



Blissful ignorance? A natural experiment on the effect of feedback on students' performance[☆]



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HIGHLIGHTS

- Feedback on exam performance improves students' future performance by 13% of a standard deviation.
- The effect of feedback is stronger at higher quantiles and for students who have less information to start with.
- The findings suggest that feedback might be a cost-effective means to increase students' exam performance.

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ABSTRACT

We provide evidence on whether providing university students with feedback on their past exam performance affects their future exam performance. Our identification strategy exploits a natural experiment in a leading UK university where different departments have historically different rules on the provision of feedback to their students. We find that the provision of feedback has a positive effect on students' subsequent test scores: the mean impact corresponds to 13% of a standard deviation in test scores. The impact of feedback is stronger for more able students and for students who have less information to start with about the academic environment, while no subset of individuals is found to be discouraged by feedback. Our findings suggest that students have imperfect information on how their effort translates into test scores and that the provision of feedback might be a cost-effective means to increase students' exam performance.

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1. Introduction

The effectiveness of many public services depends on the effort of those who deliver them as well as the effort of those who receive them. The production function for education, in particular, is increasing in both teachers' and students' effort. Consequently, researchers and

policy makers have been concerned with ways to motivate teachers as well as students.

We contribute to this literature by evaluating the effect of feedback policies on students' effort and performance. To do so we exploit a natural experiment in a leading UK university where different departments have different feedback policies regarding exam grades.³ Feedback on exam grades gives students information on how their effort translates into grades and can thus affect future effort choices if this information is imperfect to start with. The effect of feedback is however theoretically ambiguous because changes in the perceived returns to effort will generate income and substitution effects of opposite signs. For instance, if the perceived return to effort increases, a positive substitution effect

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³ In a standard economic framework with perfect information, agents optimally choose the effort to devote to a task by equating its known marginal return to its known marginal cost, and performance feedback is of no use. When information is not perfect, however, feedback on past performance provides information on the marginal return to effort and this can affect future performance. Consequently, performance feedback can be used by principals to influence their agents' effort choices (Lizzeri et al., 2002; Ertac, 2006; Ederer, 2010).

will make students exert more effort (as they reallocate time from leisure to effort in studying) while the negative income effect will make them exert less (as now they know they can achieve the same exam outcome with less effort, all else equal).

We answer our research question using administrative records on the performance of 7738 students enrolled full time on one-year graduate degree programs, over the academic years 1999/00–2003/04. The academic year in this university can be divided into two periods, and students are evaluated at the end of each. The natural experiment we exploit is that some departments provide students with their individual period one test score before they begin exerting effort towards their period two test score, while other departments do not.

A key feature of our setting is that we observe the performance of the same student in the same department before and after feedback is provided. This allows us to identify the effect of feedback from the difference-in-difference between period one and period two exam performance of students in different feedback regimes, thus controlling for time invariant unobserved sources of department and student heterogeneity that might create a spurious correlation between feedback regime and exam performance. As we observe the same student in both periods, we estimate the effect of feedback on the difference in performance of the same student across periods and feedback regimes, conditional on time invariant unobserved heterogeneity across students and departments. The identifying assumption is that the choice of feedback policy is orthogonal to unobservables that cause systematic differences in test scores across periods, and we later present evidence in support of this assumption.

Our main results are as follows. First, controlling for unobserved heterogeneity across students and departments, the difference-in-difference in test scores across periods and feedback regimes is significantly greater than zero. The magnitude of this effect corresponds to 13% of a standard deviation in the difference in test scores across periods in the no-feedback regime. The implied effect size of feedback is at the lower end of estimates of the effect size on test scores of class sizes in primary, secondary, and tertiary education (Angrist and Lavy, 1999; Krueger, 1999; Bandiera et al., 2010), of the effect size of teacher quality on test scores (Aaronson et al., 2007; Rockoff, 2004; Rivkin et al., 2005) and of the effect size of academic support and financial incentives for college freshmen (Angrist et al., 2009). However, as all these interventions are significantly more costly than the provision of feedback.

Second, to provide evidence on whether the effect of the feedback policy works through an information channel, we exploit the fact that different students differ in their initial information depending on whether they were undergraduates at the same university. We find that the effect of feedback is entirely driven by students who have less information to start with, i.e. those who are new to the academic institution we study. This consistent with the idea that feedback acts as a signal for an unknown parameter of the production function for test scores. This also rules out that the estimates are driven by department level unobservables that are correlated with the feedback policy and that affect students equally regardless of whether they are new to the institution. Moreover, quantile regression analysis reveals that the provision of feedback has a close to zero effect on students below or at the 30th quantile of the distribution of test scores (so that the weakest students are not discouraged by feedback), while the effect is significantly different from zero at higher quantiles and increasing until the 80th quantile.

Finally, we exploit the fact that some students take period one courses in departments other than the one they are enrolled in, to devise a placebo test that allows us to disentangle the effect of feedback from the effect of having period two scores assigned by a department that has chosen to provide feedback. Reassuringly, we find that students' period two performance is only affected by the actual feedback received, and not by the feedback policy of the department they are enrolled in. Taken together, the results of the placebo test and the heterogeneous impacts described above, are in line with our identifying assumption. Therefore, while we cannot, and do not, claim that the

choice of feedback policy is randomly assigned across departments, the evidence suggests that departmental policies over the provision of feedback by departments are more accidents of history and therefore orthogonal to unobservables that cause systematic differences in test scores across periods, rather than being chosen as an endogenous response to how test scores are generated across periods in this setting.

Taken together, the findings suggest that students have imperfect information on the return to their study effort, and that the provision of feedback on their absolute performance reduces this uncertainty and hence improves future performance. The fact that the effect of feedback is largest for students with the strongest ex ante exam performance, suggests that the substitution effect of feedback prevails over the income effect of feedback, as students do better when they receive positive feedback.

Our paper is closely related to Stinebrickner and Stinebrickner (2012, 2014) who use a unique longitudinal survey of college students to show that learning about one's academic ability through exam performance determines the decision to drop-out. Our findings are consistent because they suggest that in our setting, like in theirs, students have imperfect information about how their effort translates into grades and feedback on past exam performance allows them to update that information, and this affects their future choices. In contrast to their setting, however, drop-out is effectively out of the choice set here because we analyze one-year degree programs where feedback, if any, is provided after nine months and after students have completed 75% of the work required to graduate and only a negligible fraction performs poorly enough to fail the criteria for the degree.

Our paper on the provision of feedback on one's own *absolute* performance, complements a small literature that evaluates the effect of providing *relative rank* feedback on students' performance. The findings of that literature are mixed: Tran and Zeckhauser (2012) and Azmat and Iriberry (2010) show that providing relative feedback improves the performance of university and high school students, respectively, while Ashraf et al. (2014) show that relative rank information (both private and public) lowers the exam performance of trainee nurses by discouraging those at the bottom of the exam score distribution.⁴ In this paper we take a step back and show that feedback on one's own absolute past performance can affect future performance even if it is not accompanied by rank information, suggesting that rank feedback might affect behavior both by providing information on one's own performance and one's performance relative to others.

The paper is organized as follows. Section 2 describes the empirical setting and administrative data. Section 3 presents the empirical analysis. Section 4 concludes with a discussion of the external validity of our results. Appendix A tests alternative explanations and reports further robustness checks.

2. Context and data description

2.1. Institutional setting

Our analysis is based on the administrative records of individual students from a leading UK university. The UK higher education system comprises three tiers — a three-year undergraduate degree, a one or two-year M.Sc. degree, and Ph.D. degrees of variable duration. Our working sample focuses on 7738 students enrolled full time on one-year M.Sc. degree programs, over academic years 1999/00–2003/04. These students will therefore have already completed a three year undergraduate degree program at some university and have chosen to stay on in higher education for another year. Students are not restricted to only apply to M.Sc. degree programs in the same field as that in which they majored in as an undergraduate. In addition, the vast majority of

⁴ The empirical evidence on the effect of providing rank information in the workplace is also mixed. Dur et al. (2013) show positive effects, while Bandiera et al. (2013), Barankay (2012), and Eriksson et al. (2009) find that rank information reduces productivity.

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