Technical Appendix

Definition

Feedback is information given to the learner and/or teacher about the learner's performance relative to learning goals or outcomes. It should aim to (and be capable of) producing improvement in students' learning. Feedback redirects or refocuses either the teacher's or the learner's actions to achieve a goal, by aligning effort and activity with an outcome. It can be about the output of the activity, the process of the activity, the student's management of their learning or self-regulation, or them as individuals. This feedback can be verbal or written, or can be given through tests or via digital technology. It can come from a teacher or someone taking a teaching role, or from peers.

Search terms: feedback; formative evaluation; assessment for learning; feedback interventions. corrective feedback.

Evidence Rating

There are seven meta-analyses of feedback and feedback interventions which have consistently found high average effects of feedback on learning and academic performance. Only two of these have been conducted in the last 10 years. Many of the studies included are small scale studies from psychology which demonstrate theoretical principles, but which may be difficult to generalise to educational practice. Larger scale educational studies tend to have lower effects. The meta-analyses include a very wide range of effects. Overall the evidence is rated as moderate.

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Summary of effects

Meta-analyses	Effect size	FSM effect size	
Bangert-Drowns, R. L., Kulik, C. L. C., Kulik, J. A., & Morgan, M., (1991)	0.26	-	
Fuchs, L.S. & Fuchs, D., (1986)	0.72	-	
Graham, S., Hebert, M., & Harris, K. R., (2015)	0.61	-	Writing
Kingston, N. & Nash, B., (2011)	0.20	-	(AfL)
Kluger, A. N., & DeNisi, A., (1996)	0.41	-	
Lysakowski, R.S., & Walberg, H.J., (1982)	0.97	-	
Tenenbaum, G., & Goldring, E., (1989)	0.72	-	
Weighted mean	0.63		

The right hand column provides detail on the specific outcome measures or, if in brackets, details of the intervention or control group.

Meta-analyses abstracts

1 *Bangert-Drowns, R. L., Kulik, C. L. C., Kulik, J. A., & Morgan, M. (1991)*

Feedback is an essential construct for many theories of learning and instruction and an understanding of the conditions for effective feedback should facilitate both theoretical development and instructional practice. In an early review of feedback effects in written instruction Kulhavy (1977) proposed that feedback's chief instructional significance is to correct errors. This error-correcting action was thought to be a function of presentation timing, response certainty and whether students could merely copy answers from feedback without having to generate their own. The present meta-analysis reviewed 58 effect sizes from 40 reports. Feedback effects were found to vary with for control for pre-search availability, type of feedback, use of pre-tests and type of instruction and could be quite large under optimal conditions. Mediated intentional feedback for retrieval and application of specific knowledge appears to stimulate the correction of erroneous responses in situations where its mindful (Solomon & Globerson, 1987) reception is encouraged.

7 *Fuchs, L.S. & Fuchs, D. (1986)*

While the aptitude treatment interaction (ATI) approach to educational measurement emphasizes establishing salient learner characteristics, systematic formative evaluation provides ongoing evaluation for instructional program modification. Systematic formative evaluation appears more tenable than ATI for developing individualized instructional programs. This meta-analysis investigates the effects of educational programs on student achievement. Twenty-one controlled studies generated 95 relevant effect sizes, with an average effect size of .72. The magnitude of effect size was associated with publication type, data evaluation methods, and use of behaviour modification. Findings indicate that unlike reported ATI approaches to individualization, systematic formative evaluation procedures reliably increase academic achievement. This suggests that, given an adequate measurement methodology, practitioners can inductively formulate successful individualized educational programs.

8 *Graham, S., Hebert, M., & Harris, K. R. (2015)*

To determine whether formative writing assessments that are directly tied to everyday classroom teaching and learning enhance students' writing performance, we conducted a meta-analysis of true and quasi-experiments conducted with students in grades 1 to 8. We found that feedback to students about writing from adults, peers, self, and computers statistically enhanced writing quality, yielding average weighted effect sizes of 0.87, 0.58, 0.62, and 0.38, respectively. We did not find, however, that teachers' monitoring of students' writing progress or implementation of the 6 _ 1 Trait Writing model meaningfully enhanced students' writing. The findings from this meta-analysis provide support for the use of formative writing assessments that provide feedback directly to students as part of everyday teaching and learning. We argue that such assessments should be used more frequently by teachers, and that they should play a stronger role in the Next-Generation Assessment Systems being developed by Smarter Balanced and PARCC.

10 *Kingston, N. & Nash, B. (2011)*

An effect size of about .70 (or .40–.70) is often claimed for the efficacy of formative assessment, but is not supported by the existing research base. More than 300 studies that appeared to address the efficacy of formative assessment in grades K- 12 were reviewed. Many of the studies had severely flawed research designs yielding un-interpretable results. Only 13 of the studies provided sufficient information to calculate relevant effect sizes. A total of 42 independent effect sizes were available. The median observed effect size was .25. Using a random effects model, a weighted mean effect size of .20 was calculated. Moderator analyses suggested that formative assessment might be more effective in English language arts (ELA) than in mathematics or science, with estimated effect sizes of .32, .17, and .09, respectively. Two types of implementation of formative assessment, one based on professional development and the other on the use of computer-based formative systems, appeared to be more effective than other approaches, yielding mean effect size of .30 and .28, respectively. Given the wide use and potential efficacy of good formative assessment practices, the paucity of the current research base is problematic. A call for more high-quality studies is issued.

11 *Kluger, A. N., & DeNisi, A. (1996)*

Since the beginning of the century, feedback interventions (FIs) produced negative—but largely ignored—effects on performance. A meta-analysis (607 effect sizes; 23,663 observations) suggests that FIs improved performance on average (d = .41) but that over '/3 of the FIs decreased performance. This finding cannot be explained by sampling error, feedback sign, or existing theories. The authors proposed a preliminary FI theory (FIT) and tested it with moderator analyses. The central assumption of FIT is that FIs change the locus of attention among 3 general and hierarchically organized levels of control: task learning, task motivation, and meta-tasks (including self-related) processes. The results suggest that FI effectiveness decreases as attention moves up the hierarchy closer to the self and away from the task. These findings are further moderated by task characteristics that are still poorly understood.

13 *Lysakowski, R.S., & Walberg, H.J. (1982)*

To estimate the instructional effects of cues, participation, and corrective feedback on learning 94 effect sizes were calculated from statistical data in 54 studies containing a combined sample of 14,689 students in approximately 700 classes. The mean of the study-weighted effect size is .97, which suggest average percentiles on learning outcomes of 83 and 50 respectively, for experimental and control groups. The strong effects appeared constant from elementary level through college, and across socioeconomic levels, races, private and public schools, and community types. In addition the effects were not significantly different across the categories of methodological rigor such as experiments and quasi-experiments.

15 *Tenenbaum, G., & Goldring, E. (1989)*

Estimated the effect of enhanced instruction on motor skill acquisition in a metaanalysis of 15 studies that used 4–5 yr old children and 4th–21th graders in Israel. Ss exposed to enhanced instruction gained more qualified motor skills than over 75% of the Ss exposed to regular instruction in a variety of motor skills. Enhanced instruction used cues and explanations by the instructor to clarify the motor skill, encouraged Ss to actively participate in the task over 70% of the time, reinforced Ss' responses, and supplied ongoing feedback and correctives to ensure motor skill acquisition.