feedforward and the guidance document on a good performance.

Students' feedback via the essay and surveys helped shape the feedback spiral, offering students the possibility of formative learning, dialogue about feedback, reflecting on what is needed and valuable, and developing strategies for future actions. At the same time, it offered the teachers the opportunity to refine processes and improve and develop future feedback cycles.

Based on students' views, we believe that the feedback spiral could be fruitfully used in other modules to engage students and teachers in a transparent conversation about expectations and standards of achievements and to help students gain valuable evaluative skills.

Data and descriptive statistics

The following section describes the variables of interest used in the analysis. The two primary data extraction sources are Sussex Direct, the gateway to the University information, and the Canvas VLE. The empirical investigation aimed to explore the main determinants of students' performances in the essay, final exam, and overall module. The explanatory variables included gender, reasonable adjustments for a disability, seminar participation and engagement, students' feedback, and other metrics from students' analytics (i.e. frequency of use of specific Canvas items).

Moreover, to look at how disability affects grades, we created categorical variables for different conditions and disabilities, leading to reasonable adjustments in assessments and teaching to minimize barriers to their studies. Finally, we grouped these disabilities into two groups: the first group included long-term health conditions, mobility difficulties, specific learning differences, and different types of impairments; the second group included mental health conditions. For each student, we considered their total number of presences at the ten seminars, as recorded in Sussex Direct, and used quartile distribution in our estimates to account for seminar participation and engagement.

In addition to in-class presence and work, we used the Canvas Page View data analytics tool to track weekly students' activity and use of material. The Canvas page view variable records any students' Canvas activities for the module. It is based on requests to the server, and hence it tends to include more than a traditional page view. For instance, it would include clicks to educational resources uploaded in Canvas, such as videos, links, and e-texts. Nevertheless, this metric is an excellent proxy for student activity, and it is valuable for comparisons across students.

For each student we collected the overall weekly usage of any Canvas page and its total up to week 20, and therefore up to the point of release of exam results. This complete set of weekly activities allowed us to capture each student's behavior and responses during the teaching term, and the exam period. Because the number of Canvas pages and their content increases as the term progresses, we standardised the weekly page views to make them comparable.

Students' reflections on the guidance received and the feedforward 'package' offered for the essay were collected, coded, and included among the explanatory variables. The students' qualitative responses were grouped into a categorical variable (Reflection on Guidance/Feedforward) ranging from zero to 3. A zero-value meant that the student did not provide any answer. All the other non-zero qualitative responses expressed a positive view of the module and helpfulness of the guidance and teaching material with requests of specific feedback on the essay. The responses scoring a value of one showed a simple and less articulated answer, mainly listing items as very helpful among marking answer criteria, instructions, good performance document, and feedback received in lectures/ seminars/ office hours/ emails/ discussion boards. A value of two showed a medium-developed answer, mentioning two or more learning items as very helpful and adding some reflections. A value of three indicated a more articulated and elaborated answer. In this case, the student highly appreciated and discussed the usefulness of at least three guidance/teaching items. Overall, the most popular items were the good performance document and the specific grading criteria for the guidance they provided in structuring the essay.

We briefly present some module descriptive statistics for selected variables such as Seminar Recorded Attendance, Reflection on Guidance/Feedforward, and Gender. Table 4 describes the frequency of total attendance throughout the ten weeks. Students on average attended 7 of 10 seminars, 13 students did not participate in any sessions, and 39% of the students attended all sessions. The median is between 8 and 9

attendance and shows a skewed distribution, suggesting the need to work with quartiles. Therefore, if we split the analysis into quartiles, the first quartile is between 5 and 6 seminars attended, or 25 percent of the cumulative distribution.

Table 4 Seminar Total Attendance

Total attendance	**No. of students**	***Percentage out of 292***	***Cumulative***
0	13	4.45	4.45
1	9	3.08	7.53
2	11	3.77	11.30
3	7	2.40	13.70
4	15	5.14	18.84
5	15	5.14	23.97 (1st quartile)
6	14	4.79	28.77
7	31	10.62	39.38
8	30	10.27	49.66 Median
9	33	11.30	60.96
10	114	39.04	100.00 (3rd and 4th quartiles)
Total	292	100.00	

Figure 1 below shows the mean, and the median of weekly number of page views in Canvas of 292 students (left scale) and the weekly percentage of attendance (right scale) from the beginning of the teaching term to the final exam date. The activities explain peaks and troughs during the term. For instance, the submission of the essay was in week 10, when the trend started to fall and went up in week 15, when the MCQ exam was scheduled. The weeks following week 6 (reading week), when the details about the essay were uploaded, show a steady increase in the usage of Canvas. The mean weekly page views are above the median of every week. In addition, the graph shows there is skewness in the distribution. This discrepancy between the average and the median suggested again working with a non-normal distribution.

Figure 1 Weekly Average Canvas Views and Percentage Weekly Attendance

With regards to the students' Reflection on Guidance/Feedforward statistics, figure 2 below shows that 39% of students responded with a medium developed answer, 32% provided elaborated and detailed reflections (some as long as one page), and 15% of students replied with a basic level of information, whereas 14% did not provide any answer.

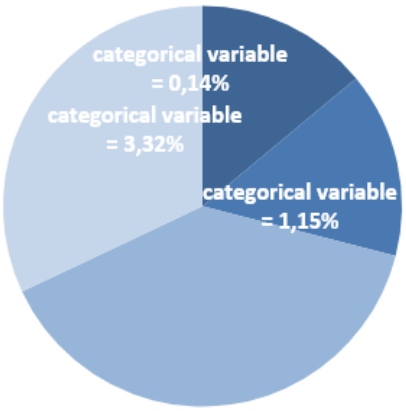

Figure 2 Students' Reflection on Guidance/Feedforward

Empirical methodology

The primary objective of the study was to explore if and to what extent the use of the iterative feedback (feedback spiral) based on the new grading criteria of the Connector project could affect students' marks, directly (in the essay) and indirectly (in the exam and the final grade).

We estimated three equations, the first for the essay performance, the second for the final exam (MCQ) grades, and the third for the overall module's performance. The skewness of the distribution in the dataset and the range of the outcome variables (positive decimal figures up to 1) justify using the Beta regression method that we used to estimate the parameters.

The equation for the dependent variables Essay was as follows:

$$Y_i = \alpha + \beta G_i + \sum_{j=2}^{4} \delta_j Att_{i,j} + \sum_{p=1}^{3} \gamma_p FF_{i,p} + \sum_{n=1}^{2} \partial_n Dis_{i,n} + \sum_{w} \sum_{m=2}^{4} \theta_{w,v} C_{i,m,w} + \quad + \sum_{p} \sum_{n} INT(FF, Dis)_i + \varepsilon_i,$$

Where the subscript "i" refers to the individual (student) "i"; Y_i is the essay grade; G_i represents a gender dummy; $Att_{i,j}$ represents the j[th] quartile of term seminar attendance (the first quartile is the reference category); $FF_{i,p}$ represents the Reflection on Guidance/Feedforward categorical variable (zero is the reference category); $Dis_{i,n}$ is the Disability variables (either used as a dummy or as a categorical variable for two types of disabilities, when no-disability is the reference category); $C_{i,m,v}$ captures Canvas activity in week "w" for the "m[th]" quartile; *INT*(*FF, Dis*) is the interaction term between the *FF* and *Dis* variables. The variable ε_i is the usual stochastic error term. The equations for the exam grades and the final overall grade are very similar to equation [1], with some specificities. For instance, we removed the Attendance variable from the final grade equation (being this variable part of the overall grade) and included the BSc Economics course.

Discussion of results

The estimates of Beta regression coefficients and the statistically significant marginal effects are reported in Table 5. Because the Beta regression model uses a logistic link function to keep the conditional-mean model inside the (0,1) interval, it is not possible to determine the magnitude of the effect of the predictor variables from these original estimates. Therefore, the best way to obtain interpretable effect sizes for the covariates is by using marginal effect.

The column of the marginal effect shows the effect on the dependent variable's conditional mean of a unit change of a continuous explanatory variable or of a discrete change of a factor variable from its reference category. Thus, in discussing the results, we refer to the marginal effects of various factors on the essay, the final exam, and the final overall grades, expressed in percentage changes.

Table 5 Beta Regression and Average Marginal Effects

Beta regression. Link function: g(u) = log(u/(1-u)) [Logit]. Slink function: g(u) = log(u) [Log]									
Dependent var	**Essay grade (N=291)**			**MCQ exam (N=283)**			**Final grade (N=283)**		
	Coeff.	Sd. Error	Marg. effect	Coeff.	Sd. Error	Marg. effect	Coeff.	Sd. Error	Marg. effect
Gender *(Female = ref. categ.)*	-0.067	0.062		0.002	0.066		-0.431	0.050	
Atten.*: (above median= ref.cat)*									
1st quartile	-0.193***	0.072	-4.68	-0.145***	0.072	-3.39			
2nd quartile	-0.109*	0.059	-2.60	-0.041	0.069				
FF=0 & Dis=0 (ref category)									
FF=0 & Type 1 disability	0.184	0.152					-0.123	0.137	
FF=0 & Type 2 disability	-0.258	0.260					-0.332***	0.114	-7.87
FF=1 & non disability	0.038	0.093					-0.007	0.075	
FF=1 & Type 1 disability	-0.038	0.125					0.187**	0.092	4.45
FF=1 & Type 2 disability	0.151	0.190					-0.214	0.168	
FF=2 & no disability	0.163*	0.092	3.88				0.074	0.077	
FF=2 & Type 1 disability	0.544***	0.098	12.96				0.298***	0.089	7.07
FF=2 & Type 2 disability	0.311**	0.125	7.40				0.183	0.125	
FF=3 & no disability	0.327***	0.084	7.80				0.246***	0.071	5.83
FF=3 & Type 1 disability	0.368**	0.186	8.77				0.309*	0.161	7.35
FF=3 & Type 2 disability	0.794***	0.169	18.91				0.631***	0.165	14.99
Disability *(no dis= ref. cat.)*									
Type 1 disability				-0.896	1.960				
Type 2 disability				-0.911***	0.374	-0.14			
Essay grade & Disability:									
Essay grade & no disab.				0.774***	0.240	0.18			
Essay grade & Type 1 dis.				1.278	3.135				
Essay grade & Type 2 dis.				1.584***	0.629	0.55			
BSc Econ				0.158***	0.061	3.66	0.075**	0.044	1.79

***Canvas views**:*									
Week 4 (1st quart.= ref. cat.)									
2nd quartile	0.190**	0.082	4.58				0.186***	0.068	4.50
3rd quartile	0.128	0.082					0.128***	0.067	3.10
4th quartile	0.280***	0.088	6.72				0.286***	0.074	6.80
Week 5 (1st quart.= ref. cat.)									
2nd quartile	0.082	0.086					0.062	0.065	
3rd quartile	0.171**	0.079	4.13				0.146**	0.062	3.50
4th quartile	0.299***	0.077	7.15				0.141**	0.070	3.40
Week 9 (1st quart.= ref. cat.)									
2nd quartile	0.007	0.082		0.004	0.075		-0.029	0.063	
3rd quartile	0.080	0.087		0.100	0.072		0.114*	0.068	2.70
4th quartile	0.230***	0.079	5.48	0.259***	0.092	5.96	0.243***	0.071	5.80
Week 11 (1st quart.= ref. cat.)									
2nd quartile	-0.052	0.069		-0.008	0.077				
3rd quartile	-0.005	0.073		0.225***	0.082	5.17			
4th quartile	-0.203**	0.081	-4.85	0.078	0.084				
Week 14 (1st quart.= ref. cat.)									
2nd quartile							0.107	0.067	
3rd quartile							0.162***	0.062	3.90
4th quartile							0.096	0.072	
Week 15 (1st quart. ref. cat.)									
2nd quartile				-0.215***	0.761	-4.95	0.062	0.060	
3rd quartile				-0.119*	0.069	-2.71	0.044	0.065	
4th quartile				-0.226***	0.080	-5.20	-0.044	0.065	
Constant	-0.061	0.109		0.028	0.173		-0.167*	0.099	
Scale : Constant	3.133***	0.089		2.904***	0.096		3.543***	0.086	
Conditional mean			57.1			61.9			58.9
	Wald Chi^2(25) = 5874 Prob>Chi^2 = 0.00			*Wald Chi^2(18)= 88. 3 Prob>Chi^2 = 0.00*			*Wald Chi^2(27) = 820 Prob>Chi^2 = 0.00*		
	Log pseudolikelihood = 259.5			*Log pseudolikelihood = 226.6*			*Log pseudolikelihood = 308.3*		
*Robust Standard Errors. Marginal effects are expressed in percentage point changes. Inference: ***<0.01; **<0.05; * <0.1*									

Essay grade

An attendance score below the class median value would negatively affect the essay grade. The effect is more substantial if a student's attendance is in the lowest quartile of the distribution. Canvas usage was statistically relevant during weeks 4, 5, 9, and 11 (week 10 was the submission week of the essay). Results suggest that during the weeks before the essay submission, the students with a relatively higher frequency of Canvas, falling in the third or the highest quartile of the usage distribution, gained on average 4 to 6 marks above those falling in first (or second) quartile. However, if this intensity of Canvas engagement occurred in week 11, the effects of the highest usage become negative. This result may be explained by the fact that students with high Canvas engagement after the submission date are those who have a late submission. Unless granted ECs (Exceptional Circumstances), these students faced a penalty of 10%.

The combined effects of Reflection on Guidance/Feedback (FF variable) and the categories of disabilities deserve some attention. The interaction across these two categorical variables resulted in twelve mutually exclusive different groups, and every student would fall into only one of them. The reference category was the group with no disability and no reflection on feedforward. The marginal effects, relative to the reference group, indicate that irrespective of the presence and type of disabilities, a value of 2 for the FF variable is associated with an increase in the average grade relative to lower values of the same variable. Thus, expressing increasingly positive views on the usefulness of the guidance/feedforward package is associated with higher grades. This effect is particularly relevant for students with the first type of disability (long term). However, when we move to the highest value of the FF category, students with the second type of disability are the ones who benefit the most from the guidance/feedforward tools. Thus, we can conclude that there are differential gains, linked to types of disabilities, when the reported helpfulness and use of Guidance/Feedforward tools move from a low or a medium to a higher level and students with Type 2 disabilities seem to have benefitted more from these tools than all other students.

Final exam grade

Having attended half or fewer seminars during the term seems to negatively affect the exam grade, reducing it by about 3.6 marks relative to those with higher attendance. In addition, students enrolled in the BSc economics course report an increase in the MCQs grade of 3.7 marks relative to other students.

Students in the 4th quartile of the Canvas usage distribution in weeks 9 and 11 benefit in terms of an increase of 6 and 5 marks relative to those in lower quartiles. Again, if, however, this more intense engagement occurred in week 15 (week of the test), the effects would be detrimental, showing, as with the essay case, that students who left the preparation of the test to the very last week, performed less well than students who made use of Canvas before the test.

Type 2 disability (anxieties and mental health issues) tends to have a minimal negative effect (-0.14 marks) on the average performance of timed online quiz compared to the non-disability or Type 1 disability cases. Given the possible anxiety that a timed quiz can create, this result is not surprising. However, when we combine the disability with the essay performance, we can see that higher performance in the essay is associated with higher performance in the final exam (MCQ) grade. The effect is more substantial for students with Type 2 disabilities, who show a net differential effect of about 0.41 (0.55-0.14) marks, doubled that of all other students (0.18). For these Type 2 disability students, an increase of one mark in the essay performance would result in almost half a mark increase in their MCQs grade. In other words, a higher essay performance matters for all students, but it matters more for students with Type 2 disabilities.

This differential effect may be linked to the fact that students with Type 2 disabilities, who have benefited more from feedforward, may retain that advantage in the revision for the final test. The direct (via essay) and indirect (via final exam) effects of feedforward can be detected by looking at the final overall grade.

Overall final grade

There are differential gains in using the Guidance/Feedforward package offered for the essay, depending on the self-reported usefulness and disabilities. In general, there is an association between higher values of the FF variable and higher gains in grades. The highest benefits accrue to Type 2 disability students, who also reported higher helpfulness of the Feedforward package. For these students, the increases in marks are double or triple those accrued to students with Type one disability or no disability.

Students in the BSc Econ course have a slight advantage in performance of almost two marks, increasing the chance of achieving an upper second-class grade, given the cohort conditional average of 59. Using Canvas resources above the weekly median is beneficial, and highly engaged students using Canvas resources in the top quartile of the page view distribution in weeks 4,5,9 are awarded consistently higher grades than those in lower quartiles. Unlike previous results, a high Canvas engagement after submission/exam weeks (students missing the deadlines) has no adverse effects on grades.

Conclusion

Our study suggests the importance of dialogical feedback and monitoring of students' engagement with the course material. The use of interactive feedback and data analytics may significantly affect student performance. Our study reveals that attendance and higher engagement with VLE positively impact performance. Thus, early monitoring of students' engagement can help detect issues and plan early interventions.

Iterative feedback has a significant role in students' formative learning process. Our results suggest that dialoguing with students in a feedback spiral process can affect their performance. We found a significant positive association between students' grades and their reported use and helpfulness of interactive feedforward, particularly when students are affected by different learning characteristics and needs. For example, in piloting a ‘feedforward package’ for essay submission, we noticed differential gains in the effectiveness of assessment instructions and guidance according to types of disabilities. Students who reported more detailed feedback on their use of grading criteria tended to gain higher scores in all assessments, which might align with the literature that states feedback should evolve to be effective (Barker & Pinard, 2014). Students affected by disabilities, particularly those experiencing anxieties and mental issues, have benefitted the most from the use of the feedback spiral initiative. These findings support previous results about the importance of effective, individual, and personalised feedback to students with disabilities.

We believe that dialogical interactive feedback around grading criteria and guidance on standards leads to more transparency, removes uncertainty, and as a result, may indirectly act on students' confidence and motivation and ultimately on performance.

Biographies

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